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HUMAN HEALTH RISK ASSESSMENT FOR THE SMURFIT-STONE/FRENCHTOWN MILL OPERABLE UNIT 2 SITE LOCATED IN MISSOULA COUNTY, MONTANA

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LIST OF ACRONYMS AND ABBREVIATIONS

95UCL	95% Upper Confidence Limit
ABSd	Dermal Absorption Fraction
ABS_{GI}	Fraction absorbed in gastrointestinal tract
AT	Averaging Time
BW	Body Weight
C	Concentration
CF	Conversion Factor
CFR	Clark Fork River
COPC	Contaminant of Potential Concern
CSM	Conceptual Site Model
CTE	Central Tendency Exposure
DAD	Dermal Absorbed Dose
DAevent	Absorbed dose per event
DAF	Dermal Adherence Factor
DI	Daily Intake
DI_L	Daily Intake, averaged over a lifetime
DL	Dioxin-Like
DRI	Daily Recommended Intake
EC	Exposure Concentration
ED	Exposure Duration
EF	Exposure Frequency
EPC	Exposure Point Concentration
EPD	Effective Predictive Domain
ET	Exposure Time
EU	Exposure Unit
EV	Event Frequency
FSP	Field Sampling Plan
HDPT	High Density Pulp Tank
HHRA	Human Health Risk Assessment
HI	Hazard Index
HIF	Human Intake Factor
HQ	Hazard Quotient
IR	Intake Rate
IRIS	Integrated Risk Information System
Kow	Octanol/water partition coefficient
LOAEL	Lowest Observed Adverse Effect Level
MDEQ	Montana Department of Environmental Quality
MDL	Method Detection Limit
MPDES	Montana Pollution Discharge Elimination System
MW	Molecular Weight
ND	Non-Detect
NOAEL	No Observed Adverse Effect Level

NPL	National Priorities List
OCC	Old Corrugated Container
OU	Operable Unit
PAH	Polyaromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PCDD	Polychlorinated Dibenzo-p-dioxin
PCDF	Polychlorinated Dibenzo-p-furan
PEF	Particulate Emission Factor
PPRTV	Provisional Peer Reviewed Toxicity Value
PRP	Potentially Responsible Party
QAPP	Quality Assurance Project Plan
RBA	Relative Bioavailability
RBC	Risk-Based Concentration
RIWP	Remedial Investigation Work Plan
RfC	Reference Concentration
RfD	Reference Dose
RfD_{ABS}	Absorbed Reference Dose
RL	Reporting Limit
RME	Reasonable Maximum Exposure
RSL	Regional Screening Level
SA	Surface Area
SF	Slope Factor
SF_{ABS}	Absorbed Slope Factor
SI	Site Investigation
SL	Screening Level
STSC	Superfund Technical Support Center
SVOC	Semi-volatile Organic Compound
TCDD	2,3,7,8-Tetrachlorodibenzo-p-dioxin
TEF	Toxicity Equivalence Factor
TEQ	Toxicity Equivalent
TSB	Transformer Storage Building
TWA	Time Weighted Average
TWF	Time Weighting Factor
UR	Unit Risk
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
WMW	Wilcoxon-Mann-Whitney

1.0 INTRODUCTION

1.1 Purpose

This document is a human health risk assessment (HHRA) for the Smurfit-Stone/Frenchtown Mill Operable Unit 2 Site (hereafter referred to as "the OU2 Site") located in Montana. The purpose of this document is to evaluate potential risks to humans, both now and in the future, from Site-related chemicals that are present at the OU2 Site, assuming that no steps are taken to remediate the environment or to reduce human contact with contaminated environmental media.

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 Site-related chemicals, and to help determine if there is a need for action to protect public health at the OU2 Site. The methods used to evaluate risks in this assessment are consistent with current guidelines for human health risk assessment provided by the U.S. Environmental Protection Agency (USEPA) for use at Superfund sites (USEPA 1989; 1991a; 1991b; 1991c; 1992; 2002; 2014).

1.2 Organization

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

Section 2	This section provides a description of the Site and a review of data that have been collected to characterize the environmental contamination at the Site.
Section 3	This section identifies human exposure scenarios of potential concern at the OU2 Site and describes the approach for identifying chemicals of potential concern (COPCs) for each exposure medium.
Section 4	This section includes the toxicity assessment and identifies potential non-cancer and cancer effects and toxicity values for the COPCs identified at the OU2 Site.
Section 5	This section summarizes estimated exposure and risk to humans from COPCs at the OU2 Site.
Section 6	This section provides full citations for USEPA guidance documents, Site-related 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.

2.0 SITE CHARACTERIZATION

A detailed description of the Smurfit-Stone/Frenchtown Mill Site and its history is provided in the Remedial Investigation Work Plan (RIWP) report for the Site (NewFields 2015). Site information is also provided on EPA's Superfund Page for the Site[1]. Pertinent information derived from these sources is summarized in the following subsections.

2.1 Site Overview

The Smurfit-Stone/Frenchtown Mill Site is in Missoula County, Montana and is located 11 miles northwest of Missoula, Montana (Figure 2-1). The entire Site consists of three operable units and encompasses approximately 3,150 acres.

Historically, a pulp and paper mill operated on site from 1957 to 2010. Wood was chipped, and the chips were washed and digested using sodium hydroxide and sodium sulfide to create a wood fiber pulp. Beginning in 1990, pulp was also created from recycling old corrugated containers at a recycled fiber plant on site. Waste bark and wood (hog fuel) generated as part of the on-site chipping of logs was conveyed to a storage yard on site and burned in a boiler. Most of the pulp was used to produce un-bleached linerboard, but a small fraction (about 6 percent) of the total pulp produced from 1960-1999 was used to create white linerboard or sold as bleached pulp.

The core industrial footprint of the Site includes the former mill, recycling plant, a wood chipping staging area, the hog fuel area, and various equipment storage areas. During the production of pulp and paper, high usage of water and energy resulted in large amounts of wastewater, solid waste (e.g., treatment sludges, boiler ash, wood processing residuals, lime kiln grits, inert materials, and general refuse) and air emissions. The paper making process at the Site was designed to recover and recycle chemicals utilized in the washing and digesting processes. Stack emissions from recovery boilers, power boilers, and lime kilns were controlled and monitored, and releases to the atmosphere were subject to permit standards. The Mill included a wastewater treatment system that included a primary clarifier and settling ponds (primary treatment), sludge dewatering plant, aeration basins (secondary treatment), polishing ponds, a color removal plant (tertiary treatment) and a series of unlined holding ponds used to store treated effluent prior to discharge. When holding ponds were at capacity, treated wastewater was moved to infiltration basins and infiltrated to groundwater. Treated wastewaters discharged to the Clark Fork River (CFR) was subject to MPDES permit standards.

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[1] Smurfit-Stone Mill Frenchtown, Missoula, MT webpage:
https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0802850

The USEPA conducted an initial site investigation (SI) in 2011 to support evaluation of the Site for possible inclusion in the National Priority List (NPL) (USEPA 2012). This investigation was focused on the former wastewater treatment and storage area, O'Keefe Creek, and the CFR. The Smurfit-Stone/Frenchtown Mill Site was proposed to be added to the National Priority List (NPL) on December 12, 2013. Although the Site has not been added to the NPL, an agreement was reached in November 2015 between the USEPA and the Respondents[2] to conduct a remedial investigation (RI). For assessment and management purposes, the USEPA has divided the Site into three operable units (OUs) based on historic use and the nature of the potential environmental concerns, as follows (Figure 2-2):

> **OU1** encompasses about 1,200 acres of the Site. This area has been and continues to be used largely for agricultural purposes, including grasslands for cattle grazing and cropland irrigated for alfafa and grain crops.
>
> **OU2** encompasses approximately 255 acres of the Site and includes the former industrial area. This area includes the former buildings and process areas for the Mill.
>
> **OU3** encompasses approximately 1,700 acres of the Site and includes areas of the Site where solid and aqueous wastes were treated and stored. This area includes the former wastewater treatment system (settling ponds, aeration basins, polishing ponds, solid waste basins, spoils basins, holding ponds, and infiltration basins), the holding ponds areas within the 100-year floodplain, and parts of the CFR where hazardous substances from historic mill operations may have come to be located.

This assessment focuses on OU2. OU2 comprises the core industrial footprint of the Site. This includes the former pulp and paper mill building, the recycle plant (old corrugated container or OCC), a wood chip staging area, the hog fuel area, a chlorinated bleach plant, pulp tanks, multi-fuel and recovery boilers, lime kilns, a transformer storage building, an equipment repair building, offices, and various equipment storage areas.

Within the Administrative Order on Consent (AOC) for the Remedial Investigation/Feasibility Study (RI/FS), OU3 is defined to include site-wide groundwater (USEPA 2015a). Since the USEPA is evaluating human health risks separately for each individual OU, each HHRA includes evaluation of groundwater collected from wells within the boundary for the OU being assessed. For the purposes of this assessment, groundwater data collected from wells within the OU2 land boundary were evaluated as described in further detail below.

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[2] International Paper Company, WestRock CP, LLC, and M2Green LLC as defined in the Administrative Order on Consent (AOC).

2.2 Basis for Potential Human Health Concern

Mill operations (predominantly the pulping and bleaching processes) used or produced various hazardous chemicals on site, including volatile and semi-volatile organic compounds (VOCs and SVOCs), and bleaching chemicals. The use of chlorine for the bleaching of pulp produces chlorinated organic compounds, including dioxins and furans. Pulping operations may have resulted in contamination of surface soils within OU2 and subsequent contamination of subsurface soils and groundwater via fate and transport mechanisms discussed in further detail below. Previous site investigations have identified COPCs at the Site to include dioxins/furans, heavy metals, polychlorinated biphenyls (PCBs), SVOCs, and VOCs. Exposures to these types of COPCs may cause a range of non-cancer and cancer effects in humans, so humans who reside in, work at, and/or visit the OU2 Site now or in the future could be at risk of adverse health effects if excessive exposure to contaminated environmental media were to occur.

2.3 Data Overview

As described in the RIWP, numerous environmental studies and compliance monitoring events have been conducted at the Site in support of ongoing RI activities (NewFields 2015). In April 2014, the Potential Responsible Party (PRP) for the Site commissioned the collection of environmental samples to initiate the ongoing site investigation. Follow-up sampling was conducted in a series of sampling events in accordance with the USEPA approved RIWP and associated Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP) as follows:

- November and December 2015 (NewFields 2015)
- June 2016 (RIWP Addendum 1; NewFields 2016a)
- August 2016 (RIWP Addendum 2; NewFields 2016b)
- March 2017 (RIWP Addendum 3; NewFields 2017a)
- June 2017 (RIWP Addendum 4; NewFields 2017b)
- October 2017 (RIWP Addendum 7; NewFields 2017d)

The environmental data collected during the site investigations described above from 2014-2017 were considered in this assessment.

The environmental data for the OU2 Site considered in this assessment include analytical results for soil and groundwater samples collected within the boundaries of OU2 by NewFields in 2014, 2015, 2016 and 2017 (see Table 2-1). All of these data have been validated and are considered to be appropriate for use in this assessment. Figures 2-3 and 2-4 present the sampling locations corresponding to the surface soil and subsurface soil samples collected within OU2, respectively. Figure 2-5 presents the locations of the groundwater wells identified for inclusion in this assessment for OU2 (MCSMW1, MW4, MW7, NFMW13, NFMW14, NFMW15, NFMW16, NFMW17, NFMW18, NFMW5, NFMW6, and WFB1).

Soil data collected in 2014-2016 from the High Density Pulp Tank Foundation (HDPT) and Transformer Storage Building (TSB) areas were excluded from this assessment and replaced with data for backfill soil as described in Appendix A. This was done because following the detection of PCBs (Aroclors 1254 and 1260) in soils at elevated concentrations at these locations, a soil removal effort was conducted in December 2017 as per Addendum 5 of the RIWP (NewFields 2017c).

Appendix A summarizes data reduction procedures and provides Excel files containing the data in electronic format. Summary statistics are provided in Tables 2-2 to 2-4.

Specific Data Considerations

Polychlorinated Biphenyls (PCBs)

There are 209 distinct PCB congeners. PCBs generally occur as a mixture of congeners; the most common commercial mixtures are Aroclors. Soil samples collected in 2014, 2015 and 2016 were analyzed for PCBs as Aroclor mixtures. Soil samples collected in 2017 were analyzed for both Aroclors and PCB congeners. Congener-specific analyses generally offer lower detection limits and detection of concentrations biased by interference caused by chemicals that coelute, and account for changes in mixture composition related to weathering, metabolism, or degradation in the environment. The approach applied in this assessment to account for the OU2 soil dataset including a mixture of PCB data, including both Aroclor concentrations and PCB congener concentrations, was to maintain separation between these analyses. This was achieved by calculating exposure estimates based on either Aroclor or PCB congeners separately. PCB congener data was preferred over Aroclor data where available.

Another consideration in using the available PCB congener data was to consider that some PCB congeners have a dioxin-like (DL) mode of action (USEPA 1996). The dioxin-like congeners were evaluated following the toxicity equivalent (TEQ) approach described below. However, dioxin equivalence explains only part of a PCB mixture's toxicity. As such, Total PCB concentrations for non-DL PCB congeners were also calculated as described in Appendix A.

Calculation of Toxicity Equivalents

For this assessment, data for dioxins/furans and dioxin-like PCB congeners were converted to a 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) toxicity equivalent value (TEQ)[3]. This was done because polychlorinated dibenzo-p-dioxin (PCDD) and furan (PCDF) congeners and dioxin-like PCB congeners all act by the same mechanism as TCDD. TEQ values were calculated by computing the sum across congeners of the product of congener-specific concentration and relative Toxicity Equivalence Factor (TEF):

$$TEQ = \Sigma \, (Ci \times TEFi)$$

TEFs were based on USEPA (2010a). The USEPA Scribe database for the Smurfit-Stone/Frenchtown Mill Site includes three alternative TEQ values that were computed based on evaluating ND concentrations as zero, at one-half the MDL and at one-half the reporting limit (RL). Although summary statistics are provided for each of these alternatives, risk calculations included in this risk assessment were based on evaluating NDs at ½ MDL, unless otherwise noted (i.e., comparison to background concentrations as described in Section 3.3). Evaluation of NDs at ½ the MDL when calculating TEQ is consistent with evaluations conducted at other USEPA sites in the region.

Inorganic Data in Groundwater

Groundwater samples were analyzed for both total recoverable and dissolved concentrations of inorganics. In general, filtered water data may underestimate actual exposure to humans if contaminants of concern are primarily associated with particulate matter. For risk assessment purposes, USEPA Region 8 evaluates exposures to groundwater assuming that the water is consumed without filtration. Thus, dissolved metal concentrations were not used to quantify risks in this assessment.

[3] https://www.epa.gov/superfund/risk-assessment-dioxin-superfund-sites

3.0 EXPOSURE ASSESSMENT

Exposure is the process by which humans come in to 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, food), and these exposures can occur through several routes (e.g., ingestion, dermal contact, inhalation).

3.1 Site Conceptual Model

Figure 3-1 presents a Conceptual Site Model (CSM) for OU2 that summarizes USEPA's current understanding of how chemicals that have been released to the environment within OU2 might result in exposure of human receptors. This CSM is based on the most current understanding of expected land use now and in the future. The main features of this CSM are discussed below.

3.1.1 Primary Sources of Contamination

As noted above and as described in further detail in the RIWP, historic Mill operations included the creation of pulp, wood chipping, recycling of OCC, burning of solid fuels in boilers, and paper making (NewFields 2015). These operations are potential sources of metals, as well as VOCs and SVOCs including polycyclic aromatic hydrocarbons (PAHs). Chlorinated bleaching operations related to the production of linerboard produced by the mill occurred in OU2 from 1960 to 1999, and are a potential source of dioxins and furans. Activities within the HDPT and transformers stored in the former TSB within OU2 are potential sources of PCBs. Releases during such historic Mill operations, as well as releases associated with leaks and spills resulted in direct deposition of Site-related contaminants to OU2 surface soils.

3.1.2 Transport in the Environment

Chemicals generated and/or released from historic Mill operations in OU2 may migrate in the environment by several processes:

- Transport of chemicals emitted to the air from boiler emissions can result in direct deposition of chemicals in OU2 surface soils.
- Fine-grained soil particulates may be released into air as a consequence either of wind erosion and/or human disturbances.
- Chemicals in soil may be dissolved by water (rain or snowmelt) and infiltrate into subsurface soils and downward into groundwater.

O'Keefe Creek runs along the southern edge of OU2 as shown in Figure 2-2. It is possible that runoff from surface soils may result in the transport of contamination from OU2 surface soils into O'Keefe Creek. However, this assessment for OU2 will not include evaluation of exposures along O'Keefe Creek outside of the OU2 boundary. Exposures associated with O'Keefe Creek were evaluated as part of the HHRAs for the other two operable units.

3.1.3 Land Use

Remaining buildings in OU2 are unoccupied with the exception of a part-time employee (20-30 hours per week). Some of the equipment and machinery in OU2 were previously salvaged and sold. In addition, OU2 includes a 23-acre area that was used as a petroleum land farm that is permitted by the Montana Department of Environmental Quality (MDEQ).

Information provided to USEPA by the Missoula County Planner indicated that the Smurfit Stone/Frenchtown Mill Site is not currently zoned for a specific land use. Therefore, although future land uses for OU2 are expected to be primarily commercial/industrial, no land use restrictions are currently in place.

3.1.4 Potentially Exposed Populations

Potentially exposed populations represent people that could be exposed to Site-related chemicals, and include the following.

<u>Current and Hypothetical Future Residents</u>

No person currently resides within OU2. Consequently, current residential exposure was not evaluated in this assessment. However, as noted above, OU2 is not currently zoned and there are no restrictions in place to prohibit development of OU2 for residential use in the future. On this basis, the CSM includes a hypothetical future residential receptor.

<u>Current and Hypothetical Future Commercial/Industrial Workers</u>

As noted above, there is not a current worker population at OU2 outside of an individual part-time employee. However, expected future land use of OU2 is anticipated to include additional commercial/industrial development. On this basis, the CSM includes hypothetical future commercial/industrial workers who may be exposed to Site contamination while working at locations within OU2.

Hypothetical Future Construction Workers

With hypothetical future residential, commercial, or industrial development, future construction activities at the OU2 Site are anticipated. These activities would involve soil excavation and construction. On this basis, the CSM includes a hypothetical future construction worker receptor.

3.2 Exposure Pathways of Chief Concern

Not all of the potential exposure routes to these populations of receptors are likely to be of equal concern. First, in order 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. Exposure pathways that are not complete are indicated in Figure 3-1 by open boxes. 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. Exposure scenarios that are likely to result in the highest level of exposure are shown in Figure 3-1 by boxes containing a solid circle (●). Greatest attention is focused on quantification of exposure from these pathways in order to determine if the pathway contributes significant risk. Pathways that are complete but which are judged to contribute only minor exposures, at least in comparison to other pathways, are shown by boxes with an open circle (❍). Because of their minor contribution, these pathways are not evaluated quantitatively.

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

Exposures to Surface Soil

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 is evaluated for all receptors.

Dermal Contact with Surface Soil

Humans who come into contact with contaminated soils may get some of the material on their skin. As such, dermal exposure to surface soil is considered a complete exposure pathway and is evaluated quantitatively for all receptors.

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 was considered a minor pathway for all potential human receptors. Appendix B presents screening level calculations to support this designation.

When soil is disturbed by mechanical forces such as construction equipment, 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 through the use of construction equipment was evaluated quantitatively for hypothetical future construction workers.

Inhalation of Vapors Emitted from Surface Soils

Whenever contaminated soils are exposed at the surface, volatile chemicals may volatilize into the air and humans in the area could inhale those vapors. OU2 data suggest that most VOCs are generally present at non-detectable levels within OU2 soils (<5% detection frequency). However, some VOCs were detected in both surface soil and subsurface soil. Volatilization of SVOCs expected in OU2 soils (including dioxins/furans and PAHs) is generally not expected to be significant given the relatively low volatility of these chemicals and the absence of a continuous source. Also, the amount of vapor inhaled from air is generally quite small compared to the amount that is typically assumed for incidental ingestion. Therefore, inhalation of vapors emitted from surface soils was considered a minor pathway for all potential human receptors. Appendix B presents screening level calculations to support this designation.

Exposures to Subsurface Soil

Due to the nature of the work, construction workers may be exposed via direct contact to soils down to a depth of 10 feet. Construction workers who have direct contact with contaminated soils may get soils on their skin and incidentally ingest small amounts that adhere to their hands during construction activities. On this basis, incidental ingestion of and dermal contact with subsurface soils were considered complete exposure pathways for hypothetical future construction workers.

3.2.2 Exposures to Groundwater

Groundwater is not currently used as a drinking water source in OU2. A public water supply system is available in OU2 that extracts groundwater upgradient of all potential sources of contamination at the Site. Therefore, current exposures to groundwater are not evaluated quantitatively. However, it is possible that groundwater from OU2 could be used within future residences and/or commercial/industrial buildings. There are three primary pathways by which a hypothetical future resident or commercial worker may be exposed to groundwater as described below.

Ingestion of Drinking Water

Hypothetical future residents or commercial workers may ingest Site groundwater as drinking water.

Dermal Contact with Groundwater

If Site groundwater was used in residential homes in the future, dermal exposure by residents would primarily be the result of showering/bathing. If Site groundwater was used in commercial/industrial buildings in the future, dermal exposure by workers would primarily be the result of hand washing. Metals and dioxins/furans have been detected in OU2 groundwater samples. USEPA guidance recommends against quantifying exposure and risk based on dermal contact with 2,3,7,8-TCDD in water because the molecular weight (MW) and octanol/water partition coefficient (Kow) are outside of the effective predictive domain (EPD) (USEPA 2004). Uptake of metals across the skin from contact with water is usually a minor exposure pathway due to the relatively low tendency of metals to cross the skin even when contact does occur. Furthermore, risk associated with dermal contact to metals in water is expected to be relatively small compared to the amount that is typically assumed for ingestion of drinking water. On this basis, dermal exposure to groundwater by hypothetical future residents and workers is considered a minor pathway in the CSM. Appendix B presents screening level calculations to support this designation. Thus, dermal exposure to contaminants in groundwater by hypothetical future residents and workers was considered a minor pathway and was not evaluated quantitatively in this assessment.

Inhalation of Vapors Released from Water

Volatile chemicals in water can be released to indoor air by two pathways: 1) vaporization to indoor air through standard indoor water uses, and 2) vapor intrusion in which vapors rise from the groundwater through the soil underlying a building foundation and get into the building through cracks in the foundation. Although these pathways may be complete at future residences and/or commercial/industrial buildings within the OU2 Site, the chemicals detected at a high frequency in OU2 groundwater (dioxins/furans, metals) are not considered to be of sufficient volatility to expect significant exposures via these pathways. Therefore, these pathways were not evaluated quantitatively in this assessment.

3.2.3 Exposures to Food Items

Ingestion of Homegrown Produce Items

Hypothetical future residential use within OU2 may include residential gardens used to grow vegetables or fruit in Site-impacted soils. Area residents who ingest home-grown produce may be exposed to certain contaminants that may be taken up by the vegetables or fruit. No data are available on the levels of contaminants that may be present in vegetation within OU2. Therefore, this pathway cannot be evaluated quantitatively in this risk assessment without modeling uptake from soils into plants. Dioxins/furans, Aroclors and metals have been detected in OU2 soils. USEPA (1999) notes that most plants do not generally absorb dioxin. Similarly, most metals have little tendency to accumulate in plant tissue (Life Systems 1995; Weston 1997). USEPA (2017c) notes that most plants do not bioaccumulate PCBs from contaminated soil due to the presence of a waxy layer which binds the PCBs and prevents them from being absorbed into the plant. However, there are certain vegetables, such as squash and tomatoes that may accumulate PCBs from soil via their roots or leaves, respectively. As noted above, the OU2 soils associated with the TSB and HDPT where Aroclors were detected at high levels were excavated as part of the removal effort described in Addendum 5 of the RIWP (NewFields 2017c).

Thus, in general, uptake of contaminants detected in OU2 soils by home-grown fruits or vegetables is expected to be minor. In addition, exposure to contaminants from ingestion of washed garden produce is likely to be a minor source of exposure compared with direct ingestion of soil. On this basis, ingestion of home grown produce by a hypothetical future resident was not evaluated quantitatively in this risk assessment. A qualitative evaluation of excluding this pathway from the risk characterization is discussed in the uncertainty assessment.

3.2.4 Summary of Exposure Pathways for Quantitative Assessment

Table 3-1 summarizes the exposure pathways that were selected for quantitative evaluation in this risk assessment.

3.3 Selection of Chemicals of Potential Concern

COPCs are chemicals which exist in the environment at concentration levels that might be of potential health concern to humans and which are or might be derived, at least in part, from Site-related sources.

3.3.1 COPC Selection Process

The procedure used to identify COPCs for the evaluation of risks to human receptors from contaminated environmental media (soil and groundwater) is shown in Figure 3-2. It is important to note that this COPC selection procedure is intended to be conservative. That is, it is expected that some chemicals may be identified as COPCs that are actually of little or no concern, but that no chemicals of authentic concern will be overlooked.

The COPC selection procedure includes two primary steps:

(1) Comparison of Site data to risk-based concentrations,
(2) Comparison of Site data to background data.

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

- COPC
- Not a COPC
- Source of Uncertainty

In Step 1, the process begins by determining if the chemical has a risk-based concentration (RBC) that can be used to evaluate potential risk. 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.

If an RBC is available, the next step is to evaluate the detection frequency. If a chemical was detected in 5% or more of the Site samples, the maximum detected concentration for each chemical in each medium is compared to the RBC. If the maximum detected concentration exceeds the RBC, the chemical moves into Step 2, the background comparison. If the maximum detected concentration does not exceed the RBC, it may be concluded that the chemical does not pose a significant risk to humans and may be excluded as a COPC.

If the chemical was detected in fewer than 5% of the Site samples, or if the chemical was not detected, then the detection limit is evaluated. If the detection limit is lower than the RBC, then it is very unlikely that the chemical will pose a significant risk to human health and may be excluded as a COPC. However, if the detection limit is above the RBC, this is identified as a source of uncertainty.

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 average intake from Site media is similar to the range that is considered healthful.

In Step 2, Site data for chemicals identified as having a maximum detected concentration above an available RBC value are compared to appropriate background concentrations.

If the measured level of a chemical is not statistically (based on an alpha of 0.05, see section 3.3.4) higher than the level that would be expected for that chemical based on background levels, then it may be concluded that the Site-related contribution for that chemical is sufficiently minor and further quantitative evaluation is not needed. If the chemical is observed to be present at a level higher than would otherwise be expected, then that chemical is retained for quantitative risk evaluation.

In summary, a chemical is identified as a COPC if the maximum detected concentration exceeds an available RBC, and Site concentrations for that chemical are significantly higher than background concentrations.

3.3.2 Source of Risk-Based Screening Level Values

Risk-based screening levels (SLs or RBCs) used in this assessment were selected based on the human receptor identified in the CSM (Figure 3-1) who is expected to receive the highest exposure. In general, this is the hypothetical future resident. Therefore, RBC values for use in the COPC selection protocol were derived from USEPA's Regional Screening Level (RSL)

Tables (USEPA, 2017a)[4], using values that are protective of residents. USEPA's RSL Tables include generic SLs for a resident exposed to soil or drinking water calculated assuming default exposure parameters that represent Reasonable Maximum Exposure (RME) conditions for chronic exposures via the oral, dermal and inhalation pathways.

3.3.3 Evaluation of Beneficial Minerals

A number of metals are beneficial minerals, and a certain level of intake is required to maintain good health. This includes calcium, chromium (III), copper, iron, magnesium, manganese, molybdenum, potassium, selenium, sodium, and zinc. However, excess intake of these minerals may cause adverse effects. If a SL was available for such minerals in USEPA's RSL Tables, they were evaluated as described above. Because of their low toxicity (even at high doses), USEPA has not derived RBC values for some minerals, including calcium, magnesium, potassium, and sodium. These four chemicals were evaluated by calculating an effective RBC as follows:

Effective RBC (beneficial) = DRI / DI

Where:

DRI = Daily Reference Intake (mg/day), derived from the Food and Nutrition Board (FNB 2013)

DI = Daily intake of Site medium (kg/day of soil; L/day of water)

3.3.4 Background Screen

Concentrations of a chemical in the environment are characterized by distributions, whereby a comparison between Site data and background data must be based on sound statistical techniques. For the purposes of this assessment, USEPA's ProUCL Software (v 5.0) was used to compare available Site data to available background data (USEPA 2013). This was done using the Wilcoxon-Mann-Whitney (WMW) two sample hypothesis test in ProUCL for the null hypothesis Site >= background. If ProUCL concludes that the Form 2 null hypothesis can not be rejected with 95% confidence, the WMW two sample hypothesis test is conducted for the null hypothesis Site = background at a confidence coefficient of 95%. The Gehan test was used when multiple detection limits are present as prompted by the ProUCL output based on the WMW test.

[4] https://www.epa.gov/risk/regional-screening-levels-rsls (Tables last updated November 2017)

Background Data

The background soil and groundwater data evaluated in this assessment are provided in electronic format in Appendix A, and summary statistics are provided in Tables 3-2 and 3-3.

Soil

Background soil data considered in this assessment are based on surface soil samples collected across the state of Montana by the MDEQ and analyzed for dioxins/furans and inorganics (MDEQ, 2013; 2011). MDEQ categorized soils as urban or rural. Urban soils were further categorized as residential, commercial or industrial. Site data were compared against the background data for each of these categories. Of note, MDEQ evaluated NDs using reporting limits (RLs). As such, for the purposes of comparing Site concentrations to background concentrations, ND results in the Site dataset were evaluated at ½ RL.

Groundwater

Five wells within the boundary of the Smurfit-Stone/Frenchtown Mill Site (CountyMW, SMW1, SMW5, SMW6, and WFBW) were previously identified as background groundwater locations. These wells were identified as being upgradient from any potential Site contamination during Mill operations. Groundwater samples were collected from these wells in April 2014, December 2015, May 2016, and March/June/July 2017 as part of ongoing RI activities. Samples were analyzed for dioxins/furans, PCBs (as Aroclors), total and dissolved metals, SVOCs and VOCs; although not all samples were analyzed for all of these contaminant classes.

3.3.5 COPC Screening Results

Tables 3-4 and 3-5 present the application of this COPC selection process to the OU2 soil and groundwater data, respectively. The results are briefly summarized below.

Risk-based Screen

As seen in Tables 3-4 and 3-5, maximum detected concentrations were below respective RBCs in soil and groundwater for all chemicals except the following:

- TEQ, non-DL PCBs, Aroclor-1254, aluminum, arsenic, chromium, cobalt, iron, manganese and thallium in soil.

- TEQ, arsenic, barium, chromium, cobalt, manganese, fluoride and phosphorus in groundwater.

Background Screen

Of the chemicals listed above with maximum detected concentrations above respective RBCs, the following were identified in the background screening process as being present within OU2 above background concentrations:

- TEQ in soil
- Manganese in groundwater

Appendix C includes the ProUCL output for the background comparisons for these chemicals. As seen in Appendix C, concentrations of metals in OU2 soils were determined to be statistically lower than background concentrations (Reject H0, conclude Site < background). TEQ based on dioxin/furan congener concentrations in OU2 soils were determined to be statistically greater than background concentrations (Do not reject H0, conclude Site > background) when compared to the MDEQ urban and rural datasets. This was also the outcome when compared to the residential sub-set of MDEQ background data. However, TEQ concentrations in OU2 soil were determined to be statistically comparable to the commercial and industrial sub-sets of MDEQ background data (Do not reject H0, conclude Site = background).

Data on PCB levels in background soils were not available for this assessment. As such, a background comparison could not be completed for Total non-DL PCBs or Aroclor-1254, both of which were detected in OU2 soils at concentrations exceeding the respective RBCs. Thus, DL-PCBs, non-DL PCBs, and Aroclor-1254 were retained as COPCs in OU2 soil.

Summary

Following screening of the available data for OU2 in accordance with the COPC selection procedure outlined in Figure 3-2, COPCs for OU2 are:

- TEQ (dioxins/furans/PCB-congeners), Total non-DL PCBs, and Aroclor-1254 in surface soil

- Manganese in groundwater

3.4 Quantification of Exposure

3.4.1 Basic Equations

Ingestion Exposures

The amount of chemical which is ingested by receptors exposed to Site 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 per kg of body weight per day).
C	=	Concentration of the chemical in the contaminated environmental medium (soil, water) to which the person is exposed. The units are mg/kg for soil and µg/L for water.
IR	=	Intake rate of the contaminated environmental medium. The units are kg/day for soil and L/day for water.
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.
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 for soil and L/kg-day for water.

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 hazards and cancer risks as recommended in USEPA Guidance (USEPA 1989).

Dermal Exposures

The amount of a chemical which is absorbed across the skin is referred to as the dermally absorbed dose (DAD). Procedures for estimation of the DAD as outlined in USEPA (2004) are used in this assessment and described below. Exposure is quantified using an equation of the following general form:

$$DAD = DA_{event} \cdot EF \cdot ED \cdot EV \cdot SA / (BW \cdot AT)$$

where:

DAD = Dermal absorbed dose (mg of chemical per kg of body weight per day).

DA_{event} = Absorbed dose per event (mg of chemical per square centimeter of skin surface area per event). This is media-specific and is further described below.

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.
EV	=	Event frequency (events/day). This describes the number of times per day a person comes in contact with a contaminant in soil.
SA	=	Surface area (cm^2). This describes the amount of skin exposed to the contaminated media.
BW	=	Body weight of the exposed person (kg).
AT	=	Averaging time (days). This term specifies the length of time over which the average dose is calculated.

For contaminants in soil, DA_{event} is estimated as follows:

$$DA_{event} = C_{soil} \cdot CF_s \cdot DAF \cdot ABS_d$$

where:

C_{soil}	=	Chemical concentration in soil (mg of chemical per kg of soil).
CF_s	=	Conversion factor for soil (10^{-6} kg/mg).
DAF	=	Dermal adherence factor (mg of soil per square centimeter of skin surface area per event). This describes the amount of soil that adheres to the skin per unit of surface area.
ABS_d	=	Dermal absorption fraction (unitless). This value is chemical-specific and represents the contribution of absorption of a chemical across a person's skin from soil to the systemic dose.

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

Soil: $DAD = C_{soil} \cdot ABS_d \cdot HIF_{soil}$

where:

$HIF_{soil} = (SA \cdot DAF \cdot EF \cdot ED \cdot EV \cdot CF_s) / (BW \cdot AT)$

The units of HIF are kg/kg-day for soil.

Inhalation Exposures

Inhalation exposures are evaluated in accordance with the inhalation dosimetry methodology presented in USEPA (2009). In accordance with this guidance, the human intake equation does not include an inhalation rate (m^3/day) or body weight because the amount of the chemical that reaches the target site is not a simple function of these factors. Instead, the interaction of the inhaled contaminant with the respiratory tract is affected by factors such as species-specific relationships of exposure concentrations to deposited/delivered doses and physiochemical characteristics of the inhaled contaminant (USEPA 2009). 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 (µg/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 (µg/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 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 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.

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, exposure was calculated as the TWA lifetime exposure for evaluating non-cancer and cancer risks.

3.4.2 Human 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 due to 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 RME, respectively.

Tables 3-6 to 3-8 list the CTE and RME exposure parameters and resultant HIF values used in this assessment for hypothetical future residential and worker populations. Most of the values are based on USEPA default guidelines. Other values were informed by Site information or professional judgment.

3.4.3 Exposure Areas

An exposure area (also referred to as an exposure unit) is an area throughout which a receptor moves about at random and encounters an environmental medium for the duration of the exposure (USEPA 2002). A receptor may be exposed to one or more environmental media within an exposure area.

Soil

For the purposes of this assessment, soil exposure units (EUs) were defined as geographic areas of an assumed size identified based on random grid assignment. OU2 was subdivided into 25 20-acre grids as shown in Figure 2-3. Each 20-acre area is assumed to represent the maximum area within which a hypothetical future resident or worker may be exposed at random over their entire exposure duration. In concept, this assumes that a receptor is expected to contact all locations within an individual grid equally over their exposure duration (i.e., 26 or 70 years). Thus, each 20-acre grid identified in Figure 2-3 represents an individual soil EU.

Groundwater

When groundwater is used for drinking water, exposure evaluation is often performed on a well-by-well basis. This is because wells in different areas and screened at different depths may draw water with differing levels of contamination. Table 3-9 summarizes the groundwater samples collected per well for which manganese concentrations were measured. As shown in the table, there are insufficient numbers of samples (1 or 2 samples) with data on manganese for some wells to support evaluation on an individual well basis. Figures 3-3 plots total manganese concentrations, respectively by well within OU2. As shown, the highest concentrations are found within wells NFMW6 and NFMW15 located within the middle of OU2. Manganese concentrations are lower at wells northwest and east/southeast of these two wells, but concentrations are variable without a clear spatial pattern. Thus, for the purposes of this assessment, the groundwater well data were grouped into three separate groundwater EUs as follows:

- EU1: NFMW13, NFMW5, NFMW14
- EU2: NFMW6, NFMW15
- EU3: NFMW16, NFMW17, NFMW18, MW7, MW4, MCSMW1, WFB1

3.4.4 Exposure Point Concentrations

Based on the assumption of random exposure over an exposure area, risk from a contaminant within an EU is related to the arithmetic mean concentration of that contaminant averaged over the entire EU.

Soil

As described above, surface soil data have been collected at this Site over the course of four years during three separate sampling events (2014, 2015 and 2017). Soil sampling conducted in 2014 and 2015 involved the collection of 5-point composites collected over a 1-square meter area (2014 sampling event) or over an area of 1 to 3-meter radius (2015 sampling event) following a biased sampling approach (sampling locations selected based on Site knowledge to identify areas of highest environmental concern). During the most recent sampling event in 2017, one 20-point composite sample was collected from those EUs where fewer than two 5-pt composites had previously been collected. The 20-point composite sample was comprised of 20 grab samples collected across the entire EU. This sampling approach is recommended by the USEPA because it is designed to provide a representative sample of the average concentration in the exposure unit (ITRC 2012).

Table 3-10 summarizes the soil samples collected per 20-acre grid. The surface soil data available for each 20-acre grid falls into one of the following categories:

a) One 20-point composite sample only
b) One 20-point composite plus one 5-point composite
c) One or more 5-point composites

As described in USEPA (1992), the USEPA recommends that a 95% upper confidence limit (95UCL) of the arithmetic mean at each exposure area be used as the exposure point concentration (EPC) when calculating exposure and risk at that location. This is because the true arithmetic mean concentration cannot be calculated with certainty from a limited number of measurements. However, OU2 soil data are available based on unequally weighted samples which limits characterization of the EPC using a 95UCL. The larger the number of grab samples used to create the composite sample, the lower the variability around the mean estimate. Additionally, the larger the area within the EU that a composite sample is based, the more representative of the mean exposure across the EU. A 20-point composite comprised of 20 grab samples collected across the whole of the EU provides a representative estimate of the mean. Whereas, a mean concentration derived based on a localized 5-point composite is more uncertain, and the variability around the mean could be much greater. Thus, for this assessment, the available data for each EU will be used to represent the best estimate of the mean for each of the data categories listed above, as described below.

Category a. For exposure areas where a single 20-point composite sample is available, this concentration will be used as the EPC, since this is the only data point available.

Category b. For exposure areas in Category b, the EPC will be based on weighting the data by the number of grab samples collected. For example, if for a given contaminant, the concentration in a 5-point composite sample collected from an exposure area was 5 mg/kg and the concentration in a 20-point composite sample was 3 mg/kg, the EPC would be calculated as follows:

(5 mg/kg * 5) + (3 mg/kg * 20) / (20 + 5) = 3.4 mg/kg

This approach effectively places more confidence in the value of the 20-point composite because this sample provides an unbiased estimate of the mean concentration over the entire exposure area, while the 5-point composite samples represent only a small area of the exposure unit and may tend to be biased high given that they were collected at locations assumed to be of greatest potential contamination.

Category c. For exposure areas where two or more 5-point composite samples are available and there is no 20-point composite, the average concentration will be used as the EPC. If the 5-point composites were unbiased, use of the maximum value would normally be preferred to help ensure that the EPC does not underestimate the true mean. However, since all of the 5-point composites are likely to be biased high, a simple average of the values is likely to be adequately conservative, and use of the maximum value would likely result in a substantial overestimate of the true mean.

Grab samples were also collected from boreholes at depth in the subsurface. For evaluating exposures to hypothetical future construction workers, data for both surface and subsurface data were combined into a single dataset. The same approach outlined above was followed for calculating grid-specific EPCs, except a grid-specific weighted concentration accounted for an additional sample result based on the average across subsurface samples if available.

<u>Airborne Dust from Construction Activities</u>

No Site-specific data are available on particulate levels in air generated during mechanical disturbances with construction equipment. In the absence of measured values, the concentration of contaminants in air that would occur during hypothetical future construction activities was estimated using the following equation:

C(air) = C(soil) / PEF

where:

C(air) = concentration of contaminant in air (mg/m^3)
C(soil) = concentration of contaminant in soil (mg/kg)
PEF = particulate emission factor (m^3 of air per kg of soil) for a construction scenario

The PEF assumed for evaluating exposures related to construction activities is assumed to be 4.4E+08 m^3/kg. This value is consistent with the recommendation in USEPA (2002) that accounts for the mass of dust emitted by traffic on unpaved roads during construction activities and the mass of dust emitted by wind erosion. Because inhalation toxicity values are based on an assumed continuous exposure over a specified exposure duration, when exposure is less than continuous, the value of EC used to quantify risk is calculated from C(air) as follows:

EC (non-cancer effects) = C(air) · ET/24 · EF/365
EC (cancer effects) = C(air) · ET/24 · EF/365 · ED/70

where:

ET = exposure time (hrs/day)
EF = exposure frequency (days/yr)
ED = exposure duration (years)

Groundwater

The mathematical approach that is most appropriate for computing the 95UCL of a data set 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 (USEPA 2002). Because of the complexity of this process, the USEPA Technical Support Center has developed a software application called ProUCL v5.0 (USEPA 2013) to assist in the estimation of 95UCL values. ProUCL calculates 95UCLs for a data set using several different strategies and recommends which 95UCL is considered preferable based on the properties of the data set.

As noted above, wells in OU2 were grouped into three exposure units, based on the levels of manganese measured in the wells. All measured values from each well in each exposure unit were provided to ProUCL for evaluation. In the case of EU2, the recommended 95UCL based on the Student's t-test was higher than the maximum detected concentration. Thus, for EU2, the EPC was based on the maximum detected concentration. For EU1 and EU3, the EPC was based on the 95UCLs recommended by ProUCL.

3.4.5 Relative Bioavailability of Dioxins in Soil

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 site media compared to the amount of absorption that occurred in the toxicity studies used to derive the toxicity factors. This ratio (amount absorbed from site media compared to the amount absorbed in toxicity tests) is referred to as Relative Bioavailability (RBA).

The oral RBA value for dioxins in soil is assumed to be 100% in accordance with USEPA (USEPA 2010b). This is considered to be a conservative assumption, because reports summarized by USEPA (2010b) indicate that absorption of dioxins from soils through the gastrointestinal tract is usually less than 50%.

4.0 TOXICITY ASSESSMENT

4.1 Toxicity Overview

The basic objective of a toxicity assessment is to identify what adverse health effects a chemical may cause, 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 (subchronic, chronic, or lifetime). 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. The relationship between the dose of the chemical administered or received and the incidence of adverse health effects in the exposed population forms the basis for a quantitative dose-response relationship. Toxicity values (e.g, reference doses and slope factors) are derived based on such dose-response relationships.

4.1.1 Non-cancer Effects

Essentially all chemicals can cause adverse health effects if given at a high enough dose. However, when the dose is sufficiently low, typically adverse non-cancer effects are not 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 (health 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 or Reference Concentration (RfC) 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 a NOAEL (or a LOAEL if a reliable NOAEL is not available) by dividing by an "uncertainty factor". If the data are from studies in humans, and if the observations are considered to be very reliable, the uncertainty factor may be as small as 1.0. However, the uncertainty factor is normally at least 10, and can be much higher if the data are limited. The effect of dividing the NOAEL or the LOAEL by an uncertainty factor 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 an RfD and RfC values, and doses equal to or less than the RfD or RfC are nearly certain to be without any risk of adverse effect. Doses higher than the RfD or RfC may carry some risk, but because of the margin of safety, a dose above the RfD or RfC does not mean that an effect will necessarily occur.

4.1.2 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 the EPA using the system summarized below:

WOE	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

More recently, USEPA has developed a revised classification system for characterizing the weight of evidence for carcinogens (USEPA 2005). 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, 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 un-measurable) slope at low dose. In order to account for the uncertainty in this extrapolation process, USEPA typically chooses to employ the upper 95th upper confidence limit of the slope as the SF. That is, there is a 95 percent 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 as well as non-cancer risk estimates.

For inhalation exposures, cancer risk is characterized by an inhalation Unit Risk (UR) 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 $\mu g/m^3$ in air.

4.2 Human Toxicity Values

In 2003, USEPA's Superfund program revised its hierarchy of human health toxicity values into the following three-tiered approach (USEPA 2003):

1. USEPA's Integrated Risk Information System (IRIS)[5].

2. The Provisional Peer Reviewed Toxicity Values (PPRTVs) derived by USEPA's Superfund Health Risk Technical Support Center (STSC)[6].

3. Other toxicity values including additional USEPA and non-USEPA sources of toxicity information. 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.

Table 4-1 presents the toxicity values used for evaluating human health risks from COPCs at the OU2 Site. The basis of these toxicity values is discussed in further detail below.

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[5] https://www.epa.gov/iris
[6] https://hhpprtv.ornl.gov/

Dioxin

In February 2012, USEPA released an IRIS RfD for TCDD of 0.7 pg/kg-day (7E-10 mg/kg-day). This value is based on two epidemiological studies reporting reproductive effects in populations exposed to TCDD from an industrial accident. This RfD was derived based on an adjusted LOAEL of 20 pg/kg-day and an uncertainty factor of 30 (10 for extrapolation from a LOAEL to a NOAEL and 3 for human-to-human variability). No Tier 1 cancer toxicity criteria are available for TCDD. Currently, the USEPA recommends evaluating human health risks from exposures to dioxins using the IRIS RfD (USEPA 2017b). USEPA considers the RfD to be protective of both non-cancer and cancer effects and anticipates that dioxin cleanup levels based on the RfD to be within the cancer risk range.

There is no USEPA IRIS RfC or IRIS UR for TCDD. The USEPA RSL Tables (USEPA 2017a) provide dioxin soil screening levels for the inhalation pathway based on the California EPA RfC and UR values. However, inhalation risk based on particulate emissions from soil, estimated using the California EPA RfC value, shows that the contribution of the inhalation pathway compared to the ingestion pathway is well below 1% (USEPA 2013b).

PCBs

In October 1994, USEPA published an IRIS RfD for Aroclor-1254 of 2E-5 mg/kg-day. This value is based on immune, dermal and ocular effects observed in a series of monkey studies. This RfD was derived based on a LOAEL of 0.005 mg/kg-day and an uncertainty factor of 300. PCBs are classified as probably human carcinogens under IRIS. The cancer potency of PCB mixtures is assessed using the IRIS SF of 2 $(mg/kg\text{-}day)^{-1}$ for high risk PCBs. This value was used to calculate a high-risk inhalation UR of 5.7E-04 $(\mu g/m^3)^{-1}$by dividing by body weight over inhalation rate (70 kg / 20 m3), and applying a conversion factor of 1,000 µg/mg.

Manganese

Two oral RfD values are available for manganese (food, nonfood). The IRIS RfD (1.4E-01 mg/kg-day) includes manganese from all sources, including diet (USEPA 1995). This RfD is derived to be protective against central nervous system effects in humans following oral exposure, and is based on the upper range of total dietary intake (10 mg/day) as recommended in the 1989 Food and Nutrition Board National Research Council report. USEPA (1995) notes that intakes above the RfD derived from the upper range of total dietary intake are not necessarily associated with toxicity. IRIS recommends using a modifying factor of 3 when calculating risks associated with non-food sources due to a number of uncertainties, leading to an RfD of 4.7E-02 mg/kg-day. This RfD based on non-food sources was used in this assessment for groundwater.

5.0 RISK CHARACTERIZATION

As outlined above, dioxins/furans/DL-PCBs, non-DL PCBs, Aroclor-1254, and manganese are the COPCs at the OU2 Site. As noted in the toxicity assessment, human health risks evaluated in this assessment are those associated with non-cancer effects caused by exposures to TEQ and Aroclor-1254 in soil, and by exposures to manganese in groundwater. Human health risks associated with cancer effects evaluated in this assessment are those caused by exposures to PCBs (non-DL PCBs and Aroclor-1254).

Non-cancer Effects

The potential for non-cancer effects is evaluated by comparing the estimated exposure concentration for a receptor over a specified time period to a reference threshold that represents the exposure below which it is unlikely for even sensitive populations to experience adverse health effects (USEPA 1989). This ratio of exposure to toxicity is called a Hazard Quotient (HQ). When a receptor is exposed to a COPC by more than one route, or is exposed to more than one COPC, these values may be summed to yield a hazard Index (HI). If the HQ or HI value is equal to or less than one, it is believed that there is no appreciable risk that non-cancer health effects will occur. If an HQ or HI exceeds one, there is some possibility that non-cancer effects may occur, although an HQ or HI above one does not indicate an effect will definitely occur. This is because of the margin of safety inherent in the derivation of all toxicity values (see Section 4). However, the larger the HQ or HI value, the more likely it is that an adverse effect may occur.

Ingestion Exposures

For most chemicals, the potential for non-cancer effects 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 (USEPA 1989):

$$HQ = DI / RfD$$

where:

DI	=	Daily Intake (mg/kg-day)
RfD	=	Reference Dose (mg/kg-day)

Dermal Exposures

For most chemicals, the potential for non-cancer effects following dermal exposure is evaluated by comparing the estimated absorbed dose of the chemical over a specific time period with the absorbed RfD for that chemical derived for a similar exposure period, as follows (USEPA 1989):

$$HQ = DAD / RfD_{ABS}$$

where:

DAD =	Dermal absorbed dose (mg/kg-day)
RfD_{ABS}=	Absorbed Reference Dose (mg/kg-day)
	$RfD_{ABS} = RfD \cdot ABS_{GI}$

The ABS_{GI} term is unitless, chemical-specific and is applied to the available oral toxicity value to account for the absorption efficiency of an administered dose across the gastrointestinal tract and into the bloodstream. For TCDD, this value is assumed to equal 1.

Inhalation Exposures

As per the CSM (Figure 3-1), inhalation exposures were only evaluated for hypothetical future construction workers exposed to soils down to a depth of 10 feet during construction activities. As described above, there is no RfC available for evaluating non-cancer effects from inhalation exposures to PCBs. For TEQ, there is no Tier I RfC available, and exposures to dioxins in soils via the inhalation pathway are considered minor by comparison to the ingestion pathway (USEPA 2013b). Thus, non-cancer hazards associated with inhalation exposures of soil particulates by construction workers were not quantified.

<u>Cancer Effects</u>

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, the USEPA 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 desirable[7]. Excess cancer risks that range between 1E-04 and 1E-06 are generally considered to be within USEPA health guidelines (USEPA 1991b), although this is evaluated on a case by case basis, and USEPA may determine that risks lower than 1E-04 are not sufficiently protective and warrant remedial action. Furthermore, the MDEQ allowable cancer risk level is 1E-05, which will be considered as part of the risk management decisions associated with this Site. Cancer risks for each chemical are calculated as described below.

Ingestion Exposures

The excess risk of cancer from ingestion exposure to a chemical is calculated as follows (USEPA 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 $(\text{mg/kg-day})^{-1}$

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

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

Dermal Exposures

The excess risk of cancer from dermal exposure to a chemical is calculated as follows (USEPA 2004):

$$\text{Excess Cancer Risk} = DAD_L \cdot SF_{ABS}$$

where:

DAD_L = Dermal Absorbed Dose, averaged over a lifetime (mg/kg-day)

[7] Note that 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 10,000or 10^{-4}. For the purposes of this document, all cancer risks are presented in a scientific notation format (*i.e.,* 1E-06).

SF_{ABS} = Absorbed Slope Factor $(mg/kg\text{-}day)^{-1}$
$SF_{ABS} = SF / ABS_{GI}$

Inhalation Exposures

The excess risk of cancer from inhalation exposure is calculated based on inhalation UR values, as follows (USEPA 2009):

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

where:

EC = Exposure Concentration ($\mu g/m^3$)
UR = Unit Risk $(\mu g/m^3)^{-1}$

5.1 Risks from Exposures to COPCs in OU2 Soils

Detailed calculations of exposure and risk are presented in Appendix D. Risk estimates associated with exposures to COPCs in OU2 soils are summarized in Tables 5-1 to 5-3. Non-cancer hazards that exceed the USEPA guidelines of HQ ≤1E+00 and cancer risk ≤ 1E-04 are shaded. Inspection of Tables 5-1, 5-2 and 5-3 reveals the following main conclusions.

Residents

- Non-cancer hazards and cancer risks to hypothetical future residents within OU2 from ingestion and dermal contact with soil appear to be within usual USEPA guidelines.

Workers

- Non-cancer hazards and cancer risks to hypothetical future commercial/industrial workers and hypothetical future construction workers within OU2 from ingestion and dermal contact with soil appear to be within usual USEPA guidelines.

Non-cancer hazards and cancer risks were calculated to be within or below the USEPA guidelines (HQ ≤1E+00 and cancer risk ≤ 1E-04) in all grid exposure units across OU2 for all receptors regardless of how PCBs were quantified (Aroclors versus PCB congeners).

5.2 Risks from Exposures to Manganese in OU2 Groundwater Wells

Detailed calculations of exposure and risk are presented in Appendix D. Risk estimates associated with exposures to manganese in groundwater wells within OU2 are summarized in Table 5-4. Non-cancer hazards that exceed the USEPA guideline of HQ ≤1E+00 are shaded. Inspection of Table 5-4 reveals the following main conclusions.

Residents

- The non-cancer hazard to hypothetical future residents within OU2 from ingestion of manganese in groundwater within EU2 (NFMW6 and NFMW15) is above USEPA's level of concern for a RME receptor. Non-cancer hazards appear to be within usual USEPA guidelines for groundwater for the CTE receptor within EU2, and for both the CTE and RME receptors within the other EUs.

Workers

- Non-cancer hazards to hypothetical future workers within OU2 from ingestion of manganese in groundwater appear to be within usual USEPA guidelines.

To further support risk management decisions, Figure 5-1 presents a map of non-cancer HQs for manganese in individual OU2 groundwater wells. These HQs are calculated based on exposure by an RME resident assuming the max detected total manganese concentration as the EPC in each well, and likely overestimate actual risk. As seen, HQ values exceed 1E+00 in 2 wells. These calculations are included in Appendix D.

5.3 Risks from Exposures to Soil and Groundwater

Non-cancer hazards associated with exposures to COPCs in OU2 surface soil and manganese in groundwater wells within OU2 are summarized in Table 5-5. As shown, the additional exposure to hypothetical future residents or workers from incidental ingestion of and dermal contact with surface soil does not appreciably increase the total risk when combined with exposure to manganese in groundwater.

6.0 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 main sources of uncertainty in the exposure assessment and risk characterization presented in this assessment include uncertainties from exposure pathways not evaluated, as well as uncertainties in the exposure parameters and toxicity values used to derive screening levels as described in further detail below.

6.1 Uncertainties in Exposure Assessment

Uncertainties in Exposure Pathways Not Evaluated

Omission of exposure pathways believed to be minor compared to one or more other pathways that were evaluated may result in a small underestimation of exposure and risk, but the magnitude of this underestimation is not expected to be significant.

Uncertainties from Chemicals Not Evaluated

As discussed above, quantitative risk estimates are derived only for COPCs. Contaminants that were measured in Site samples but excluded as a COPC may contribute a small amount of added risk, but the contribution is expected to be so small that this is not a source of significant uncertainty. The same is expected of contaminants that could not be evaluated as COPCs due to the lack of a risk-based screening level (no toxicity value), or contaminants qualified as not detected but whose MDL is greater than the available RBC. Although these contaminants are flagged as sources of uncertainty in the COPC screens, their relative contribution to the total risk is expected to be minor.

There are three groundwater wells within OU2 with no data on total manganese (MW4, MW7 and WFB1). As such, exposures and risks associated with these wells were not included in the quantitative evaluation presented above. However, measures of dissolved manganese in these wells indicate that concentrations are low (ranging from 1 to 2.8 μg/L), well below the screening

RBC of 43 µg/L (HQ=0.1), indicating that non-cancer hazards associated with manganese concentrations in these wells are below a level of concern.

In addition, due to the nature of past sampling at the Site, there are more data on dissolved inorganic concentrations than there are data on total recoverable inorganic concentrations (i.e., groundwater samples collected in 2015 and 2016 were analyzed for dissolved inorganic concentrations, but not for total inorganic concentrations). For some inorganics, the maximum detected concentration observed in groundwater within OU2 based on the dissolved fraction in a sample that was not analyzed for the total recoverable fraction is higher than the maximum detected concentration based on the total recoverable fraction used in the COPC screen. On this basis, the uncertainty associated with the lack of total recoverable data for these samples is evaluated using the available dissolved concentrations. If the COPC screen and subsequent risk calculations presented in Sections 3 and 5 are reconstructed based on using the groundwater data for the dissolved inorganic concentrations, the same general conclusions are obtained. The exception is that dissolved cobalt concentrations in OU2 groundwater were found to be significantly elevated above dissolved cobalt concentrations in the background wells. However, HQ values for hypothetical future residents exposed to cobalt are all below 1E+00. The HIs based on dissolved manganese and dissolved cobalt are 2E+00 in EU2, and below 1E+00 in EUs 1 and 3, consistent with the overall conclusions presented in Section 5.

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, the USEPA (1989, 1992) recommends that the exposure estimate be based on the 95UCL. The groundwater EPCs were based on 95UCLs where appropriate. 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.

95UCL values were not calculated for soil due to the mix of sample types and limited sample sizes. In cases where a 20-point composite was collected over the entire exposure area, variability around the mean is characterized better than within a 5-point composite. Without additional data it is uncertain if the use of a single 20-point composite may overestimate or underestimate the true mean. In cases where additional data from localized samples (5-point composites collected over a small area, or grab samples) collected through biased sampling at areas identified as being of environmental concern, the weighted EPC is likely biased slightly high.

Uncertainties in Human Exposure Parameters

Accurate calculation of exposures 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. 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 thought to be more likely to overestimate than underestimate actual exposure and risk.

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. Currently available information suggests that RBA of dioxin in soils can be expected to be less than 100%, but available estimates of soil dioxin RBA are not adequate to derive an alternative to assuming an RBA of 1.0. Use of this default assumption is likely to overestimate the true risk with the magnitude of the error depending on the true RBA value.

6.2 Uncertainties in Toxicity Assessment

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., oral SF, RfD, RfC, inhalation UR). 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 USEPA uses in dealing with these uncertainties, it is much more likely that the uncertainty will result in an overestimation rather than an underestimation of risk.

For manganese, toxicity data in humans generally agree that occupational exposures to manganese dust in the air results in central nervous system pathology. However, data on the neurotoxicity of orally ingested manganese at relatively low doses are less consistent, albeit suggestive. Additionally, many variables including environmental factors and biological factors can influence manganese absorption. The IRIS oral RfD for manganese in water is particularly uncertain as it is based on an upper dietary intake rate of 10 mg/day, instead of quantitative information to indicate toxic levels of manganese in the diet of humans. A modifying factor of 3 is applied for evaluating exposures from drinking water adding to the conservativeness of the overall non-diet RfD. Because of the conservativeness of the oral RfD for manganese, it is likely that uncertainty associated with this toxicity value will result in an overestimation rather than an underestimation of risk.

6.3 Uncertainties in Risk Characterization

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.

For non-carcinogens, summing HQ values across different COPCs is properly applied only to compounds that induce the same effect by the same mechanism of action. Consequently, summation of HQ values for COPCs 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 of the HI values in this report, are likely to overestimate the true level of human health non-cancer hazard.

Non-cancer hazards associated with manganese exposures in groundwater are not associated with similar hazards from exposures to Site soils. As described above, releases of Site-related contaminants are expected to have occurred primarily by deposition into surface soils, but levels of manganese in OU2 surface soils do not appear to be elevated above background.

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TABLES

Table 2-1. Smurfit-Stone/Frenchtown Mill OU2 Data Summary

Media	Sample Date	Sample Description	Analysis
Surface Soil	April 2014	Surface (0-2.4 inches) soil sample (5-point composite) was collected from 1 location (n=1).	Aroclors, TAL metals, dioxins and furans.
	November/ December 2015	Surface soil samples (5-point composites) were collected from 0-2 inch and 1-2 inch depth intervals at 25 locations (n=25).	Aroclors (n=5), TAL metals (n=21), PAHs (n=19), VOCs (n=2), dioxins and furans (n=19).
	August 2016	Surface (0-12 inches) soil samples (5-point composites) were collected from 7 HDPT or TSB locations (n=7).	Aroclors
	October 2017	20-point composite surface (0-6 inches) soil samples were collected from 9 grids (n=9).	Aroclors, PCB congeners, dioxins and furans, TAL metals, and TOC.
Subsurface Soil	November/ December 2015	Subsurface soil samples were collected from various depth intervals between 0 and 10 feet at 5 HDPT or TSB locations (n=40).	Aroclors (n=30), TAL metals (n=40), SVOCs (n=20), VOCs (n=40), dioxins and furans (n=11).
	August 2016	Subsurface (0-12 inches) soil samples were collected from 7 HDPT or TSB locations (n=7).	Aroclors
	October 2017	Subsurface (24-30 inches) soil samples were collected from 10 grids (n=10).	Aroclors, PCB congeners, dioxins and furans, TAL metals, and TOC.
Groundwater	April 2014	Three wells sampled (n=3).	Aroclors, total and dissolved TAL metals, dioxins and furans.
	December 2015	Eleven wells sampled (n=11). Two of the wells sampled in 2014 were also sampled during this event.	Aroclors, total and dissolved TAL metals, dioxins and furans, SVOCs, and VOCs.
	June 2016	Five wells sampled (n=5). All of the wells were previoulsy sampled in 2015.	Aroclors (n=4), dissolved TAL metals (n=5), dioxins and furans (n=4).
	July 2017	Eight wells sampled (n=8). All of the wells were previously sampled at least once before from 2014-2016.	Aroclors (n=4), total and dissolved TAL metals (n=8), dioxins and furans (n=7), SVOCs (n=4), and VOCs (n=4).

HDPT = High Density Pulp Tank; TSB = Transformer Storage Building; TAL = Total Analyte List; PAH = Polyaromatic Hydrocarbons;
VOC = Volatile Organic Compounds; SVOC = Semi-volatile Organic Compounds; PCB = Polychlorinated Biphenyls

Table 2-2. OU2 Surface Soil (0-6 inches) Summary Statistics[a]

Analysis	Contaminant	N	N Detect	Detection Frequency (%)	Average Concentration[b]	Standard Deviation[b]	Maximum Detected Concentration	Average MDL
TEQ	TEQ - Dioxins/Furans (ND=0)	31	31	100	5.11E-06	6.39E-06	2.53E-05	--
	TEQ - Dioxins/Furans (ND=1/2RL)	31	31	100	5.31E-06	6.27E-06	2.53E-05	--
	TEQ - Dioxins/Furans (ND=1/2MDL)	31	31	100	5.13E-06	6.38E-06	2.53E-05	--
	TEQ - Dioxins/Furans/DL-PCBs (ND=0)	9	9	100	1.74E-05	1.41E-05	4.20E-05	--
	TEQ - Dioxins/Furans/DL-PCBs (ND=1/2MDL)	9	9	100	1.74E-05	1.41E-05	4.20E-05	--
	TEQ - DL-PCBs (ND=0)	9	9	100	7.05E-06	1.03E-05	3.33E-05	--
	TEQ - DL-PCBs (ND=1/2MDL)	9	9	100	7.06E-06	1.03E-05	3.33E-05	--
PCBs	Total PCBs - non-DL (ND=1/2MDL)	9	9	100	1.74E-01	3.18E-01	1.01E+00	--
	Total PCBs - DL (ND=1/2MDL)	9	9	100	1.92E-02	3.73E-02	1.17E-01	--
	Aroclor-1016	16	0	0	4.58E-03	1.56E-03	--	9.15E-03
	Aroclor-1221	16	0	0	5.46E-03	1.36E-03	--	1.09E-02
	Aroclor-1232	16	0	0	5.49E-03	1.31E-03	--	1.10E-02
	Aroclor-1242	16	0	0	6.19E-03	1.56E-03	--	1.24E-02
	Aroclor-1248	16	0	0	5.39E-03	3.32E-04	--	1.08E-02
	Aroclor-1254	16	7	44	4.96E-02	1.05E-01	4.13E-01	8.51E-03
	Aroclor-1260	16	3	19	2.11E-02	4.21E-02	1.54E-01	7.32E-03
	Aroclor-1262	16	0	0	5.08E-03	1.43E-03	0.00E+00	1.02E-02
	Aroclor-1268	16	0	0	3.21E-03	7.59E-04	0.00E+00	6.42E-03
Total Metals	Aluminum	33	33	100	1.12E+04	6.11E+03	2.84E+04	5.32E+00
	Antimony	12	8	67	2.13E-01	1.21E-01	3.60E-01	1.67E-01
	Arsenic	33	33	100	4.21E+00	1.78E+00	1.14E+01	1.66E-01
	Barium	33	33	100	2.43E+02	1.75E+02	1.08E+03	1.21E-01
	Beryllium	12	12	100	5.58E-01	2.96E-01	1.20E+00	7.69E-02
	Cadmium	33	33	100	3.96E-01	5.95E-01	3.50E+00	3.23E-02
	Calcium	12	12	100	7.69E+03	5.35E+03	2.17E+04	2.55E+01
	Chromium	33	33	100	1.30E+01	6.61E+00	3.95E+01	1.87E-01
	Cobalt	33	33	100	4.94E+00	1.47E+00	8.00E+00	2.30E-01
	Copper	33	33	100	2.92E+01	2.32E+01	1.13E+02	3.34E-01
	Iron	33	33	100	1.37E+04	5.87E+03	3.73E+04	2.76E+01
	Lead	33	33	100	1.27E+01	7.44E+00	3.88E+01	4.39E-02
	Magnesium	12	12	100	5.27E+03	1.38E+03	8.13E+03	7.00E+00
	Manganese	33	33	100	4.79E+02	5.11E+02	3.04E+03	2.50E-01
	Mercury	33	31	94	3.43E-02	5.36E-02	3.10E-01	8.65E-03
	Nickel	33	33	100	1.10E+01	6.61E+00	4.25E+01	1.71E-01
	Potassium	12	12	100	2.37E+03	1.01E+03	4.14E+03	3.25E+01
	Selenium	12	12	100	1.26E+00	5.77E-01	2.10E+00	2.78E-01
	Silver	33	6	18	1.20E-01	1.27E-01	7.40E-01	1.54E-01
	Sodium	12	12	100	1.72E+02	1.53E+02	5.59E+02	2.03E+01
	Thallium	33	33	100	1.25E-01	8.55E-02	5.50E-01	4.31E-02
	Vanadium	33	33	100	1.32E+01	4.26E+00	2.62E+01	3.35E-01
	Zinc	33	33	100	1.10E+02	1.03E+02	4.46E+02	1.46E+00
Semivolatiles	Acenaphthene	21	1	5	4.64E-04	9.63E-04	6.30E-04	8.89E-04
	Acenaphthylene	21	1	5	4.96E-04	9.65E-04	2.00E-03	8.34E-04
	Anthracene	21	4	19	9.61E-04	1.96E-03	8.00E-03	7.56E-04
	Benzo(a)anthracene	21	4	19	1.43E-03	3.65E-03	1.56E-02	4.51E-04
	Benzo(a)pyrene	21	6	29	3.07E-03	7.94E-03	3.60E-02	4.88E-04
	Benzo(b)fluoranthene	21	9	43	6.09E-03	9.20E-03	3.38E-02	8.60E-04
	Benzo(g,h,i)perylene	21	5	24	2.30E-03	4.68E-03	1.93E-02	8.71E-04
	Benzo(k)fluoranthene	21	6	29	1.89E-03	3.20E-03	1.20E-02	9.87E-04
	Chrysene	21	7	33	5.12E-03	7.97E-03	2.42E-02	6.04E-04
	Dibenzo(a,h)anthracene	21	2	10	1.11E-03	2.22E-03	8.70E-03	1.05E-03
	Fluoranthene	21	9	43	5.20E-03	7.75E-03	3.07E-02	5.38E-04
	Fluorene	21	0	0	3.79E-04	8.19E-04	--	7.59E-04
	Indeno(1,2,3-cd)pyrene	21	5	24	1.82E-03	2.90E-03	1.04E-02	9.47E-04
	Naphthalene	21	2	10	8.27E-03	2.35E-02	5.40E-03	1.59E-02
	Phenanthrene	21	2	10	8.96E-04	1.94E-03	7.00E-03	6.11E-04
	Pyrene	21	9	43	4.18E-03	6.34E-03	2.59E-02	5.92E-04
Volatile Organics	1,1,1,2-Tetrachloroethane	3	0	0	8.78E-03	2.93E-03	--	1.76E-02
	1,1,1-Trichloroethane	3	0	0	8.90E-03	2.94E-03	--	1.78E-02
	1,1,2,2-Tetrachloroethane	3	0	0	8.75E-03	2.90E-03	--	1.75E-02
	1,1,2-Trichloroethane	3	0	0	1.25E-02	4.17E-03	--	2.50E-02
	1,1-Dichloroethane	3	0	0	8.75E-03	2.90E-03	--	1.75E-02
	1,1-Dichloroethene	3	0	0	1.04E-02	3.48E-03	--	2.08E-02

Table 2-2. OU2 Surface Soil (0-6 inches) Summary Statistics[a]

Analysis	Contaminant	N	N Detect	Detection Frequency (%)	Average Concentration[b]	Standard Deviation[b]	Maximum Detected Concentration	Average MDL
Volatile Organics	1,1-Dichloropropene	3	0	0	9.15E-03	3.03E-03	--	1.83E-02
	1,2,3-Trichlorobenzene	3	0	0	1.78E-02	5.89E-03	--	3.55E-02
	1,2,3-Trichloropropane	3	0	0	1.26E-02	4.20E-03	--	2.52E-02
	1,2,4-Trichlorobenzene	3	0	0	8.33E-03	2.76E-03	--	1.67E-02
	1,2,4-Trimethylbenzene	3	2	67	4.16E-02	3.11E-02	5.96E-02	1.83E-02
	1,2-Dibromo-3-chloropropane	3	0	0	3.54E-02	1.18E-02	--	7.08E-02
	1,2-Dibromoethane	3	0	0	7.35E-03	2.42E-03	--	1.47E-02
	1,2-Dichlorobenzene	3	0	0	1.11E-02	3.70E-03	--	2.21E-02
	1,2-Dichloroethane	3	0	0	1.02E-02	3.41E-03	--	2.05E-02
	1,2-Dichloropropane	3	0	0	9.33E-03	3.10E-03	--	1.87E-02
	1,3,5-Trimethylbenzene	3	0	0	8.85E-03	2.94E-03	--	1.77E-02
	1,3-Dichlorobenzene	3	0	0	1.12E-02	3.72E-03	--	2.23E-02
	1,3-Dichloropropane	3	0	0	7.15E-03	2.38E-03	--	1.43E-02
	1,4-Dichlorobenzene	3	0	0	9.68E-03	3.23E-03	--	1.94E-02
	2,2-Dichloropropane	3	0	0	1.85E-02	6.12E-03	--	3.69E-02
	Acetone	3	1	33	6.43E-01	6.90E-01	1.44E+00	4.10E-01
	Allyl chloride	3	0	0	1.12E-02	3.72E-03	--	2.23E-02
	Benzene	3	0	0	6.40E-03	2.12E-03	--	1.28E-02
	Bromobenzene	3	0	0	1.11E-02	3.70E-03	--	2.21E-02
	Bromochloromethane	3	0	0	8.75E-03	2.90E-03	--	1.75E-02
	Bromoform	3	0	0	1.09E-02	3.62E-03	--	2.18E-02
	Bromomethane	3	0	0	8.03E-02	2.67E-02	--	1.61E-01
	Carbon tetrachloride	3	0	0	1.11E-02	3.70E-03	--	2.21E-02
	Chlorobenzene	3	0	0	7.42E-03	2.48E-03	--	1.48E-02
	Chloroethane	3	0	0	2.19E-02	7.27E-03	--	4.37E-02
	Chloroform	3	0	0	7.65E-03	2.55E-03	--	1.53E-02
	Chloromethane	3	0	0	9.25E-03	3.07E-03	--	1.85E-02
	cis-1,2-Dichloroethylene	3	0	0	1.63E-02	5.40E-03	--	3.26E-02
	cis-1,3-Dichloropropylene	3	0	0	4.75E-03	1.60E-03	--	9.50E-03
	Cumene	3	0	0	8.30E-03	2.77E-03	--	1.66E-02
	Dibromochloromethane	3	0	0	7.07E-03	2.35E-03	--	1.41E-02
	Dichlorobromomethane	3	0	0	8.15E-03	2.73E-03	--	1.63E-02
	Dichlorodifluoromethane	3	0	0	1.13E-02	3.72E-03	--	2.25E-02
	Dichlorofluoromethane	3	0	0	4.30E-02	1.43E-02	--	8.59E-02
	Ethyl ether	3	0	0	1.49E-02	4.95E-03	--	2.98E-02
	Ethylbenzene	3	0	0	6.83E-03	2.28E-03	--	1.37E-02
	Hexachlorobutadiene	3	0	0	1.95E-02	6.48E-03	--	3.90E-02
	Methyl ethyl ketone	3	0	0	7.58E-02	2.51E-02	--	1.52E-01
	Methyl isobutyl ketone	3	0	0	5.81E-02	1.93E-02	--	1.16E-01
	Methylene bromide	3	0	0	1.08E-02	3.58E-03	--	2.16E-02
	Methylene chloride	3	1	33	1.20E-01	1.79E-01	3.27E-01	2.73E-02
	MTBE (Methyl tert-butyl ether)	3	0	0	8.58E-03	2.84E-03	--	1.72E-02
	Naphthalene	1	0	0	4.06E-02	--	--	8.12E-02
	n-Butyl benzene	3	0	0	8.60E-03	2.86E-03	--	1.72E-02
	n-Propyl benzene	3	0	0	9.80E-03	3.25E-03	--	1.96E-02
	o-Chlorotoluene	3	0	0	9.42E-03	3.13E-03	--	1.88E-02
	p-Chlorotoluene	3	0	0	8.58E-03	2.84E-03	--	1.72E-02
	p-Isopropyltoluene	3	1	33	7.25E-03	3.94E-03	2.70E-03	1.30E-02
	sec-Butyl benzene	3	0	0	9.33E-03	3.10E-03	--	1.87E-02
	Styrene	3	0	0	7.25E-03	2.42E-03	--	1.45E-02
	tert-Butyl benzene	3	0	0	1.23E-02	4.07E-03	--	2.45E-02
	Tetrachloroethylene	3	0	0	9.42E-03	3.13E-03	--	1.88E-02
	Tetrahydrofuran	3	2	67	1.79E-01	1.16E-01	2.46E-01	1.45E-01
	Toluene	3	3	100	5.90E-04	1.13E-04	7.20E-04	5.27E-04
	trans-1,2-Dichloroethylene	3	0	0	7.50E-03	2.51E-03	--	1.50E-02
	trans-1,3-Dichloropropylene	3	0	0	1.78E-02	5.89E-03	--	3.55E-02
	Trichloroethylene	3	0	0	1.11E-02	3.70E-03	--	2.21E-02
	Trichlorofluoromethane	3	2	67	1.50E-01	1.13E-01	2.15E-01	6.33E-02
	Trichlorotrifluoroethane	3	0	0	1.08E-02	3.58E-03	--	2.16E-02
	Vinyl chloride	3	0	0	8.22E-03	2.74E-03	--	1.64E-02
	Xylenes (total)	3	0	0	2.74E-02	9.09E-03	--	5.47E-02

TEQ = toxicity equivalent; ND = non-detect; RL = reporting limit; MDL = method detection imit; DL = dioxin-like; PCB = polychlorinated biphenyl

[a]All concentrations reported in units of mg/kg.

[b]Non-detects evaluated at 1/2 the MDL when calculating average and standard deviation.

Table 2-3. OU2 Subsurface Soil (0-10 feet) Summary Statistics[a]

Analysis	Contaminant	N	N Detect	Detection Frequency (%)	Average Concentration[b]	Standard Deviation	Maximum Detected Concentration	Average MDL
TEQ	TEQ - Dioxins/Furans (ND=0)	21	21	100	8.42E-07	1.40E-06	5.52E-06	--
	TEQ - Dioxins/Furans (ND=1/2RL)	21	21	100	1.37E-06	1.60E-06	5.84E-06	--
	TEQ - Dioxins/Furans (ND=1/2MDL)	21	21	100	8.85E-07	1.39E-06	5.54E-06	--
	TEQ - Dioxins/Furans/DL-PCBs (ND=0)	10	10	100	1.08E-06	2.21E-06	6.37E-06	--
	TEQ - Dioxins/Furans/DL-PCBs (ND=1/2MDL)	10	10	100	1.15E-06	2.20E-06	6.42E-06	--
	TEQ - DL-PCBs (ND=0)	10	10	100	6.77E-07	1.43E-06	3.97E-06	--
	TEQ - DL-PCBs (ND=1/2MDL)	10	10	100	6.90E-07	1.42E-06	3.97E-06	--
PCBs	Total PCBs - non-DL (ND=1/2MDL)	10	10	100	2.13E-02	4.41E-02	1.10E-01	--
	Total PCBs - DL (ND=1/2MDL)	10	10	100	1.69E-03	4.19E-03	1.32E-02	--
	Aroclor-1016	35	0	0	3.86E-03	8.01E-04	--	7.72E-03
	Aroclor-1221	35	0	0	6.64E-03	1.38E-03	--	1.33E-02
	Aroclor-1232	35	0	0	4.73E-03	1.79E-03	--	9.46E-03
	Aroclor-1242	35	0	0	7.31E-03	1.95E-03	--	1.46E-02
	Aroclor-1248	35	0	0	5.44E-03	7.22E-04	--	1.09E-02
	Aroclor-1254	35	7	20	2.82E-02	7.01E-02	3.74E-01	6.75E-03
	Aroclor-1260	35	4	11	1.24E-02	3.21E-02	1.72E-01	5.51E-03
	Aroclor-1262	35	0	0	4.20E-03	1.68E-03	--	8.39E-03
	Aroclor-1268	35	0	0	2.67E-03	8.96E-04	--	5.34E-03
Total Metals	Aluminum	35	35	100	9.38E+03	6.37E+03	2.41E+04	4.26E+00
	Antimony	12	2	17	1.13E-01	6.24E-02	2.60E-01	1.80E-01
	Arsenic	35	35	100	3.02E+00	1.15E+00	6.40E+00	1.55E-01
	Barium	35	35	100	1.55E+02	1.15E+02	5.64E+02	9.85E-02
	Beryllium	12	12	100	6.78E-01	3.74E-01	1.20E+00	7.82E-02
	Cadmium	35	33	94	9.00E-02	5.81E-02	2.60E-01	2.90E-02
	Calcium	12	12	100	8.25E+03	1.36E+04	5.10E+04	3.20E+01
	Chromium	35	35	100	9.68E+00	3.95E+00	1.87E+01	1.80E-01
	Cobalt	35	35	100	4.26E+00	2.02E+00	9.60E+00	1.98E-01
	Copper	35	35	100	1.62E+01	7.78E+00	3.22E+01	2.89E-01
	Iron	35	35	100	1.14E+04	5.18E+03	2.24E+04	2.42E+01
	Lead	35	35	100	7.49E+00	3.33E+00	1.53E+01	4.00E-02
	Magnesium	12	12	100	6.03E+03	3.05E+03	1.40E+04	6.37E+00
	Manganese	35	35	100	2.37E+02	1.28E+02	5.58E+02	2.01E-01
	Mercury	35	21	60	1.58E-02	1.91E-02	1.00E-01	8.03E-03
	Nickel	35	35	100	8.42E+00	3.57E+00	1.74E+01	1.54E-01
	Potassium	12	12	100	2.15E+03	9.05E+02	3.66E+03	2.81E+01
	Selenium	12	3	25	1.79E-01	6.65E-02	3.20E-01	2.82E-01
	Silver	35	1	3	7.12E-02	2.61E-02	1.50E-01	1.37E-01
	Sodium	12	12	100	2.38E+02	1.70E+02	5.04E+02	2.01E+01
	Thallium	35	32	91	1.08E-01	6.67E-02	2.40E-01	3.95E-02
	Vanadium	35	35	100	1.11E+01	5.35E+00	2.19E+01	3.49E-01
	Zinc	35	35	100	5.34E+01	6.85E+01	4.16E+02	1.32E+00

Table 2-3. OU2 Subsurface Soil (0-10 feet) Summary Statistics[a]

Analysis	Contaminant	N	N Detect	Detection Frequency (%)	Average Concentration[b]	Standard Deviation	Maximum Detected Concentration	Average MDL
Semivolatiles	1,2,4-Trichlorobenzene	12	0	0	2.91E-02	1.31E-03	--	5.82E-02
	1,2-Dichlorobenzene	12	0	0	1.14E-02	5.07E-04	--	2.28E-02
	1,2-Diphenylhydrazine	12	0	0	8.84E-02	3.97E-03	--	1.77E-01
	1,3-Dichlorobenzene	12	0	0	1.11E-02	4.98E-04	--	2.23E-02
	1,4-Dichlorobenzene	12	0	0	1.18E-02	5.20E-04	--	2.35E-02
	1-Methylnaphthalene	12	0	0	3.04E-02	1.35E-03	--	6.09E-02
	2,4,5-Trichlorophenol	12	0	0	2.11E-02	9.45E-04	--	4.22E-02
	2,4,6-Trichlorophenol	12	0	0	2.27E-02	1.01E-03	--	4.55E-02
	2,4-Dichlorophenol	12	0	0	3.32E-02	1.49E-03	--	6.65E-02
	2,4-Dimethylphenol	12	0	0	3.31E-02	1.48E-03	--	6.61E-02
	2,4-Dinitrophenol	12	0	0	8.84E-02	3.97E-03	--	1.77E-01
	2,4-Dinitrotoluene	12	0	0	8.84E-02	3.97E-03	--	1.77E-01
	2,6-Dinitrotoluene	12	0	0	1.51E-02	6.71E-04	--	3.02E-02
	2-Chloronaphthalene	12	0	0	2.77E-02	1.23E-03	--	5.53E-02
	2-Chlorophenol	12	0	0	4.12E-02	1.84E-03	--	8.24E-02
	2-Methylnaphthalene	12	0	0	3.16E-02	1.41E-03	--	6.31E-02
	2-Nitroaniline	12	0	0	1.92E-02	8.51E-04	--	3.83E-02
	2-Nitrophenol	12	0	0	3.02E-02	1.36E-03	--	6.04E-02
	3,3`-Dichlorobenzidine	12	0	0	2.46E-02	1.10E-03	--	4.92E-02
	3-Nitroaniline	12	0	0	1.80E-02	8.03E-04	--	3.61E-02
	4,6-Dinitro-o-cresol	12	0	0	3.51E-02	1.57E-03	--	7.02E-02
	4-Bromophenyl phenyl ether	12	0	0	1.88E-02	8.40E-04	--	3.76E-02
	4-Chloro-3-methylphenol	12	0	0	8.84E-02	3.97E-03	--	1.77E-01
	4-Chlorophenyl phenyl ether	12	0	0	2.03E-02	9.06E-04	--	4.07E-02
	4-Nitroaniline	12	0	0	1.55E-02	6.96E-04	--	3.09E-02
	4-Nitrophenol	12	0	0	1.85E-02	8.36E-04	--	3.70E-02
	Acenaphthene	14	0	0	1.75E-02	7.38E-03	--	3.50E-02
	Acenaphthylene	14	0	0	1.98E-02	8.38E-03	--	3.97E-02
	Anthracene	14	0	0	7.58E-02	3.22E-02	--	1.52E-01
	Benzo(a)anthracene	14	0	0	7.58E-02	3.23E-02	--	1.52E-01
	Benzo(a)pyrene	14	0	0	7.58E-02	3.23E-02	--	1.52E-01
	Benzo(b)fluoranthene	14	0	0	1.92E-02	8.10E-03	--	3.84E-02
	Benzo(g,h,i)perylene	14	0	0	1.84E-02	7.77E-03	--	3.68E-02
	Benzo(k)fluoranthene	14	0	0	1.94E-02	8.17E-03	--	3.88E-02
	bis(2-chloroethoxy)methane	12	0	0	3.45E-02	1.54E-03	--	6.90E-02
	bis(2-chloroethyl)ether	12	0	0	1.23E-02	5.50E-04	--	2.46E-02
	Bis(2-chloroisopropyl)ether	12	0	0	4.08E-02	1.83E-03	--	8.16E-02
	Bis(2-ethylhexyl)phthalate	12	2	17	6.09E-02	9.10E-02	3.46E-01	6.04E-02
	Butyl benzyl phthalate	12	0	0	8.84E-02	3.97E-03	--	1.77E-01
	Carbazole	12	0	0	8.84E-02	3.97E-03	--	1.77E-01
	Chrysene	14	0	0	2.03E-02	8.61E-03	--	4.07E-02
	Dibenzo(a,h)anthracene	14	0	0	7.58E-02	3.22E-02	--	1.52E-01
	Dibenzofuran	12	0	0	8.84E-02	3.97E-03	--	1.77E-01
	Dibutyl phthalate	12	1	8	2.70E-02	8.49E-03	5.37E-02	4.90E-02
	Diethyl phthalate	12	0	0	8.84E-02	3.97E-03	--	1.77E-01
	Dimethyl phthalate	12	0	0	8.84E-02	3.97E-03	--	1.77E-01
	Di-n-octyl phthalate	12	0	0	8.84E-02	3.97E-03	--	1.77E-01
	Fluoranthene	14	0	0	7.58E-02	3.23E-02	--	1.52E-01
	Fluorene	14	0	0	7.58E-02	3.22E-02	--	1.52E-01
	Hexachlorobenzene	12	0	0	2.32E-02	1.05E-03	--	4.64E-02
	Hexachlorobutadiene	12	0	0	1.49E-02	6.57E-04	--	2.98E-02
	Hexachloroethane	12	0	0	1.12E-02	4.95E-04	--	2.25E-02
	Indeno(1,2,3-cd)pyrene	14	0	0	7.58E-02	3.22E-02	--	1.52E-01
	Isophorone	12	0	0	2.82E-02	1.25E-03	--	5.64E-02
	m & p-cresols	12	0	0	3.53E-02	1.58E-03	--	7.06E-02
	Naphthalene	14	0	0	3.96E-02	1.66E-02	--	7.92E-02
	Nitrobenzene	12	0	0	3.57E-02	1.59E-03	--	7.14E-02
	N-Nitrosodimethylamine	12	0	0	8.84E-02	3.97E-03	--	1.77E-01
	N-Nitrosodi-n-propylamine	12	0	0	2.40E-02	1.07E-03	--	4.81E-02
	N-Nitrosodiphenylamine	12	0	0	8.84E-02	3.97E-03	--	1.77E-01
	o-Cresol	12	0	0	3.82E-02	1.70E-03	--	7.64E-02
	p-Chloroaniline	12	0	0	2.71E-02	1.21E-03	--	5.42E-02
	Pentachlorophenol	12	0	0	8.84E-02	3.97E-03	--	1.77E-01

Table 2-3. OU2 Subsurface Soil (0-10 feet) Summary Statistics[a]

Analysis	Contaminant	N	N Detect	Detection Frequency (%)	Average Concentration[b]	Standard Deviation	Maximum Detected Concentration	Average MDL
Semivolatiles	Phenanthrene	14	0	0	2.17E-02	9.18E-03	--	4.33E-02
	Phenol	12	0	0	3.86E-02	1.73E-03	--	7.72E-02
	Pyrene	14	1	7	2.08E-02	1.08E-02	4.59E-02	3.82E-02
Volatile Organics	1,1,1,2-Tetrachloroethane	16	0	0	8.84E-03	4.67E-03	--	1.77E-02
	1,1,1-Trichloroethane	16	0	0	9.15E-03	4.39E-03	--	1.83E-02
	1,1,2,2-Tetrachloroethane	16	1	6	8.42E-03	5.05E-03	9.40E-04	1.68E-02
	1,1,2-Trichloroethane	16	0	0	1.26E-02	6.73E-03	--	2.51E-02
	1,1-Dichloroethane	16	0	0	8.83E-03	4.59E-03	--	1.77E-02
	1,1-Dichloroethene	16	0	0	1.06E-02	5.27E-03	--	2.13E-02
	1,1-Dichloropropene	16	0	0	9.36E-03	4.58E-03	--	1.87E-02
	1,2,3-Trichlorobenzene	16	0	0	1.77E-02	9.69E-03	--	3.54E-02
	1,2,3-Trichloropropane	16	0	0	1.28E-02	6.50E-03	--	2.56E-02
	1,2,4-Trichlorobenzene	16	0	0	8.37E-03	4.44E-03	--	1.67E-02
	1,2,4-Trimethylbenzene	16	3	19	2.07E-02	2.75E-02	9.89E-02	1.83E-02
	1,2-Dibromo-3-chloropropane	16	0	0	3.56E-02	1.89E-02	--	7.12E-02
	1,2-Dibromoethane	16	0	0	7.44E-03	3.83E-03	--	1.49E-02
	1,2-Dichlorobenzene	16	0	0	1.11E-02	5.98E-03	--	2.22E-02
	1,2-Dichloroethane	16	0	0	1.03E-02	5.49E-03	--	2.06E-02
	1,2-Dichloropropane	16	0	0	9.43E-03	4.89E-03	--	1.89E-02
	1,3,5-Trimethylbenzene	16	0	0	8.90E-03	4.72E-03	--	1.78E-02
	1,3-Dichlorobenzene	16	0	0	1.12E-02	6.01E-03	--	2.24E-02
	1,3-Dichloropropane	16	0	0	7.21E-03	3.80E-03	--	1.44E-02
	1,4-Dichlorobenzene	16	0	0	9.72E-03	5.23E-03	--	1.94E-02
	2,2-Dichloropropane	16	0	0	1.86E-02	9.73E-03	--	3.73E-02
	Acetone	16	2	13	1.88E-01	1.12E-01	3.49E-02	3.68E-01
	Allyl chloride	16	0	0	1.13E-02	5.88E-03	--	2.25E-02
	Benzene	16	0	0	6.56E-03	3.20E-03	--	1.31E-02
	Bromobenzene	16	0	0	1.12E-02	5.81E-03	--	2.24E-02
	Bromochloromethane	16	0	0	8.79E-03	4.72E-03	--	1.76E-02
	Bromoform	16	0	0	1.09E-02	5.88E-03	--	2.18E-02
	Bromomethane	16	0	0	8.01E-02	4.40E-02	--	1.60E-01
	Carbon tetrachloride	16	0	0	1.10E-02	6.07E-03	--	2.21E-02
	Chlorobenzene	16	0	0	7.48E-03	3.91E-03	--	1.50E-02
	Chloroethane	16	0	0	2.19E-02	1.17E-02	--	4.39E-02
	Chloroform	16	1	6	9.73E-03	8.56E-03	3.81E-02	1.55E-02
	Chloromethane	16	0	0	9.39E-03	4.74E-03	--	1.88E-02
	cis-1,2-Dichloroethylene	16	0	0	1.63E-02	8.79E-03	--	3.26E-02
	cis-1,3-Dichloropropylene	16	0	0	4.75E-03	2.58E-03	--	9.51E-03
	Cumene	16	0	0	8.40E-03	4.36E-03	--	1.68E-02
	Dibromochloromethane	16	0	0	7.17E-03	3.68E-03	--	1.43E-02
	Dichlorobromomethane	16	0	0	8.22E-03	4.28E-03	--	1.64E-02
	Dichlorodifluoromethane	16	0	0	1.15E-02	5.70E-03	--	2.30E-02
	Dichlorofluoromethane	16	0	0	4.29E-02	2.35E-02	--	8.58E-02
	Ethyl ether	16	0	0	1.49E-02	8.03E-03	--	2.99E-02
	Ethylbenzene	16	1	6	8.80E-03	7.93E-03	3.54E-02	1.38E-02
	Hexachlorobutadiene	16	0	0	1.97E-02	1.03E-02	--	3.93E-02
	Methyl ethyl ketone	16	0	0	7.62E-02	4.08E-02	--	1.52E-01
	Methyl isobutyl ketone	16	0	0	5.82E-02	3.14E-02	--	1.16E-01
	Methylene bromide	16	0	0	1.08E-02	5.83E-03	--	2.16E-02
	Methylene chloride	16	1	6	1.63E-02	1.11E-02	4.91E-02	2.79E-02
	MTBE (Methyl tert-butyl ether)	16	0	0	8.61E-03	4.60E-03	--	1.72E-02
	Naphthalene	14	0	0	6.38E-02	3.88E-02	--	1.28E-01
	n-Butyl benzene	16	0	0	8.69E-03	4.50E-03	--	1.74E-02
	n-Propyl benzene	16	0	0	9.88E-03	5.16E-03	--	1.98E-02
	o-Chlorotoluene	16	0	0	9.48E-03	5.03E-03	--	1.90E-02
	p-Chlorotoluene	16	0	0	8.58E-03	4.68E-03	--	1.72E-02
	p-Isopropyltoluene	16	2	13	2.10E-01	6.50E-01	2.56E+00	1.61E-02
	sec-Butyl benzene	16	0	0	9.44E-03	4.87E-03	--	1.89E-02
	Styrene	16	0	0	7.29E-03	3.89E-03	--	1.46E-02
	tert-Butyl benzene	16	0	0	1.23E-02	6.53E-03	--	2.47E-02
	Tetrachloroethylene	16	0	0	9.59E-03	4.82E-03	--	1.92E-02
	Tetrahydrofuran	16	4	25	1.16E-01	9.39E-02	3.32E-01	1.45E-01
	Toluene	16	11	69	4.54E-03	6.11E-03	1.47E-02	7.71E-03

Table 2-3. OU2 Subsurface Soil (0-10 feet) Summary Statistics[a]

Analysis	Contaminant	N	N Detect	Detection Frequency (%)	Average Concentration[b]	Standard Deviation	Maximum Detected Concentration	Average MDL
Volatile Organics	trans-1,2-Dichloroethylene	16	0	0	7.68E-03	3.77E-03	--	1.54E-02
	trans-1,3-Dichloropropylene	16	0	0	1.77E-02	9.81E-03	--	3.53E-02
	Trichloroethylene	16	0	0	1.12E-02	5.81E-03	--	2.24E-02
	Trichlorofluoromethane	16	4	25	7.62E-02	8.41E-02	2.16E-01	6.40E-02
	Trichlorotrifluoroethane	16	0	0	1.08E-02	5.85E-03	--	2.16E-02
	Vinyl chloride	16	0	0	8.24E-03	4.43E-03	--	1.65E-02
	Xylenes (total)	16	0	0	2.74E-02	1.48E-02	--	5.49E-02

TEQ = toxicity equivalent; ND = non-detect; RL = reporting limit; MDL = method detection imit; DL = dioxin-like; PCB = polychlorinated biphenyl

[a]All concentrations reported in units of mg/kg.

[b]Non-detects evaluated at 1/2 the MDL when calculating average and standard deviation.

Table 2-4. OU2 Groundwater Summary Statistics[a]

Analysis	Contaminant	N	N Detect	DF (%)	Average Concentration[b]	Standard Deviation[b]	Maximum Detected Concentration	Average MDL
TEQ	TEQ - Dioxins/Furans (ND=0)	25	13	52	2.45E-07	7.88E-07	3.49E-06	--
	TEQ - Dioxins/Furans (ND=1/2RL)	25	13	52	1.82E-06	8.57E-07	5.09E-06	--
	TEQ - Dioxins/Furans (ND=1/2MDL)	25	13	52	6.14E-07	7.67E-07	3.75E-06	--
PCBs	Aroclor-1016	21	0	0	2.06E-02	3.21E-03	--	4.12E-02
	Aroclor-1221	21	0	0	1.52E-02	5.05E-03	--	3.04E-02
	Aroclor-1232	21	0	0	1.85E-02	3.07E-03	--	3.70E-02
	Aroclor-1242	21	0	0	2.02E-02	5.51E-03	--	4.04E-02
	Aroclor-1248	21	0	0	1.25E-02	5.95E-03	--	2.50E-02
	Aroclor-1254	21	0	0	1.54E-02	7.02E-03	--	3.07E-02
	Aroclor-1260	21	1	4.8	1.54E-02	1.57E-02	8.10E-02	2.47E-02
	Aroclor-1262	21	0	0	2.12E-02	4.18E-03	--	4.24E-02
	Aroclor-1268	21	0	0	1.67E-02	6.00E-03	--	3.34E-02
Total Metals	Aluminum	11	11	100	6.79E+01	9.99E+01	3.56E+02	1.93E+00
	Antimony	11	7	64	2.00E-01	1.07E-01	3.60E-01	1.39E-01
	Arsenic	11	11	100	2.73E+00	2.61E+00	8.40E+00	1.99E-01
	Barium	11	11	100	2.13E+02	9.32E+01	3.91E+02	1.18E-01
	Beryllium	3	0	0	3.30E-02	0.00E+00	--	6.60E-02
	Cadmium	11	2	18	1.83E-02	1.01E-02	4.20E-02	2.66E-02
	Calcium	11	11	100	5.06E+04	1.60E+04	6.45E+04	8.61E+01
	Chromium	11	9	82	3.42E-01	1.82E-01	6.20E-01	1.56E-01
	Cobalt	11	4	36	2.28E-01	2.91E-01	1.00E+00	1.54E-01
	Copper	11	11	100	1.64E+00	1.41E+00	4.60E+00	2.42E-01
	Iron	11	10	91	4.20E+02	4.89E+02	1.32E+03	9.25E+00
	Lead	11	9	82	1.85E-01	1.66E-01	4.70E-01	3.00E-02
	Magnesium	11	11	100	1.95E+04	6.23E+03	2.58E+04	7.01E+01
	Manganese	11	11	100	9.10E+02	1.18E+03	2.82E+03	7.26E-01
	Mercury	11	0	0	2.61E-02	8.41E-03	--	5.22E-02
	Nickel	11	9	82	5.60E-01	5.96E-01	1.80E+00	1.46E-01
	Potassium	11	11	100	5.53E+03	3.70E+03	9.97E+03	4.33E+02
	Selenium	11	1	9	1.08E-01	5.51E-02	2.60E-01	1.85E-01
	Silver	11	1	9	5.53E-02	3.49E-02	1.00E-02	1.10E-01
	Sodium	11	11	100	5.63E+04	5.53E+04	1.63E+05	1.69E+02
	Thallium	11	0	0	1.17E-02	4.06E-03	--	2.34E-02
	Vanadium	11	10	91	1.77E+00	1.19E+00	4.70E+00	2.20E-01
	Zinc	11	10	91	2.34E+00	1.98E+00	6.90E+00	1.27E+00
Dissolved Metals	Aluminum	27	25	93	1.07E+02	3.02E+02	1.41E+03	2.37E+00
	Antimony	11	8	73	2.72E-01	1.32E-01	4.50E-01	1.47E-01
	Arsenic	27	27	100	3.23E+00	3.21E+00	1.34E+01	1.47E-01
	Barium	27	27	100	1.92E+02	9.59E+01	3.82E+02	8.91E-02
	Beryllium	3	0	0	3.30E-02	0.00E+00	--	6.60E-02
	Cadmium	27	8	30	2.11E-02	2.17E-02	1.20E-01	2.36E-02
	Calcium	27	27	100	4.42E+04	1.93E+04	7.05E+04	6.53E+01
	Chromium	27	26	96	5.31E-01	3.83E-01	1.80E+00	1.59E-01
	Cobalt	27	21	78	6.60E-01	7.74E-01	3.20E+00	1.24E-01
	Copper	27	23	85	2.19E+00	2.48E+00	9.00E+00	2.51E-01
	Iron	27	17	63	3.17E+02	3.97E+02	1.36E+03	1.23E+01
	Lead	27	13	48	1.90E-01	3.16E-01	1.20E+00	3.38E-02
	Magnesium	27	27	100	1.61E+04	6.98E+03	2.62E+04	3.81E+01
	Manganese	27	27	100	7.91E+02	1.10E+03	3.05E+03	9.30E-01
	Mercury	27	0	0	1.80E-02	8.76E-03	--	3.60E-02
	Nickel	27	25	93	8.06E-01	1.03E+00	5.10E+00	1.44E-01
	Potassium	27	23	85	4.27E+03	3.18E+03	9.75E+03	2.32E+02
	Selenium	11	1	9	1.13E-01	6.23E-02	2.90E-01	1.88E-01
	Silver	27	2	7	6.02E-02	3.02E-02	7.80E-02	1.13E-01
	Sodium	27	27	100	5.47E+04	5.24E+04	1.83E+05	8.46E+01
	Thallium	27	5	19	1.15E-02	5.74E-03	3.00E-02	1.77E-02
	Vanadium	27	25	93	1.64E+00	1.26E+00	5.10E+00	2.26E-01
	Zinc	27	20	74	2.65E+00	2.55E+00	1.29E+01	1.64E+00

Table 2-4. OU2 Groundwater Summary Statistics[a]

Analysis	Contaminant	N	N Detect	DF (%)	Average Concentration[b]	Standard Deviation[b]	Maximum Detected Concentration	Average MDL
Miscellaneous Parameters	Chloride	24	24	100	1.76E+04	2.26E+04	1.17E+05	4.20E-01
	Fluoride	24	24	100	1.73E+02	4.23E+01	2.70E+02	4.19E+01
	Nitrogen, NO2 plus NO3	24	24	100	4.61E+02	6.39E+02	2.60E+03	7.32E-03
	Phosphorus (as P)	24	24	100	1.47E+02	1.25E+02	4.50E+02	3.00E+00
	Sulfate	24	24	100	4.75E+04	3.43E+04	1.66E+05	3.58E-01
Semivolatiles	1,2,4-Trichlorobenzene	14	0	0	2.84E+00	5.80E+00	--	5.68E+00
	1,2-Dichlorobenzene	14	0	0	2.51E+00	4.82E+00	--	5.02E+00
	1,2-Diphenylhydrazine	14	0	0	1.57E+00	1.58E+00	--	3.14E+00
	1,3-Dichlorobenzene	14	0	0	2.72E+00	5.74E+00	--	5.44E+00
	1,4-Dichlorobenzene	14	0	0	2.43E+00	4.67E+00	--	4.85E+00
	1-Methylnaphthalene	14	0	0	1.85E+00	2.75E+00	--	3.69E+00
	2,4,5-Trichlorophenol	14	0	0	1.37E+00	1.35E+00	--	2.74E+00
	2,4,6-Trichlorophenol	14	0	0	1.38E+00	1.35E+00	--	2.76E+00
	2,4-Dichlorophenol	14	0	0	1.65E+00	1.98E+00	--	3.30E+00
	2,4-Dimethylphenol	14	0	0	3.99E+00	3.41E+00	--	7.99E+00
	2,4-Dinitrophenol	14	0	0	2.28E+00	3.19E+00	--	4.55E+00
	2,4-Dinitrotoluene	14	0	0	1.48E+00	1.68E+00	--	2.96E+00
	2,6-Dinitrotoluene	14	0	0	1.20E+00	7.59E-01	--	2.40E+00
	2-Chloronaphthalene	14	0	0	1.96E+00	2.92E+00	--	3.93E+00
	2-Chlorophenol	14	0	0	1.40E+00	1.39E+00	--	2.79E+00
	2-Methylnaphthalene	14	0	0	2.05E+00	3.34E+00	--	4.11E+00
	2-Nitroaniline	14	0	0	1.81E+00	1.89E+00	--	3.63E+00
	2-Nitrophenol	14	0	0	1.69E+00	2.15E+00	--	3.39E+00
	3,3`-Dichlorobenzidine	14	0	0	2.48E+00	1.44E+00	--	4.96E+00
	3-Nitroaniline	14	0	0	2.51E+00	1.45E+00	--	5.01E+00
	4,6-Dinitro-o-cresol	14	0	0	2.10E+00	1.83E+00	--	4.20E+00
	4-Bromophenyl phenyl ether	14	0	0	2.08E+00	3.02E+00	--	4.15E+00
	4-Chloro-3-methylphenol	14	0	0	1.35E+00	1.94E+00	--	2.69E+00
	4-Chlorophenyl phenyl ether	14	0	0	1.31E+00	2.01E+00	--	2.62E+00
	4-Nitroaniline	14	0	0	2.69E+00	2.49E+00	--	5.37E+00
	4-Nitrophenol	14	0	0	2.58E+00	3.29E+00	--	5.16E+00
	Acenaphthene	14	0	0	1.57E+00	2.48E+00	--	3.14E+00
	Acenaphthylene	14	0	0	1.70E+00	2.18E+00	--	3.40E+00
	Anthracene	14	0	0	1.57E+00	1.58E+00	--	3.14E+00
	Benzo(a)anthracene	14	0	0	2.54E+00	1.51E+00	--	5.09E+00
	Benzo(a)pyrene	14	0	0	1.76E+00	2.19E+00	--	3.53E+00
	Benzo(b)fluoranthene	14	0	0	1.82E+00	2.19E+00	--	3.64E+00
	Benzo(g,h,i)perylene	14	0	0	2.01E+00	2.70E+00	--	4.01E+00
	Benzo(k)fluoranthene	14	0	0	1.94E+00	2.20E+00	--	3.87E+00
	bis(2-chloroethoxy)methane	14	0	0	1.27E+00	1.75E+00	--	2.54E+00
	bis(2-chloroethyl)ether	14	0	0	1.45E+00	1.38E+00	--	2.89E+00
	Bis(2-chloroisopropyl)ether	14	0	0	1.53E+00	1.70E+00	--	3.06E+00
	Bis(2-ethylhexyl)phthalate	14	0	0	3.20E+00	6.28E+00	--	6.40E+00
	Butyl benzyl phthalate	14	0	0	1.61E+00	2.31E+00	--	3.23E+00
	Carbazole	14	0	0	1.56E+00	1.32E+00	--	3.11E+00
	Chrysene	14	0	0	1.76E+00	2.23E+00	--	3.51E+00
	Dibenzo(a,h)anthracene	14	0	0	1.78E+00	2.87E+00	--	3.56E+00
	Dibenzofuran	14	0	0	1.69E+00	2.04E+00	--	3.37E+00
	Dibutyl phthalate	14	0	0	1.60E+00	1.67E+00	--	3.20E+00
	Diethyl phthalate	14	0	0	1.63E+00	1.75E+00	--	3.26E+00
	Dimethyl phthalate	14	0	0	1.51E+00	1.55E+00	--	3.03E+00
	Di-n-octyl phthalate	14	0	0	1.69E+00	2.73E+00	--	3.37E+00
	Fluoranthene	14	0	0	1.70E+00	1.84E+00	--	3.39E+00
	Fluorene	14	0	0	1.61E+00	1.81E+00	--	3.21E+00
	Hexachlorobenzene	14	0	0	2.07E+00	2.79E+00	--	4.14E+00
	Hexachlorobutadiene	14	0	0	2.24E+00	4.36E+00	--	4.48E+00
	Hexachloroethane	14	0	0	2.36E+00	4.71E+00	--	4.72E+00
	Indeno(1,2,3-cd)pyrene	14	0	0	1.69E+00	2.68E+00	--	3.37E+00
	Isophorone	14	0	0	1.18E+00	1.48E+00	--	2.35E+00
	m & p-cresols	14	0	0	1.37E+00	1.25E+00	--	2.74E+00
	Naphthalene	14	0	0	1.97E+00	3.16E+00	--	3.94E+00
	Nitrobenzene	14	0	0	1.59E+00	1.58E+00	--	3.18E+00
	N-Nitrosodimethylamine	14	0	0	1.40E+00	1.24E+00	--	2.79E+00

Table 2-4. OU2 Groundwater Summary Statistics[a]

Analysis	Contaminant	N	N Detect	DF (%)	Average Concentration[b]	Standard Deviation[b]	Maximum Detected Concentration	Average MDL
Semivolatiles	N-Nitrosodi-n-propylamine	14	0	0	1.39E+00	1.22E+00	--	2.77E+00
	N-Nitrosodiphenylamine	14	0	0	2.03E+00	1.28E+00	--	4.06E+00
	o-Cresol	14	0	0	1.71E+00	2.49E+00	--	3.42E+00
	p-Chloroaniline	14	0	0	2.33E+00	2.35E+00	--	4.65E+00
	Pentachlorophenol	14	0	0	2.16E+00	3.48E+00	--	4.32E+00
	Phenanthrene	14	0	0	1.45E+00	1.17E+00	--	2.90E+00
	Phenol	14	0	0	1.43E+00	1.42E+00	--	2.85E+00
	Pyrene	14	0	0	1.68E+00	1.86E+00	--	3.36E+00
Volatile Organics	1,1,1,2-Tetrachloroethane	14	0	0	8.06E-02	3.19E-02	--	1.61E-01
	1,1,1-Trichloroethane	14	0	0	7.96E-02	3.35E-02	--	1.59E-01
	1,1,2,2-Tetrachloroethane	14	0	0	8.64E-02	3.87E-02	--	1.73E-01
	1,1,2-Trichloroethane	14	0	0	9.49E-02	4.13E-02	--	1.90E-01
	1,1-Dichloroethane	14	0	0	8.64E-02	3.87E-02	--	1.73E-01
	1,1-Dichloroethene	14	0	0	8.84E-02	3.54E-02	--	1.77E-01
	1,1-Dichloropropene	14	0	0	6.89E-02	1.83E-02	--	1.38E-01
	1,2,3-Trichlorobenzene	14	0	0	1.06E-01	1.41E-02	--	2.13E-01
	1,2,3-Trichloropropane	14	0	0	2.06E-01	7.27E-02	--	4.11E-01
	1,2,4-Trichlorobenzene	14	0	0	9.86E-02	1.88E-02	--	1.97E-01
	1,2,4-Trimethylbenzene	14	1	7	1.15E-01	1.87E-01	7.60E-01	1.34E-01
	1,2-Dibromo-3-chloropropane	14	0	0	3.36E-01	2.34E-02	--	6.71E-01
	1,2-Dibromoethane	14	0	0	9.53E-02	3.23E-02	--	1.91E-01
	1,2-Dichlorobenzene	14	0	0	8.97E-02	3.33E-02	--	1.79E-01
	1,2-Dichloroethane	14	0	0	7.10E-02	2.30E-02	--	1.42E-01
	1,2-Dichloropropane	14	0	0	1.59E-01	8.30E-02	--	3.19E-01
	1,3,5-Trimethylbenzene	14	0	0	7.74E-02	3.70E-02	--	1.55E-01
	1,3-Dichlorobenzene	14	0	0	8.71E-02	2.93E-02	--	1.74E-01
	1,3-Dichloropropane	14	0	0	9.41E-02	4.24E-02	--	1.88E-01
	1,4-Dichlorobenzene	14	1	7	7.25E-02	1.78E-02	9.40E-02	1.37E-01
	2,2-Dichloropropane	14	0	0	1.42E-01	6.19E-02	--	2.85E-01
	Acetone	14	4	29	5.14E+00	2.71E+00	1.03E+01	5.25E+00
	Allyl chloride	14	0	0	2.43E-01	7.74E-02	--	4.86E-01
	Benzene	14	0	0	8.10E-02	3.94E-02	--	1.62E-01
	Bromobenzene	14	0	0	1.02E-01	3.82E-02	--	2.03E-01
	Bromochloromethane	14	0	0	1.33E-01	6.05E-02	--	2.66E-01
	Bromoform	14	0	0	1.62E-01	7.03E-02	--	3.24E-01
	Bromomethane	14	0	0	1.57E-01	3.75E-02	--	3.14E-01
	Carbon tetrachloride	14	0	0	1.36E-01	6.35E-02	--	2.73E-01
	Chlorobenzene	14	1	7	1.01E-01	3.85E-02	1.60E-01	1.83E-01
	Chloroethane	14	0	0	1.39E-01	5.16E-02	--	2.77E-01
	Chloroform	14	0	0	1.26E-01	1.41E-02	--	2.53E-01
	Chloromethane	14	0	0	2.40E-01	1.31E-01	--	4.80E-01
	cis-1,2-Dichloroethylene	14	0	0	1.06E-01	3.05E-02	--	2.13E-01
	cis-1,3-Dichloropropylene	14	0	0	8.49E-02	3.31E-02	--	1.70E-01
	Cumene	14	0	0	6.99E-02	2.48E-02	--	1.40E-01
	Dibromochloromethane	14	0	0	6.40E-02	2.63E-02	--	1.28E-01
	Dichlorobromomethane	14	0	0	7.40E-02	2.63E-02	--	1.48E-01
	Dichlorodifluoromethane	14	0	0	1.86E-01	9.73E-02	--	3.71E-01
	Dichlorofluoromethane	14	0	0	8.63E-02	3.89E-02	--	1.73E-01
	Ethyl ether	14	0	0	1.49E-01	6.80E-02	--	2.97E-01
	Ethylbenzene	14	0	0	9.29E-02	3.63E-02	--	1.86E-01
	Hexachlorobutadiene	14	0	0	1.90E-01	8.20E-02	--	3.80E-01
	m & p-Xylenes	14	0	0	1.62E-01	7.03E-02	--	3.24E-01
	Methyl ethyl ketone	14	0	0	1.05E+00	3.28E-01	--	2.10E+00
	Methyl isobutyl ketone	14	0	0	9.71E-01	3.75E-01	--	1.94E+00
	Methylene bromide	14	0	0	1.31E-01	3.98E-02	--	2.61E-01
	Methylene chloride	14	0	0	2.14E-01	1.09E-01	--	4.28E-01
	MTBE (Methyl tert-butyl ether)	14	0	0	7.81E-02	3.59E-02	--	1.56E-01
	Naphthalene	14	0	0	5.91E-02	1.78E-02	--	1.18E-01
	n-Butyl benzene	14	0	0	5.25E-02	1.80E-02	--	1.05E-01
	n-Propyl benzene	14	0	0	8.20E-02	3.77E-02	--	1.64E-01
	o-Chlorotoluene	14	0	0	9.06E-02	3.19E-02	--	1.81E-01
	o-Xylene	14	0	0	7.41E-02	3.42E-02	--	1.48E-01
	p-Chlorotoluene	14	0	0	9.26E-02	4.50E-02	--	1.85E-01

Table 2-4. OU2 Groundwater Summary Statistics[a]

Analysis	Contaminant	N	N Detect	DF (%)	Average Concentration[b]	Standard Deviation[b]	Maximum Detected Concentration	Average MDL
Volatile Organics	p-Isopropyltoluene	14	0	0	6.63E-02	2.25E-02	--	1.33E-01
	sec-Butyl benzene	14	0	0	7.06E-02	1.55E-02	--	1.41E-01
	Styrene	14	0	0	4.73E-02	1.27E-02	--	9.46E-02
	tert-Butyl benzene	14	0	0	7.16E-02	3.02E-02	--	1.43E-01
	Tetrachloroethylene	14	0	0	8.64E-02	1.41E-02	--	1.73E-01
	Tetrahydrofuran	14	0	0	1.64E+00	5.86E-01	--	3.29E+00
	Toluene	14	1	7	6.02E-02	2.82E-02	1.40E-01	1.10E-01
	trans-1,2-Dichloroethylene	14	0	0	9.64E-02	1.41E-02	--	1.93E-01
	trans-1,3-Dichloropropylene	14	0	0	8.49E-02	4.13E-02	--	1.70E-01
	Trichloroethylene	14	0	0	5.63E-02	2.25E-02	--	1.13E-01
	Trichlorofluoromethane	14	0	0	7.21E-02	2.93E-02	--	1.44E-01
	Trichlorotrifluoroethane	14	0	0	1.69E-01	6.80E-02	--	3.37E-01
	Vinyl chloride	14	0	0	4.29E-02	3.98E-03	--	8.59E-02
	Xylenes (total)	14	0	0	2.36E-01	1.05E-01	--	4.71E-01

DF = Detection Frequency; TEQ = Toxicity Equivalence; PCBs = Polychlorinated Biphenyls; ND = non-detect; RL = reporting limit; MDL = method detection limit

[a]Concentrations reported in units of µg/L.

[b]Non-detects evaluated at 1/2 the MDL when calculating average and standard deviation.

Table 3-1. Exposure Pathways Evaluated Quantitatively

Exposed Population	Exposure Pathways
Hypothetical future residents (adults and children age 0-6 years)	• Incidental ingestion of surface soil • Dermal contact with surface soil • Ingestion of groundwater as drinking water
Hypothetical future commercial/industrial workers	• Incidental ingestion of surface soil • Dermal contact with surface soil • Ingestion of groundwater as drinking water
Hypothetical future construction workers	• Incidental ingestion of surface and subsurface soil • Dermal contact with surface and subsurface soil • Inhalation of soil particulates created by mechanical disturbances of surface soils

Table 3-2. MDEQ Background Surface Soil Summary Statistics[a,b]

Analysis	Contaminant	N	N Detect	Detection Frequency (%)	Average Concentration[c]	Standard Deviation[c]	Maximum Detected Concentration	Average RL
TEQ	Rural, TEQ (ND=1/2RL)	58	52	90	7.17E-07	4.77E-07	1.85E-06	4.46E-07
	Urban, TEQ (ND=1/2RL)	59	58	98	1.59E-06	1.64E-06	9.34E-06	1.24E-07
Metals	Aluminum	112	112	100	1.55E+04	5.76E+03	3.37E+04	--
	Antimony	112	89	79	1.95E-01	1.88E-01	1.20E+00	1.00E-01
	Arsenic	112	112	100	1.14E+01	1.16E+01	8.19E+01	--
	Barium	112	112	100	1.96E+02	1.06E+02	5.75E+02	--
	Beryllium	112	112	100	6.85E-01	2.46E-01	1.40E+00	--
	Cadmium	112	97	87	2.89E-01	2.03E-01	1.10E+00	1.00E-01
	Chromium	112	112	100	1.96E+01	1.22E+01	1.30E+02	--
	Cobalt	112	112	100	7.33E+00	2.76E+00	1.64E+01	--
	Copper	112	112	100	1.76E+01	1.01E+01	7.07E+01	--
	Iron	112	112	100	1.82E+04	6.78E+03	5.92E+04	--
	Lead	112	112	100	1.53E+01	6.37E+00	3.69E+01	--
	Manganese	112	112	100	5.08E+02	3.69E+02	2.92E+03	--
	Mercury	112	1	1	2.54E-02	4.06E-03	6.80E-02	5.00E-02
	Nickel	112	112	100	1.66E+01	9.50E+00	8.15E+01	--
	Selenium	112	88	79	3.83E-01	2.43E-01	1.60E+00	2.00E-01
	Silver	112	30	27	1.12E-01	8.09E-02	5.00E-01	1.74E-01
	Thallium	112	112	100	2.48E-01	1.12E-01	8.40E-01	--
	Vanadium	112	112	100	3.09E+01	1.35E+01	9.22E+01	--
	Zinc	112	112	100	6.05E+01	2.33E+01	1.47E+02	--

TEQ = toxicity equivalent; ND = non-detect; RL = reporting limit

[a] Data summarized in MDEQ (2011; 2013); USEPA received raw data files from personal correspondence with MDEQ.

[b] All concentrations reported in units of mg/kg.

[c] Non-detects evaluated at 1/2 the RL when calculating average and standard deviation.

Table 3-3. Background Groundwater Summary Statistics[a,b]

Analysis	Contaminant	N	N Detect	Detection Frequency (%)	Average Concentration[c]	Standard Deviation[c]	Maximum Detected Concentration	Average MDL
TEQ	TEQ - Dioxins/Furans (ND=0)	12	1	8	1.52E-08	5.28E-08	1.83E-07	--
	TEQ - Dioxins/Furans (ND=1/2RL)	12	1	8	1.87E-06	7.00E-07	9.96E-07	--
	TEQ - Dioxins/Furans (ND=1/2MDL)	12	1	8	4.26E-07	1.21E-07	4.96E-07	--
PCBs	Aroclor-1016	6	0	0	1.83E-02	2.84E-03	--	3.63E-02
	Aroclor-1221	6	0	0	1.79E-02	4.28E-03	--	3.58E-02
	Aroclor-1232	6	0	0	1.72E-02	3.72E-03	--	3.42E-02
	Aroclor-1242	6	0	0	2.30E-02	4.22E-03	--	4.58E-02
	Aroclor-1248	6	0	0	1.59E-02	4.78E-03	--	3.18E-02
	Aroclor-1254	6	0	0	1.90E-02	5.45E-03	--	3.80E-02
	Aroclor-1260	6	0	0	1.50E-02	4.00E-03	--	3.00E-02
	Aroclor-1262	6	0	0	1.93E-02	4.08E-03	--	3.83E-02
	Aroclor-1268	6	0	0	2.11E-02	7.10E-03	--	4.22E-02
Total Metals	Aluminum	6	5	83	1.08E+01	1.22E+01	3.46E+01	1.85E+00
	Antimony	6	4	67	1.43E-01	5.27E-02	2.20E-01	8.30E-02
	Arsenic	6	6	100	2.36E+00	1.82E+00	5.10E+00	1.37E-01
	Barium	6	6	100	2.33E+02	7.57E+01	3.59E+02	5.93E-02
	Beryllium	1	0	0	3.30E-02	#DIV/0!	--	6.60E-02
	Cadmium	6	0	0	9.42E-03	4.59E-03	--	1.88E-02
	Calcium	6	6	100	5.37E+04	8.92E+03	6.35E+04	6.23E+01
	Chromium	6	5	83	3.07E-01	1.46E-01	5.20E-01	1.52E-01
	Cobalt	6	3	50	5.43E-02	4.10E-02	5.00E-02	8.07E-02
	Copper	6	6	100	2.60E+00	2.01E+00	6.60E+00	3.37E-01
	Iron	6	2	33	2.49E+01	3.52E+01	9.57E+01	1.48E+01
	Lead	6	3	50	9.75E-02	1.98E-01	5.00E-01	2.03E-02
	Magnesium	6	6	100	1.96E+04	3.35E+03	2.37E+04	4.38E+01
	Manganese	6	5	83	1.05E+00	1.18E+00	2.80E+00	1.26E-01
	Mercury	6	0	0	2.80E-02	7.35E-03	--	5.60E-02
	Nickel	6	2	33	2.53E-01	3.25E-01	8.00E-01	1.24E-01
	Potassium	6	6	100	2.77E+03	6.55E+02	3.52E+03	3.13E+02
	Selenium	6	3	50	2.09E-01	1.47E-01	4.50E-01	1.57E-01
	Silver	6	1	17	2.30E-02	3.17E-02	1.10E-02	4.38E-02
	Sodium	6	6	100	1.69E+04	5.38E+03	2.33E+04	1.21E+02
	Thallium	6	0	0	6.82E-03	5.01E-03	--	1.36E-02
	Vanadium	6	6	100	1.12E+00	4.54E-01	1.60E+00	1.37E-01
	Zinc	6	4	67	1.14E+01	2.51E+01	6.27E+01	1.07E+00
Dissolved Metals	Aluminum	12	8	67	3.83E+00	3.15E+00	1.13E+01	2.28E+00
	Antimony	7	6	86	2.25E-01	7.23E-02	3.40E-01	8.83E-02
	Arsenic	12	12	100	2.38E+00	1.72E+00	5.20E+00	1.30E-01
	Barium	12	12	100	2.23E+02	8.03E+01	3.68E+02	6.99E-02
	Beryllium	1	0	0	3.30E-02	#DIV/0!	--	6.60E-02
	Cadmium	12	1	8	1.45E-02	1.35E-02	5.60E-02	2.08E-02
	Calcium	1	1	100	5.89E+04	#DIV/0!	5.89E+04	2.50E+02
	Calcium	11	11	100	5.15E+04	7.90E+03	6.28E+04	3.85E+01
	Chromium	12	11	92	5.30E-01	3.10E-01	1.10E+00	1.55E-01
	Cobalt	12	5	42	8.43E-02	3.73E-02	1.80E-01	9.79E-02
	Copper	12	12	100	2.83E+00	2.81E+00	1.02E+01	2.88E-01
	Iron	12	0	0	7.04E+00	2.34E+00	--	1.41E+01
	Lead	12	6	50	1.05E-01	1.41E-01	4.30E-01	2.88E-02
	Magnesium	12	12	100	1.89E+04	3.15E+03	2.34E+04	2.98E+01
	Manganese	12	5	42	6.29E-01	1.01E+00	2.70E+00	1.62E-01
	Mercury	12	0	0	2.03E-02	9.62E-03	--	4.05E-02
	Nickel	12	8	67	3.99E-01	3.73E-01	1.00E+00	1.34E-01
	Potassium	12	12	100	2.92E+03	6.88E+02	4.13E+03	2.03E+02
	Selenium	7	4	57	2.05E-01	1.34E-01	4.70E-01	1.59E-01
	Silver	12	2	17	4.44E-02	3.61E-02	1.10E-02	8.69E-02
	Sodium	12	12	100	1.67E+04	5.74E+03	2.61E+04	7.34E+01
	Thallium	12	3	25	1.61E-02	2.10E-02	7.80E-02	1.48E-02
	Vanadium	12	12	100	1.15E+00	4.75E-01	1.80E+00	1.91E-01
	Zinc	12	8	67	1.10E+01	2.13E+01	6.26E+01	1.47E+00
Miscellaneous Parameters	Chloride	11	11	100	1.08E+04	6.74E+03	2.78E+04	2.43E-01
	Fluoride	11	11	100	2.16E+02	4.90E+01	3.00E+02	4.49E+01
	Nitrogen, NO2 plus NO3	11	11	100	2.13E+03	1.20E+03	3.90E+03	5.49E-02
	Phosphorus (as P)	11	11	100	9.27E+01	4.39E+01	1.70E+02	1.99E+00
	Sulfate	11	11	100	2.60E+04	8.85E+03	4.04E+04	1.52E-01

Table 3-3. Background Groundwater Summary Statistics[a,b]

Analysis	Contaminant	N	N Detect	Detection Frequency (%)	Average Concentration[c]	Standard Deviation[c]	Maximum Detected Concentration	Average MDL
Semivolatiles	1,2,4-Trichlorobenzene	4	0	0	1.65E+00	7.52E-01	--	3.30E+00
	1,2-Dichlorobenzene	4	0	0	1.55E+00	4.56E-01	--	3.10E+00
	1,2-Diphenylhydrazine	4	0	0	9.13E-01	2.84E-01	--	1.83E+00
	1,3-Dichlorobenzene	4	0	0	1.68E+00	6.96E-01	--	3.35E+00
	1,4-Dichlorobenzene	4	0	0	1.54E+00	4.07E-01	--	3.08E+00
	1-Methylnaphthalene	4	0	0	1.09E+00	6.29E-02	--	2.18E+00
	2,4,5-Trichlorophenol	4	0	0	8.50E-01	2.92E-01	--	1.70E+00
	2,4,6-Trichlorophenol	4	0	0	8.25E-01	2.72E-01	--	1.65E+00
	2,4-Dichlorophenol	4	0	0	9.75E-01	1.66E-01	--	1.95E+00
	2,4-Dimethylphenol	4	0	0	4.75E+00	5.15E+00	--	9.50E+00
	2,4-Dinitrophenol	4	0	0	1.26E+00	2.17E-01	--	2.53E+00
	2,4-Dinitrotoluene	4	0	0	8.25E-01	1.85E-01	--	1.65E+00
	2,6-Dinitrotoluene	4	0	0	6.74E-01	4.11E-01	--	1.35E+00
	2-Chloronaphthalene	4	0	0	1.19E+00	4.79E-02	--	2.38E+00
	2-Chlorophenol	4	0	0	8.88E-01	3.04E-01	--	1.78E+00
	2-Methylnaphthalene	4	0	0	1.21E+00	1.93E-01	--	2.43E+00
	2-Nitroaniline	4	0	0	1.06E+00	3.01E-01	--	2.13E+00
	2-Nitrophenol	4	0	0	1.04E+00	1.31E-01	--	2.08E+00
	3,3`-Dichlorobenzidine	4	0	0	1.33E+00	9.21E-01	--	2.65E+00
	3-Nitroaniline	4	0	0	1.56E+00	1.06E+00	--	3.13E+00
	4,6-Dinitro-o-cresol	4	0	0	1.04E+00	5.48E-01	--	2.08E+00
	4-Bromophenyl phenyl ether	4	0	0	1.09E+00	3.59E-01	--	2.18E+00
	4-Chloro-3-methylphenol	4	0	0	8.88E-01	1.44E-01	--	1.78E+00
	4-Chlorophenyl phenyl ether	4	0	0	7.88E-01	4.79E-02	--	1.58E+00
	4-Nitroaniline	4	0	0	1.51E+00	5.54E-01	--	3.03E+00
	4-Nitrophenol	4	0	0	1.45E+00	2.16E-01	--	2.90E+00
	Acenaphthene	4	0	0	9.50E-01	9.13E-02	--	1.90E+00
	Acenaphthylene	4	0	0	1.04E+00	1.31E-01	--	2.08E+00
	Anthracene	4	0	0	9.88E-01	3.33E-01	--	1.98E+00
	Benzo(a)anthracene	4	0	0	1.19E+00	9.75E-01	--	2.38E+00
	Benzo(a)pyrene	4	0	0	1.05E+00	1.58E-01	--	2.10E+00
	Benzo(b)fluoranthene	4	0	0	9.38E-01	2.87E-01	--	1.88E+00
	Benzo(g,h,i)perylene	4	0	0	1.09E+00	2.10E-01	--	2.18E+00
	Benzo(k)fluoranthene	4	0	0	1.03E+00	3.12E-01	--	2.05E+00
	bis(2-chloroethoxy)methane	4	0	0	8.50E-01	2.04E-01	--	1.70E+00
	bis(2-chloroethyl)ether	4	0	0	9.00E-01	3.19E-01	--	1.80E+00
	Bis(2-chloroisopropyl)ether	4	0	0	9.38E-01	2.46E-01	--	1.88E+00
	Bis(2-ethylhexyl)phthalate	4	0	0	1.75E+00	8.91E-01	--	3.50E+00
	Butyl benzyl phthalate	4	0	0	9.75E-01	2.89E-02	--	1.95E+00
	Carbazole	4	0	0	8.88E-01	3.79E-01	--	1.78E+00
	Chrysene	4	0	0	9.50E-01	2.04E-01	--	1.90E+00
	Dibenzo(a,h)anthracene	4	0	0	1.00E+00	2.27E-01	--	2.00E+00
	Dibenzofuran	4	0	0	9.63E-01	1.60E-01	--	1.93E+00
	Dibutyl phthalate	4	0	0	9.13E-01	2.50E-01	--	1.83E+00
	Diethyl phthalate	4	0	0	9.38E-01	2.50E-01	--	1.88E+00
	Dimethyl phthalate	4	0	0	8.50E-01	2.48E-01	--	1.70E+00
	Di-n-octyl phthalate	4	0	0	1.05E+00	1.08E-01	--	2.10E+00
	Fluoranthene	4	0	0	9.38E-01	2.43E-01	--	1.88E+00
	Fluorene	4	0	0	8.75E-01	2.53E-01	--	1.75E+00
	Hexachlorobenzene	4	0	0	1.13E+00	2.33E-01	--	2.25E+00
	Hexachlorobutadiene	4	0	0	1.38E+00	4.17E-01	--	2.75E+00
	Hexachloroethane	4	0	0	1.46E+00	4.85E-01	--	2.93E+00
	Indeno(1,2,3-cd)pyrene	4	0	0	9.50E-01	1.78E-01	--	1.90E+00
	Isophorone	4	0	0	8.00E-01	2.48E-01	--	1.60E+00
	m & p-cresols	4	0	0	1.03E+00	6.01E-01	--	2.05E+00
	Naphthalene	4	0	0	1.16E+00	1.31E-01	--	2.33E+00
	Nitrobenzene	4	0	0	9.38E-01	2.93E-01	--	1.88E+00
	N-Nitrosodimethylamine	4	0	0	8.50E-01	3.49E-01	--	1.70E+00
	N-Nitrosodi-n-propylamine	4	0	0	8.63E-01	3.61E-01	--	1.73E+00
	N-Nitrosodiphenylamine	4	0	0	1.26E+00	7.72E-01	--	2.53E+00
	o-Cresol	4	0	0	1.35E+00	6.34E-01	--	2.70E+00
	p-Chloroaniline	4	0	0	1.94E+00	1.31E+00	--	3.88E+00
	Pentachlorophenol	4	0	0	1.09E+00	5.06E-01	--	2.18E+00
	Phenanthrene	4	0	0	8.00E-01	3.67E-01	--	1.60E+00
	Phenol	4	0	0	8.50E-01	2.68E-01	--	1.70E+00
	Pyrene	4	0	0	9.38E-01	2.43E-01	--	1.88E+00

Table 3-3. Background Groundwater Summary Statistics[a,b]

Analysis	Contaminant	N	N Detect	Detection Frequency (%)	Average Concentration[c]	Standard Deviation[c]	Maximum Detected Concentration	Average MDL
Volatile Organics	1,1,1,2-Tetrachloroethane	4	0	0	4.90E-02	3.40E-02	--	9.80E-02
	1,1,1-Trichloroethane	4	0	0	4.64E-02	3.58E-02	--	9.28E-02
	1,1,2,2-Tetrachloroethane	4	0	0	4.81E-02	4.13E-02	--	9.63E-02
	1,1,2-Trichloroethane	4	0	0	5.40E-02	4.40E-02	--	1.08E-01
	1,1-Dichloroethane	4	0	0	4.81E-02	4.13E-02	--	9.63E-02
	1,1-Dichloroethene	4	0	0	5.34E-02	3.78E-02	--	1.07E-01
	1,1-Dichloropropene	4	0	0	5.08E-02	1.95E-02	--	1.02E-01
	1,2,3-Trichlorobenzene	4	0	0	9.25E-02	1.50E-02	--	1.85E-01
	1,2,3-Trichloropropane	4	0	0	1.34E-01	7.75E-02	--	2.68E-01
	1,2,4-Trichlorobenzene	4	0	0	8.00E-02	2.00E-02	--	1.60E-01
	1,2,4-Trimethylbenzene	4	0	0	4.55E-02	2.30E-02	--	9.10E-02
	1,2-Dibromo-3-chloropropane	4	0	0	3.13E-01	2.50E-02	--	6.25E-01
	1,2-Dibromoethane	4	0	0	6.33E-02	3.45E-02	--	1.27E-01
	1,2-Dichlorobenzene	4	0	0	5.68E-02	3.55E-02	--	1.14E-01
	1,2-Dichloroethane	4	0	0	4.83E-02	2.45E-02	--	9.65E-02
	1,2-Dichloropropane	4	0	0	7.73E-02	8.85E-02	--	1.55E-01
	1,3,5-Trimethylbenzene	4	0	0	4.08E-02	3.95E-02	--	8.15E-02
	1,3-Dichlorobenzene	4	0	0	5.81E-02	3.13E-02	--	1.16E-01
	1,3-Dichloropropane	4	0	0	5.21E-02	4.53E-02	--	1.04E-01
	1,4-Dichlorobenzene	4	0	0	5.04E-02	1.98E-02	--	1.01E-01
	2,2-Dichloropropane	4	0	0	8.10E-02	6.60E-02	--	1.62E-01
	Acetone	4	2	50	3.64E+00	2.58E+00	6.60E+00	2.26E+00
	Allyl chloride	4	0	0	1.66E-01	8.25E-02	--	3.33E-01
	Benzene	4	1	25	1.03E-01	1.65E-01	3.50E-01	8.40E-02
	Bromobenzene	4	0	0	6.39E-02	4.08E-02	--	1.28E-01
	Bromochloromethane	4	0	0	7.33E-02	6.45E-02	--	1.47E-01
	Bromoform	4	0	0	9.25E-02	7.50E-02	--	1.85E-01
	Bromomethane	4	0	0	1.20E-01	4.00E-02	--	2.40E-01
	Carbon tetrachloride	4	0	0	7.34E-02	6.78E-02	--	1.47E-01
	Chlorobenzene	4	0	0	5.35E-02	4.10E-02	--	1.07E-01
	Chloroethane	4	0	0	8.75E-02	5.50E-02	--	1.75E-01
	Chloroform	4	0	0	1.13E-01	1.50E-02	--	2.25E-01
	Chloromethane	4	0	0	1.10E-01	1.40E-01	--	2.20E-01
	cis-1,2-Dichloroethylene	4	0	0	7.63E-02	3.25E-02	--	1.53E-01
	cis-1,3-Dichloropropylene	4	0	0	5.21E-02	3.53E-02	--	1.04E-01
	Cumene	4	0	0	4.53E-02	2.65E-02	--	9.05E-02
	Dibromochloromethane	4	0	0	3.80E-02	2.80E-02	--	7.60E-02
	Dichlorobromomethane	4	0	0	4.80E-02	2.80E-02	--	9.60E-02
	Dichlorodifluoromethane	4	0	0	8.94E-02	1.04E-01	--	1.79E-01
	Dichlorofluoromethane	4	0	0	4.78E-02	4.15E-02	--	9.55E-02
	Ethyl ether	4	0	0	8.13E-02	7.25E-02	--	1.63E-01
	Ethylbenzene	4	0	0	5.69E-02	3.88E-02	--	1.14E-01
	Hexachlorobutadiene	4	0	0	1.09E-01	8.75E-02	--	2.18E-01
	m & p-Xylenes	4	0	0	9.25E-02	7.50E-02	--	1.85E-01
	Methyl ethyl ketone	4	0	0	7.25E-01	3.50E-01	--	1.45E+00
	Methyl isobutyl ketone	4	0	0	6.00E-01	4.00E-01	--	1.20E+00
	Methylene bromide	4	0	0	9.13E-02	4.25E-02	--	1.83E-01
	Methylene chloride	4	0	0	1.06E-01	1.16E-01	--	2.13E-01
	MTBE (Methyl tert-butyl ether)	4	0	0	4.26E-02	3.83E-02	--	8.53E-02
	Naphthalene	4	0	0	4.15E-02	1.90E-02	--	8.30E-02
	n-Butyl benzene	4	0	0	7.04E-02	1.93E-02	--	1.41E-01
	n-Propyl benzene	4	0	0	4.46E-02	4.03E-02	--	8.93E-02
	o-Chlorotoluene	4	0	0	5.90E-02	3.40E-02	--	1.18E-01
	o-Xylene	4	0	0	4.03E-02	3.65E-02	--	8.05E-02
	p-Chlorotoluene	4	0	0	4.80E-02	4.80E-02	--	9.60E-02
	p-Isopropyltoluene	4	0	0	4.40E-02	2.40E-02	--	8.80E-02
	sec-Butyl benzene	4	0	0	5.53E-02	1.65E-02	--	1.11E-01
	Styrene	4	0	0	3.48E-02	1.35E-02	--	6.95E-02
	tert-Butyl benzene	4	0	0	4.16E-02	3.23E-02	--	8.33E-02
	Tetrachloroethylene	4	0	0	7.25E-02	1.50E-02	--	1.45E-01
	Tetrahydrofuran	4	0	0	1.06E+00	6.25E-01	--	2.13E+00
	Toluene	4	1	25	7.35E-02	6.65E-02	1.70E-01	7.68E-02
	trans-1,2-Dichloroethylene	4	0	0	8.25E-02	1.50E-02	--	1.65E-01
	trans-1,3-Dichloropropylene	4	0	0	4.40E-02	4.40E-02	--	8.80E-02
	Trichloroethylene	4	0	0	3.40E-02	2.40E-02	--	6.80E-02
	Trichlorofluoromethane	4	0	0	4.31E-02	3.13E-02	--	8.63E-02
	Trichlorotrifluoroethane	4	0	0	1.01E-01	7.25E-02	--	2.03E-01
	Vinyl chloride	4	0	0	4.69E-02	4.25E-03	--	9.38E-02
	Xylenes (total)	4	0	0	1.31E-01	1.13E-01	--	2.63E-01

TEQ = toxicity equivalent; ND = non-detect; RL = reporting limit; MDL = method detection imit; DL = dioxin-like; PCB = polychlorinated biphenyl

[a] Data collected from the County well, SMW1, SMW5, SMW6 and deep well WFBW.

[b] All concentrations reported in units of µg/L.

[c] Non-detects evaluated at 1/2 the MDL when calculating average and standard deviation.

Table 3-4. OU2 Soil COPC Screening[a]

Analysis	Contaminant	Detection Frequency (%)	Maximum Detected Concentration	Average MDL	RBC[b]		COPC SELECTION STEPS					OU2 SOIL COPCs		
							Does chemical have an RBC?	Is chemical detected ≥5%?	Is Max Detect > RBC?	Detection Limit[c]	Background[d]			
										Is MDL > RBC?	Are site concentrations > background?	COPC	Not a COPC	Source of Uncertainty
TEQ	**TEQ - Dioxins/Furans (ND=1/2MDL)**	100	2.53E-05	--	5.1E-06	NC	yes	yes	yes		yes	X		
	TEQ - Dioxins/Furans/DL-PCBs (ND=1/2MDL)	100	4.20E-05	--	5.1E-06	NC	yes	yes	yes		N/A	X		
	TEQ - DL-PCBs (ND=1/2DL)	100	3.33E-05	--	5.1E-06	NC	yes	yes	yes		N/A	X		
PCBs	**Total PCBs - non-DL (ND=1/2MDL)**	100	1.01E+00	--	2.3E-01	C	yes	yes	yes		N/A	X		
	Total PCBs - DL (ND=1/2MDL)	100	1.17E-01	--	2.3E-01	C	yes	yes	no				X	
	Aroclor-1016	0	--	8.17E-03	4.1E-01	NC	yes	no		no			X	
	Aroclor-1221	0	--	1.25E-02	2.0E-01	C	yes	no		no			X	
	Aroclor-1232	0	--	9.94E-03	1.7E-01	C	yes	no		no			X	
	Aroclor-1242	0	--	1.39E-02	2.3E-01	C	yes	no		no			X	
	Aroclor-1248	0	--	1.09E-02	2.3E-01	C	yes	no		no			X	
	Aroclor-1254	27	4.13E-01	7.30E-03	1.2E-01	NC	yes	yes	yes		N/A	X		
	Aroclor-1260	14	1.72E-01	6.08E-03	2.4E-01	C	yes	yes	no				X	
	Aroclor-1262	0	--	8.95E-03			no							X
	Aroclor-1268	0	--	5.68E-03			no							X
Total Metals	**Aluminum**	100	2.84E+04	4.78E+00	7.7E+03	NC	yes	yes	yes		no		X	
	Antimony	42	3.60E-01	1.73E-01	3.1E+00	NC	yes	yes	no				X	
	Arsenic	100	1.14E+01	1.60E-01	6.8E-01	C	yes	yes	yes		no		X	
	Barium	100	1.08E+03	1.10E-01	1.5E+03	NC	yes	yes	no				X	
	Beryllium	100	1.20E+00	7.75E-02	1.6E+01	NC	yes	yes	no				X	
	Cadmium	97	3.50E+00	3.06E-02	7.1E+00	NC	yes	yes	no				X	
	Calcium	100	5.10E+04	2.88E+01	4.0E+06	EN	yes	yes	no				X	
	Chromium	100	3.95E+01	1.83E-01	3.0E-01	C	yes	yes	yes		no		X	
	Cobalt	100	9.60E+00	2.14E-01	2.3E+00	NC	yes	yes	yes		no		X	
	Copper	100	1.13E+02	3.11E-01	3.1E+02	NC	yes	yes	no				X	
	Iron	100	3.73E+04	2.58E+01	5.5E+03	NC	yes	yes	yes		no		X	
	Lead	100	3.88E+01	4.19E-02	4.0E+02	NC	yes	yes	no				X	
	Magnesium	100	1.40E+04	6.68E+00	7.0E+07	EN	yes	yes	no				X	
	Manganese	100	3.04E+03	2.25E-01	1.8E+02	NC	yes	yes	yes		no		X	
	Mercury	76	3.10E-01	8.33E-03	2.3E+00	NC	yes	yes	no				X	
	Nickel	100	4.25E+01	1.62E-01	1.5E+02	NC	yes	yes	no				X	
	Potassium	100	4.14E+03	3.03E+01	2.1E+07	EN	yes	yes	no				X	
	Selenium	63	2.10E+00	2.80E-01	3.9E+01	NC	yes	yes	no				X	
	Silver	10	7.40E-01	1.45E-01	3.9E+01	NC	yes	yes	no				X	
	Sodium	100	5.59E+02	2.02E+01	5.0E+06	EN	yes	yes	no				X	
	Thallium	96	5.50E-01	4.12E-02	7.8E-02	NC	yes	yes	yes		no		X	
	Vanadium	100	2.62E+01	3.42E-01	3.9E+01	NC	yes	yes	no				X	
	Zinc	100	4.46E+02	1.39E+00	2.3E+03	NC	yes	yes	no				X	
Semivolatiles	1,2,4-Trichlorobenzene	0	--	5.82E-02	5.8E+00	NC	yes	no		no			X	
	1,2-Dichlorobenzene	0	--	2.28E-02	1.8E+02	NC	yes	no		no			X	
	1,2-Diphenylhydrazine	0	--	1.77E-01	6.8E-01	C	yes	no		no			X	
	1,3-Dichlorobenzene	0	--	2.23E-02			no							X
	1,4-Dichlorobenzene	0	--	2.35E-02	2.6E+00	C	yes	no		no			X	
	1-Methylnaphthalene	0	--	6.09E-02	1.8E+01	C	yes	no		no			X	
	2,4,5-Trichlorophenol	0	--	4.22E-02	6.3E+02	NC	yes	no		no			X	
	2,4,6-Trichlorophenol	0	--	4.55E-02	6.3E+00	NC	yes	no		no			X	
	2,4-Dichlorophenol	0	--	6.65E-02	1.9E+01	NC	yes	no		no			X	
	2,4-Dimethylphenol	0	--	6.61E-02	1.3E+02	NC	yes	no		no			X	
	2,4-Dinitrophenol	0	--	1.77E-01	1.3E+01	NC	yes	no		no			X	
	2,4-Dinitrotoluene	0	--	1.77E-01	1.7E+00	C	yes	no		no			X	
	2,6-Dinitrotoluene	0	--	3.02E-02	3.6E-01	C	yes	no		no			X	
	2-Chloronaphthalene	0	--	5.53E-02	4.8E+02	NC	yes	no		no			X	
	2-Chlorophenol	0	--	8.24E-02	3.9E+01	NC	yes	no		no			X	
	2-Methylnaphthalene	0	--	6.31E-02	2.4E+01	NC	yes	no		no			X	
	2-Nitroaniline	0	--	3.83E-02	6.3E+01	NC	yes	no		no			X	
	2-Nitrophenol	0	--	6.04E-02			no							X

Table 3-4. OU2 Soil COPC Screening[a]

Analysis	Contaminant	Detection Frequency (%)	Maximum Detected Concentration	Average MDL	RBC[b]	COPC SELECTION STEPS: Does chemical have an RBC?	Is chemical detected ≥5%?	Is Max Detect > RBC?	Detection Limit[c]: Is MDL > RBC?	Background[d]: Are site concentrations > background?	OU2 SOIL COPCs: COPC	Not a COPC	Source of Uncertainty
Semivolatiles	3,3`-Dichlorobenzidine	0	--	4.92E-02	1.2E+00 C	yes	no		no			X	
	3-Nitroaniline	0	--	3.61E-02		no							X
	4,6-Dinitro-o-cresol	0	--	7.02E-02	5.1E-01 NC	yes	no		no			X	
	4-Bromophenyl phenyl ether	0	--	3.76E-02		no							X
	4-Chloro-3-methylphenol	0	--	1.77E-01	6.3E+02 NC	yes	no		no			X	
	4-Chlorophenyl phenyl ether	0	--	4.07E-02		no							X
	4-Nitroaniline	0	--	3.09E-02	2.5E+01 NC	yes	no		no			X	
	4-Nitrophenol	0	--	3.70E-02		no							X
	Acenaphthene	3	6.30E-04	1.45E-02	3.6E+02 NC	yes	no		no			X	
	Acenaphthylene	3	2.00E-03	1.64E-02		no							X
	Anthracene	11	8.00E-03	6.11E-02	1.8E+03 NC	yes	yes	no				X	
	Benzo(a)anthracene	11	1.56E-02	6.09E-02	1.1E+00 C	yes	yes	no				X	
	Benzo(a)pyrene	17	3.60E-02	6.09E-02	1.1E-01 C	yes	yes	no				X	
	Benzo(b)fluoranthene	26	3.38E-02	1.59E-02	1.1E+00 C	yes	yes	no				X	
	Benzo(g,h,i)perylene	14	1.93E-02	1.53E-02		no							X
	Benzo(k)fluoranthene	17	1.20E-02	1.61E-02	1.1E+01 C	yes	yes	no				X	
	bis(2-chloroethoxy)methane	0	--	6.90E-02	1.9E+01 NC	yes	no		no			X	
	bis(2-chloroethyl)ether	0	--	2.46E-02	2.3E-01 C	yes	no		no			X	
	Bis(2-chloroisopropyl)ether	0	--	8.16E-02	3.1E+02 NC	yes	no		no			X	
	Bis(2-ethylhexyl)phthalate	17	3.46E-01	6.04E-02	3.9E+01 C	yes	yes	no				X	
	Butyl benzyl phthalate	0	--	1.77E-01	2.9E+02 C	yes	no		no			X	
	Carbazole	0	--	1.77E-01		no							X
	Chrysene	20	2.42E-02	1.66E-02	1.1E+02 C	yes	yes	no				X	
	Dibenzo(a,h)anthracene	6	8.70E-03	6.13E-02	1.1E-01 C	yes	yes	no				X	
	Dibenzofuran	0	--	1.77E-01	7.3E+00 NC	yes	no		no			X	
	Dibutyl phthalate	8	5.37E-02	4.90E-02	6.3E+02 NC	yes	yes	no				X	
	Diethyl phthalate	0	--	1.77E-01	5.1E+03 NC	yes	no		no			X	
	Dimethyl phthalate	0	--	1.77E-01		no							X
	Di-n-octyl phthalate	0	--	1.77E-01	6.3E+01 NC	yes	no		no			X	
	Fluoranthene	26	3.07E-02	6.09E-02	2.4E+02 NC	yes	yes	no				X	
	Fluorene	0	--	6.11E-02	2.4E+02 NC	yes	no		no			X	
	Hexachlorobenzene	0	--	4.64E-02	2.1E-01 C	yes	no		no			X	
	Hexachlorobutadiene	0	--	2.98E-02	1.2E+00 C	yes	no		no			X	
	Hexachloroethane	0	--	2.25E-02	1.8E+00 C	yes	no		no			X	
	Indeno(1,2,3-cd)pyrene	14	1.04E-02	6.12E-02	1.1E+00 C	yes	yes	no				X	
	Isophorone	0	--	5.64E-02	5.7E+02 C	yes	no		no			X	
	m & p-cresols	0	--	7.06E-02	3.2E+02 NC	yes	no		no			X	
	Naphthalene	6	5.40E-03	4.12E-02	3.8E+00 C	yes	yes	no				X	
	Nitrobenzene	0	--	7.14E-02	5.1E+00 C	yes	no		no			X	
	N-Nitrosodimethylamine	0	--	1.77E-01	2.0E-03 C	yes	no		yes			X	
	N-Nitrosodi-n-propylamine	0	--	4.81E-02	7.8E-02 C	yes	no		no			X	
	N-Nitrosodiphenylamine	0	--	1.77E-01	1.1E+02 C	yes	no		no			X	
	o-Cresol	0	--	7.64E-02	3.2E+02 NC	yes	no		no			X	
	p-Chloroaniline	0	--	5.42E-02	2.7E+00 C	yes	no		no			X	
	Pentachlorophenol	0	--	1.77E-01	1.0E+00 C	yes	no		no			X	
	Phenanthrene	6	7.00E-03	1.77E-02		no							X
	Phenol	0	--	7.72E-02	1.9E+03 NC	yes	no		no			X	
	Pyrene	29	4.59E-02	1.56E-02	1.8E+02 NC	yes	yes	no				X	

Table 3-4. OU2 Soil COPC Screening[a]

Analysis	Contaminant	Detection Frequency (%)	Maximum Detected Concentration	Average MDL	RBC[b]	COPC SELECTION STEPS			Detection Limit[c]	Background[d]	OU2 SOIL COPCs		
						Does chemical have an RBC?	Is chemical detected ≥5%?	Is Max Detect > RBC?	Is MDL > RBC?	Are site concentrations > background?	COPC	Not a COPC	Source of Uncertainty
Volatile Organics	1,1,1,2-Tetrachloroethane	0	--	1.77E-02	2.0E+00 C	yes	no		no			X	
	1,1,1-Trichloroethane	0	--	1.82E-02	8.1E+02 NC	yes	no		no			X	
	1,1,2,2-Tetrachloroethane	5	9.40E-04	1.69E-02	6.0E-01 C	yes	yes	no				X	
	1,1,2-Trichloroethane	0	--	2.51E-02	1.5E-01 NC	yes	no		no			X	
	1,1-Dichloroethane	0	--	1.76E-02	3.6E+00 C	yes	no		no			X	
	1,1-Dichloroethene	0	--	2.12E-02	2.3E+01 NC	yes	no		no			X	
	1,1-Dichloropropene	0	--	1.87E-02		no							X
	1,2,3-Trichlorobenzene	0	--	3.55E-02	6.3E+00 NC	yes	no		no			X	
	1,2,3-Trichloropropane	0	--	2.56E-02	5.1E-03 C	yes	no		yes			X	
	1,2,4-Trichlorobenzene	0	--	1.67E-02	5.8E+00 NC	yes	no		no			X	
	1,2,4-Trimethylbenzene	26	9.89E-02	1.83E-02	3.0E+01 NC	yes	yes	no				X	
	1,2-Dibromo-3-chloropropane	0	--	7.12E-02	5.3E-03 C	yes	no		yes			X	
	1,2-Dibromoethane	0	--	1.49E-02	3.6E-02 C	yes	no		no			X	
	1,2-Dichlorobenzene	0	--	2.22E-02	1.8E+02 NC	yes	no		no			X	
	1,2-Dichloroethane	0	--	2.05E-02	4.6E-01 C	yes	no		no			X	
	1,2-Dichloropropane	0	--	1.88E-02	1.6E+00 NC	yes	no		no			X	
	1,3,5-Trimethylbenzene	0	--	1.78E-02	2.7E+01 NC	yes	no		no			X	
	1,3-Dichlorobenzene	0	--	2.24E-02		no							X
	1,3-Dichloropropane	0	--	1.44E-02	1.6E+02 NC	yes	no		no			X	
	1,4-Dichlorobenzene	0	--	1.94E-02	2.6E+00 C	yes	no		no			X	
	2,2-Dichloropropane	0	--	3.72E-02		no							X
	Acetone	16	1.44E+00	3.75E-01	6.1E+03 NC	yes	yes	no				X	
	Allyl chloride	0	--	2.25E-02	1.7E-01 NC	yes	no		no			X	
	Benzene	0	--	1.31E-02	1.2E+00 C	yes	no		no			X	
	Bromobenzene	0	--	2.23E-02	2.9E+01 NC	yes	no		no			X	
	Bromochloromethane	0	--	1.76E-02	1.5E+01 NC	yes	no		no			X	
	Bromoform	0	--	2.18E-02	1.9E+01 C	yes	no		no			X	
	Bromomethane	0	--	1.60E-01	6.8E-01 NC	yes	no		no			X	
	Carbon tetrachloride	0	--	2.21E-02	6.5E-01 C	yes	no		no			X	
	Chlorobenzene	0	--	1.49E-02	2.8E+01 NC	yes	no		no			X	
	Chloroethane	0	--	4.38E-02	1.4E+03 NC	yes	no		no			X	
	Chloroform	5	3.81E-02	1.54E-02	3.2E-01 C	yes	yes	no				X	
	Chloromethane	0	--	1.87E-02	1.1E+01 NC	yes	no		no			X	
	cis-1,2-Dichloroethylene	0	--	3.26E-02	1.6E+01 NC	yes	no		no			X	
	cis-1,3-Dichloropropylene	0	--	9.51E-03		no							X
	Cumene	0	--	1.68E-02	1.9E+02 NC	yes	no		no			X	
	Dibromochloromethane	0	--	1.43E-02	8.3E+00 C	yes	no		no			X	
	Dichlorobromomethane	0	--	1.64E-02	2.9E-01 C	yes	no		no			X	
	Dichlorodifluoromethane	0	--	2.29E-02	8.7E+00 NC	yes	no		no			X	
	Dichlorofluoromethane	0	--	8.58E-02		no							X
	Ethyl ether	0	--	2.99E-02	1.6E+03 NC	yes	no		no			X	
	Ethylbenzene	5	3.54E-02	1.38E-02	5.8E+00 C	yes	yes	no				X	
	Hexachlorobutadiene	0	--	3.93E-02	1.2E+00 C	yes	no		no			X	
	Methyl ethyl ketone	0	--	1.52E-01	2.7E+03 NC	yes	no		no			X	
	Methyl isobutyl ketone	0	--	1.16E-01	3.3E+03 NC	yes	no		no			X	
	Methylene bromide	0	--	2.16E-02	2.4E+00 NC	yes	no		no			X	
	Methylene chloride	11	3.27E-01	2.78E-02	3.5E+01 NC	yes	yes	no				X	
	MTBE (Methyl tert-butyl ether)	0	--	1.72E-02	4.7E+01 C	yes	no		no			X	
	Naphthalene	0	--	1.25E-01	3.8E+00 C	yes	no		no			X	
	n-Butyl benzene	0	--	1.74E-02	3.9E+02 NC	yes	no		no			X	
	n-Propyl benzene	0	--	1.97E-02	3.8E+02 NC	yes	no		no			X	
	o-Chlorotoluene	0	--	1.89E-02	1.6E+02 NC	yes	no		no			X	
	p-Chlorotoluene	0	--	1.72E-02	1.6E+02 NC	yes	no		no			X	
	p-Isopropyltoluene	16	2.56E+00	1.57E-02		no							X
	sec-Butyl benzene	0	--	1.88E-02	7.8E+02 NC	yes	no		no			X	
	Styrene	0	--	1.46E-02	6.0E+02 NC	yes	no		no			X	

Table 3-4. OU2 Soil COPC Screening[a]

Analysis	Contaminant	Detection Frequency (%)	Maximum Detected Concentration	Average MDL	RBC[b]	COPC SELECTION STEPS			Detection Limit[c]	Background[d]	OU2 SOIL COPCs		
						Does chemical have an RBC?	Is chemical detected ≥5%?	Is Max Detect > RBC?	Is MDL > RBC?	Are site concentrations > background?	COPC	Not a COPC	Source of Uncertainty
Volatile Organics	tert-Butyl benzene	0	--	2.46E-02	7.8E+02 NC	yes	no		no			X	
	Tetrachloroethylene	0	--	1.91E-02	8.1E+00 NC	yes	no		no			X	
	Tetrahydrofuran	32	3.32E-01	1.45E-01	1.8E+03 NC	yes	yes	no				X	
	Toluene	74	1.47E-02	6.58E-03	4.9E+02 NC	yes	yes	no				X	
	trans-1,2-Dichloroethylene	0	--	1.53E-02	1.6E+02 NC	yes	no		no			X	
	trans-1,3-Dichloropropylene	0	--	3.53E-02		no							X
	Trichloroethylene	0	--	2.23E-02	4.1E-01 NC	yes	no		no			X	
	Trichlorofluoromethane	32	2.16E-01	6.38E-02	2.3E+03 NC	yes	yes	no				X	
	Trichlorotrifluoroethane	0	--	2.16E-02	6.7E+02 NC	yes	no		no			X	
	Vinyl chloride	0	--	1.65E-02	5.9E-02 C	yes	no		no			X	
	Xylenes (total)	0	--	5.48E-02	5.8E+01 NC	yes	no		no			X	

TEQ = Toxicity Equivalence; PCBs = Polychlorinated Biphenyls; ND = non-detect; MDL = method detection limit; EN = essential nutrient; C = cancer; NC = non-cancer.

Bolded contaminants are those where the maximum detected concentration exceeds the respective RBC.

[a]Concentrations are in units of mg/kg.

[b]Risk-based concentrations are based on generic residential soil RSL values (November 2017) using a target cancer risk of 1E-06 ("C" = cancer based value) or a target HQ of 0.1 ("NC" = non-cancer based value).

[c]Detection limts were evaluated for those chemicals with a detection frequency <5%.

[d]Only those chemicals identified as having a detection frequency ≥5% and a maximum detected concentration > RBC were evaluated for comparison to background.

Table 3-5. OU2 Groundwater COPC Screening[a]

Analysis	Contaminant	Detection Frequency (%)	Maximum Detected Concentration	Average MDL	RBC[b]		COPC SELECTION STEPS					OU2 GROUNDWATER COPCs		
							Does chemical have an RBC?	Is chemical detected ≥5%?	Is Max Detect > RBC?	Detection Limit[c]	Background[d]			
										Is MDL > RBC?	Are site concentrations > background?	COPC	Not a COPC	Source of Uncertainty
TEQ	**TEQ (ND = 1/2 MDL)**	52	3.8E-06	--	1.2E-06	NC	yes	yes	yes		no		X	
PCBs	Aroclor-1016	0	--	4.1E-02	1.4E-01	NC	yes	no		no			X	
	Aroclor-1221	0	--	3.0E-02	4.7E-03	C	yes	no		yes				X
	Aroclor-1232	0	--	3.7E-02	4.7E-03	C	yes	no		yes				X
	Aroclor-1242	0	--	4.0E-02	7.8E-03	C	yes	no		yes				X
	Aroclor-1248	0	--	2.5E-02	7.8E-03	C	yes	no		yes				X
	Aroclor-1254	0	--	3.1E-02	7.8E-03	C	yes	no		yes				X
	Aroclor-1260	4.8	8.1E-02	2.5E-02	7.8E-03	C	yes	no		yes				X
	Aroclor-1262	0	--	4.2E-02			no							X
	Aroclor-1268	0	--	3.3E-02			no							X
Total Metals	Aluminum	100	3.6E+02	1.9E+00	2.0E+03	NC	yes	yes	no				X	
	Antimony	64	3.6E-01	1.4E-01	7.8E-01	NC	yes	yes	no				X	
	Arsenic	100	8.4E+00	2.0E-01	5.2E-02	C	yes	yes	yes		no		X	
	Barium	100	3.9E+02	1.2E-01	3.8E+02	NC	yes	yes	yes		no		X	
	Beryllium	0	--	6.6E-02	2.5E+00	NC	yes	no		no			X	
	Cadmium	18	4.2E-02	2.7E-02	9.2E-01	NC	yes	yes	no				X	
	Calcium	100	6.5E+04	8.6E+01	4.4E+05	EN	yes	yes	no				X	
	Chromium	82	6.2E-01	1.6E-01	3.5E-02	C	yes	yes	yes		no		X	
	Cobalt	36	1.0E+00	1.5E-01	6.0E-01	NC	yes	yes	yes		no		X	
	Copper	100	4.6E+00	2.4E-01	8.0E+01	NC	yes	yes	no				X	
	Iron	91	1.3E+03	9.3E+00	1.4E+03	NC	yes	yes	no				X	
	Lead	82	4.7E-01	3.0E-02	1.5E+01	NC	yes	yes	no				X	
	Magnesium	100	2.6E+04	7.0E+01	1.3E+05	EN	yes	yes	no				X	
	Manganese	100	2.8E+03	7.3E-01	4.3E+01	NC	yes	yes	yes		yes	X		
	Mercury	0	--	5.2E-02	5.7E-01	NC	yes	no		no			X	
	Nickel	82	1.8E+00	1.5E-01	3.9E+01	NC	yes	yes	no				X	
	Potassium	100	1.0E+04	4.3E+02	1.9E+06	EN	yes	yes	no				X	
	Selenium	9	2.6E-01	1.8E-01	1.0E+01	NC	yes	yes	no				X	
	Silver	9	1.0E-02	1.1E-01	9.4E+00	NC	yes	yes	no				X	
	Sodium	100	1.6E+05	1.7E+02	5.6E+05	EN	yes	yes	no				X	
	Thallium	0	--	2.3E-02	2.0E-02	NC	yes	no		yes				X
	Vanadium	91	4.7E+00	2.2E-01	8.6E+00	NC	yes	yes	no				X	
	Zinc	91	6.9E+00	1.3E+00	6.0E+02	NC	yes	yes	no				X	
Miscellaneous Parameters	Chloride	100	1.2E+05	4.2E-01			no							X
	Fluoride	100	2.7E+02	4.2E+01	8.0E+01	NC	yes	yes	yes		no		X	
	Nitrogen, NO2 plus NO3	100	2.6E+03	7.3E-03	1.0E+04	MCL	yes	yes	no				X	
	Phosphorus (as P)	100	4.5E+02	3.0E+00	4.0E-02	NC	yes	yes	yes		no		X	
	Sulfate	100	1.7E+05	3.6E-01			no							X

Table 3-5. OU2 Groundwater COPC Screening[a]

Analysis	Contaminant	Detection Frequency (%)	Maximum Detected Concentration	Average MDL	RBC[b]		COPC SELECTION STEPS: Does chemical have an RBC?	Is chemical detected ≥5%?	Is Max Detect > RBC?	Detection Limit[c]: Is MDL > RBC?	Background[d]: Are site concentrations > background?	OU2 GROUNDWATER COPCs: COPC	Not a COPC	Source of Uncertainty
Semivolatiles	1,2,4-Trichlorobenzene	0	--	5.7E+00	4.0E-01	NC	yes	no		yes				X
	1,2-Dichlorobenzene	0	--	5.0E+00	3.0E+01	NC	yes	no		no			X	
	1,2-Diphenylhydrazine	0	--	3.1E+00	7.8E-02	C	yes	no		yes				X
	1,3-Dichlorobenzene	0	--	5.4E+00			no							X
	1,4-Dichlorobenzene	0	--	4.9E+00	4.8E-01	C	yes	no		yes				X
	1-Methylnaphthalene	0	--	3.7E+00	1.1E+00	C	yes	no		yes				X
	2,4,5-Trichlorophenol	0	--	2.7E+00	1.2E+02	NC	yes	no		no			X	
	2,4,6-Trichlorophenol	0	--	2.8E+00	1.2E+00	NC	yes	no		yes				X
	2,4-Dichlorophenol	0	--	3.3E+00	4.6E+00	NC	yes	no		no			X	
	2,4-Dimethylphenol	0	--	8.0E+00	3.6E+01	NC	yes	no		no			X	
	2,4-Dinitrophenol	0	--	4.6E+00	3.9E+00	NC	yes	no		yes				X
	2,4-Dinitrotoluene	0	--	3.0E+00	2.4E-01	C	yes	no		yes				X
	2,6-Dinitrotoluene	0	--	2.4E+00	4.9E-02	C	yes	no		yes				X
	2-Chloronaphthalene	0	--	3.9E+00	7.5E+01	NC	yes	no		no			X	
	2-Chlorophenol	0	--	2.8E+00	9.1E+00	NC	yes	no		no			X	
	2-Methylnaphthalene	0	--	4.1E+00	3.6E+00	NC	yes	no		yes				X
	2-Nitroaniline	0	--	3.6E+00	1.9E+01	NC	yes	no		no			X	
	2-Nitrophenol	0	--	3.4E+00			no							X
	3,3`-Dichlorobenzidine	0	--	5.0E+00	1.3E-01	C	yes	no		yes				X
	3-Nitroaniline	0	--	5.0E+00			no							X
	4,6-Dinitro-o-cresol	0	--	4.2E+00	1.5E-01	NC	yes	no		yes				X
	4-Bromophenyl phenyl ether	0	--	4.2E+00			no							X
	4-Chloro-3-methylphenol	0	--	2.7E+00	1.4E+02	NC	yes	no		no			X	
	4-Chlorophenyl phenyl ether	0	--	2.6E+00			no							X
	4-Nitroaniline	0	--	5.4E+00	3.8E+00	C	yes	no		yes				X
	4-Nitrophenol	0	--	5.2E+00			no							X
	Acenaphthene	0	--	3.1E+00	5.3E+01	NC	yes	no		no			X	
	Acenaphthylene	0	--	3.4E+00			no							X
	Anthracene	0	--	3.1E+00	1.8E+02	NC	yes	no		no			X	
	Benzo(a)anthracene	0	--	5.1E+00	3.0E-02	C	yes	no		yes				X
	Benzo(a)pyrene	0	--	3.5E+00	2.5E-02	C	yes	no		yes				X
	Benzo(b)fluoranthene	0	--	3.6E+00	2.5E-01	C	yes	no		yes				X
	Benzo(g,h,i)perylene	0	--	4.0E+00			no							X
	Benzo(k)fluoranthene	0	--	3.9E+00	2.5E+00	C	yes	no		yes				X
	bis(2-chloroethoxy)methane	0	--	2.5E+00	5.9E+00	NC	yes	no		no			X	
	bis(2-chloroethyl)ether	0	--	2.9E+00	1.4E-02	C	yes	no		yes				X
	Bis(2-chloroisopropyl)ether	0	--	3.1E+00	7.1E+01	NC	yes	no		no			X	
	Bis(2-ethylhexyl)phthalate	0	--	6.4E+00	5.6E+00	C	yes	no		yes				X
	Butyl benzyl phthalate	0	--	3.2E+00	1.6E+01	C	yes	no		no			X	
	Carbazole	0	--	3.1E+00			no							X
	Chrysene	0	--	3.5E+00	2.5E+01	C	yes	no		no			X	
	Dibenzo(a,h)anthracene	0	--	3.6E+00	2.5E-02	C	yes	no		yes				X
	Dibenzofuran	0	--	3.4E+00	7.9E-01	NC	yes	no		yes				X
	Dibutyl phthalate	0	--	3.2E+00	9.0E+01	NC	yes	no		no			X	
	Diethyl phthalate	0	--	3.3E+00	1.5E+03	NC	yes	no		no			X	
	Dimethyl phthalate	0	--	3.0E+00			no							X
	Di-n-octyl phthalate	0	--	3.4E+00	2.0E+01	NC	yes	no		no			X	
	Fluoranthene	0	--	3.4E+00	8.0E+01	NC	yes	no		no			X	

Table 3-5. OU2 Groundwater COPC Screening[a]

Analysis	Contaminant	Detection Frequency (%)	Maximum Detected Concentration	Average MDL	RBC[b]		COPC SELECTION STEPS: Does chemical have an RBC?	Is chemical detected ≥5%?	Is Max Detect > RBC?	Detection Limit[c]: Is MDL > RBC?	Background[d]: Are site concentrations > background?	OU2 GROUNDWATER COPCs: COPC	Not a COPC	Source of Uncertainty
Semivolatiles	Fluorene	0	--	3.2E+00	2.9E+01	NC	yes	no		no			X	
	Hexachlorobenzene	0	--	4.1E+00	9.8E-03	C	yes	no		yes				X
	Hexachlorobutadiene	0	--	4.5E+00	1.4E-01	C	yes	no		yes				X
	Hexachloroethane	0	--	4.7E+00	3.3E-01	C	yes	no		yes				X
	Indeno(1,2,3-cd)pyrene	0	--	3.4E+00	2.5E-01	C	yes	no		yes				X
	Isophorone	0	--	2.4E+00	7.8E+01	C	yes	no		no			X	
	m & p-cresols	0	--	2.7E+00	9.3E+01	NC	yes	no		no			X	
	Naphthalene	0	--	3.9E+00	1.7E-01	C	yes	no		yes				X
	Nitrobenzene	0	--	3.2E+00	1.4E-01	C	yes	no		yes				X
	N-Nitrosodimethylamine	0	--	2.8E+00	1.1E-04	C	yes	no		yes				X
	N-Nitrosodi-n-propylamine	0	--	2.8E+00	1.1E-02	C	yes	no		yes				X
	N-Nitrosodiphenylamine	0	--	4.1E+00	1.2E+01	C	yes	no		no			X	
	o-Cresol	0	--	3.4E+00	9.3E+01	NC	yes	no		no			X	
	p-Chloroaniline	0	--	4.7E+00	3.7E-01	C	yes	no		yes				X
	Pentachlorophenol	0	--	4.3E+00	4.1E-02	C	yes	no		yes				X
	Phenanthrene	0	--	2.9E+00			no							X
	Phenol	0	--	2.9E+00	5.8E+02	NC	yes	no		no			X	
	Pyrene	0	--	3.4E+00	1.2E+01	NC	yes	no		no			X	
Volatile Organics	1,1,1,2-Tetrachloroethane	0	--	1.6E-01	5.7E-01	C	yes	no		no			X	
	1,1,1-Trichloroethane	0	--	1.6E-01	8.0E+02	NC	yes	no		no			X	
	1,1,2,2-Tetrachloroethane	0	--	1.7E-01	7.6E-02	C	yes	no		yes				X
	1,1,2-Trichloroethane	0	--	1.9E-01	4.1E-02	NC	yes	no		yes				X
	1,1-Dichloroethane	0	--	1.7E-01	2.8E+00	C	yes	no		no			X	
	1,1-Dichloroethene	0	--	1.8E-01	2.8E+01	NC	yes	no		no			X	
	1,1-Dichloropropene	0	--	1.4E-01			no							X
	1,2,3-Trichlorobenzene	0	--	2.1E-01	7.0E-01	NC	yes	no		no			X	
	1,2,3-Trichloropropane	0	--	4.1E-01	7.5E-04	C	yes	no		yes				X
	1,2,4-Trichlorobenzene	0	--	2.0E-01	4.0E-01	NC	yes	no		no			X	
	1,2,4-Trimethylbenzene	7	7.6E-01	1.3E-01	5.6E+00	NC	yes	yes	no				X	
	1,2-Dibromo-3-chloropropane	0	--	6.7E-01	3.3E-04	C	yes	no		yes				X
	1,2-Dibromoethane	0	--	1.9E-01	7.5E-03	C	yes	no		yes				X
	1,2-Dichlorobenzene	0	--	1.8E-01	3.0E+01	NC	yes	no		no			X	
	1,2-Dichloroethane	0	--	1.4E-01	1.7E-01	C	yes	no		no			X	
	1,2-Dichloropropane	0	--	3.2E-01	8.2E-01	NC	yes	no		no			X	
	1,3,5-Trimethylbenzene	0	--	1.5E-01	6.0E+00	NC	yes	no		no			X	
	1,3-Dichlorobenzene	0	--	1.7E-01			no							X
	1,3-Dichloropropane	0	--	1.9E-01	3.7E+01	NC	yes	no		no			X	
	1,4-Dichlorobenzene	7	9.4E-02	1.4E-01	4.8E-01	C	yes	yes	no				X	
	2,2-Dichloropropane	0	--	2.8E-01			no							X
	Acetone	29	1.0E+01	5.3E+00	1.4E+03	NC	yes	yes	no				X	
	Allyl chloride	0	--	4.9E-01	2.1E-01	NC	yes	no		yes				X
	Benzene	0	--	1.6E-01	4.6E-01	C	yes	no		no			X	
	Bromobenzene	0	--	2.0E-01	6.2E+00	NC	yes	no		no			X	
	Bromochloromethane	0	--	2.7E-01	8.3E+00	NC	yes	no		no			X	
	Bromoform	0	--	3.2E-01	3.3E+00	C	yes	no		no			X	
	Bromomethane	0	--	3.1E-01	7.5E-01	NC	yes	no		no			X	
	Carbon tetrachloride	0	--	2.7E-01	4.6E-01	C	yes	no		no			X	
	Chlorobenzene	7	1.6E-01	1.8E-01	7.8E+00	NC	yes	yes	no				X	

Table 3-5. OU2 Groundwater COPC Screening[a]

Analysis	Contaminant	Detection Frequency (%)	Maximum Detected Concentration	Average MDL	RBC[b]		COPC SELECTION STEPS			Detection Limit[c]	Background[d]	OU2 GROUNDWATER COPCs		
							Does chemical have an RBC?	Is chemical detected ≥5%?	Is Max Detect > RBC?	Is MDL > RBC?	Are site concentrations > background?	COPC	Not a COPC	Source of Uncertainty
Volatile Organics	Chloroethane	0	--	2.8E-01	2.1E+03	NC	yes	no		no			X	
	Chloroform	0	--	2.5E-01	2.2E-01	C	yes	no		yes				X
	Chloromethane	0	--	4.8E-01	1.9E+01	NC	yes	no		no			X	
	cis-1,2-Dichloroethylene	0	--	2.1E-01	3.6E+00	NC	yes	no		no			X	
	cis-1,3-Dichloropropylene	0	--	1.7E-01			no							X
	Cumene	0	--	1.4E-01	4.5E+01	NC	yes	no		no			X	
	Dibromochloromethane	0	--	1.3E-01	8.7E-01	C	yes	no		no			X	
	Dichlorobromomethane	0	--	1.5E-01	1.3E-01	C	yes	no		yes				X
	Dichlorodifluoromethane	0	--	3.7E-01	2.0E+01	NC	yes	no		no			X	
	Dichlorofluoromethane	0	--	1.7E-01			no							X
	Ethyl ether	0	--	3.0E-01	3.9E+02	NC	yes	no		no			X	
	Ethylbenzene	0	--	1.9E-01	1.5E+00	C	yes	no		no			X	
	Hexachlorobutadiene	0	--	3.8E-01	1.4E-01	C	yes	no		yes				X
	m & p-Xylenes	0	--	3.2E-01			no							X
	Methyl ethyl ketone	0	--	2.1E+00	5.6E+02	NC	yes	no		no			X	
	Methyl isobutyl ketone	0	--	1.9E+00	6.3E+02	NC	yes	no		no			X	
	Methylene bromide	0	--	2.6E-01	8.3E-01	NC	yes	no		no			X	
	Methylene chloride	0	--	4.3E-01	1.1E+01	NC	yes	no		no			X	
	MTBE (Methyl tert-butyl ether)	0	--	1.6E-01	1.4E+01	C	yes	no		no			X	
	Naphthalene	0	--	1.2E-01	1.7E-01	C	yes	no		no			X	
	n-Butyl benzene	0	--	1.1E-01	1.0E+02	NC	yes	no		no			X	
	n-Propyl benzene	0	--	1.6E-01	6.6E+01	NC	yes	no		no			X	
	o-Chlorotoluene	0	--	1.8E-01	2.4E+01	NC	yes	no		no			X	
	o-Xylene	0	--	1.5E-01	1.9E+01	NC	yes	no		no			X	
	p-Chlorotoluene	0	--	1.9E-01	2.5E+01	NC	yes	no		no			X	
	p-Isopropyltoluene	0	--	1.3E-01			no							X
	sec-Butyl benzene	0	--	1.4E-01	2.0E+02	NC	yes	no		no			X	
	Styrene	0	--	9.5E-02	1.2E+02	NC	yes	no		no			X	
	tert-Butyl benzene	0	--	1.4E-01	6.9E+01	NC	yes	no		no			X	
	Tetrachloroethylene	0	--	1.7E-01	4.1E+00	NC	yes	no		no			X	
	Tetrahydrofuran	0	--	3.3E+00	3.4E+02	NC	yes	no		no			X	
	Toluene	7	1.4E-01	1.1E-01	1.1E+02	NC	yes	yes	no				X	
	trans-1,2-Dichloroethylene	0	--	1.9E-01	3.6E+01	NC	yes	no		no			X	
	trans-1,3-Dichloropropylene	0	--	1.7E-01			no							X
	Trichloroethylene	0	--	1.1E-01	2.8E-01	NC	yes	no		no			X	
	Trichlorofluoromethane	0	--	1.4E-01	5.2E+02	NC	yes	no		no			X	
	Trichlorotrifluoroethane	0	--	3.4E-01	1.0E+03	NC	yes	no		no			X	
	Vinyl chloride	0	--	8.6E-02	1.9E-02	C	yes	no		yes				X
	Xylenes (total)	0	--	4.7E-01	1.9E+01	NC	yes	no		no			X	

TEQ = Toxicity Equivalence; PCBs = Polychlorinated Biphenyls; ND = non-detect; MDL = method detection limit; EN = essential nutrient; MCL = maximum contaminant level; C = cancer; NC = non-cancer

Bolded contaminants are those where the maximum detected concentration exceeds the respective RBC.

[a]Concentrations in units of µg/L.

[b]Risk-based concentrations are based on generic residential tapwater RSL values (November 2017) using a target cancer risk of 1E-06 ("C" = cancer based value) or a target HQ of 0.1 ("NC" = non-cancer based value).

[c]Detection limts were evaluated for those chemicals with a detection frequency <5%.

[d]Only those chemicals identified as having a detection frequency ≥5% and a maximum detected concentration > RBC were evaluated for comparison to background.

Table 3-6. Exposure Parameters for a Hypothetical Future Resident

Exposure Pathway	Exposure Input Parameter	Units	CTE		RME	
			Value	Source	Value	Source
General	Body Weight - adult	kg	80	[1]	80	[1]
	Body Weight - child	kg	15	[1]	15	[1]
	Exposure frequency	days/yr	256	[4, a]	350	[1]
	Exposure duration - adult	yr	9	[4, b]	20	[1]
	Exposure duration - child	yr	3	[4, b]	6	[1]
	Exposure duration (total)	yr	12	[4, b]	26	[1]
	Averaging Time, Cancer	yr	70	[2]	70	[2]
Incidental Ingestion of Soil	Ingestion rate - adult	mg/day	50	[3, c]	100	[1]
	Ingestion rate - child	mg/day	100	[3, c]	200	[1]
	Conversion Factor	kg/mg	1.00E-06		1.00E-06	
	HIF (noncancer)	**kg/kg-day**	**1.50E-06**		**3.87E-06**	
	HIF (cancer)	**kg/kg-day**	**2.57E-07**		**1.44E-06**	
Ingestion of Water	Ingestion rate - adult	L/day	1.2	[4, d]	2.5	[1]
	Ingestion rate - child	L/day	0.45	[4, d]	0.78	[1]
	HIF (noncancer)	**L/kg-d**	**1.32E-02**		**3.46E-02**	
	HIF (cancer)	**L/kg-d**	**2.25E-03**		**1.28E-02**	
Dermal Exposure to Soil	Exposed Surface Area - adult	cm^2/event	6,032	[1]	6,032	[1]
	Exposed Surface Area - child	cm^2/event	2,373	[1]	2,373	[1]
	Adherence Factor - adult	mg/cm^2	0.01	[5]	0.07	[1]
	Adherence Factor - child	mg/cm^2	0.04	[5]	0.2	[1]
	Dermal Absorption Fraction (ABSd)	unitless	CS	[5]	CS	[5]
	Event Frequency	events/day	1	[5]	1	[5]
	Conversion Factor	kg/mg	1.00E-06		1.00E-06	
	HIF (noncancer)	**kg/kg-day**	**1.51E-06**		**1.09E-05**	
	HIF (cancer)	**kg/kg-day**	**2.58E-07**		**4.05E-06**	

RME = Reasonable Maximum Exposure; CTE = Central Tendency Exposure; CS = chemical-specific

Sources:

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

[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 1993. Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

[4] USEPA 2011. Exposure Factors Handbook.

[5] USEPA 2004. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E). Office of Solid Waste and Emergency Response. July.

[6] MDEQ 2016. Development of Montana-Specific Default Soil Exposure Frequencies. June.

[7] Professional judgment.

Notes:

[a] Estimated frequency based on the average percent of time spent at home (70%, see Table 16-16) and multiplying by 365 days/year.

[b] Average residential occupancy period =12 years (Table 16-5); delegation of years between adult and child based on professional judgment and consistent with other Regional risk assessments.

[c] CTE ingestion rate assumed to be half that of the RME receptor.

[d] Weighted mean of consumer-only ingestion of drinking water (Table 3-1).

Table 3-7. Proposed Exposure Parameters for Hypothetical Future Commercial/Industrial Workers

Exposure Pathway	Exposure Input Parameter	Units	CTE		RME	
			Value	Source	Value	Source
General	Body Weight	kg	80	[1]	80	[1]
	Exposure frequency	days/yr	219	[3]	250	[1]
	Exposure duration	yr	9	[3]	25	[1]
	Averaging Time, Noncancer	days	3,285	[2]	9,125	[2]
	Averaging Time, Cancer	days	25,550	[2]	25,550	[2]
Incidental Ingestion of Soil	Ingestion rate	mg/day	50	[5, c]	100	[1]
	Conversion factor	kg/mg	1.00E-06		1.00E-06	
	HIF (noncancer)	**kg/kg-day**	**3.75E-07**		**8.56E-07**	
	HIF (cancer)	**kg/kg-day**	**4.82E-08**		**3.06E-07**	
Ingestion of Water	Ingestion rate	L/day	0.63	[5, c]	1.25	[4, a]
	HIF (noncancer)	**L/kg-d**	**4.69E-03**		**1.07E-02**	
	HIF (cancer)	**L/kg-d**	**6.03E-04**		**3.82E-03**	
Dermal Exposure to Soil	Exposed Surface Area (SA)	cm^2/event	3,527	[1]	3,527	[1]
	Adherence Factor (AF)	mg/cm^2	0.07	[1,3 b]	0.12	[1]
	Dermal Absorption Fraction (ABSd)	unitless	CS	[3]	CS	[3]
	Event Frequency (EV)	events/day	1	[3]	1	[3]
	Conversion Factor	kg/mg	1.00E-06		1.00E-06	
	HIF (noncancer)	**kg/kg-day**	**1.85E-06**		**3.62E-06**	
	HIF (cancer)	**kg/kg-day**	**2.38E-07**		**1.29E-06**	

RME = Reasonable Maximum Exposure; CTE = Central Tendency Exposure; CS = chemical-specific

Sources:

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

[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 2004. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E). Office of Solid Waste and Emergency Response. July.

[4] USEPA 1991. OSWER Directive 9285.6-03.

[5] Professional judgment.

Notes:

[a] USEPA 1991 states that half of an individual's daily water intake is assumed to occur at work. Thus, the RME value is based on half of the default daily water intake is 2.5 L/day. This is consistent with the FAQs for OSWER Directive 9200.1-120.

[b] The CTE adherence factor is based on adherence factor for an RME adult resident (derived using the 50th percentile weighted AF for a high-end activity [gardening]).

[c] CTE ingestion rate assumed to be half that of the RME receptor.

Table 3-8. Exposure Parameters for Hypothetical Future Construction Workers

Exposure Pathway	Exposure Input Parameter	Units	CTE		RME	
			Value	Source	Value	Source
General	Body Weight	kg	80	[1]	80	[1]
	Exposure frequency	days/yr	62	[6, a]	124	[5]
	Exposure duration	yr	0.5	[6, a]	1	[4]
	Averaging Time, Noncancer	days	183	[2]	365	[2]
	Averaging Time, Cancer	days	25,550	[2]	25,550	[2]
Ingestion of Soil	Ingestion rate	mg/day	165	[6, a]	330	[4, b]
	Conversion factor	kg/mg	1.00E-06		1.00E-06	
	HIF (noncancer)	**kg/kg-day**	**3.50E-07**		**1.40E-06**	
	HIF (cancer)	**kg/kg-day**	**2.50E-09**		**2.00E-08**	
Inhalation of Particulates	Exposure time	hr/day	8	[4, c]	8	[4, c]
	Particulate Emission Factor (PEF)	m^3/kg	4.40E+08	[4, d]	4.40E+08	[4, d]
	TWF (noncancer)	**unitless**	**5.66E-02**		**1.13E-01**	
	TWF (cancer)	**unitless**	**4.04E-04**		**1.62E-03**	
Dermal Exposure to Soil	Exposed Surface Area (SA)	cm^2/event	3,527	[1, e]	3,527	[1, e]
	Adherence Factor (AF)	mg/cm^2	0.1	[3, f]	0.3	[3, f]
	Dermal Absorption Fraction (ABSd)	unitless	CS	[3]	CS	[3]
	Event Frequency (EV)	events/day	1	[3]	1	[3]
	Conversion Factor	kg/mg	1.00E-06		1.00E-06	
	HIF (noncancer)	**kg/kg-day**	**7.49E-07**		**4.49E-06**	
	HIF (cancer)	**kg/kg-day**	**5.35E-09**		**6.42E-08**	

RME = Reasonable Maximum Exposure; CTE = Central Tendency Exposure; CS = chemical-specific

Sources:

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

[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 2004. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E). Office of Solid Waste and Emergency Response. July.

[4] USEPA 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites.

[5] MDEQ 2016. Development of Montana-Specific Default Soil Exposure Frequencies. June.

[6] Professional judgment.

Notes:

[a] CTE value assumed to be half that of the RME receptor.

[b] RME value is based on the default value for construction scenario (Exhibit 5-1) is based on the 95th percentile value for adult soil intake rates reported in a soil ingestion mass-balance study.

[c] Assumes the entire 8-hour workday is outdoors.

[d] Particle emission factor is based on the value recommended for off-site residents of a construction site. This value normalizese the mass of fugitive dust over 30 years but accounts for the mass of dust emited by traffic on unpaved roads during construction and the mass of dust emitted by wind erosion.

[e] Construction workers are assumed to wear a short-sleeved shirt, long pants, and shoes. Assumes that the exposed surface area is equal to the USEPA default for a worker based on assumed exposure to the head, hands and forearms.

[f] Exhibit 3-3; based on the 95th percentile value (0.3) AF for the RME receptor and the geometric mean value (0.1) AF for the CTE receptor.

Table 3-9. Summary of OU2 Manganese Groundwater Data

Well ID	SampleDate	Sample Number	Analysis	
			Total Metals	Dissolved Metals
MCSMW1	4/15/2014	MCSMW-1_4/15/14_NM	X	X
MW4	12/11/2015	MW4_20151211_NM		X
MW7	12/14/2015	MW7_20151214_NM		X
NFMW13	12/10/2015	NFMW13_20151210_NM		X
	6/2/2016	NFMW13_20160602_NM		X
	7/5/2017	NFMW13_20170705_NM	X	X
NFMW14	12/10/2015	NFMW14_20151210_NM		X
	7/12/2017	NFMW14_20170712_NM	X	X
NFMW15	12/10/2015	NFMW15_20151210_NM		X
	6/3/2016	NFMW15_20160603_NM		X
	7/12/2017	NFMW15_20170712_NM	X	X
NFMW16	12/11/2015	NFMW16_20151211_NM		X
	6/3/2016	NFMW16_20160603_NM		X
	7/13/2017	NFMW16_20170713_NM	X	X
NFMW17	12/11/2015	NFMW17_20151211_NM		X
	7/12/2017	NFMW17_20170712_NM	X	X
NFMW18	12/21/2015	NFMW18_20151221_NM		X
	6/3/2016	NFMW18_20160603_NM		X
	7/7/2017	NFMW18_20170707_NM	X	X
NFMW5	4/15/2014	NFMW-5_4/15/14_NM	X	X
	12/10/2015	NFMW5_20151210_NM		X
	6/2/2016	NFMW5_20160602_NM		X
	7/11/2017	NFMW5_20170711_NM	X	X
NFMW6	4/15/2014	NFMW-6_4/15/14_NM	X	X
	12/18/2015	NFMW6_20151218_NM		X
	7/12/2017	NFMW6_20170712_NM	X	X
WFB1	12/21/2015	WFB1_20151221_NM		X

Table 3-10. Summary of OU2 Soil COPC Data

Grid Number	SampleDate	Sample Number	Sample Type		Analysis			
					PCBs Reported as Aroclors		PCBs Reported as Congeners	
					TEQ-Dioxins/Furans	Aroclor-1254	TEQ-Dioxins/Furans/ DL-PCBs	Total Non-DL PCBs
1	10/16/2017	Grid 1-SSComp-01_20171016_NM	SS	20-point composite	X	X	X	X
	11/23/2015	SS1-IN-(0-2)c	SS	5-point composite	X			
2	10/16/2017	Grid 2-SSComp-01_20171016_NM	SS	20-point composite	X	X	X	X
	11/23/2015	SS2-IN-(0-2)c	SS	5-point composite	X			
4	10/17/2017	Grid 4&7-SSComp-01_20171017_NM	SS	20-point composite	X	X	X	X
	11/23/2015	SS3-IN-(0-2)c	SS	5-point composite	X			
	10/17/2017	Grid 4&7-SB-(24-30in)_20171017_NM	SB	grab	X	X	X	X
5	11/23/2015	SS4-IN-(0-2)c	SS	5-point composite	X			
	12/14/2015	SB1A-IN-(1-2)	SS	5-point composite		X		
	12/14/2015	SB1-IN-(6-7)	SB	grab		X		
6	11/23/2015	SS6-IN-(0-2)c	SS	5-point composite	X			
	10/17/2017	Grid 6-SB-(24-30in)_20171017_NM	SB	grab	X	X	X	X
7	10/17/2017	Grid 4&7-SSComp-01_20171017_NM	SS	20-point composite	X	X	X	X
	11/23/2015	SS5-IN-(0-2)c	SS	5-point composite	X			
	10/17/2017	Grid 4&7-SB-(24-30in)_20171017_NM	SB	grab	X	X	X	X
8	10/18/2017	Grid 8-SSComp-01_20171018_NM	SS	20-point composite	X	X	X	X
	10/17/2017	Grid 8-SB-(24-30in)_20171017_NM	SB	grab	X	X	X	X
	12/14/2015	SB4-IN-(2-3)	SB	grab		X		
	12/14/2015	SB5-IN-(8-9)	SB	grab		X		
	12/14/2015	SB6-IN-(2.5-3)	SB	grab		X		
	12/11/2015	SB7-IN-(6-8)	SB	grab		X		
	12/14/2015	SB8-IN-(2-3)	SB	grab		X		
9	10/18/2017	Grid 9-SSComp-01_20171018_NM	SS	20-point composite	X	X	X	X
	11/23/2015	SS8-IN-(0-2)c	SS	5-point composite	X			
11	12/6/2017	BACKFILL-HDPT-SS	SS	5-point composite	X	X		
	11/23/2015	SS7-IN-(0-2)c	SS	5-point composite	X			
	12/15/2015	SS20-IN-(12)	SB	grab	X	X		
	12/15/2015	SS21-IN-(24)	SB	grab	X	X		
	12/15/2015	SS26-IN-(12)	SB	grab	X	X		
	12/15/2015	SS27-IN-(24)	SB	grab	X	X		
	10/17/2017	Grid 11-SB-(24-30in)_20171017_NM	SB	grab	X	X	X	X
	12/6/2017	BACKFILL-HDPT-SB	SB	grab	X	X		
	12/1/2015	SB101-NFMW15-(5.5-7.5)	SB	grab	X	X		
	8/23/2016	IN-HDPT41-SB1	SB	grab		X		
	8/23/2016	IN-HDPT41-SB5	SB	grab		X		
12	11/24/2015	SS10-IN-(0-2)c	SS	5-point composite	X			
	12/3/2015	SS32-IN-(0-2)c	SS	5-point composite	X			
	12/4/2015	SS33-IN-(0-2)c	SS	5-point composite	X			
	12/15/2015	SS22-IN-(12)	SB	grab	X	X		
	12/15/2015	SS23-IN-(24)	SB	grab	X	X		
	12/15/2015	SS24-IN-(12)	SB	grab	X	X		
	12/15/2015	SS25-IN-(24)	SB	grab	X	X		
	12/14/2015	SB21-IN-(8-9)	SB	grab		X		
	12/14/2015	SB24-IN-(9-10)	SB	grab		X		
13	10/19/2017	Grid 13-SSComp-01_20171019_NM	SS	20-point composite	X	X	X	X
	11/24/2015	SS11-IN-(0-2)c	SS	5-point composite	X			
	10/16/2017	Grid 13-SB-(24-30in)_20171016_NM	SB	grab	X	X	X	X

Table 3-10. Summary of OU2 Soil COPC Data

Grid Number	SampleDate	Sample Number	Sample Type		Analysis			
					PCBs Reported as Aroclors		PCBs Reported as Congeners	
					TEQ-Dioxins/Furans	Aroclor-1254	TEQ-Dioxins/Furans/ DL-PCBs	Total Non-DL PCBs
14	10/17/2017	Grid 14-SSComp-01_20171017_NM	SS	20-point composite	X	X	X	X
	11/23/2015	SS9-IN-(0-2)c	SS	5-point composite	X			
	10/17/2017	Grid 14-SB-(24-30in)_20171017_NM	SB	grab	X	X	X	X
15	11/24/2015	SS13-IN-(0-2)c	SS	5-point composite	X			
	12/6/2017	BACKFILL-TSB-SS	SS	5-point composite	X	X		
	12/4/2015	SS29-IN-(0-2)c	SS	5-point composite		X		
	12/4/2015	SS30-IN-(0-2)c	SS	5-point composite		X		
	12/4/2015	SS31-IN-(0-2)c	SS	5-point composite		X		
	10/16/2017	Grid 15-SB-(24-30in)_20171016_NM	SB	grab	X	X	X	X
	12/6/2017	BACKFILL-TSB-SB	SB	grab	X	X		
	12/9/2015	SB11-IN-(8-10)	SB	grab		X		
	12/10/2015	SB13-IN-(2-4)	SB	grab		X		
	12/10/2015	SB15-IN-(8-10)	SB	grab		X		
	12/10/2015	SB17-IN-(8-10)	SB	grab		X		
16	11/24/2015	SS12-IN-(0-2)c	SS	5-point composite	X			
17	11/23/2015	SS14-IN-(0-2)c	SS	5-point composite	X			
	11/23/2015	SS17-IN-(0-2)c	SS	5-point composite	X			
18	11/24/2015	SS16-IN-(0-2)c	SS	5-point composite	X			
	10/17/2017	Grid 18-SB-(24-30in)_20171017_NM	SB	grab	X	X	X	X
19	11/24/2015	SS15-IN-(0-2)c	SS	5-point composite	X			
	10/16/2017	Grid 19-SB-(24-30in)_20171016_NM	SB	grab	X	X	X	X
22	10/18/2017	Grid 22-SSComp-01_20171018_NM	SS	20-point composite	X	X	X	X
	4/18/2014	LF-1-SS_4/18/14_NM	SS	5-point composite	X	X		
23	10/18/2017	Grid 23-SSComp-01_20171018_NM	SS	20-point composite	X	X	X	X
	10/16/2017	Grid 23-SB-(24-30in)_20171016_NM	SB	grab	X	X	X	X

SS = surface soil; SB = subsurface soil; TEQ = toxicity equivalent; PCB = polychlorinated biphenyl; MDL = method detection limit; DL = dioxin-like

Table 4-1. Human Health Toxicity Values for OU2 COPCs

Analyte	CAS No.	Oral				Note	Dermal			Inhalation				Note
		RfD (mg/kg-day)	Source	CSF $(mg/kg\text{-}day)^{-1}$	Source		Absorption Fraction	RfD_{ABS} (mg/kg-day) [1]	CSF_{ABS} $(mg/kg\text{-}day)^{-1}$ [2]	RfC (mg/m^3)	Source	UR $(\mu g/m^3)^{-1}$	Source	
2,3,7,8-TCDD	1746-01-6	7.0E-10	I	1.3E+05	C		1	7.0E-10	1.3E+05	4.0E-08	C	3.8E+01	C	[4]
Aroclor-1254	11097-69-1	2.0E-05	I	2.0E+00	I		1	2.0E-05	2.0E+00			5.7E-04	I	
Total PCBs (high risk)	1336-36-3			2.0E+00	I		1		2.0E+00			5.7E-04	I	
Manganese (Nonfood)	7439-96-5	4.7E-02	I			[3]	0.04	1.9E-03		5.0E-05	I			

Key: I = IRIS; C = CalEPA.

Notes:

[1] Absorbed Reference Doses for Dermal were derived using the Oral Reference Dose as follows: $RFD_{ABS} = RfD_o * ABS_{GI}$ (Equation 4.3 from USEPA 2004).

[2] Absorbed Cancer Slope Factors for Dermal were derived using the Oral Cancer Slope Factors as follows: $SF_{ABS} = SF_o / ABS_{GI}$ (Equation 4.2 from USEPA 2004).

[3] The IRIS RfD if based on adjusting the RfD of 0.14 mg/kg-day by a modifying factor of 3.

[4] USEPA (2013) noted that the contribution of the inhalation pathway to total risk is well below 1%.

Table 5-1. Risk Estimates for Hypothetical Future Residents Exposed to OU2 Surface Soils[a,b]

Exposure Unit	Exposure Route	Non-cancer HI		Excess cancer Risk	
		CTE	RME	CTE	RME
Grid 1	Incidental Ingestion	1E-02	3E-02	1E-07	6E-07
	Dermal Contact	9E-04	6E-03	1E-08	8E-08
	Total	1E-02	3E-02	1E-07	6E-07
Grid 2	Incidental Ingestion	7E-03	2E-02	1E-08	8E-08
	Dermal Contact	3E-04	2E-03	2E-09	1E-08
	Total	7E-03	2E-02	2E-08	9E-08
Grid 4	Incidental Ingestion	3E-03	7E-03	6E-08	3E-07
	Dermal Contact	2E-03	1E-02	8E-09	4E-08
	Total	4E-03	2E-02	7E-08	4E-07
Grid 5	Incidental Ingestion	2E-03	5E-03	1E-09	6E-09
	Dermal Contact	8E-05	6E-04	1E-10	2E-09
	Total	2E-03	6E-03	1E-09	8E-09
Grid 6	Incidental Ingestion	5E-02	1E-01		
	Dermal Contact	1E-03	1E-02		
	Total	5E-02	1E-01		
Grid 7	Incidental Ingestion	2E-03	6E-03	6E-08	3E-07
	Dermal Contact	2E-03	1E-02	8E-09	4E-08
	Total	4E-03	2E-02	7E-08	4E-07
Grid 8	Incidental Ingestion	2E-02	5E-02	5E-07	3E-06
	Dermal Contact	3E-03	2E-02	7E-08	4E-07
	Total	2E-02	7E-02	6E-07	3E-06
Grid 9	Incidental Ingestion	2E-02	5E-02	2E-08	9E-08
	Dermal Contact	7E-04	5E-03	2E-09	1E-08
	Total	2E-02	5E-02	2E-08	1E-07
Grid 11	Incidental Ingestion	7E-03	2E-02	2E-09	1E-08
	Dermal Contact	2E-04	2E-03	3E-10	5E-09
	Total	7E-03	2E-02	3E-09	2E-08
Grid 12	Incidental Ingestion	7E-03	2E-02		
	Dermal Contact	2E-04	2E-03		
	Total	7E-03	2E-02		
Grid 13	Incidental Ingestion	8E-03	2E-02	8E-09	4E-08
	Dermal Contact	2E-04	2E-03	1E-09	6E-09
	Total	9E-03	2E-02	9E-09	5E-08
Grid 14	Incidental Ingestion	4E-02	1E-01	3E-08	2E-07
	Dermal Contact	2E-03	1E-02	5E-09	3E-08
	Total	5E-02	1E-01	4E-08	2E-07
Grid 15	Incidental Ingestion	3E-03	8E-03	1E-09	8E-09
	Dermal Contact	1E-04	9E-04	2E-10	3E-09
	Total	3E-03	9E-03	2E-09	1E-08
Grid 16	Incidental Ingestion	1E-02	3E-02		
	Dermal Contact	3E-04	2E-03		
	Total	1E-02	3E-02		
Grid 17	Incidental Ingestion	4E-03	1E-02		
	Dermal Contact	1E-04	9E-04		
	Total	4E-03	1E-02		
Grid 18	Incidental Ingestion	1E-02	4E-02		
	Dermal Contact	4E-04	3E-03		
	Total	1E-02	4E-02		
Grid 19	Incidental Ingestion	6E-03	2E-02		
	Dermal Contact	2E-04	1E-03		
	Total	6E-03	2E-02		
Grid 22	Incidental Ingestion	3E-02	8E-02	5E-08	3E-07
	Dermal Contact	2E-03	1E-02	7E-09	4E-08
	Total	3E-02	9E-02	6E-08	3E-07
Grid 23	Incidental Ingestion	6E-04	1E-03	4E-09	2E-08
	Dermal Contact	4E-05	3E-04	5E-10	3E-09
	Total	6E-04	2E-03	4E-09	2E-08

[a]Non-cancer hazards and cancer risks are based on TEQ-dioxins/furans/DL-PCBs and Total Non-DL PCBs if PCB congener data were available for that grid. Non-cancer hazards and cancer risks are based on TEQ-dioxins/furans and Aroclor-1254 data if PCB congener data were not available.

[b]Empty cells indicate no data available for the OU2 soil COPCs in this grid.

Table 5-2. Risk Estimates for Current/Hypothetical Future Commercial/Industrial Workers Exposed to OU2 Surface Soils[a,b]

Exposure Unit	Exposure Route	Non-cancer HI		Excess cancer Risk	
		CTE	RME	CTE	RME
Grid 1	Incidental Ingestion	3E-03	6E-03	2E-08	1E-07
	Dermal Contact	1E-03	2E-03	3E-09	2E-08
	Total	4E-03	8E-03	2E-08	1E-07
Grid 2	Incidental Ingestion	2E-03	4E-03	3E-09	2E-08
	Dermal Contact	4E-04	8E-04	4E-10	2E-09
	Total	2E-03	5E-03	3E-09	2E-08
Grid 4	Incidental Ingestion	7E-04	2E-03	1E-08	7E-08
	Dermal Contact	2E-03	4E-03	2E-09	1E-08
	Total	3E-03	5E-03	1E-08	8E-08
Grid 5	Incidental Ingestion	5E-04	1E-03	2E-10	1E-09
	Dermal Contact	1E-04	2E-04	1E-10	7E-10
	Total	6E-04	1E-03	3E-10	2E-09
Grid 6	Incidental Ingestion	1E-02	3E-02		
	Dermal Contact	2E-03	3E-03		
	Total	1E-02	3E-02		
Grid 7	Incidental Ingestion	6E-04	1E-03	1E-08	7E-08
	Dermal Contact	2E-03	4E-03	2E-09	1E-08
	Total	3E-03	5E-03	1E-08	8E-08
Grid 8	Incidental Ingestion	5E-03	1E-02	1E-07	6E-07
	Dermal Contact	3E-03	7E-03	1E-08	9E-08
	Total	8E-03	2E-02	1E-07	7E-07
Grid 9	Incidental Ingestion	5E-03	1E-02	3E-09	2E-08
	Dermal Contact	8E-04	2E-03	4E-10	3E-09
	Total	6E-03	1E-02	4E-09	2E-08
Grid 11	Incidental Ingestion	2E-03	4E-03	5E-10	3E-09
	Dermal Contact	3E-04	6E-04	3E-10	2E-09
	Total	2E-03	4E-03	8E-10	5E-09
Grid 12	Incidental Ingestion	2E-03	4E-03		
	Dermal Contact	3E-04	5E-04		
	Total	2E-03	4E-03		
Grid 13	Incidental Ingestion	2E-03	5E-03	1E-09	9E-09
	Dermal Contact	3E-04	6E-04	2E-10	1E-09
	Total	2E-03	5E-03	2E-09	1E-08
Grid 14	Incidental Ingestion	1E-02	3E-02	6E-09	4E-08
	Dermal Contact	2E-03	5E-03	9E-10	6E-09
	Total	1E-02	3E-02	7E-09	5E-08
Grid 15	Incidental Ingestion	8E-04	2E-03	3E-10	2E-09
	Dermal Contact	1E-04	3E-04	2E-10	1E-09
	Total	1E-03	2E-03	5E-10	3E-09
Grid 16	Incidental Ingestion	3E-03	6E-03		
	Dermal Contact	4E-04	8E-04		
	Total	3E-03	7E-03		
Grid 17	Incidental Ingestion	1E-03	2E-03		
	Dermal Contact	2E-04	3E-04		
	Total	1E-03	3E-03		
Grid 18	Incidental Ingestion	4E-03	8E-03		
	Dermal Contact	5E-04	1E-03		
	Total	4E-03	9E-03		
Grid 19	Incidental Ingestion	2E-03	4E-03		
	Dermal Contact	2E-04	5E-04		
	Total	2E-03	4E-03		
Grid 22	Incidental Ingestion	8E-03	2E-02	1E-08	6E-08
	Dermal Contact	2E-03	4E-03	1E-09	9E-09
	Total	1E-02	2E-02	1E-08	7E-08
Grid 23	Incidental Ingestion	1E-04	3E-04	7E-10	4E-09
	Dermal Contact	5E-05	9E-05	9E-11	6E-10
	Total	2E-04	4E-04	8E-10	5E-09

[a]Non-cancer hazards and cancer risks are based on TEQ-dioxins/furans/DL-PCBs and Total Non-DL PCBs if PCB congener data were available for that grid. Non-cancer hazards and cancer risks are based on TEQ-dioxins/furans and Aroclor-1254 data if PCB congener data were not available.

[b]Empty cells indicate no data available for the OU2 soil COPCs in this grid.

Table 5-3. Risk Estimates for Hypothetical Future Construction Workers Exposed to OU2 Surface and Subsurface Soils[a,b]

Exposure Unit	Exposure Route	Non-cancer HI		Excess cancer Risk	
		CTE	RME	CTE	RME
Grid 1	Incidental Ingestion	3E-03	1E-02	1E-09	8E-09
	Dermal Contact	4E-04	3E-03	1E-10	1E-09
	Inhalation (particulates)[c]			1E-13	4E-13
	Total	3E-03	1E-02	1E-09	9E-09
Grid 2	Incidental Ingestion	2E-03	7E-03	1E-10	1E-09
	Dermal Contact	2E-04	1E-03	2E-11	2E-10
	Inhalation (particulates)			1E-14	6E-14
	Total	2E-03	8E-03	2E-10	1E-09
Grid 4	Incidental Ingestion	6E-04	2E-03	5E-10	4E-09
	Dermal Contact	8E-04	5E-03	7E-11	6E-10
	Inhalation (particulates)			6E-14	2E-13
	Total	1E-03	7E-03	6E-10	5E-09
Grid 5	Incidental Ingestion	5E-04	2E-03	1E-11	8E-11
	Dermal Contact	4E-05	2E-04	3E-12	4E-11
	Inhalation (particulates)			1E-15	4E-15
	Total	5E-04	2E-03	1E-11	1E-10
Grid 6	Incidental Ingestion	9E-03	4E-02	2E-12	2E-11
	Dermal Contact	5E-06	3E-05	3E-13	3E-12
	Inhalation (particulates)			2E-16	1E-15
	Total	9E-03	4E-02	3E-12	2E-11
Grid 7	Incidental Ingestion	5E-04	2E-03	5E-10	4E-09
	Dermal Contact	8E-04	5E-03	7E-11	6E-10
	Inhalation (particulates)			6E-14	2E-13
	Total	1E-03	7E-03	6E-10	5E-09
Grid 8	Incidental Ingestion	4E-03	2E-02	5E-09	4E-08
	Dermal Contact	1E-03	8E-03	7E-10	5E-09
	Inhalation (particulates)			5E-13	2E-12
	Total	6E-03	2E-02	6E-09	4E-08
Grid 9	Incidental Ingestion	4E-03	2E-02	2E-10	1E-09
	Dermal Contact	3E-04	2E-03	2E-11	2E-10
	Inhalation (particulates)			2E-14	7E-14
	Total	5E-03	2E-02	2E-10	1E-09
Grid 11	Incidental Ingestion	1E-03	5E-03	5E-10	4E-09
	Dermal Contact	1E-04	8E-04	7E-11	6E-10
	Inhalation (particulates)			5E-14	2E-13
	Total	1E-03	6E-03	6E-10	5E-09
Grid 12	Incidental Ingestion	3E-03	1E-02	3E-10	2E-09
	Dermal Contact	4E-04	3E-03	9E-11	1E-09
	Inhalation (particulates)			3E-14	1E-13
	Total	3E-03	1E-02	4E-10	4E-09
Grid 13	Incidental Ingestion	2E-03	8E-03	7E-11	6E-10
	Dermal Contact	1E-04	7E-04	1E-11	8E-11
	Inhalation (particulates)			7E-15	3E-14
	Total	2E-03	8E-03	8E-11	6E-10
Grid 14	Incidental Ingestion	1E-02	4E-02	3E-10	3E-09
	Dermal Contact	9E-04	6E-03	4E-11	4E-10
	Inhalation (particulates)			3E-14	1E-13
	Total	1E-02	5E-02	4E-10	3E-09
Grid 15	Incidental Ingestion	6E-04	2E-03	6E-12	5E-11
	Dermal Contact	1E-05	9E-05	9E-13	7E-12
	Inhalation (particulates)			6E-16	3E-15
	Total	6E-04	3E-03	7E-12	6E-11
Grid 16	Incidental Ingestion	3E-03	1E-02		
	Dermal Contact	2E-04	1E-03		
	Inhalation (particulates)				
	Total	3E-03	1E-02		
Grid 17	Incidental Ingestion	1E-03	4E-03		
	Dermal Contact	7E-05	4E-04		
	Inhalation (particulates)				
	Total	1E-03	4E-03		
Grid 18	Incidental Ingestion	3E-03	1E-02	1E-12	1E-11
	Dermal Contact	4E-06	2E-05	2E-13	1E-12
	Inhalation (particulates)			1E-16	5E-16
	Total	3E-03	1E-02	1E-12	1E-11
Grid 19	Incidental Ingestion	2E-03	8E-03	2E-13	2E-12
	Dermal Contact	3E-06	2E-05	3E-14	3E-13
	Inhalation (particulates)			3E-17	1E-16
	Total	2E-03	8E-03	3E-13	2E-12
Grid 22	Incidental Ingestion	7E-03	3E-02	5E-10	4E-09
	Dermal Contact	8E-04	5E-03	7E-11	6E-10
	Inhalation (particulates)			5E-14	2E-13
	Total	8E-03	3E-02	6E-10	5E-09
Grid 23	Incidental Ingestion	1E-04	5E-04	3E-11	3E-10
	Dermal Contact	2E-05	1E-04	5E-12	4E-11
	Inhalation (particulates)			3E-15	1E-14
	Total	1E-04	6E-04	4E-11	3E-10

[a]Non-cancer hazards and cancer risks are based on TEQ-dioxins/furans/DL-PCBs and Total Non-DL PCBs if PCB congener data were available for that grid. Non-cancer hazards and cancer risks are based on TEQ-dioxins/furans and Aroclor-1254 data if PCB congener data were not available.

[b]Empty cells indicate no data available for the OU2 soil COPCs in this grid.

[c]Non-cancer hazards from inhalation of soil particulates generated by soil disturbance during construction activities were not estimated because there is no RfC for PCBs and it is known that the inhalation pathway contributes less than 1% of the total dioxin risk when compared to ingestion exposures.

Table 5-4. Risks to Hypothetical Future Residents and Commercial/Industrial Workers From Ingestion of OU2 Groundwater as Drinking Water

Exposure Area	Risks to Hypothetical Future Residents		Risks to Current/Hypothetical Future Commercial/Industrial Workers	
	HQ		HQ	
	CTE	RME	CTE	RME
EU1	3E-01	7E-01	1E-01	2E-01
EU2	8E-01	2E+00	3E-01	6E-01
EU3	6E-02	2E-01	2E-02	5E-02

Pink shading indicates non-cancer hazards above a level of concern (HQ > 1).

Table 5-5. Total Risk to Hypothetical Future Residents and Workers

Population **Hypothetical Future Residents**
Exposure Area **OU2**
Medium **Groundwater [HQ for EU] + Surface Soil [Max HI for grid within GW EU]**

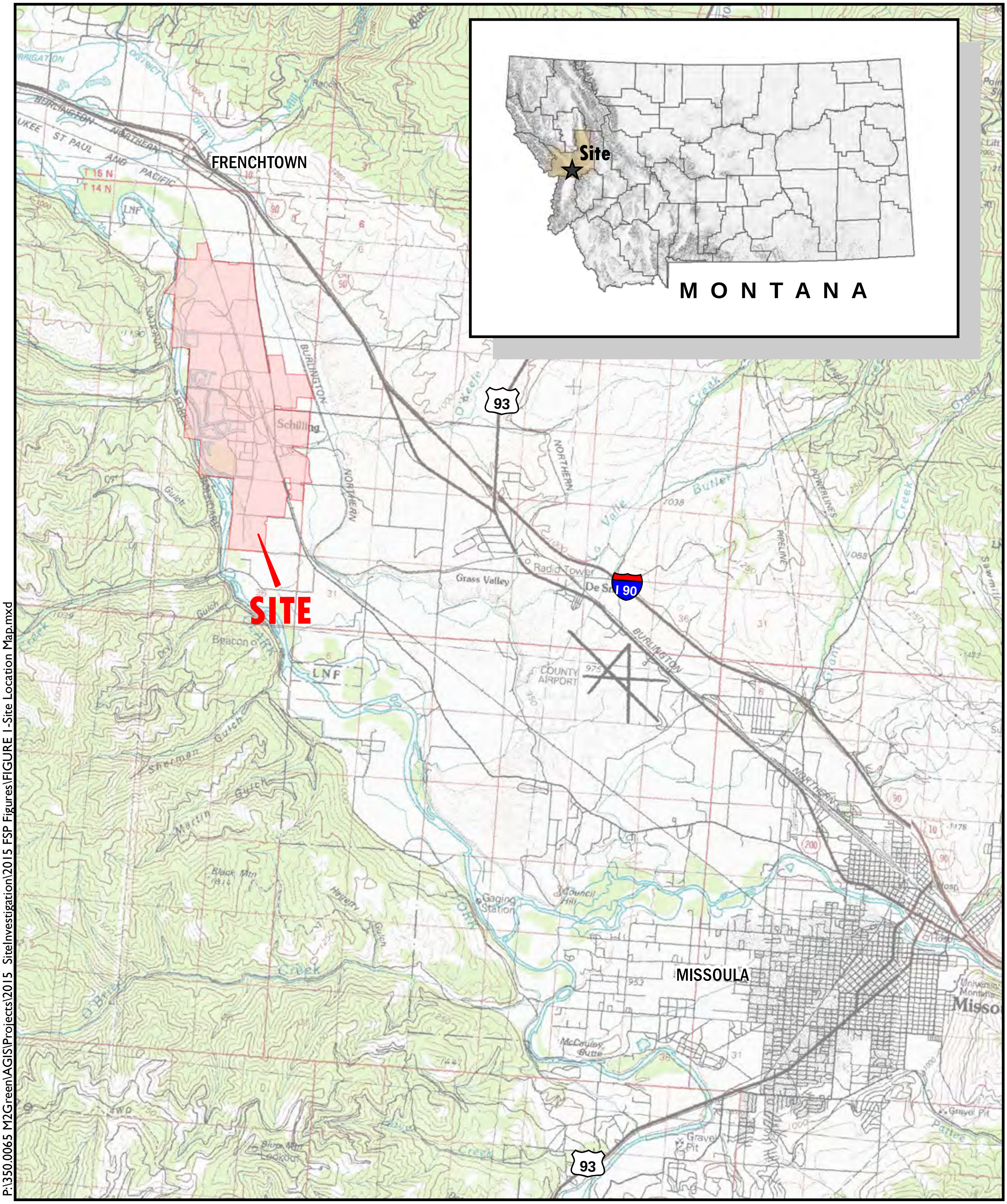
	Groundwater		Surface Soil		Total	
	Non-Cancer HQ		Non-Cancer HI		Non-Cancer HI	
Exposure Area	CTE	RME	CTE	RME	CTE	RME
EU1/Grid 8	3E-01	7E-01	2E-02	7E-02	3E-01	8E-01
EU2/Grid 11	8E-01	2E+00	7E-03	2E-02	8E-01	2E+00
EU3/Grid 14	6E-02	2E-01	5E-02	1E-01	1E-01	3E-01

Pink shading indicates non-cancer hazards above a level of concern (HQ > 1).

Population **Hypothetical Future Workers**
Exposure Area **OU2**
Medium **Groundwater [HQ for EU] + Surface Soil [Max HI for grid within GW EU]**

	Groundwater		Surface Soil		Total	
	Non-Cancer HQ		Non-Cancer HI		Non-Cancer HI	
Exposure Area	CTE	RME	CTE	RME	CTE	RME
EU1/Grid 8	1E-01	2E-01	8E-03	2E-02	1E-01	2E-01
EU2/Grid 11	3E-01	6E-01	2E-03	4E-03	3E-01	7E-01
EU3/Grid 14	2E-02	5E-02	1E-02	3E-02	3E-02	8E-02

FIGURES



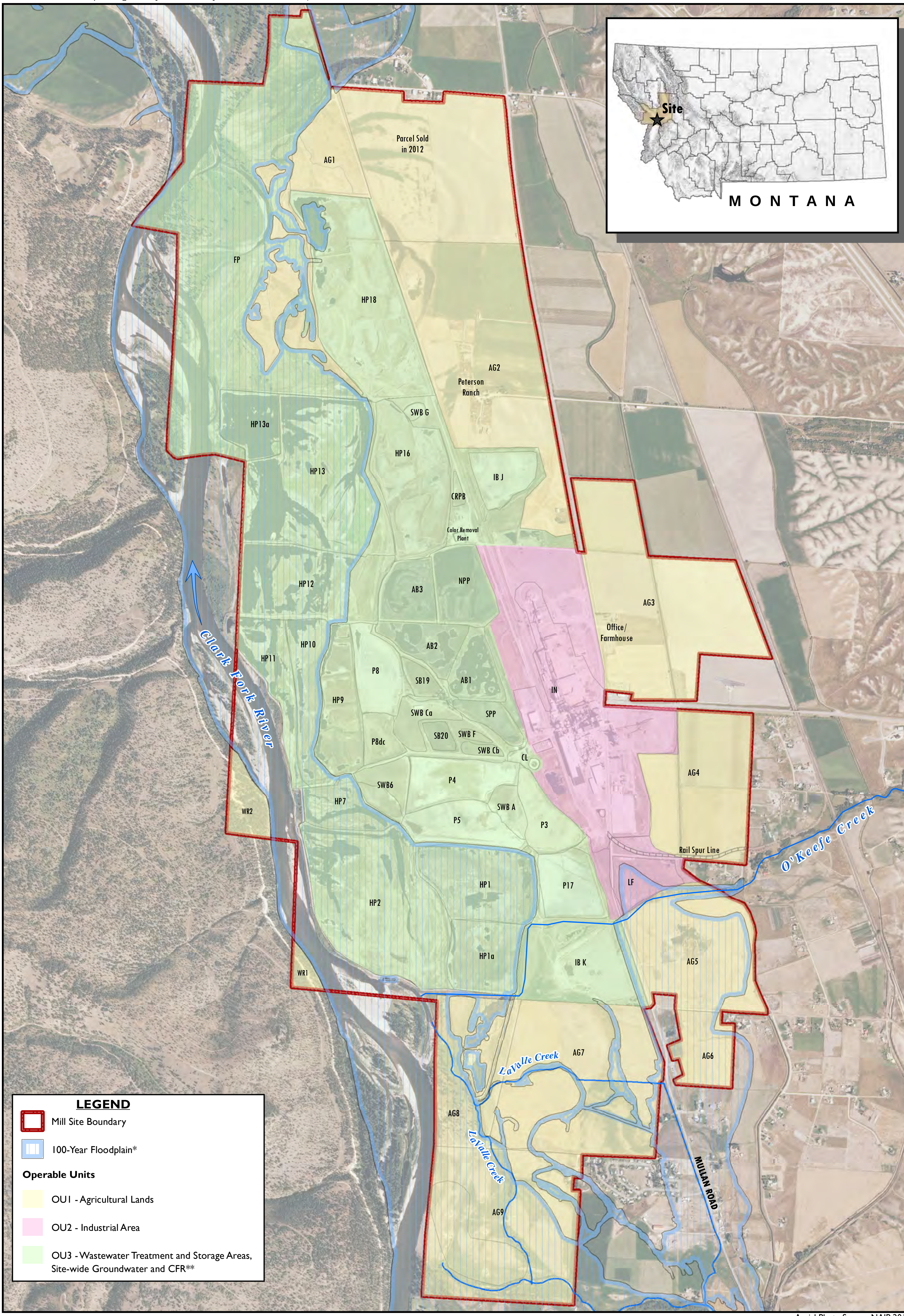
Source: Montana USGS 100K Topographic Map

0 Feet 10,000

P:\350.0065 M2Green\AGIS\Projects\2015 FSP Figures\FIGURE 1-Site Location Map.mxd

NewFields

Site Location Map
Former Frenchtown Mill Site
Missoula County, Montana
FIGURE 2-1



*Floodplain Source:
As defined by the Federal Emergency Management Agency (FEMA) 2013 Digital Flood Insurance Rate Map (DFIRM). (NFIP 2013)

**Where Contaminant of Potential Concern from the Site have come to be located in the CFR

Notes

AG - Agricultural Land
AB - Aeration Stabilization Basin
CFR - Clark Fork River
CRPB - Color Removal Plant Basin
CL - Clarifier
FP - Floodplain Area
HP - Holding or Storage Pond
IB - Rapid Infiltration Basin
LF - Land farm
IN - Industrial Area
NPP - North Polishing Pond
OU - Operable Unit
P - Settling Pond
SB - Spoils Basin
SPP - South Polishing Pond
SWB - Solid Waste Basin
WR - West of the Clark Fork River

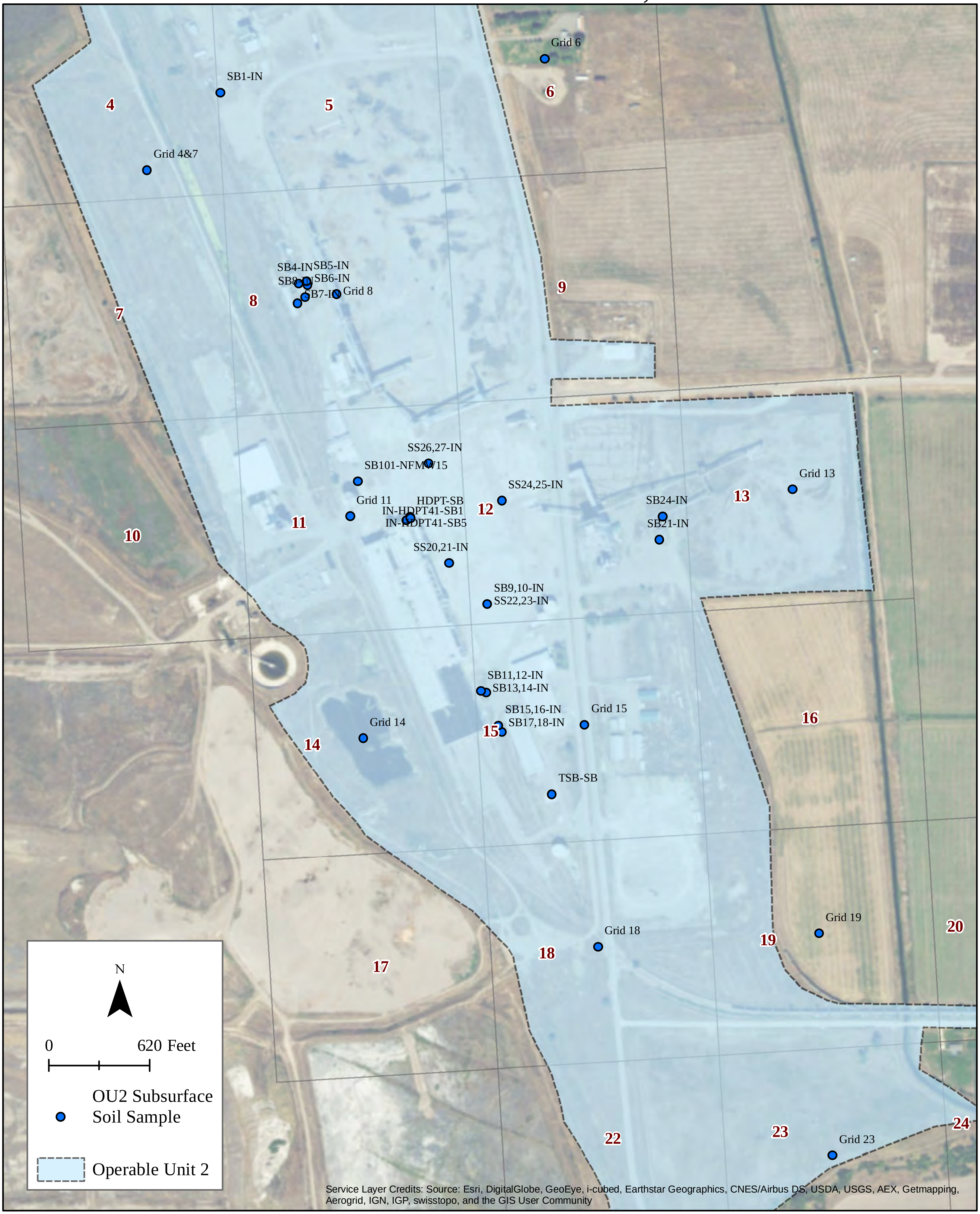
NewFields

Site Plan and Operable Units
Former Frenchtown Mill Site
Missoula County, Montana
FIGURE 2-2

Figure 2-3. Surface Soil Sampling Locations in OU2: Smurfit-Stone/Frenchtown Mill Site, Montana

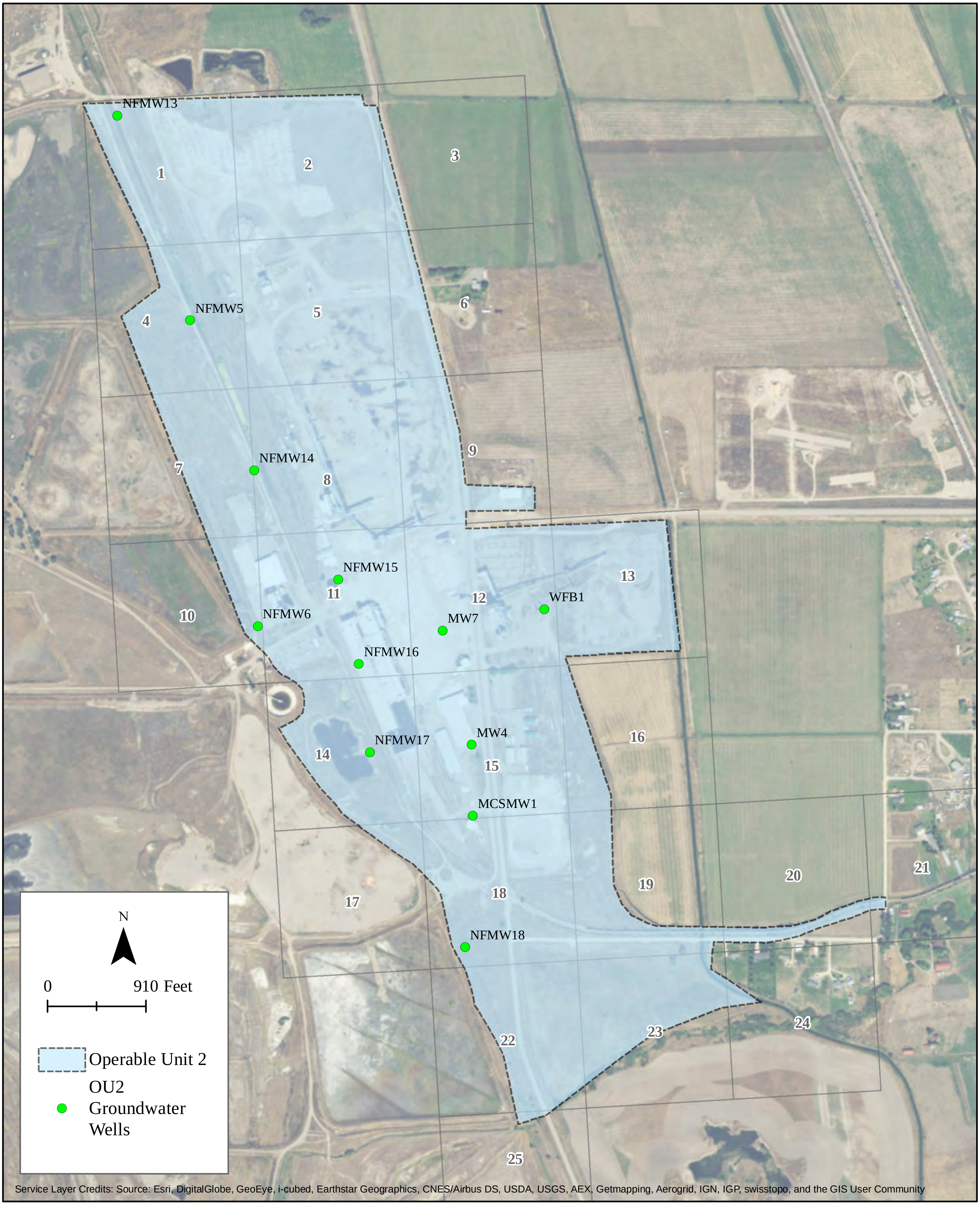
SRC

Figure 2-4. Subsurface Soil Sampling Locations in OU2: Smurfit-Stone/Frenchtown Mill Site, Montana



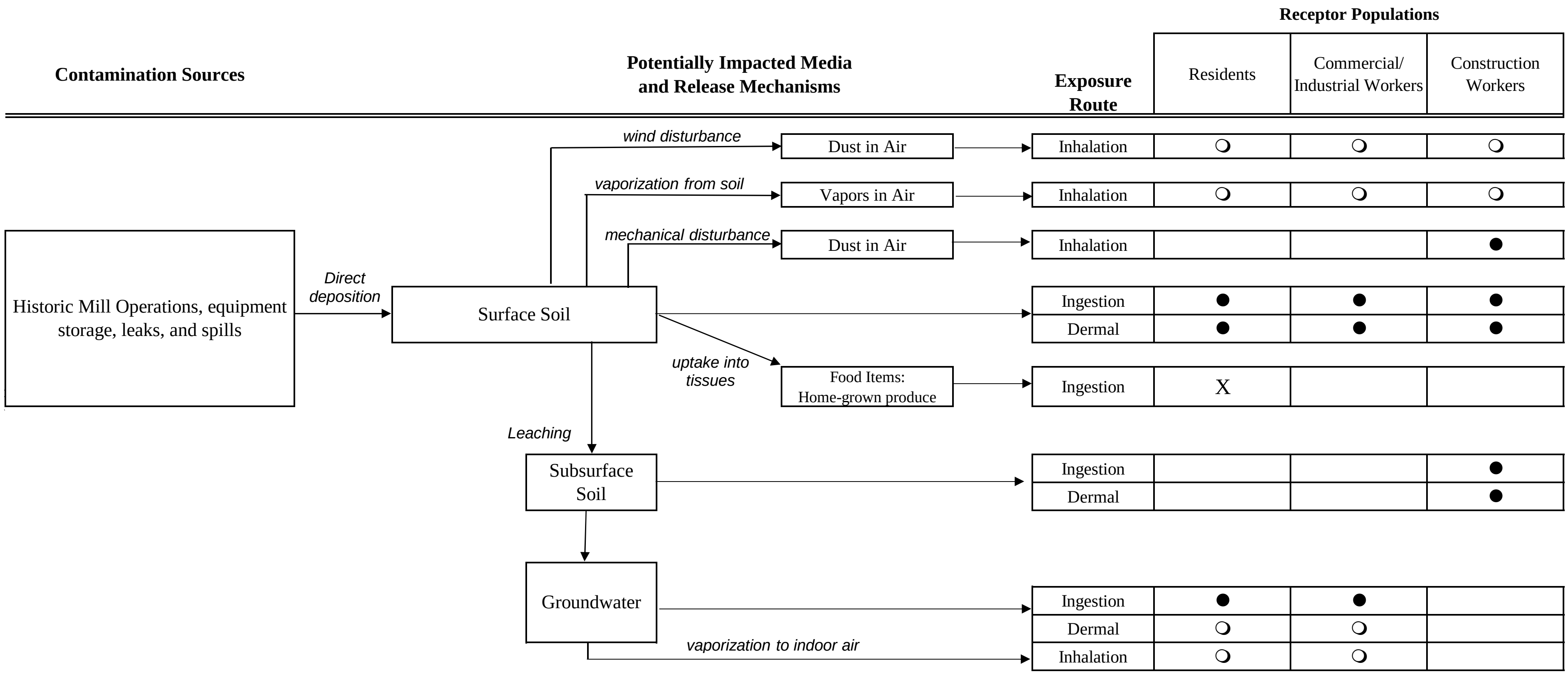
SRC

Figure 2-5. Groundwater Well Locations in OU2: Smurfit-Stone/Frenchtown Mill Site, Montana



SRC

Figure 3-1. Conceptual Site Model for Human Exposure at OU2



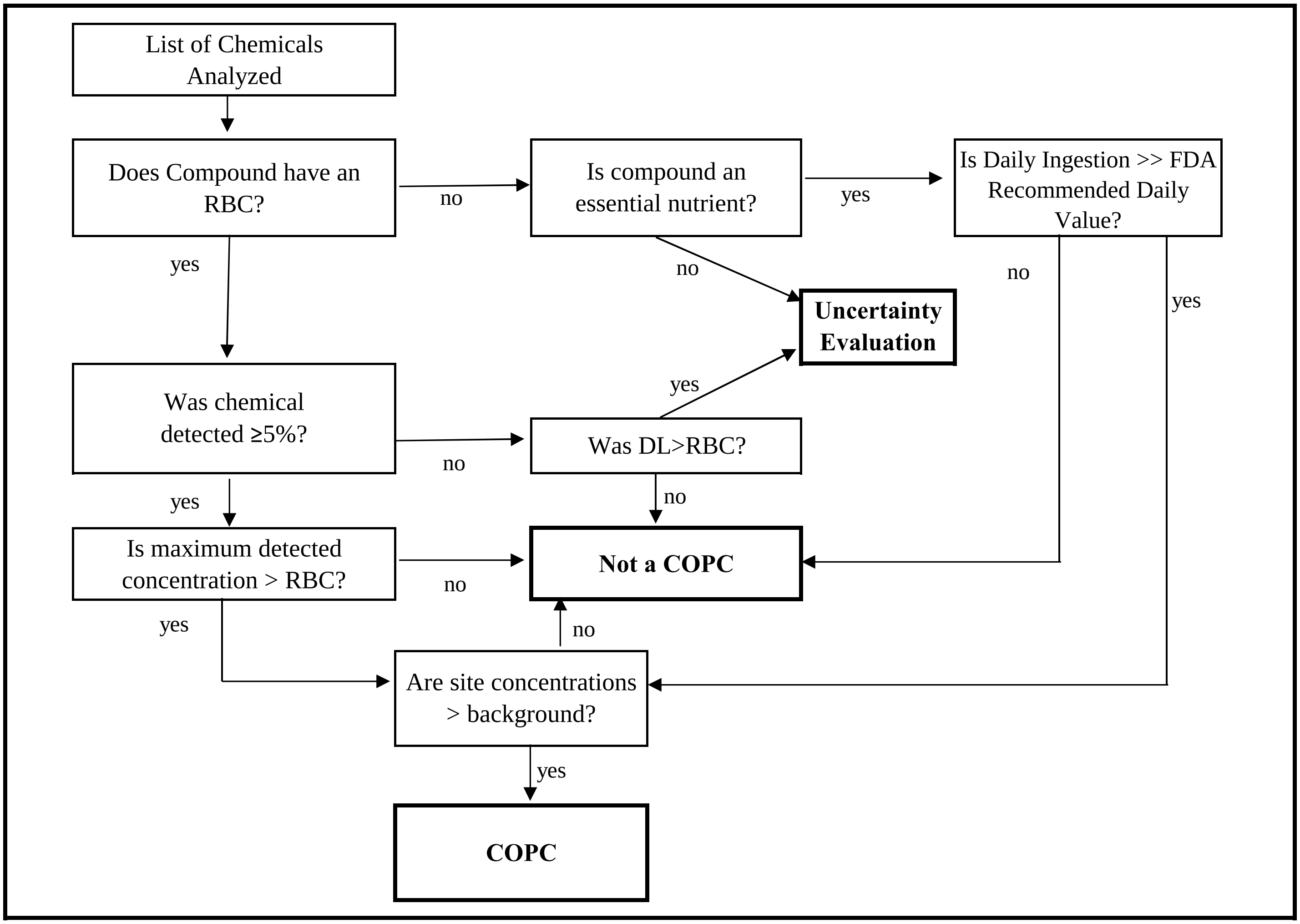
LEGEND

●	Pathway is complete and might be significant; quantitative evaluation.
❍	Pathway is complete, but is relatively minor; semi-quantitative evaluation.
	Pathway is not complete; no evaluation required.

<u>Notes:</u>

[1] Future land use is expected to be consistent with current and past use, although OU2 is currently not zoned for a specific land use.

Figure 3-2. COPC Selection Procedure for Human Health



Notes:

RBC = Risk-based concentration (HQ = 0.1, Cancer risk = 1E-06)

COPC = chemical of potential concern

DL = detection limit

Figure 3-3. Total Manganese Concentrations in Groundwater in OU2: Smurfit-Stone/Frenchtown Mill Site, Montana

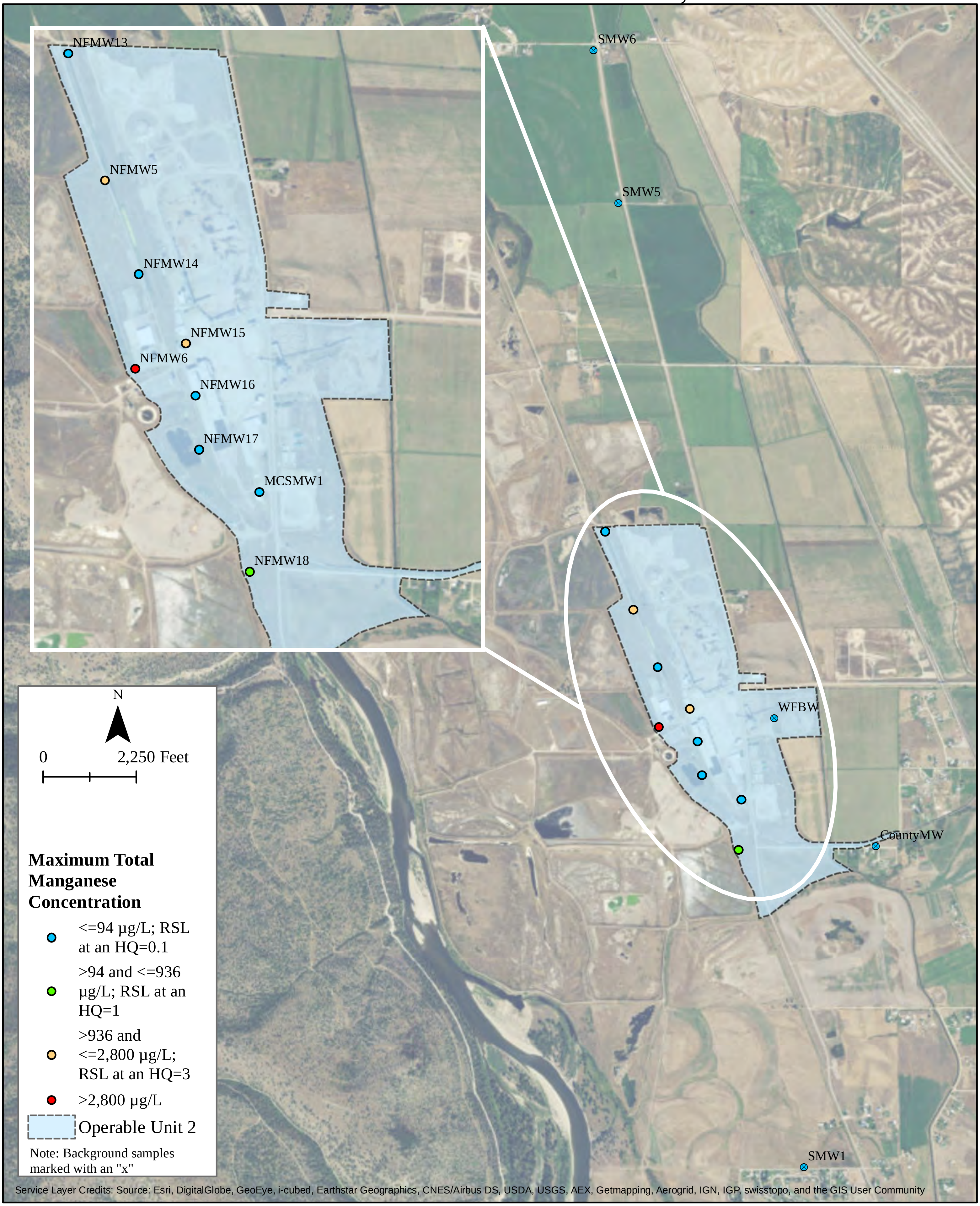
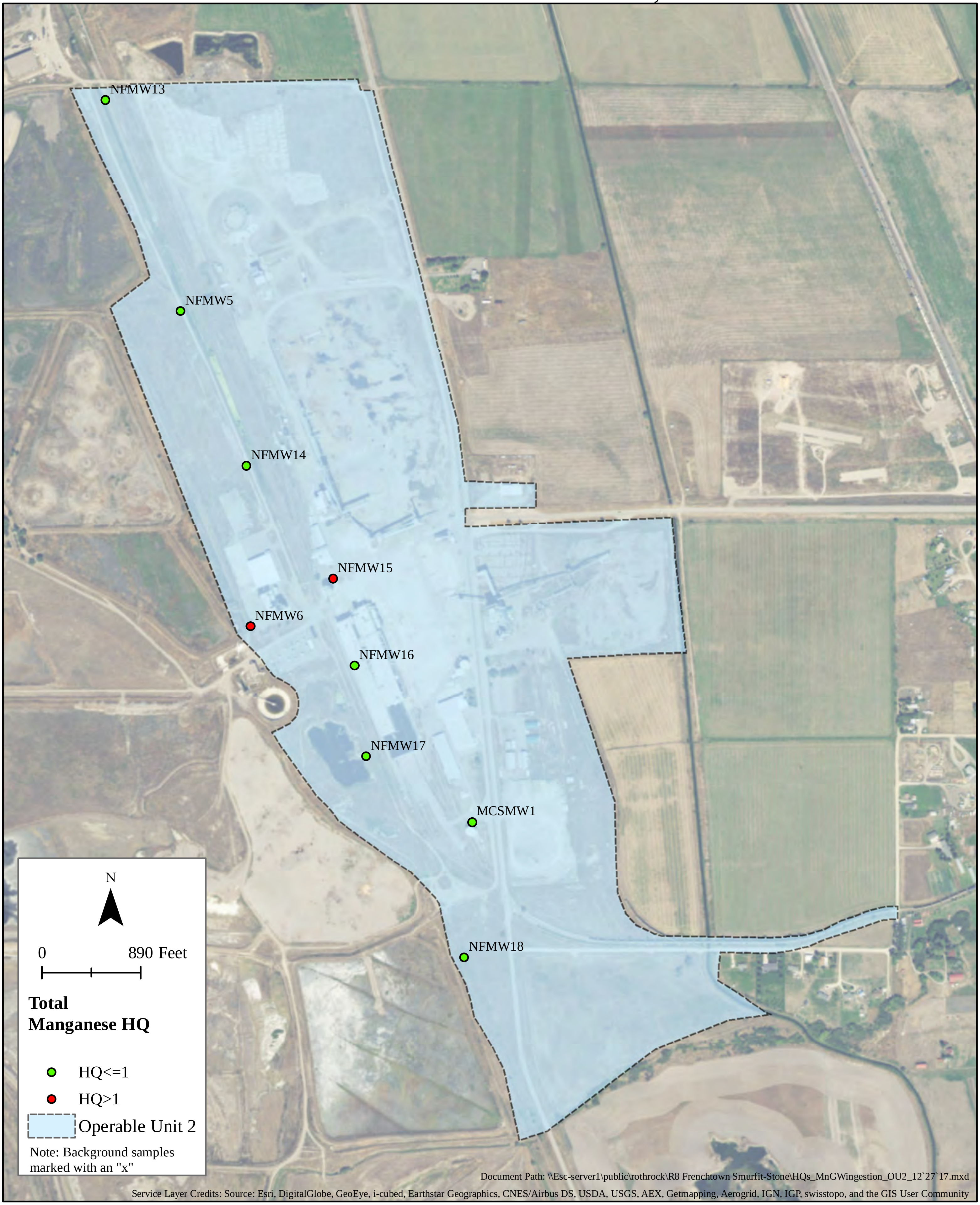


Figure 5-1. Total Manganese Hazard Quotients in OU2 Groundwater: Smurfit-Stone/Frenchtown Mill Site, Montana



APPENDIX A

OU2 Data Summary

1.0 INTRODUCTION

This appendix summarizes the data utilized in this OU2 HHRA. As described in the main text of this OU2 HHRA, soil and groundwater samples were collected within OU2 in 2014, 2015, 2016 and 2017. These data were collected by NewFields following approved sampling plans as part of ongoing RI activities. Additional data not collected by NewFields utilized in this OU2 HHRA includes background soil data collected across Montana by the Montana Department of Environmental Quality (MDEQ). All data collected by NewFields have been uploaded to a USEPA Scribe database for the Smurfit-Stone/Frenchtown Mill site. Data considered for use in the OU2 HHRA were based on a Scribe download conducted on December 5, 2017. Not all of the data in Scribe were utilized in the OU2 risk evaluations presented within the HHRA. The available raw data (site and background) were reduced to produce the site and background datasets utilized in the OU2 HHRA as described below. Data used in the OU2 HHRA are provided as an electronic data file in Attachment 1 to this appendix.

2.0 DATA SUMMARY

2.1 Site Soil

Soil samples were collected at locations throughout OU2 in April 2014, November/December 2015, August 2016, and October 2017. OU2 soil samples were analyzed for metals, dioxins/furans, polychlorinated biphenyls (PCBs; as Aroclors), semi-volatile organic compounds (SVOCs) and volatile organic compounds (VOCs). These data are briefly summarized in the main text. Further details on these sampling efforts are available in the RI reports.

2.2 Background Soil

The MDEQ has produced two reports summarizing efforts to quantify background concentrations of dioxins and furans and metals in surface soil samples collected across Montana (MDEQ 2011, 2013). The summary reports are publicly available online[12]. The raw data files supporting MDEQ (2013) are also publicly available online[1]. USEPA received the raw data files supporting MDEQ (2011) directly from MDEQ. Brief descriptions of these data and how they were utilized for the purposes of the OU2 HHRA are presented below.

[1] http://deq.mt.gov/Land/statesuperfund/background
[2] https://deq.mt.gov/Portals/112/Land/StateSuperfund/Documents/DioxinGuide/DioxinBackgroundStudy.pdf

2.2.1 Dioxins/Furans

In 2008, MDEQ collected composite surface soil samples (0-2 inches below ground surface) from locations that were not indicated to be impacted by point sources of dioxins (MDEQ 2011). Surface soil samples were collected using a stratified approach based on land use category and were analyzed for polychlorinated dioxins and dibenzofurans. Land use categories were first stratified into two primary categories, urban and rural, and were then stratified into secondary categories, as follows:

- Urban secondary categories: residential, commercial, or industrial.
- Rural secondary categories: agricultural, open space, or forest.

MDEQ had identified several samples as possible outliers in the dioxin dataset using visual inspection of histograms, box plots, and normal-quantile plots for each secondary land use category (MDEQ 2011). The USEPA identified the following samples as outliers that were excluded from analysis given that the reported TEQ concentrations exceeded the maximum detected TEQ values reported in Table 4 of the MDEQ (2011) report:

- MBDS-R02-F01
- MBDS-R10-F01
- MBDS-R02-O01
- MBDS-U18-R01
- MBDS-U19-R01
- MBDS-U20-C01

2.2.2 Metals

In 2012, the MDEQ collected composite surface soil samples (0-6 inches below ground surface) from locations that were not indicated to be impacted by point sources of inorganics (MDEQ 2013). All soil samples were analyzed for total analyte list (TAL) metals and mercury in both the bulk (unsieved) and fine (60-mesh sieved) fractions. Only the bulk results were utilized in the OU2 HHRA. No outlier analysis was performed on the MDEQ inorganics data (MDEQ 2013). The “detection limit” value included in the raw data file (believed to be the reporting limit) was used to evaluate non-detects.

2.3 Site Groundwater

Within the Scribe database, the location zone for all groundwater samples is entered as “OU3”. Based on past discussions between the USEPA, MDEQ and the RPs, the following groundwater wells have been identified for inclusion in OU2: MCMW1, MW4, MW7, NFMW13, NFMW14, NFMW15, NFMW16, NFMW17, NFMW18, NFMW5, NFMW6, and WFB1.

Groundwater sampling occurred at the twelve wells identified to be within or on the boundary of OU2. Three wells were sampled in April 2014, 11 wells were sampled in December 2015, five wells were sampled in June 2016, and eight wells were sampled in July 2017. Samples collected in 2014 and 2016 were analyzed for dioxins/furans, PCBs (as aroclors), and metals (total and dissolved). Samples collected in 2015 and 2017 were also analyzed for these contaminant classes as well as SVOCs and VOCs. Various field parameters were also measured including pH, temperature, dissolved oxygen, oxidation reduction potential, specific conductance, alkalinity and anions.

2.4 Background Groundwater

The USEPA, the MDEQ and the RPs have identified the following five wells as background groundwater locations: CountyMW, SMW1, SMW5, SMW6, and WFBW. Background groundwater data are available for samples collected from these wells as part of RI activities conducted at the site in April 2014, December 2015, May 2016, and March, June, and July 2017. Samples collected from these wells have been analyzed for dioxins/furans, PCBs (as Aroclor mixtures), total and dissolved metals, SVOCs, and VOCs.

3.0 DATA REDUCTION

3.1 Categorization as Surface Soil and Subsurface Soil

For the purposes of the HHRA, surface soil samples were classified as samples collected from a starting depth of either zero or one inch down to six inches below ground surface (bgs). Samples collected from at or below one foot bgs were classified as subsurface soil samples. Subsurface data used in the OU2 HHRA were restricted to samples collected within the top 10 feet bgs.

3.2 Treatment of Field Duplicates

In accordance with the RIWP QAPP, blind field duplicates (one for every twenty natural samples) were collected for Quality Assurance/Quality Control purposes. Two concentration results for a parent sample-duplicate pair were reduced to a single value for each contaminant as follows:

- If both the parent sample and the duplicate sample results were detected, the maximum detected concentration was retained and the result was flagged as a detect.

- If both the parent sample and the duplicate sample results were qualified as not detected, the maximum MDL was retained and the result was flagged as a non-detect.

- If one result from the sample pair was detected, while the other was qualified as not detected, the detected concentration was retained and the result was flagged as a detect.

Total PCB and TEQ concentrations were calculated for each parent sample and field duplicate as described in Section 2.6. For each sample pair, the results were reduced to a single value for each calculated result in accordance with the protocol presented above. Duplicate reduction was not done at the congener level.

3.3 Treatment of Multiple Analytical Results

Some soil samples collected within OU2 were analyzed using two extraction methods during VOC analysis: EPA 5035/5030B and EPA 5035 Low. This resulted in several samples having two results for each VOC in the Scribe database. These results were reduced to a single value for each contaminant as follows:

- If both the results were detected, the maximum detected concentration was retained and the result was flagged as a detect.

- If both results were qualified as not detected, the maximum MDL was retained and the result was flagged as a non-detect.

- If one of the results was detected, while the other was qualified as not detected, the detected concentration was retained and the result was flagged as a detect.

3.4 Treatment of Non-detects

USEPA Region 8 evaluates analytical results qualified as non-detects using the respective MDL values. As per the analytical reports included in the RI Work Plan, the MDL is defined as the smallest amount that we can be 99% certain of seeing, if it is present. Using the MDL to evaluate non-detects minimizes false positives. The MDL is usually lower than the RL which is the level at which method, permit, regulatory and customer-specific objectives are incorporated. Reporting non-detects to higher detection limits than needed tends to adversely impact data quality and increase data uncertainty. Thus, to remain consistent with other regional site assessments, non-detects were evaluated using the MDL.

When calculating summary statistics, NDs were evaluated at ½ MDL. When inputting data to ProUCL for the purposes of comparing site and background data or calculating 95 UCL values, ND data were based on the MDL. The exception to this approach was in the OU2 surface soil data input to ProUCL to compare site concentrations to background concentrations reported in the MDEQ background soil reports. In this case, NDs were evaluated using the RL consistent with the MDEQ background data files.

3.5 Calculation Total PCB Concentrations

There are 209 PCB congeners. PCBs generally occur as a mixture of congeners. Aroclors are commercial mixtures of PCB congeners that contain many of the individual congeners in varying ratios. When Aroclors are released into the environment, the original congener composition of the PCB mixture changes due to differential fate and transport processes (USEPA 1996). Chemical analyses of environmental samples often report PCB concentrations in terms of the Aroclor mixture(s) they most closely resemble. All PCB data in OU2 soil collected prior to 2017, and all PCB data in OU2 groundwater were reported in concentrations of Aroclor mixtures.

There are potential risks associated with possible enhancement of highly toxic, dioxin-like PCB congeners (toxicologically related to 2,3,7,8- TCDD), whereby congener-based analysis can be utilized to ensure that overall PCB risks are not underestimated (USEPA 1996). As such, soil samples collected from OU2 in 2017 were analyzed for individual PCB congeners. For those samples for which PCB-congener data were available, total PCB concentrations were calculated by summing across all PCB congeners assuming ½ MDL for concentrations qualified as non-detects. Total dioxin-like PCB concentrations and total non-dioxin-like PCB concentrations were also calculated in this manner.

3.6 Calculation of TEQ

Because dioxin and furan congeners and dioxin-like PCBs all act by the same mechanism as 2,3,7,8-TCDD, data for the dioxin and furan congeners and dioxin-like PCBs was converted to a TCDD toxicity equivalent value (TEQ) by computing the sum across congeners of the product of congener-specific concentration and relative Toxicity Equivalence Factor (TEF):

$$TEQ = \sum (Ci \times TEFi)$$

TEFs were based on USEPA (2010). In the site database, separate TEQ values were calculated for dioxins and furans, dioxin-like PCBs, and dioxins, furans, and dioxin-like PCBs combined. For each type of TEQ, three alternative values were computed in the site database, differing in the numeric concentration values assigned to concentrations flagged as ND as: ND = 0, ND = ½ RL, and ND = ½ MDL. A TEQ concentration is flagged as ND only if no individual was detected in that sample.

The background soil database contains calculated TEQ values that were provided by MDEQ. These TEQ concentrations are based on evaluating non-detects at one-half the RL. MDEQ (2011) does not provide an MDL in their raw data files.

4.0 SUPPLEMENTATION OF EXCAVATED SOIL

As described in the RIWP Addendum 5, PCBs were detected at elevated levels at the HDPT and the TSB locations. A soil removal action was done in December 2017 at these locations in accordance with RIWP Addendum 5. Soil data collected in 2014-2016 from areas included in the soil excavation are no longer valid for evaluating human health exposures. As such, these data were excluded from the dataset included in the OU2 HHRA. NewFields provided the USEPA with a list of sample IDs to exclude from the OU2 HHRA dataset as shown in Table A-1. Data for backfill soil were used in place of these excluded data.

Based on input from NewFields, the soil samples identified in Table A-2 that were collected in 2014, 2015, and 2017 were used to generate backfill concentrations that were added to the site database for use in the OU2 HHRA. Concentrations for the samples listed in Table A-2 were reduced to a single concentration for each contaminant analyzed as follows:

- For each contaminant, the average concentration across the samples was calculated and used as the backfill concentration. If a result was qualified as a non-detect, the MDL was used to calculate the average.

- For each contaminant, if at least one sample result was detected, the average value was considered detected. If concentrations across samples for a given contaminant were all qualified as non-detect, the calculated average concentrations were flagged as non-detect.

This approach resulted concentration data for a single contrived backfill sample. This sample was used in place of the samples listed in Table A-1 for characterizing both surface soil and subsurface soil concentrations at the HDPT foundation and TSB foundation areas. These data are included in Attachment 1 with the following sample IDs:

- BACKFILL-HDPT-SS
- BACKFILL-HDPT-SB
- BACKFILL-TSB-SS
- BACKFILL-TSB-SB

5.0 REFERENCES

MDEQ. 2011. Montana Dioxin Background Investigation Report. Montana Department of Environmental Quality. April 2011.

MDEQ. 2013. Background Concentrations of Inorganic Constituents in Montana Surface Soils. Montana Department of Environmental Quality. September 2013.

USEPA 1996. PCBs: Cancer Dose-Response Assessment and Application to Environmental Mixtures. EPA/600/P-96/001F. September. 1996.

USEPA 2010. Recommended Toxicity Equivalence Factors (TEFs) for Human Health Risk Assessments of 2,3,7,8-Tetrachlorodibenzo-p-dioxin and Dioxin-Like Compounds. EPA/100/R 10/005. December.

Table A-1. Sample Collected from HDPT and TSB
December 2017 Removal Action Areas

Location	Sample	Sample Date
High Density Pulp Tank (HDPT)	SS18-IN-(12)	12/15/2015
	SS19-IN-(24)	12/15/2015
	IN-HDPT40-SB1	8/22/2016
	FD1-SO (Dup)	8/22/2016
	IN-HDPT38-SB1	8/22/2016
	IN-HDPT38-SB2	8/22/2016
	IN-HDPT38-SB3	8/22/2016
	IN-HDPT38-SB4	8/22/2016
	IN-HDPT39-SB1	8/22/2016
	IN-HDPT39-SB2	8/22/2016
	IN-HDPT39-SB4	8/22/2016
	IN-HDPT39-SB6	8/22/2016
	IN-HDPT40-SB1	8/22/2016
	IN-HDPT40-SB2	8/22/2016
	IN-HDPT40-SB3	8/22/2016
	IN-HDPT40-SB4	8/22/2016
Transformer Storage Building (TSB)	IN-TSB44-SB1	8/22/2016
	IN-TSB44-SB2	8/22/2016
	IN-TSB45-SB1	8/22/2016
	IN-TSB46-SB1	8/22/2016
	IN-TSB47-SB1	8/22/2016
	SS28-IN-(0-2)c	12/4/2015

Table A-2. Samples Used to Generate Backfill Concentrations

Sample	Sample Date	Analysis				
		Metals	TEQ	SVOC	VOC	PCB
AG8-1-SS_4/18/14_NM	4/18/2014	X	X			
SS69-AG8-(0-2)c	11/22/2015	X	X	X		
Backfill Source AG8	10/28/2017					X
SS70-AG8-(5-7)c	11/22/2015	X	X	X		
SS22-IN-(12)	12/15/2015				X	
SS23-IN-(24)	12/15/2015				X	

ATTACHMENT 1

Data Used in the Smurfit-Stone/Frenchtown Mill OU2 HHRA

Electronic File

[Appendix A_Attachment 1.xlsx]

APPENDIX B

Screening Level Evaluations

This appendix presents a screening level evaluation of those pathways identified as “minor” in the OU2 conceptual site model (CSM) (see Figure 3-1 of the main document). These pathways include the following:

- Inhalation of soil particulates generated via wind erosion
- Inhalation of vapors released from surface soils
- Dermal contact with groundwater used in future residential and commercial buildings

As discussed in the main text of the human health risk assessment (HHRA) for the OU2 Site, ingestion is the primary pathway by which exposure to site media is expected to occur at the OU2 Site. In general, the above pathways are considered minor exposure pathways when compared to the ingestion pathway. This screening level evaluation considers the relative risks from exposure to a chemical from each of the pathways listed above compared to the relative risks from exposure of the same chemical via the ingestion pathway.

Inhalation of Contaminants in Soil

As described in the main text of this HHRA, human receptors at the OU2 Site may be exposed to contaminated soil via inhalation of soil particulates suspended in air by wind disturbance or via inhalation of vapors in the air emitted from soil. This section evaluates the relative comparison between the ingestion pathway and the inhalation pathway for exposures to soil. The basic equations recommended by USEPA (1989; 2009) for evaluating exposures via ingestion and inhalation are described in brief below.

<u>Ingestion Exposures</u>

The daily ingested intake for chronic exposures is calculated as (USEPA 1989):

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

where:

DI	=	Daily intake of chemical (mg per kg of body weight per day).
C	=	Concentration of the chemical in the contaminated environmental medium (soil, water) to which the person is exposed. The units are mg/kg for soil and mg/m^3 for air.
IR	=	Intake rate of the contaminated environmental medium. The units are kg/day for soil and L/day for water.
BW	=	Body weight of the exposed person (kg).

EF	=	Exposure frequency (days/year).
ED	=	Exposure duration (years).
AT	=	Averaging time (days).

Inhalation Exposures

The inhaled exposure concentration (EC) for chronic exposures is calculated as (USEPA 2009):

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

where:

EC	=	Exposure Concentration ($\mu g/m^3$). This is the time-weighted concentration based on the characteristics of the exposure scenario being evaluated.
Ca	=	Concentration of the chemical in air ($\mu g/m^3$) to which the person is exposed.
ET	=	Exposure time (hours/day).
EF	=	Exposure frequency (days/year).
ED	=	Exposure duration (years).
AT	=	Averaging time (hours).

and

$$Ca = Cs / PEF \text{ or } VF$$

where:

Cs	=	Concentration of the chemical in soil (mg/kg)
PEF	=	Particulate Emission Factor (m^3/kg)
VF	=	Volatilization Factor (m^3/kg)

To compare the relative contributions to exposure from the two pathways, non-cancer hazards and cancer risks were calculated as follows:

Non-cancer hazard quotients

$$HQ = DI / RfD \quad \text{(ingestion pathway)}$$

$$HQ = EC / RfC \quad \text{(inhalation pathway)}$$

<u>Cancer risks</u>

Risk = DI · SF (ingestion pathway)

Risk = EC · UR (inhalation pathway)

Based on the above equations, the relative magnitude of risks from inhalation exposures can be compared to risks from ingestion exposure by calculating the ratio as follows:

Ratio = Inhalation Risk / Ingestion Risk

Using the exposure parameters for a resident, cancer risks and non-cancer HQ values were calculated for 2,3,7,8-TCDD (herein referred to as dioxin) as an example, assuming an arbitrary soil concentration.

Media	**Endpoint**	**Pathway**	**Ratio (Inhalation/Ingestion)**
Soil	Cancer	Inhalation (particulates)	6E-05 (<0.01%)
		Inhalation (vapor)	4E-02 (4%)
	Non-cancer	Inhalation (particulates)	3E-06 (<0.001%)
		Inhalation (vapor)	2E-03 (0.2%)

As shown in the table above, risks from inhalation exposures are small compared to risks from ingestion exposures (<5%). These findings support designating the inhalation pathways for soil exposures as minor for the purposes of this assessment.

Dermal Contact with Water

As described in the main text of this HHRA, if groundwater were used in future residential buildings at the OU2 site, residents may be exposed while bathing/showering. The basic equations recommended by USEPA (1989; 2004) for evaluating exposures and risk via dermal contact are described in brief below.

<u>Dermal Exposure</u>

The dermally absorbed dose (DAD) is quantified using an equation of the following general form (USEPA 2004):

$$DAD = DA_{event} \cdot EF \cdot ED \cdot EV \cdot SA / (BW \cdot AT)$$

where:

DAD	=	Dermally absorbed dose (mg of chemical per kg of body weight per day).
DA_{event}	=	Absorbed dose per event (mg of chemical per square centimeter of skin surface area per event).
EF	=	Exposure frequency (days/year).
ED	=	Exposure duration (years).
EV	=	Event frequency (events/day).
SA	=	Surface area (cm^2).
BW	=	Body weight of the exposed person (kg).
AT	=	Averaging time (days).

Non-cancer hazard quotients

$$HQ = DAD/RfD_{ABS} \quad \text{(dermal pathway; } RfD_{ABS}=RfD \cdot ABS_{GI}\text{)}$$

Cancer Risk

$$Risk = DAD \cdot SF_{ABS} \quad \text{(dermal pathway; } SF_{ABS} = SF/ABS_{GI}\text{)}$$

Using the exposure parameters for a resident, dermal cancer risks and non-cancer HQ values were calculated for antimony as an example, assuming an arbitrary water concentration. The (dermal/ingestion) ratio between the non-cancer HQs for antimony is 8E-05 (0.01%). These findings support designating the dermal pathway for groundwater exposures to hypothetical future commercial workers as minor for the purposes of this assessment.

References

USEPA. 1989. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A). United States Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC.

USEPA. 2004. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. United States Environmental Protection Agency, Office of Emergency and Remedial Response. EPA/540/R/99/005. July.

USEPA. 2009. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment). Final. United States Environmental Protection Agency, Office of Emergency and Remedial Response. EPA-540-R-070-002. OSWER 9285.7-82. January.

USEPA. 2016. Vapor Intrusion Screening Level Calculator (VISL). Version 3.5.1. Based on the May 2016 USEPA Regional Screening Level Tables. https://www.epa.gov/vaporintrusion/vapor-intrusion-screening-levels-visls.

Appendix C

ProUCL Output for Site versus Background Comparisons

Appendix C. ProUCL Results Comparing OU2 Soil to Background Soil from MDEQ (2011; 2013)

From File	ProUCL_OU2_Soil_IN.xls
Confidence Coefficient	95%

ALUMINUM

Sample 1 Data: Aluminum
Sample 2 Data: BkgAluminum

Raw Statistics

	Sample 1	Sample 2
Number of Valid Data	33	112
Number of Non-Detects	0	0
Number of Detect Data	33	112
Minimum Non-Detect	N/A	N/A
Maximum Non-Detect	N/A	N/A
Percent Non-detects	0.00%	0.00%
Minimum Detect	2860	4150
Maximum Detect	28400	33700
Mean of Detects	11240	15522
Median of Detects	9890	15000
SD of Detects	6114	5758

Wilcoxon-Mann-Whitney (WMW) Test

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

Sample 1 Rank Sum W-Stat	1583
Standardized WMW U-Stat	-3.898
Mean (U)	1848
SD(U) - Adj ties	212
Approximate U-Stat Critical Value (0.05)	-1.645
P-Value (Adjusted for Ties)	4.85E-05

Conclusion with Alpha = 0.05
Reject H0, Conclude Sample 1 < Sample 2
P-Value < alpha (0.05)

ARSENIC

Sample 1 Data: Arsenic
Sample 2 Data: BkgArsenic

Raw Statistics

	Sample 1	Sample 2
Number of Valid Data	33	112
Number of Non-Detects	0	0
Number of Detect Data	33	112
Minimum Non-Detect	N/A	N/A
Maximum Non-Detect	N/A	N/A
Percent Non-detects	0.00%	0.00%
Minimum Detect	1.933	1.5
Maximum Detect	11.4	81.9
Mean of Detects	4.214	11.41
Median of Detects	4.2	8.45
SD of Detects	1.778	11.6

Wilcoxon-Mann-Whitney (WMW) Test

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

Sample 1 Rank Sum W-Stat	983
Standardized WMW U-Stat	-6.728
Mean (U)	1848
SD(U) - Adj ties	212
Approximate U-Stat Critical Value (0.05)	-1.645
P-Value (Adjusted for Ties)	8.62E-12

Conclusion with Alpha = 0.05
Reject H0, Conclude Sample 1 < Sample 2
P-Value < alpha (0.05)

CHROMIUM

Sample 1 Data: Chromium
Sample 2 Data: BkgChromium

Raw Statistics

	Sample 1	Sample 2
Number of Valid Data	33	112
Number of Non-Detects	0	0
Number of Detect Data	33	112
Minimum Non-Detect	N/A	N/A
Maximum Non-Detect	N/A	N/A
Percent Non-detects	0.00%	0.00%
Minimum Detect	5.2	3.2
Maximum Detect	39.5	130
Mean of Detects	13.03	19.6
Median of Detects	12.5	18.05
SD of Detects	6.615	12.22

Wilcoxon-Mann-Whitney (WMW) Test

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

Sample 1 Rank Sum W-Stat	1270
Standardized WMW U-Stat	-5.376
Mean (U)	1848
SD(U) - Adj ties	212
Approximate U-Stat Critical Value (0.05)	-1.645
P-Value (Adjusted for Ties)	3.80E-08

Conclusion with Alpha = 0.05
Reject H0, Conclude Sample 1 < Sample 2
P-Value < alpha (0.05)

COBALT

Sample 1 Data: Cobalt
Sample 2 Data: BkgCobalt

Raw Statistics

	Sample 1	Sample 2
Number of Valid Data	33	112
Number of Non-Detects	0	0
Number of Detect Data	33	112
Minimum Non-Detect	N/A	N/A
Maximum Non-Detect	N/A	N/A
Percent Non-detects	0.00%	0.00%
Minimum Detect	2.6	2.1
Maximum Detect	8	16.4
Mean of Detects	4.944	7.33
Median of Detects	4.7	6.9
SD of Detects	1.468	2.756

Wilcoxon-Mann-Whitney (WMW) Test

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

Sample 1 Rank Sum W-Stat	1359
Standardized WMW U-Stat	-4.955
Mean (U)	1848
SD(U) - Adj ties	212
Approximate U-Stat Critical Value (0.05)	-1.645
P-Value (Adjusted for Ties)	3.62E-07

Conclusion with Alpha = 0.05
Reject H0, Conclude Sample 1 < Sample 2
P-Value < alpha (0.05)

IRON

Sample 1 Data: Iron
Sample 2 Data: BkgIron

Raw Statistics

	Sample 1	Sample 2
Number of Valid Data	33	112
Number of Non-Detects	0	0
Number of Detect Data	33	112
Minimum Non-Detect	N/A	N/A
Maximum Non-Detect	N/A	N/A
Percent Non-detects	0.00%	0.00%
Minimum Detect	5270	6430
Maximum Detect	37300	59200
Mean of Detects	13688	18184
Median of Detects	13200	17650
SD of Detects	5870	6781

Wilcoxon-Mann-Whitney (WMW) Test

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

Sample 1 Rank Sum W-Stat	1503
Standardized WMW U-Stat	-4.275
Mean (U)	1848
SD(U) - Adj ties	212
Approximate U-Stat Critical Value (0.05)	-1.645
P-Value (Adjusted for Ties)	9.54E-06

Conclusion with Alpha = 0.05
Reject H0, Conclude Sample 1 < Sample 2
P-Value < alpha (0.05)

MANGANESE

Sample 1 Data: Manganese
Sample 2 Data: BkgManganese

Raw Statistics

	Sample 1	Sample 2
Number of Valid Data	33	112
Number of Non-Detects	0	0
Number of Detect Data	33	112
Minimum Non-Detect	N/A	N/A
Maximum Non-Detect	N/A	N/A
Percent Non-detects	0.00%	0.00%
Minimum Detect	177.7	74
Maximum Detect	3040	2920
Mean of Detects	478.9	508.4
Median of Detects	351	425
SD of Detects	511.2	369.2

Wilcoxon-Mann-Whitney (WMW) Test

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

Sample 1 Rank Sum W-Stat	2043
Standardized WMW U-Stat	-1.728
Mean (U)	1848
SD(U) - Adj ties	212.1
Approximate U-Stat Critical Value (0.05)	-1.645
P-Value (Adjusted for Ties)	0.042

Conclusion with Alpha = 0.05
Reject H0, Conclude Sample 1 < Sample 2
P-Value < alpha (0.05)

THALLIUM
Sample 1 Data: Thallium
Sample 2 Data: BkgThallium

Raw Statistics

	Sample 1	Sample 2
Number of Valid Data	33	112
Number of Non-Detects	0	0
Number of Detect Data	33	112
Minimum Non-Detect	N/A	N/A
Maximum Non-Detect	N/A	N/A
Percent Non-detects	0.00%	0.00%
Minimum Detect	0.049	0.07
Maximum Detect	0.55	0.84
Mean of Detects	0.125	0.248
Median of Detects	0.1	0.235
SD of Detects	0.0855	0.112

Wilcoxon-Mann-Whitney (WMW) Test

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

Sample 1 Rank Sum W-Stat	948.5
Standardized WMW U-Stat	-6.894
Mean (U)	1848
SD(U) - Adj ties	211.9
Approximate U-Stat Critical Value (0.05)	-1.645
P-Value (Adjusted for Ties)	2.71E-12

Conclusion with Alpha = 0.05
Reject H0, Conclude Sample 1 < Sample 2
P-Value < alpha (0.05)

<u>TEQ (ND=1/2RL) vs. Background Residential</u>

Sample 1 Data: TEQ(NDhalfRL)
Sample 2 Data: TEQ-Res

Raw Statistics

Number of Valid Data
Number of Non-Detects
Number of Detect Data
Minimum Non-Detect
Maximum Non-Detect
Percent Non-detects
Minimum Detect
Maximum Detect
Mean of Detects
Median of Detects
SD of Detects

Wilcoxon-Mann-Whitney (WMW) Test

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

Sample 1 Rank Sum W-Stat
Standardized WMW U-Stat
Mean (U)
SD(U) - Adj ties
Approximate U-Stat Critical Value (0.05)
P-Value (Adjusted for Ties)

Conclusion with Alpha = 0.05
Do Not Reject H0, Conclude Sample 1 >= Sample 2
P-Value >= alpha (0.05)

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

Sample 1 Rank Sum W-Stat	2141
WMW U-Stat	763
Standardized WMW U-Stat	2.645
Mean (U)	546
SD(U) - Adj ties	82.06
Lower Approximate U-Stat Critical Value (0.02	-1.96
Upper Approximate U-Stat Critical Value (0.97	1.96
P-Value (Adjusted for Ties)	0.00818

Conclusion with Alpha = 0.05
Reject H0, Conclude Sample 1 <> Sample 2
P-Value < alpha (0.05)

<u>TEQ (ND=1/2RL) vs. Background Commercial/Industrial</u>

Sample 1 Data: TEQ(NDhalfRL)
Sample 2 Data: TEQ-CI

Raw Statistics

Number of Valid Data
Number of Non-Detects
Number of Detect Data
Minimum Non-Detect
Maximum Non-Detect
Percent Non-detects
Minimum Detect
Maximum Detect
Mean of Detects
Median of Detects
SD of Detects

Wilcoxon-Mann-Whitney (WMW) Test
H0: Mean/Median of Sample 1 >= Mean/Median of Sample 2

Sample 1 Rank Sum W-Stat	2493
Standardized WMW U-Stat	1.033
Mean (U)	988
SD(U) - Adj ties	122.4
Approximate U-Stat Critical Value (0.05)	-1.645
P-Value (Adjusted for Ties)	0.849

Conclusion with Alpha = 0.05
Do Not Reject H0, Conclude Sample 1 >= Sample 2
P-Value >= alpha (0.05)

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

Sample 1 Rank Sum W-Stat
WMW U-Stat
Standardized WMW U-Stat
Mean (U)
SD(U) - Adj ties
Lower Approximate U-Stat Critical Value (0.025)
Upper Approximate U-Stat Critical Value (0.975)
P-Value (Adjusted for Ties)

Conclusion with Alpha = 0.05
Do Not Reject H0, Conclude Sample 1 = Sample 2
P-Value >= alpha (0.05)

TEQ (ND=1/2RL) vs. Background Urban

Sample 1 Data: TEQ(NDhalfRL)
Sample 2 Data: TEQ-urban

Raw Statistics

	Sample 1	Sample 2
Number of Valid Data	52	59
Number of Non-Detects	0	1
Number of Detect Data	52	58
Minimum Non-Detect	N/A	1.24E-07
Maximum Non-Detect	N/A	1.24E-07
Percent Non-detects	0.00%	1.69%
Minimum Detect	3.22E-07	1.30E-07
Maximum Detect	2.53E-05	9.34E-06
Mean of Detects	3.72E-06	1.61E-06
Median of Detects	1.49E-06	1.16E-06
SD of Detects	5.29E-06	1.65E-06

Wilcoxon-Mann-Whitney (WMW) Test

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

Sample 1 Rank Sum W-Stat	3256
Standardized WMW U-Stat	2.03
Mean (U)	1534
SD(U) - Adj ties	169.2
Approximate U-Stat Critical Value (0.05)	-1.645
P-Value (Adjusted for Ties)	0.979

Conclusion with Alpha = 0.05
Do Not Reject H0, Conclude Sample 1 >= Sample 2
P-Value >= alpha (0.05)

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

Sample 1 Rank Sum W-Stat	3256
WMW U-Stat	1878
Standardized WMW U-Stat	2.033
Mean (U)	1534
SD(U) - Adj ties	169.2
Lower Approximate U-Stat Critical Value (0.02	-1.96
Upper Approximate U-Stat Critical Value (0.97	1.96
P-Value (Adjusted for Ties)	0.0421

Conclusion with Alpha = 0.05
Reject H0, Conclude Sample 1 <> Sample 2

P-Value < alpha (0.05)

TEQ (ND=1/2RL) vs. Background Rural

Sample 1 Data: TEQ(NDhalfRL)
Sample 2 Data: TEQ-rural

Raw Statistics

	Sample 1	Sample 2
Number of Valid Data	52	58
Number of Non-Detects	0	6
Number of Detect Data	52	52
Minimum Non-Detect	N/A	1.12E-07
Maximum Non-Detect	N/A	1.10E-06
Percent Non-detects	0.00%	10.34%
Minimum Detect	3.22E-07	1.20E-07
Maximum Detect	2.53E-05	1.85E-06
Mean of Detects	3.72E-06	7.49E-07
Median of Detects	1.49E-06	6.65E-07
SD of Detects	5.29E-06	4.72E-07

WMW test is meant for a Single Detection Limit Case
Use of Gehan or T-W test is suggested when multiple detection limits are preser
All observations <= 1.0986E-6 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

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

Sample 1 Rank Sum W-Stat	3552
Standardized WMW U-Stat	4.333
Mean (U)	1508
SD(U) - Adj ties	167
Approximate U-Stat Critical Value (0.05)	-1.645
P-Value (Adjusted for Ties)	1

Conclusion with Alpha = 0.05
Do Not Reject H0, Conclude Sample 1 >= Sample 2
P-Value >= alpha (0.05)

Sample 1 vs Sample 2 Gehan Test

H0: Mean of Sample 1 >= Mean of background

Gehan z Test Value	4.923
Critical z (0.05)	-1.645
P-Value	1

Conclusion with Alpha = 0.05
Do Not Reject H0, Conclude Sample 1 >= Sample 2
P-Value >= alpha (0.05)

H0: Mean of Sample 1 = Mean of background

Gehan z Test Value	4.923
Lower Critical z (0.025)	-1.96
Upper Critical z (0.975)	1.96
P-Value	8.54E-07

Conclusion with Alpha = 0.05
Reject H0, Conclude Sample 1 <> Sample 2
P-Value < alpha (0.05)

Appendix C. ProUCL Results Comparing OU2 Groundwater to Background Groundwater

From File ProUCL_OU2_GW_IN.xls
Confidence Coefficient 95%

FLUORIDE
Sample 1 Data: Fluoride
Sample 2 Data: Bkg-Fluoride

Raw Statistics

	Sample 1	Sample 2
Number of Valid Data	24	11
Number of Non-Detects	0	0
Number of Detect Data	24	11
Minimum Non-Detect	N/A	N/A
Maximum Non-Detect	N/A	N/A
Percent Non-detects	0.00%	0.00%
Minimum Detect	89	140
Maximum Detect	270	300
Mean of Detects	172.8	216.4
Median of Detects	170	220
SD of Detects	42.28	49.05

Wilcoxon-Mann-Whitney (WMW) Test

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

Sample 1 Rank Sum W-Stat	366
Standardized WMW U-Stat	-2.374
Mean (U)	132
SD(U) - Adj ties	28.02
Approximate U-Stat Critical Value (0.05)	-1.645
P-Value (Adjusted for Ties)	0.0088

Conclusion with Alpha = 0.05
Reject H0, Conclude Sample 1 < Sample 2
P-Value < alpha (0.05)

PHOSPHORUS
Sample 1 Data: Phosphorus
Sample 2 Data: Bkg-Phosphorus

Raw Statistics

	Sample 1	Sample 2
Number of Valid Data	24	11
Number of Non-Detects	0	0
Number of Detect Data	24	11
Minimum Non-Detect	N/A	N/A
Maximum Non-Detect	N/A	N/A
Percent Non-detects	0.00%	0.00%
Minimum Detect	31	25
Maximum Detect	450	170
Mean of Detects	147.4	92.73
Median of Detects	103	92
SD of Detects	124.9	43.92

Wilcoxon-Mann-Whitney (WMW) Test

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

Sample 1 Rank Sum W-Stat	457
Standardized WMW U-Stat	0.871
Mean (U)	132
SD(U) - Adj ties	28.13
Approximate U-Stat Critical Value (0.05)	-1.645
P-Value (Adjusted for Ties)	0.808

Conclusion with Alpha = 0.05
Do Not Reject H0, Conclude Sample 1 >= Sample 2
P-Value >= alpha (0.05)

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

Sample 1 Rank Sum W-Stat	457
WMW U-Stat	157
Standardized WMW U-Stat	0.889
Mean (U)	132
SD(U) - Adj ties	28.13
Lower Approximate U-Stat Critical Value (0.0:	-1.96
Upper Approximate U-Stat Critical Value (0.9	1.96
P-Value (Adjusted for Ties)	0.374

Conclusion with Alpha = 0.05
Do Not Reject H0, Conclude Sample 1 = Sample 2
P-Value >= alpha (0.05)

ARSENIC

Sample 1 Data: TotAs
Sample 2 Data: Bkg-TotAs

Raw Statistics

	Sample 1	Sample 2
Number of Valid Data	11	6
Number of Non-Detects	0	0
Number of Detect Data	11	6
Minimum Non-Detect	N/A	N/A
Maximum Non-Detect	N/A	N/A
Percent Non-detects	0.00%	0.00%
Minimum Detect	0.34	0.48
Maximum Detect	8.4	5.1
Mean of Detects	2.733	2.363
Median of Detects	2.3	1.7
SD of Detects	2.607	1.819

Wilcoxon-Mann-Whitney (WMW) Test

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

Sample 1 Rank Sum W-Stat	100.5
WMW U-Stat	34.5
Mean (U)	33
SD(U) - Adj ties	9.95
WMW U-Stat Critical Value (0.05)	17
Standardized WMW U-Stat	0.101
Approximate P-Value	0.54

Conclusion with Alpha = 0.05
Do Not Reject H0, Conclude Sample 1 >= Sample 2

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

Sample 1 Rank Sum W-Stat	100.5
WMW U-Stat	34.5
Mean (U)	33
SD(U) - Adj ties	9.95
Lower U-Stat Critical Value (0.025)	14
Upper U-Stat Critical Value (0.975)	52
Standardized WMW U-Stat	0.151
Approximate P-Value	0.88

Conclusion with Alpha = 0.05
Do Not Reject H0, Conclude Sample 1 = Sample 2

BARIUM

Sample 1 Data: TotBa
Sample 2 Data: Bkg-TotBa

Raw Statistics

	Sample 1	Sample 2
Number of Valid Data	11	6
Number of Non-Detects	0	0
Number of Detect Data	11	6
Minimum Non-Detect	N/A	N/A
Maximum Non-Detect	N/A	N/A
Percent Non-detects	0.00%	0.00%
Minimum Detect	92.2	170
Maximum Detect	391	359
Mean of Detects	212.9	233.2
Median of Detects	206	211.5
SD of Detects	93.19	75.71

Wilcoxon-Mann-Whitney (WMW) Test

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

Sample 1 Rank Sum W-Stat	94
WMW U-Stat	28
Mean (U)	33
SD(U) - Adj ties	9.95
WMW U-Stat Critical Value (0.05)	17
Standardized WMW U-Stat	-0.553
Approximate P-Value	0.29

Conclusion with Alpha = 0.05
Do Not Reject H0, Conclude Sample 1 >= Sample 2

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

Sample 1 Rank Sum W-Stat	94
WMW U-Stat	28
Mean (U)	33
SD(U) - Adj ties	9.95
Lower U-Stat Critical Value (0.025)	14
Upper U-Stat Critical Value (0.975)	52
Standardized WMW U-Stat	-0.503
Approximate P-Value	0.615

Conclusion with Alpha = 0.05
Do Not Reject H0, Conclude Sample 1 = Sample 2

CHROMIUM

Sample 1 Data: TotCr
Sample 2 Data: Bkg-TotCr

Raw Statistics

	Sample 1	Sample 2
Number of Valid Data	11	6
Number of Non-Detects	2	1
Number of Detect Data	9	5
Minimum Non-Detect	0.22	0.22
Maximum Non-Detect	0.22	0.22
Percent Non-detects	18.18%	16.67%
Minimum Detect	0.18	0.18
Maximum Detect	0.62	0.52
Mean of Detects	0.393	0.346
Median of Detects	0.42	0.36
SD of Detects	0.159	0.122

WMW test is meant for a Single Detection Limit Case
Use of Gehan or T-W test is suggested when multiple detection limits are present
All observations <= 0.22 (Max DL) are ranked the same

Sample 1 vs Sample 2 Gehan Test

H0: Mean of Sample 1 >= Mean of background

Gehan z Test Value	0.307
Critical z (0.05)	-1.645
P-Value	0.621

Conclusion with Alpha = 0.05
Do Not Reject H0, Conclude Sample 1 >= Sample 2
P-Value >= alpha (0.05)

H0: Mean of Sample 1 = Mean of background

Gehan z Test Value	0.307
Lower Critical z (0.025)	-1.96
Upper Critical z (0.975)	1.96
P-Value	0.759

Conclusion with Alpha = 0.05
Do Not Reject H0, Conclude Sample 1 = Sample 2
P-Value >= alpha (0.05)

COBALT

Sample 1 Data: TotCo
Sample 2 Data: Bkg-TotCo

Raw Statistics

	Sample 1	Sample 2
Number of Valid Data	11	6
Number of Non-Detects	7	3
Number of Detect Data	4	3
Minimum Non-Detect	0.15	0.021
Maximum Non-Detect	0.25	0.25
Percent Non-detects	63.64%	50.00%
Minimum Detect	0.038	0.026
Maximum Detect	1	0.05
Mean of Detects	0.47	0.0383
Median of Detects	0.42	0.039
SD of Detects	0.397	0.012

WMW test is meant for a Single Detection Limit Case
Use of Gehan or T-W test is suggested when multiple detection limits are present
All observations <= 0.25 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Sample 1 >= Mean/Median of Sample 2
All observations are identical in at least one group
No analysis will be performed

Sample 1 vs Sample 2 Gehan Test

H0: Mean of Sample 1 = Mean of background

Gehan z Test Value	1.324
Lower Critical z (0.025)	-1.96
Upper Critical z (0.975)	1.96
P-Value	0.186

Conclusion with Alpha = 0.05
Do Not Reject H0, Conclude Sample 1 = Sample 2
P-Value >= alpha (0.05)

MANGANESE
Sample 1 Data: TotMn
Sample 2 Data: Bkg-TotMn

Raw Statistics

	Sample 1	Sample 2
Number of Valid Data	11	6
Number of Non-Detects	0	1
Number of Detect Data	11	5
Minimum Non-Detect	N/A	0.14
Maximum Non-Detect	N/A	0.14
Percent Non-detects	0.00%	16.67%
Minimum Detect	1.3	0.15
Maximum Detect	2820	2.8
Mean of Detects	910.3	1.248
Median of Detects	236	0.89
SD of Detects	1175	1.199

Wilcoxon-Mann-Whitney (WMW) Test

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

Sample 1 Rank Sum W-Stat	128
WMW U-Stat	62
Mean (U)	33
SD(U) - Adj ties	9.95
WMW U-Stat Critical Value (0.05)	17
Standardized WMW U-Stat	2.864
Approximate P-Value	0.998

Conclusion with Alpha = 0.05
Do Not Reject H0, Conclude Sample 1 >= Sample 2

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

Sample 1 Rank Sum W-Stat	128
WMW U-Stat	62
Mean (U)	33
SD(U) - Adj ties	9.95
Lower U-Stat Critical Value (0.025)	14
Upper U-Stat Critical Value (0.975)	52
Standardized WMW U-Stat	2.864
Approximate P-Value	0.00418

Conclusion with Alpha = 0.05
Reject H0, Conclude Sample 1 <> Sample 2

TEQ (ND=1/2 MDL)
Sample 1 Data: TEQNDhalfMDL
Sample 2 Data: Bkg-TEQNDhalfMDL

Raw Statistics

	Sample 1	Sample 2
Number of Valid Data	25	12
Number of Non-Detects	12	11
Number of Detect Data	13	1
Minimum Non-Detect	3.63E-07	3.63E-07
Maximum Non-Detect	4.29E-07	7.92E-07
Percent Non-detects	48.00%	91.67%
Minimum Detect	3.33E-07	4.96E-07
Maximum Detect	3.75E-06	4.96E-07
Mean of Detects	8.27E-07	4.96E-07
Median of Detects	4.24E-07	4.96E-07
SD of Detects	1.04E-06	N/A

WMW test is meant for a Single Detection Limit Case
Use of Gehan or T-W test is suggested when multiple detection limits are present
All observations <= 7.9248E-7 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Sample 1 >= Mean/Median of Sample 2
All observations are identical in at least one group
No analysis will be performed

Sample 1 vs Sample 2 Gehan Test

H0: Mean of Sample 1 >= Mean of background

Gehan z Test Value	1.704
Critical z (0.05)	-1.645
P-Value	0.956

Conclusion with Alpha = 0.05
Do Not Reject H0, Conclude Sample 1 >= Sample 2
P-Value >= alpha (0.05)

H0: Mean of Sample 1 = Mean of background

Gehan z Test Value	1.704
Lower Critical z (0.025)	-1.96
Upper Critical z (0.975)	1.96
P-Value	0.0883

Conclusion with Alpha = 0.05
Do Not Reject H0, Conclude Sample 1 = Sample 2
P-Value >= alpha (0.05)

APPENDIX D

Detailed Risk Calculations

APPENDIX D. DETAILED RISK CALCULATIONS

Population	**Hypothetical Future Residents**
Exposure Area	**Random 20-acre grids across OU2**
Medium	**Surface Soil**
Exposure Route	**Incidental Ingestion**

Grid	COPC	EPC	RBA	Non-Cancer					Cancer				
				DI (mg/kg-d)		RfD	HQ		DI (mg/kg-d)		oSF	Risk	
		mg/kg		CTE	RME	mg/kg-d	CTE	RME	CTE	RME	(mg/kg-d)-1	CTE	RME
1	TEQ-D/F (ND=1/2 MDL)	5.2E-06	1.00	7.7E-12	2.0E-11	7.0E-10	1E-02	3E-02					
	Aroclor-1254	1.4E-01	1.00	2.1E-07	5.5E-07	2.0E-05	1E-02	3E-02	3.6E-08	2.0E-07	2.0E+00	7E-08	4E-07
2	TEQ-D/F (ND=1/2 MDL)	3.3E-06	1.00	5.0E-12	1.3E-11	7.0E-10	7E-03	2E-02					
	Aroclor-1254	2.5E-02	1.00	3.7E-08	9.6E-08	2.0E-05	2E-03	5E-03	6.3E-09	3.6E-08	2.0E+00	1E-08	7E-08
4	TEQ-D/F (ND=1/2 MDL)	1.2E-06	1.00	1.9E-12	4.8E-12	7.0E-10	3E-03	7E-03					
	Aroclor-1254	3.2E-02	1.00	4.8E-08	1.2E-07	2.0E-05	2E-03	6E-03	8.2E-09	4.6E-08	2.0E+00	2E-08	9E-08
5	TEQ-D/F (ND=1/2 MDL)	9.2E-07	1.00	1.4E-12	3.6E-12	7.0E-10	2E-03	5E-03					
	Aroclor-1254	2.1E-03	1.00	3.1E-09	7.9E-09	2.0E-05	2E-04	4E-04	5.3E-10	2.9E-09	2.0E+00	1E-09	6E-09
6	TEQ-D/F (ND=1/2 MDL)	2.2E-05	1.00	3.3E-11	8.6E-11	7.0E-10	5E-02	1E-01					
	Aroclor-1254	no data	1.00	--	--	2.0E-05	--	--	--	--	2.0E+00	--	--
7	TEQ-D/F (ND=1/2 MDL)	1.1E-06	1.00	1.7E-12	4.4E-12	7.0E-10	2E-03	6E-03					
	Aroclor-1254	3.2E-02	1.00	4.8E-08	1.2E-07	2.0E-05	2E-03	6E-03	8.2E-09	4.6E-08	2.0E+00	2E-08	9E-08
8	TEQ-D/F (ND=1/2 MDL)	8.7E-06	1.00	1.3E-11	3.4E-11	7.0E-10	2E-02	5E-02					
	Aroclor-1254	4.1E-01	1.00	6.2E-07	1.6E-06	2.0E-05	3E-02	8E-02	1.1E-07	5.9E-07	2.0E+00	2E-07	1E-06
9	TEQ-D/F (ND=1/2 MDL)	8.9E-06	1.00	1.3E-11	3.5E-11	7.0E-10	2E-02	5E-02					
	Aroclor-1254	1.6E-02	1.00	2.4E-08	6.3E-08	2.0E-05	1E-03	3E-03	4.2E-09	2.3E-08	2.0E+00	8E-09	5E-08
11	TEQ-D/F (ND=1/2 MDL)	2.9E-06	1.00	4.4E-12	1.1E-11	7.0E-10	6E-03	2E-02					
	Aroclor-1254	4.8E-03	1.00	7.2E-09	1.9E-08	2.0E-05	4E-04	9E-04	1.2E-09	6.9E-09	2.0E+00	2E-09	1E-08
12	TEQ-D/F (ND=1/2 MDL)	3.2E-06	1.00	4.8E-12	1.2E-11	7.0E-10	7E-03	2E-02					
	Aroclor-1254	no data	1.00	--	--	2.0E-05	--	--	--	--	2.0E+00	--	--
13	TEQ-D/F (ND=1/2 MDL)	3.9E-06	1.00	5.9E-12	1.5E-11	7.0E-10	8E-03	2E-02					
	Aroclor-1254	5.7E-03	1.00	8.5E-09	2.2E-08	2.0E-05	4E-04	1E-03	1.5E-09	8.2E-09	2.0E+00	3E-09	2E-08
14	TEQ-D/F (ND=1/2 MDL)	2.1E-05	1.00	3.1E-11	7.9E-11	7.0E-10	4E-02	1E-01					
	Aroclor-1254	1.0E-01	1.00	1.6E-07	4.0E-07	2.0E-05	8E-03	2E-02	2.7E-08	1.5E-07	2.0E+00	5E-08	3E-07
15	TEQ-D/F (ND=1/2 MDL)	1.4E-06	1.00	2.1E-12	5.5E-12	7.0E-10	3E-03	8E-03					
	Aroclor-1254	2.8E-03	1.00	4.2E-09	1.1E-08	2.0E-05	2E-04	5E-04	7.2E-10	4.0E-09	2.0E+00	1E-09	8E-09
16	TEQ-D/F (ND=1/2 MDL)	5.3E-06	1.00	8.0E-12	2.1E-11	7.0E-10	1E-02	3E-02					
	Aroclor-1254	no data	1.00	--	--	2.0E-05	--	--	--	--	2.0E+00	--	--
17	TEQ-D/F (ND=1/2 MDL)	2.0E-06	1.00	3.0E-12	7.9E-12	7.0E-10	4E-03	1E-02					
	Aroclor-1254	no data	1.00	--	--	2.0E-05	--	--	--	--	2.0E+00	--	--
18	TEQ-D/F (ND=1/2 MDL)	6.8E-06	1.00	1.0E-11	2.6E-11	7.0E-10	1E-02	4E-02					
	Aroclor-1254	no data	1.00	--	--	2.0E-05	--	--	--	--	2.0E+00	--	--
19	TEQ-D/F (ND=1/2 MDL)	2.9E-06	1.00	4.4E-12	1.1E-11	7.0E-10	6E-03	2E-02					
	Aroclor-1254	no data	1.00	--	--	2.0E-05	--	--	--	--	2.0E+00	--	--
22	TEQ-D/F (ND=1/2 MDL)	1.5E-05	1.00	2.2E-11	5.7E-11	7.0E-10	3E-02	8E-02					
	Aroclor-1254	2.5E-02	1.00	3.7E-08	9.7E-08	2.0E-05	2E-03	5E-03	6.4E-09	3.6E-08	2.0E+00	1E-08	7E-08
23	TEQ-D/F (ND=1/2 MDL)	2.7E-07	1.00	4.0E-13	1.0E-12	7.0E-10	6E-04	1E-03					
	Aroclor-1254	5.0E-03	1.00	7.4E-09	1.9E-08	2.0E-05	4E-04	1E-03	1.3E-09	7.1E-09	2.0E+00	3E-09	1E-08

APPENDIX D. DETAILED RISK CALCULATIONS

Population **Hypothetical Future Residents**
Exposure Area **Random 20-acre grids across OU2**
Medium **Surface Soil**
Exposure Route **Dermal Contact**

Grid	COPC	EPC	ABSd	Non-Cancer					Cancer				
		EPC	ABSd	DAD (mg/kg-d)		RfD	HQ		DAD (mg/kg-d)		oSF	Risk	
		mg/kg		CTE	RME	mg/kg-d	CTE	RME	CTE	RME	(mg/kg-d)-1	CTE	RME
1	TEQ-D/F (ND=1/2 MDL)	5.2E-06	0.03	2.3E-13	1.7E-12	7.0E-10	3E-04	2E-03					
	Aroclor-1254	1.4E-01	0.14	3.0E-08	2.2E-07	2.0E-05	1E-03	1E-02	5.1E-09	8.0E-08	2.0E+00	1E-08	2E-07
2	TEQ-D/F (ND=1/2 MDL)	3.3E-06	0.03	1.5E-13	1.1E-12	7.0E-10	2E-04	2E-03					
	Aroclor-1254	2.5E-02	0.14	5.2E-09	3.8E-08	2.0E-05	3E-04	2E-03	8.9E-10	1.4E-08	2.0E+00	2E-09	3E-08
4	TEQ-D/F (ND=1/2 MDL)	1.2E-06	0.03	5.6E-14	4.1E-13	7.0E-10	8E-05	6E-04					
	Aroclor-1254	3.2E-02	0.14	6.7E-09	4.9E-08	2.0E-05	3E-04	2E-03	1.1E-09	1.8E-08	2.0E+00	2E-09	4E-08
5	TEQ-D/F (ND=1/2 MDL)	9.2E-07	0.03	4.2E-14	3.0E-13	7.0E-10	6E-05	4E-04					
	Aroclor-1254	2.1E-03	0.14	4.3E-10	3.1E-09	2.0E-05	2E-05	2E-04	7.4E-11	1.2E-09	2.0E+00	1E-10	2E-09
6	TEQ-D/F (ND=1/2 MDL)	2.2E-05	0.03	1.0E-12	7.2E-12	7.0E-10	1E-03	1E-02					
	Aroclor-1254	no data	0.14	--	--	2.0E-05	--	--	--	--	2.0E+00	--	--
7	TEQ-D/F (ND=1/2 MDL)	1.1E-06	0.03	5.1E-14	3.7E-13	7.0E-10	7E-05	5E-04					
	Aroclor-1254	3.2E-02	0.14	6.7E-09	4.9E-08	2.0E-05	3E-04	2E-03	1.1E-09	1.8E-08	2.0E+00	2E-09	4E-08
8	TEQ-D/F (ND=1/2 MDL)	8.7E-06	0.03	4.0E-13	2.9E-12	7.0E-10	6E-04	4E-03					
	Aroclor-1254	4.1E-01	0.14	8.7E-08	6.3E-07	2.0E-05	4E-03	3E-02	1.5E-08	2.3E-07	2.0E+00	3E-08	5E-07
9	TEQ-D/F (ND=1/2 MDL)	8.9E-06	0.03	4.0E-13	2.9E-12	7.0E-10	6E-04	4E-03					
	Aroclor-1254	1.6E-02	0.14	3.4E-09	2.5E-08	2.0E-05	2E-04	1E-03	5.9E-10	9.2E-09	2.0E+00	1E-09	2E-08
11	TEQ-D/F (ND=1/2 MDL)	2.9E-06	0.03	1.3E-13	9.5E-13	7.0E-10	2E-04	1E-03					
	Aroclor-1254	4.8E-03	0.14	1.0E-09	7.3E-09	2.0E-05	5E-05	4E-04	1.7E-10	2.7E-09	2.0E+00	3E-10	5E-09
12	TEQ-D/F (ND=1/2 MDL)	3.2E-06	0.03	1.5E-13	1.1E-12	7.0E-10	2E-04	2E-03					
	Aroclor-1254	no data	0.14	--	--	2.0E-05	--	--	--	--	2.0E+00	--	--
13	TEQ-D/F (ND=1/2 MDL)	3.9E-06	0.03	1.8E-13	1.3E-12	7.0E-10	3E-04	2E-03					
	Aroclor-1254	5.7E-03	0.14	1.2E-09	8.7E-09	2.0E-05	6E-05	4E-04	2.1E-10	3.2E-09	2.0E+00	4E-10	6E-09
14	TEQ-D/F (ND=1/2 MDL)	2.1E-05	0.03	9.3E-13	6.7E-12	7.0E-10	1E-03	1E-02					
	Aroclor-1254	1.0E-01	0.14	2.2E-08	1.6E-07	2.0E-05	1E-03	8E-03	3.8E-09	5.9E-08	2.0E+00	8E-09	1E-07
15	TEQ-D/F (ND=1/2 MDL)	1.4E-06	0.03	6.4E-14	4.6E-13	7.0E-10	9E-05	7E-04					
	Aroclor-1254	2.8E-03	0.14	5.9E-10	4.3E-09	2.0E-05	3E-05	2E-04	1.0E-10	1.6E-09	2.0E+00	2E-10	3E-09
16	TEQ-D/F (ND=1/2 MDL)	5.3E-06	0.03	2.4E-13	1.7E-12	7.0E-10	3E-04	2E-03					
	Aroclor-1254	no data	0.14	--	--	2.0E-05	--	--	--	--	2.0E+00	--	--
17	TEQ-D/F (ND=1/2 MDL)	2.0E-06	0.03	9.2E-14	6.6E-13	7.0E-10	1E-04	9E-04					
	Aroclor-1254	no data	0.14	--	--	2.0E-05	--	--	--	--	2.0E+00	--	--
18	TEQ-D/F (ND=1/2 MDL)	6.8E-06	0.03	3.1E-13	2.2E-12	7.0E-10	4E-04	3E-03					
	Aroclor-1254	no data	0.14	--	--	2.0E-05	--	--	--	--	2.0E+00	--	--
19	TEQ-D/F (ND=1/2 MDL)	2.9E-06	0.03	1.3E-13	9.5E-13	7.0E-10	2E-04	1E-03					
	Aroclor-1254	no data	0.14	--	--	2.0E-05	--	--	--	--	2.0E+00	--	--
22	TEQ-D/F (ND=1/2 MDL)	1.5E-05	0.03	6.6E-13	4.8E-12	7.0E-10	9E-04	7E-03					
	Aroclor-1254	2.5E-02	0.14	5.3E-09	3.8E-08	2.0E-05	3E-04	2E-03	9.0E-10	1.4E-08	2.0E+00	2E-09	3E-08
23	TEQ-D/F (ND=1/2 MDL)	2.7E-07	0.03	1.2E-14	8.8E-14	7.0E-10	2E-05	1E-04					
	Aroclor-1254	5.0E-03	0.14	1.0E-09	7.5E-09	2.0E-05	5E-05	4E-04	1.8E-10	2.8E-09	2.0E+00	4E-10	6E-09

APPENDIX D. DETAILED RISK CALCULATIONS

Population	**Hypothetical Future Residents**
Exposure Area	**Random 20-acre grids across OU2**
Medium	**Surface Soil**
Exposure Route	**Incidental Ingestion**

Summed risks across COPCs TEQ-D/F (ND=1/2 MDL) and Aroclor-1254

Grid	Non-Cancer		Cancer	
	HI		Total Risk	
	CTE	RME	CTE	RME
1	2E-02	6E-02	7E-08	4E-07
2	9E-03	2E-02	1E-08	7E-08
4	5E-03	1E-02	2E-08	9E-08
5	2E-03	5E-03	1E-09	6E-09
6	5E-02	1E-01	--	--
7	5E-03	1E-02	2E-08	9E-08
8	5E-02	1E-01	2E-07	1E-06
9	2E-02	5E-02	8E-09	5E-08
11	7E-03	2E-02	2E-09	1E-08
12	7E-03	2E-02	--	--
13	9E-03	2E-02	3E-09	2E-08
14	5E-02	1E-01	5E-08	3E-07
15	3E-03	8E-03	1E-09	8E-09
16	1E-02	3E-02	--	--
17	4E-03	1E-02	--	--
18	1E-02	4E-02	--	--
19	6E-03	2E-02	--	--
22	3E-02	9E-02	1E-08	7E-08
23	9E-04	2E-03	3E-09	1E-08

APPENDIX D. DETAILED RISK CALCULATIONS

Population **Hypothetical Future Residents**
Exposure Area **Random 20-acre grids across OU2**
Medium **Surface Soil**
Exposure Route **Dermal Contact**

Summed risks across COPCs TEQ-D/F (ND=1/2 MDL) and Aroclor-1254

Grid	Non-Cancer		Cancer	
	HI		Total Risk	
	CTE	RME	CTE	RME
1	2E-03	1E-02	1E-08	2E-07
2	5E-04	3E-03	2E-09	3E-08
4	4E-04	3E-03	2E-09	4E-08
5	8E-05	6E-04	1E-10	2E-09
6	1E-03	1E-02	--	--
7	4E-04	3E-03	2E-09	4E-08
8	5E-03	4E-02	3E-08	5E-07
9	7E-04	5E-03	1E-09	2E-08
11	2E-04	2E-03	3E-10	5E-09
12	2E-04	2E-03	--	--
13	3E-04	2E-03	4E-10	6E-09
14	2E-03	2E-02	8E-09	1E-07
15	1E-04	9E-04	2E-10	3E-09
16	3E-04	2E-03	--	--
17	1E-04	9E-04	--	--
18	4E-04	3E-03	--	--
19	2E-04	1E-03	--	--
22	1E-03	9E-03	2E-09	3E-08
23	7E-05	5E-04	4E-10	6E-09

APPENDIX D. DETAILED RISK CALCULATIONS

Population Hypothetical Future Residents
Exposure Area Random 20-acre grids across OU2
Medium Surface Soil
Exposure Route Incidental Ingestion

Grid	COPC	EPC	RBA	Non-Cancer					Cancer				
				DI (mg/kg-d)		RfD	HQ		DI (mg/kg-d)		oSF	Risk	
		mg/kg		CTE	RME	mg/kg-d	CTE	RME	CTE	RME	(mg/kg-d)-1	CTE	RME
1	TEQ-D/F/PCBs (ND=1/2 MDL)	1.4E-05	1.00	7.7E-12	2.0E-11	7.0E-10	1E-02	3E-02					
	Total Non-DL PCBs (ND=1/2 MDL)	1.9E-01	1.00	2.1E-07	5.5E-07		--	--	5.0E-08	2.8E-07	2.0E+00	1E-07	6E-07
2	TEQ-D/F/PCBs (ND=1/2 MDL)	5.2E-06	1.00	5.0E-12	1.3E-11	7.0E-10	7E-03	2E-02					
	Total Non-DL PCBs (ND=1/2 MDL)	2.9E-02	1.00	3.7E-08	9.6E-08		--	--	7.3E-09	4.1E-08	2.0E+00	1E-08	8E-08
4	TEQ-D/F/PCBs (ND=1/2 MDL)	2.5E-05	1.00	1.9E-12	4.8E-12	7.0E-10	3E-03	7E-03					
	Total Non-DL PCBs (ND=1/2 MDL)	1.1E-01	1.00	4.8E-08	1.2E-07		--	--	2.9E-08	1.6E-07	2.0E+00	6E-08	3E-07
5	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	1.00	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	1.00	--	--		--	--	--	--	2.0E+00	--	--
6	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	1.00	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	1.00	--	--		--	--	--	--	2.0E+00	--	--
7	TEQ-D/F/PCBs (ND=1/2 MDL)	2.5E-05	1.00	1.7E-12	4.4E-12	7.0E-10	2E-03	6E-03					
	Total Non-DL PCBs (ND=1/2 MDL)	1.1E-01	1.00	4.8E-08	1.2E-07		--	--	2.9E-08	1.6E-07	2.0E+00	6E-08	3E-07
8	TEQ-D/F/PCBs (ND=1/2 MDL)	4.2E-05	1.00	1.3E-11	3.4E-11	7.0E-10	2E-02	5E-02					
	Total Non-DL PCBs (ND=1/2 MDL)	1.0E+00	1.00	6.2E-07	1.6E-06		--	--	2.6E-07	1.4E-06	2.0E+00	5E-07	3E-06
9	TEQ-D/F/PCBs (ND=1/2 MDL)	1.0E-05	1.00	1.3E-11	3.5E-11	7.0E-10	2E-02	5E-02					
	Total Non-DL PCBs (ND=1/2 MDL)	3.3E-02	1.00	2.4E-08	6.3E-08		--	--	8.4E-09	4.7E-08	2.0E+00	2E-08	9E-08
11	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	1.00	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	1.00	--	--		--	--	--	--	2.0E+00	--	--
12	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	1.00	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	1.00	--	--		--	--	--	--	2.0E+00	--	--
13	TEQ-D/F/PCBs (ND=1/2 MDL)	3.8E-06	1.00	5.9E-12	1.5E-11	7.0E-10	8E-03	2E-02					
	Total Non-DL PCBs (ND=1/2 MDL)	1.5E-02	1.00	8.5E-09	2.2E-08		--	--	3.8E-09	2.1E-08	2.0E+00	8E-09	4E-08
14	TEQ-D/F/PCBs (ND=1/2 MDL)	3.0E-05	1.00	3.1E-11	7.9E-11	7.0E-10	4E-02	1E-01					
	Total Non-DL PCBs (ND=1/2 MDL)	6.7E-02	1.00	1.6E-07	4.0E-07		--	--	1.7E-08	9.6E-08	2.0E+00	3E-08	2E-07
15	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	1.00	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	1.00	--	--		--	--	--	--	2.0E+00	--	--
16	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	1.00	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	1.00	--	--		--	--	--	--	2.0E+00	--	--
17	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	1.00	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	1.00	--	--		--	--	--	--	2.0E+00	--	--
18	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	1.00	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	1.00	--	--		--	--	--	--	2.0E+00	--	--
19	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	1.00	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	1.00	--	--		--	--	--	--	2.0E+00	--	--
22	TEQ-D/F/PCBs (ND=1/2 MDL)	2.6E-05	1.00	2.2E-11	5.7E-11	7.0E-10	3E-02	8E-02					
	Total Non-DL PCBs (ND=1/2 MDL)	1.0E-01	1.00	3.7E-08	9.7E-08		--	--	2.7E-08	1.5E-07	2.0E+00	5E-08	3E-07
23	TEQ-D/F/PCBs (ND=1/2 MDL)	5.9E-07	1.00	4.0E-13	1.0E-12	7.0E-10	6E-04	1E-03					
	Total Non-DL PCBs (ND=1/2 MDL)	6.9E-03	1.00	7.4E-09	1.9E-08		--	--	1.8E-09	1.0E-08	2.0E+00	4E-09	2E-08

APPENDIX D. DETAILED RISK CALCULATIONS

Population	**Hypothetical Future Residents**
Exposure Area	**Random 20-acre grids across OU2**
Medium	**Surface Soil**
Exposure Route	**Dermal Contact**

Grid	COPC	EPC	ABSd	Non-Cancer					Cancer				
				DI (mg/kg-d)		RfD	HQ		DI (mg/kg-d)		oSF	Risk	
		mg/kg		CTE	RME	mg/kg-d	CTE	RME	CTE	RME	(mg/kg-d)-1	CTE	RME
1	TEQ-D/F/PCBs (ND=1/2 MDL)	1.4E-05	0.03	6.1E-13	4.4E-12	7.0E-10	9E-04	6E-03					
	Total Non-DL PCBs (ND=1/2 MDL)	1.9E-01	0.14	4.1E-08	3.0E-07		--	--	7.0E-09	3.9E-08	2.0E+00	1E-08	8E-08
2	TEQ-D/F/PCBs (ND=1/2 MDL)	5.2E-06	0.03	2.3E-13	1.7E-12	7.0E-10	3E-04	2E-03					
	Total Non-DL PCBs (ND=1/2 MDL)	2.9E-02	0.14	6.0E-09	4.3E-08		--	--	1.0E-09	5.7E-09	2.0E+00	2E-09	1E-08
4	TEQ-D/F/PCBs (ND=1/2 MDL)	2.5E-05	0.03	1.1E-12	8.0E-12	7.0E-10	2E-03	1E-02					
	Total Non-DL PCBs (ND=1/2 MDL)	1.1E-01	0.14	2.3E-08	1.7E-07		--	--	4.0E-09	2.2E-08	2.0E+00	8E-09	4E-08
5	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	0.03	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	0.14	--	--		--	--	--	--	2.0E+00	--	--
6	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	0.03	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	0.14	--	--		--	--	--	--	2.0E+00	--	--
7	TEQ-D/F/PCBs (ND=1/2 MDL)	2.5E-05	0.03	1.1E-12	8.0E-12	7.0E-10	2E-03	1E-02					
	Total Non-DL PCBs (ND=1/2 MDL)	1.1E-01	0.14	2.3E-08	1.7E-07		--	--	4.0E-09	2.2E-08	2.0E+00	8E-09	4E-08
8	TEQ-D/F/PCBs (ND=1/2 MDL)	4.2E-05	0.03	1.9E-12	1.4E-11	7.0E-10	3E-03	2E-02					
	Total Non-DL PCBs (ND=1/2 MDL)	1.0E+00	0.14	2.1E-07	1.5E-06		--	--	3.6E-08	2.0E-07	2.0E+00	7E-08	4E-07
9	TEQ-D/F/PCBs (ND=1/2 MDL)	1.0E-05	0.03	4.7E-13	3.4E-12	7.0E-10	7E-04	5E-03					
	Total Non-DL PCBs (ND=1/2 MDL)	3.3E-02	0.14	6.9E-09	5.0E-08		--	--	1.2E-09	6.6E-09	2.0E+00	2E-09	1E-08
11	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	0.03	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	0.14	--	--		--	--	--	--	2.0E+00	--	--
12	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	0.03	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	0.14	--	--		--	--	--	--	2.0E+00	--	--
13	TEQ-D/F/PCBs (ND=1/2 MDL)	3.8E-06	0.03	1.7E-13	1.2E-12	7.0E-10	2E-04	2E-03					
	Total Non-DL PCBs (ND=1/2 MDL)	1.5E-02	0.14	3.1E-09	2.3E-08		--	--	5.3E-10	3.0E-09	2.0E+00	1E-09	6E-09
14	TEQ-D/F/PCBs (ND=1/2 MDL)	3.0E-05	0.03	1.4E-12	9.9E-12	7.0E-10	2E-03	1E-02					
	Total Non-DL PCBs (ND=1/2 MDL)	6.7E-02	0.14	1.4E-08	1.0E-07		--	--	2.4E-09	1.3E-08	2.0E+00	5E-09	3E-08
15	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	0.03	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	0.14	--	--		--	--	--	--	2.0E+00	--	--
16	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	0.03	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	0.14	--	--		--	--	--	--	2.0E+00	--	--
17	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	0.03	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	0.14	--	--		--	--	--	--	2.0E+00	--	--
18	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	0.03	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	0.14	--	--		--	--	--	--	2.0E+00	--	--
19	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	0.03	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	0.14	--	--		--	--	--	--	2.0E+00	--	--
22	TEQ-D/F/PCBs (ND=1/2 MDL)	2.6E-05	0.03	1.2E-12	8.7E-12	7.0E-10	2E-03	1E-02					
	Total Non-DL PCBs (ND=1/2 MDL)	1.0E-01	0.14	2.2E-08	1.6E-07		--	--	3.7E-09	2.1E-08	2.0E+00	7E-09	4E-08
23	TEQ-D/F/PCBs (ND=1/2 MDL)	5.9E-07	0.03	2.7E-14	1.9E-13	7.0E-10	4E-05	3E-04					
	Total Non-DL PCBs (ND=1/2 MDL)	6.9E-03	0.14	1.5E-09	1.1E-08		--	--	2.5E-10	1.4E-09	2.0E+00	5E-10	3E-09

APPENDIX D. DETAILED RISK CALCULATIONS

Population	**Hypothetical Future Residents**
Exposure Area	**Random 20-acre grids across OU2**
Medium	**Surface Soil**
Exposure Route	**Incidental Ingestion**

Summed risks across COPCs TEQ-D/F/DL-PCBs (ND=1/2 MDL) and Total Non-DL PCBs

Grid	Non-Cancer		Cancer	
	HI		Total Risk	
	CTE	RME	CTE	RME
1	1E-02	3E-02	1E-07	6E-07
2	7E-03	2E-02	1E-08	8E-08
4	3E-03	7E-03	6E-08	3E-07
5	--	--	--	--
6	--	--	--	--
7	2E-03	6E-03	6E-08	3E-07
8	2E-02	5E-02	5E-07	3E-06
9	2E-02	5E-02	2E-08	9E-08
11	--	--	--	--
12	--	--	--	--
13	8E-03	2E-02	8E-09	4E-08
14	4E-02	1E-01	3E-08	2E-07
15	--	--	--	--
16	--	--	--	--
17	--	--	--	--
18	--	--	--	--
19	--	--	--	--
22	3E-02	8E-02	5E-08	3E-07
23	6E-04	1E-03	4E-09	2E-08

APPENDIX D. DETAILED RISK CALCULATIONS

Population **Hypothetical Future Residents**
Exposure Area **Random 20-acre grids across OU2**
Medium **Surface Soil**
Exposure Route **Dermal Contact**

Summed risks across COPCs TEQ-D/F/DL-PCBs (ND=1/2 MDL) and Total Non-DL PCBs

Grid	Non-Cancer		Cancer	
	HI		Total Risk	
	CTE	RME	CTE	RME
1	9E-04	6E-03	1E-08	8E-08
2	3E-04	2E-03	2E-09	1E-08
4	2E-03	1E-02	8E-09	4E-08
5	--	--	--	--
6	--	--	--	--
7	2E-03	1E-02	8E-09	4E-08
8	3E-03	2E-02	7E-08	4E-07
9	7E-04	5E-03	2E-09	1E-08
11	--	--	--	--
12	--	--	--	--
13	2E-04	2E-03	1E-09	6E-09
14	2E-03	1E-02	5E-09	3E-08
15	--	--	--	--
16	--	--	--	--
17	--	--	--	--
18	--	--	--	--
19	--	--	--	--
22	2E-03	1E-02	7E-09	4E-08
23	4E-05	3E-04	5E-10	3E-09

APPENDIX D. DETAILED RISK CALCULATIONS

Population **Hypothetical Future Residents**
Exposure Area **Random 20-acre grids across OU2**
Medium **Surface Soil**

Exposure Unit	Exposure Route	TEQ-DF (ND=1/2MDL) & Aroclor-1254				TEQ-D/F/PCB (ND=1/2MDL) & Total non-DL PCBs			
		Non-cancer HI		Excess cancer Risk		Non-cancer HI		Excess cancer Risk	
		CTE	RME	CTE	RME	CTE	RME	CTE	RME
Grid 1	Incidental Ingestion	2E-02	6E-02	7E-08	4E-07	1E-02	3E-02	1E-07	6E-07
	Dermal Contact	2E-03	1E-02	1E-08	2E-07	9E-04	6E-03	1E-08	8E-08
	Total	2E-02	7E-02	8E-08	6E-07	1E-02	3E-02	1E-07	6E-07
Grid 2	Incidental Ingestion	9E-03	2E-02	1E-08	7E-08	7E-03	2E-02	1E-08	8E-08
	Dermal Contact	5E-04	3E-03	2E-09	3E-08	3E-04	2E-03	2E-09	1E-08
	Total	9E-03	3E-02	1E-08	1E-07	7E-03	2E-02	2E-08	9E-08
Grid 4	Incidental Ingestion	5E-03	1E-02	2E-08	9E-08	3E-03	7E-03	6E-08	3E-07
	Dermal Contact	4E-04	3E-03	2E-09	4E-08	2E-03	1E-02	8E-09	4E-08
	Total	5E-03	2E-02	2E-08	1E-07	4E-03	2E-02	7E-08	4E-07
Grid 5	Incidental Ingestion	2E-03	5E-03	1E-09	6E-09				
	Dermal Contact	8E-05	6E-04	1E-10	2E-09				
	Total	2E-03	6E-03	1E-09	8E-09				
Grid 6	Incidental Ingestion	5E-02	1E-01						
	Dermal Contact	1E-03	1E-02						
	Total	5E-02	1E-01						
Grid 7	Incidental Ingestion	5E-03	1E-02	2E-08	9E-08	2E-03	6E-03	6E-08	3E-07
	Dermal Contact	4E-04	3E-03	2E-09	4E-08	2E-03	1E-02	8E-09	4E-08
	Total	5E-03	2E-02	2E-08	1E-07	4E-03	2E-02	7E-08	4E-07
Grid 8	Incidental Ingestion	5E-02	1E-01	2E-07	1E-06	2E-02	5E-02	5E-07	3E-06
	Dermal Contact	5E-03	4E-02	3E-08	5E-07	3E-03	2E-02	7E-08	4E-07
	Total	5E-02	2E-01	2E-07	2E-06	2E-02	7E-02	6E-07	3E-06
Grid 9	Incidental Ingestion	2E-02	5E-02	8E-09	5E-08	2E-02	5E-02	2E-08	9E-08
	Dermal Contact	7E-04	5E-03	1E-09	2E-08	7E-04	5E-03	2E-09	1E-08
	Total	2E-02	6E-02	9E-09	6E-08	2E-02	5E-02	2E-08	1E-07
Grid 11	Incidental Ingestion	7E-03	2E-02	2E-09	1E-08				
	Dermal Contact	2E-04	2E-03	3E-10	5E-09				
	Total	7E-03	2E-02	3E-09	2E-08				
Grid 12	Incidental Ingestion	7E-03	2E-02						
	Dermal Contact	2E-04	2E-03						
	Total	7E-03	2E-02						
Grid 13	Incidental Ingestion	9E-03	2E-02	3E-09	2E-08	8E-03	2E-02	8E-09	4E-08
	Dermal Contact	3E-04	2E-03	4E-10	6E-09	2E-04	2E-03	1E-09	6E-09
	Total	9E-03	3E-02	3E-09	2E-08	9E-03	2E-02	9E-09	5E-08
Grid 14	Incidental Ingestion	5E-02	1E-01	5E-08	3E-07	4E-02	1E-01	3E-08	2E-07
	Dermal Contact	2E-03	2E-02	8E-09	1E-07	2E-03	1E-02	5E-09	3E-08
	Total	5E-02	2E-01	6E-08	4E-07	5E-02	1E-01	4E-08	2E-07
Grid 15	Incidental Ingestion	3E-03	8E-03	1E-09	8E-09				
	Dermal Contact	1E-04	9E-04	2E-10	3E-09				
	Total	3E-03	9E-03	2E-09	1E-08				
Grid 16	Incidental Ingestion	1E-02	3E-02						
	Dermal Contact	3E-04	2E-03						
	Total	1E-02	3E-02						
Grid 17	Incidental Ingestion	4E-03	1E-02						
	Dermal Contact	1E-04	9E-04						
	Total	4E-03	1E-02						
Grid 18	Incidental Ingestion	1E-02	4E-02						
	Dermal Contact	4E-04	3E-03						
	Total	1E-02	4E-02						
Grid 19	Incidental Ingestion	6E-03	2E-02						
	Dermal Contact	2E-04	1E-03						
	Total	6E-03	2E-02						
Grid 22	Incidental Ingestion	3E-02	9E-02	1E-08	7E-08	3E-02	8E-02	5E-08	3E-07
	Dermal Contact	1E-03	9E-03	2E-09	3E-08	2E-03	1E-02	7E-09	4E-08
	Total	3E-02	9E-02	1E-08	1E-07	3E-02	9E-02	6E-08	3E-07
Grid 23	Incidental Ingestion	9E-04	2E-03	3E-09	1E-08	6E-04	1E-03	4E-09	2E-08
	Dermal Contact	7E-05	5E-04	4E-10	6E-09	4E-05	3E-04	5E-10	3E-09
	Total	1E-03	3E-03	3E-09	2E-08	6E-04	2E-03	4E-09	2E-08

APPENDIX D. DETAILED RISK CALCULATIONS

Population	**Current/Hypothetical Future Commercial/Industrial Workers**
Exposure Area	**Random 20-acre grids across OU2**
Medium	**Surface Soil**
Exposure Route	**Incidental Ingestion**

				Non-Cancer					Cancer				
Grid	COPC	EPC	RBA	DI (mg/kg-d)		RfD	HQ		DI (mg/kg-d)		oSF	Risk	
		mg/kg		CTE	RME	mg/kg-d	CTE	RME	CTE	RME	(mg/kg-d)-1	CTE	RME
1	TEQ-D/F (ND=1/2 MDL)	5.2E-06	1.00	1.9E-12	4.4E-12	7.0E-10	3E-03	6E-03					
	Aroclor-1254	1.4E-01	1.00	5.3E-08	1.2E-07	2.0E-05	3E-03	6E-03	6.8E-09	4.3E-08	2.0E+00	1E-08	9E-08
2	TEQ-D/F (ND=1/2 MDL)	3.3E-06	1.00	1.2E-12	2.8E-12	7.0E-10	2E-03	4E-03					
	Aroclor-1254	2.5E-02	1.00	9.3E-09	2.1E-08	2.0E-05	5E-04	1E-03	1.2E-09	7.6E-09	2.0E+00	2E-09	2E-08
4	TEQ-D/F (ND=1/2 MDL)	1.2E-06	1.00	4.7E-13	1.1E-12	7.0E-10	7E-04	2E-03					
	Aroclor-1254	3.2E-02	1.00	1.2E-08	2.7E-08	2.0E-05	6E-04	1E-03	1.5E-09	9.7E-09	2.0E+00	3E-09	2E-08
5	TEQ-D/F (ND=1/2 MDL)	9.2E-07	1.00	3.4E-13	7.9E-13	7.0E-10	5E-04	1E-03					
	Aroclor-1254	2.1E-03	1.00	7.7E-10	1.8E-09	2.0E-05	4E-05	9E-05	9.9E-11	6.3E-10	2.0E+00	2E-10	1E-09
6	TEQ-D/F (ND=1/2 MDL)	2.2E-05	1.00	8.3E-12	1.9E-11	7.0E-10	1E-02	3E-02					
	Aroclor-1254	no data	1.00	--	--	2.0E-05	--	--	--	--	2.0E+00	--	--
7	TEQ-D/F (ND=1/2 MDL)	1.1E-06	1.00	4.3E-13	9.7E-13	7.0E-10	6E-04	1E-03					
	Aroclor-1254	3.2E-02	1.00	1.2E-08	2.7E-08	2.0E-05	6E-04	1E-03	1.5E-09	9.7E-09	2.0E+00	3E-09	2E-08
8	TEQ-D/F (ND=1/2 MDL)	8.7E-06	1.00	3.3E-12	7.5E-12	7.0E-10	5E-03	1E-02					
	Aroclor-1254	4.1E-01	1.00	1.5E-07	3.5E-07	2.0E-05	8E-03	2E-02	2.0E-08	1.3E-07	2.0E+00	4E-08	3E-07
9	TEQ-D/F (ND=1/2 MDL)	8.9E-06	1.00	3.4E-12	7.7E-12	7.0E-10	5E-03	1E-02					
	Aroclor-1254	1.6E-02	1.00	6.1E-09	1.4E-08	2.0E-05	3E-04	7E-04	7.8E-10	5.0E-09	2.0E+00	2E-09	1E-08
11	TEQ-D/F (ND=1/2 MDL)	2.9E-06	1.00	1.1E-12	2.5E-12	7.0E-10	2E-03	4E-03					
	Aroclor-1254	4.8E-03	1.00	1.8E-09	4.1E-09	2.0E-05	9E-05	2E-04	2.3E-10	1.5E-09	2.0E+00	5E-10	3E-09
12	TEQ-D/F (ND=1/2 MDL)	3.2E-06	1.00	1.2E-12	2.8E-12	7.0E-10	2E-03	4E-03					
	Aroclor-1254	no data	1.00	--	--	2.0E-05	--	--	--	--	2.0E+00	--	--
13	TEQ-D/F (ND=1/2 MDL)	3.9E-06	1.00	1.5E-12	3.4E-12	7.0E-10	2E-03	5E-03					
	Aroclor-1254	5.7E-03	1.00	2.1E-09	4.9E-09	2.0E-05	1E-04	2E-04	2.7E-10	1.7E-09	2.0E+00	5E-10	3E-09
14	TEQ-D/F (ND=1/2 MDL)	2.1E-05	1.00	7.7E-12	1.8E-11	7.0E-10	1E-02	3E-02					
	Aroclor-1254	1.0E-01	1.00	3.9E-08	8.9E-08	2.0E-05	2E-03	4E-03	5.0E-09	3.2E-08	2.0E+00	1E-08	6E-08
15	TEQ-D/F (ND=1/2 MDL)	1.4E-06	1.00	5.3E-13	1.2E-12	7.0E-10	8E-04	2E-03					
	Aroclor-1254	2.8E-03	1.00	1.0E-09	2.4E-09	2.0E-05	5E-05	1E-04	1.3E-10	8.5E-10	2.0E+00	3E-10	2E-09
16	TEQ-D/F (ND=1/2 MDL)	5.3E-06	1.00	2.0E-12	4.5E-12	7.0E-10	3E-03	6E-03					
	Aroclor-1254	no data	1.00	--	--	2.0E-05	--	--	--	--	2.0E+00	--	--
17	TEQ-D/F (ND=1/2 MDL)	2.0E-06	1.00	7.6E-13	1.7E-12	7.0E-10	1E-03	2E-03					
	Aroclor-1254	no data	1.00	--	--	2.0E-05	--	--	--	--	2.0E+00	--	--
18	TEQ-D/F (ND=1/2 MDL)	6.8E-06	1.00	2.5E-12	5.8E-12	7.0E-10	4E-03	8E-03					
	Aroclor-1254	no data	1.00	--	--	2.0E-05	--	--	--	--	2.0E+00	--	--
19	TEQ-D/F (ND=1/2 MDL)	2.9E-06	1.00	1.1E-12	2.5E-12	7.0E-10	2E-03	4E-03					
	Aroclor-1254	no data	1.00	--	--	2.0E-05	--	--	--	--	2.0E+00	--	--
22	TEQ-D/F (ND=1/2 MDL)	1.5E-05	1.00	5.5E-12	1.3E-11	7.0E-10	8E-03	2E-02					
	Aroclor-1254	2.5E-02	1.00	9.4E-09	2.1E-08	2.0E-05	5E-04	1E-03	1.2E-09	7.6E-09	2.0E+00	2E-09	2E-08
23	TEQ-D/F (ND=1/2 MDL)	2.7E-07	1.00	1.0E-13	2.3E-13	7.0E-10	1E-04	3E-04					
	Aroclor-1254	5.0E-03	1.00	1.9E-09	4.2E-09	2.0E-05	9E-05	2E-04	2.4E-10	1.5E-09	2.0E+00	5E-10	3E-09

APPENDIX D. DETAILED RISK CALCULATIONS

Population — **Current/Hypothetical Future Commercial/Industrial Workers**
Exposure Area — **Random 20-acre grids across OU2**
Medium — **Surface Soil**
Exposure Route — **Dermal Contact**

Grid	COPC	EPC	ABSd	Non-Cancer					Cancer				
				DAD (mg/kg-d)		RfD	HQ		DAD (mg/kg-d)		oSF	Risk	
		mg/kg		CTE	RME	mg/kg-d	CTE	RME	CTE	RME	(mg/kg-d)-1	CTE	RME
1	TEQ-D/F (ND=1/2 MDL)	5.2E-06	0.03	2.9E-13	5.6E-13	7.0E-10	4E-04	8E-04					
	Aroclor-1254	1.4E-01	0.14	3.7E-08	7.2E-08	2.0E-05	2E-03	4E-03	4.7E-09	2.6E-08	2.0E+00	9E-09	5E-08
2	TEQ-D/F (ND=1/2 MDL)	3.3E-06	0.03	1.8E-13	3.6E-13	7.0E-10	3E-04	5E-04					
	Aroclor-1254	2.5E-02	0.14	6.4E-09	1.3E-08	2.0E-05	3E-04	6E-04	8.2E-10	4.5E-09	2.0E+00	2E-09	9E-09
4	TEQ-D/F (ND=1/2 MDL)	1.2E-06	0.03	6.9E-14	1.4E-13	7.0E-10	1E-04	2E-04					
	Aroclor-1254	3.2E-02	0.14	8.2E-09	1.6E-08	2.0E-05	4E-04	8E-04	1.1E-09	5.8E-09	2.0E+00	2E-09	1E-08
5	TEQ-D/F (ND=1/2 MDL)	9.2E-07	0.03	5.1E-14	1.0E-13	7.0E-10	7E-05	1E-04					
	Aroclor-1254	2.1E-03	0.14	5.3E-10	1.0E-09	2.0E-05	3E-05	5E-05	6.8E-11	3.7E-10	2.0E+00	1E-10	7E-10
6	TEQ-D/F (ND=1/2 MDL)	2.2E-05	0.03	1.2E-12	2.4E-12	7.0E-10	2E-03	3E-03					
	Aroclor-1254	no data	0.14	--	--	2.0E-05	--	--	--	--	2.0E+00	--	--
7	TEQ-D/F (ND=1/2 MDL)	1.1E-06	0.03	6.3E-14	1.2E-13	7.0E-10	9E-05	2E-04					
	Aroclor-1254	3.2E-02	0.14	8.2E-09	1.6E-08	2.0E-05	4E-04	8E-04	1.1E-09	5.8E-09	2.0E+00	2E-09	1E-08
8	TEQ-D/F (ND=1/2 MDL)	8.7E-06	0.03	4.9E-13	9.5E-13	7.0E-10	7E-04	1E-03					
	Aroclor-1254	4.1E-01	0.14	1.1E-07	2.1E-07	2.0E-05	5E-03	1E-02	1.4E-08	7.5E-08	2.0E+00	3E-08	1E-07
9	TEQ-D/F (ND=1/2 MDL)	8.9E-06	0.03	5.0E-13	9.7E-13	7.0E-10	7E-04	1E-03					
	Aroclor-1254	1.6E-02	0.14	4.2E-09	8.2E-09	2.0E-05	2E-04	4E-04	5.4E-10	2.9E-09	2.0E+00	1E-09	6E-09
11	TEQ-D/F (ND=1/2 MDL)	2.9E-06	0.03	1.6E-13	3.2E-13	7.0E-10	2E-04	5E-04					
	Aroclor-1254	4.8E-03	0.14	1.2E-09	2.4E-09	2.0E-05	6E-05	1E-04	1.6E-10	8.7E-10	2.0E+00	3E-10	2E-09
12	TEQ-D/F (ND=1/2 MDL)	3.2E-06	0.03	1.8E-13	3.5E-13	7.0E-10	3E-04	5E-04					
	Aroclor-1254	no data	0.14	--	--	2.0E-05	--	--	--	--	2.0E+00	--	--
13	TEQ-D/F (ND=1/2 MDL)	3.9E-06	0.03	2.2E-13	4.3E-13	7.0E-10	3E-04	6E-04					
	Aroclor-1254	5.7E-03	0.14	1.5E-09	2.9E-09	2.0E-05	7E-05	1E-04	1.9E-10	1.0E-09	2.0E+00	4E-10	2E-09
14	TEQ-D/F (ND=1/2 MDL)	2.1E-05	0.03	1.1E-12	2.2E-12	7.0E-10	2E-03	3E-03					
	Aroclor-1254	1.0E-01	0.14	2.7E-08	5.3E-08	2.0E-05	1E-03	3E-03	3.5E-09	1.9E-08	2.0E+00	7E-09	4E-08
15	TEQ-D/F (ND=1/2 MDL)	1.4E-06	0.03	7.9E-14	1.5E-13	7.0E-10	1E-04	2E-04					
	Aroclor-1254	2.8E-03	0.14	7.2E-10	1.4E-09	2.0E-05	4E-05	7E-05	9.3E-11	5.1E-10	2.0E+00	2E-10	1E-09
16	TEQ-D/F (ND=1/2 MDL)	5.3E-06	0.03	2.9E-13	5.8E-13	7.0E-10	4E-04	8E-04					
	Aroclor-1254	no data	0.14	--	--	2.0E-05	--	--	--	--	2.0E+00	--	--
17	TEQ-D/F (ND=1/2 MDL)	2.0E-06	0.03	1.1E-13	2.2E-13	7.0E-10	2E-04	3E-04					
	Aroclor-1254	no data	0.14	--	--	2.0E-05	--	--	--	--	2.0E+00	--	--
18	TEQ-D/F (ND=1/2 MDL)	6.8E-06	0.03	3.8E-13	7.4E-13	7.0E-10	5E-04	1E-03					
	Aroclor-1254	no data	0.14	--	--	2.0E-05	--	--	--	--	2.0E+00	--	--
19	TEQ-D/F (ND=1/2 MDL)	2.9E-06	0.03	1.6E-13	3.2E-13	7.0E-10	2E-04	5E-04					
	Aroclor-1254	no data	0.14	--	--	2.0E-05	--	--	--	--	2.0E+00	--	--
22	TEQ-D/F (ND=1/2 MDL)	1.5E-05	0.03	8.1E-13	1.6E-12	7.0E-10	1E-03	2E-03					
	Aroclor-1254	2.5E-02	0.14	6.5E-09	1.3E-08	2.0E-05	3E-04	6E-04	8.3E-10	4.5E-09	2.0E+00	2E-09	9E-09
23	TEQ-D/F (ND=1/2 MDL)	2.7E-07	0.03	1.5E-14	2.9E-14	7.0E-10	2E-05	4E-05					
	Aroclor-1254	5.0E-03	0.14	1.3E-09	2.5E-09	2.0E-05	6E-05	1E-04	1.6E-10	9.0E-10	2.0E+00	3E-10	2E-09

APPENDIX D. DETAILED RISK CALCULATIONS

Population	**Current/Hypothetical Future Commercial/Indus**
Exposure Area	**Random 20-acre grids across OU2**
Medium	**Surface Soil**
Exposure Route	**Incidental Ingestion**

Summed risks across COPCs TEQ-D/F (ND=1/2 MDL) and Aroclor-1254

Grid	Non-Cancer		Cancer	
	HI		Total Risk	
	CTE	RME	CTE	RME
1	5E-03	1E-02	1E-08	9E-08
2	2E-03	5E-03	2E-09	2E-08
4	1E-03	3E-03	3E-09	2E-08
5	5E-04	1E-03	2E-10	1E-09
6	1E-02	3E-02	--	--
7	1E-03	3E-03	3E-09	2E-08
8	1E-02	3E-02	4E-08	3E-07
9	5E-03	1E-02	2E-09	1E-08
11	2E-03	4E-03	5E-10	3E-09
12	2E-03	4E-03	--	--
13	2E-03	5E-03	5E-10	3E-09
14	1E-02	3E-02	1E-08	6E-08
15	8E-04	2E-03	3E-10	2E-09
16	3E-03	6E-03	--	--
17	1E-03	2E-03	--	--
18	4E-03	8E-03	--	--
19	2E-03	4E-03	--	--
22	8E-03	2E-02	2E-09	2E-08
23	2E-04	5E-04	5E-10	3E-09

APPENDIX D. DETAILED RISK CALCULATIONS

Population	**Current/Hypothetical Future Commercial/Indus**
Exposure Area	**Random 20-acre grids across OU2**
Medium	**Surface Soil**
Exposure Route	**Dermal Contact**

Summed risks across COPCs TEQ-D/F (ND=1/2 MDL) and Aroclor-1254

Grid	Non-Cancer		Cancer	
	HI		Total Risk	
	CTE	RME	CTE	RME
1	2E-03	4E-03	9E-09	5E-08
2	6E-04	1E-03	2E-09	9E-09
4	5E-04	1E-03	2E-09	1E-08
5	1E-04	2E-04	1E-10	7E-10
6	2E-03	3E-03	--	--
7	5E-04	1E-03	2E-09	1E-08
8	6E-03	1E-02	3E-08	1E-07
9	9E-04	2E-03	1E-09	6E-09
11	3E-04	6E-04	3E-10	2E-09
12	3E-04	5E-04	--	--
13	4E-04	8E-04	4E-10	2E-09
14	3E-03	6E-03	7E-09	4E-08
15	1E-04	3E-04	2E-10	1E-09
16	4E-04	8E-04	--	--
17	2E-04	3E-04	--	--
18	5E-04	1E-03	--	--
19	2E-04	5E-04	--	--
22	1E-03	3E-03	2E-09	9E-09
23	9E-05	2E-04	3E-10	2E-09

APPENDIX D. DETAILED RISK CALCULATIONS

Population **Current/Hypothetical Future Commercial/Industrial Workers**
Exposure Area **Random 20-acre grids across OU2**
Medium **Surface Soil**
Exposure Route **Incidental Ingestion**

Grid	COPC	EPC	RBA	Non-Cancer					Cancer				
				DI (mg/kg-d)		RfD	HQ		DI (mg/kg-d)		oSF	Risk	
		mg/kg		CTE	RME	mg/kg-d	CTE	RME	CTE	RME	(mg/kg-d)-1	CTE	RME
1	TEQ-D/F/PCBs (ND=1/2 MDL)	1.4E-05	1.00	1.9E-12	4.4E-12	7.0E-10	3E-03	6E-03					
	Total Non-DL PCBs (ND=1/2 MDL)	1.9E-01	1.00	5.3E-08	1.2E-07		--	--	9.4E-09	6.0E-08	2.0E+00	2E-08	1E-07
2	TEQ-D/F/PCBs (ND=1/2 MDL)	5.2E-06	1.00	1.2E-12	2.8E-12	7.0E-10	2E-03	4E-03					
	Total Non-DL PCBs (ND=1/2 MDL)	2.9E-02	1.00	9.3E-09	2.1E-08		--	--	1.4E-09	8.7E-09	2.0E+00	3E-09	2E-08
4	TEQ-D/F/PCBs (ND=1/2 MDL)	2.5E-05	1.00	4.7E-13	1.1E-12	7.0E-10	7E-04	2E-03					
	Total Non-DL PCBs (ND=1/2 MDL)	1.1E-01	1.00	1.2E-08	2.7E-08		--	--	5.4E-09	3.4E-08	2.0E+00	1E-08	7E-08
5	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	1.00	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	1.00	--	--		--	--	--	--	2.0E+00	--	--
6	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	1.00	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	1.00	--	--		--	--	--	--	2.0E+00	--	--
7	TEQ-D/F/PCBs (ND=1/2 MDL)	2.5E-05	1.00	4.3E-13	9.7E-13	7.0E-10	6E-04	1E-03					
	Total Non-DL PCBs (ND=1/2 MDL)	1.1E-01	1.00	1.2E-08	2.7E-08		--	--	5.4E-09	3.4E-08	2.0E+00	1E-08	7E-08
8	TEQ-D/F/PCBs (ND=1/2 MDL)	4.2E-05	1.00	3.3E-12	7.5E-12	7.0E-10	5E-03	1E-02					
	Total Non-DL PCBs (ND=1/2 MDL)	1.0E+00	1.00	1.5E-07	3.5E-07		--	--	4.9E-08	3.1E-07	2.0E+00	1E-07	6E-07
9	TEQ-D/F/PCBs (ND=1/2 MDL)	1.0E-05	1.00	3.4E-12	7.7E-12	7.0E-10	5E-03	1E-02					
	Total Non-DL PCBs (ND=1/2 MDL)	3.3E-02	1.00	6.1E-09	1.4E-08		--	--	1.6E-09	1.0E-08	2.0E+00	3E-09	2E-08
11	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	1.00	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	1.00	--	--		--	--	--	--	2.0E+00	--	--
12	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	1.00	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	1.00	--	--		--	--	--	--	2.0E+00	--	--
13	TEQ-D/F/PCBs (ND=1/2 MDL)	3.8E-06	1.00	1.5E-12	3.4E-12	7.0E-10	2E-03	5E-03					
	Total Non-DL PCBs (ND=1/2 MDL)	1.5E-02	1.00	2.1E-09	4.9E-09		--	--	7.1E-10	4.5E-09	2.0E+00	1E-09	9E-09
14	TEQ-D/F/PCBs (ND=1/2 MDL)	3.0E-05	1.00	7.7E-12	1.8E-11	7.0E-10	1E-02	3E-02					
	Total Non-DL PCBs (ND=1/2 MDL)	6.7E-02	1.00	3.9E-08	8.9E-08		--	--	3.2E-09	2.0E-08	2.0E+00	6E-09	4E-08
15	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	1.00	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	1.00	--	--		--	--	--	--	2.0E+00	--	--
16	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	1.00	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	1.00	--	--		--	--	--	--	2.0E+00	--	--
17	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	1.00	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	1.00	--	--		--	--	--	--	2.0E+00	--	--
18	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	1.00	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	1.00	--	--		--	--	--	--	2.0E+00	--	--
19	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	1.00	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	1.00	--	--		--	--	--	--	2.0E+00	--	--
22	TEQ-D/F/PCBs (ND=1/2 MDL)	2.6E-05	1.00	5.5E-12	1.3E-11	7.0E-10	8E-03	2E-02					
	Total Non-DL PCBs (ND=1/2 MDL)	1.0E-01	1.00	9.4E-09	2.1E-08		--	--	5.0E-09	3.2E-08	2.0E+00	1E-08	6E-08
23	TEQ-D/F/PCBs (ND=1/2 MDL)	5.9E-07	1.00	1.0E-13	2.3E-13	7.0E-10	1E-04	3E-04					
	Total Non-DL PCBs (ND=1/2 MDL)	6.9E-03	1.00	1.9E-09	4.2E-09		--	--	3.3E-10	2.1E-09	2.0E+00	7E-10	4E-09

APPENDIX D. DETAILED RISK CALCULATIONS

Population	**Current/Hypothetical Future Commercial/Industrial Workers**
Exposure Area	**Random 20-acre grids across OU2**
Medium	**Surface Soil**
Exposure Route	**Dermal Contact**

Grid	COPC	EPC	ABSd	Non-Cancer					Cancer				
				DI (mg/kg-d)		RfD	HQ		DI (mg/kg-d)		oSF	Risk	
		mg/kg		CTE	RME	mg/kg-d	CTE	RME	CTE	RME	(mg/kg-d)-1	CTE	RME
1	TEQ-D/F/PCBs (ND=1/2 MDL)	1.4E-05	0.03	7.5E-13	1.5E-12	7.0E-10	1E-03	2E-03					
	Total Non-DL PCBs (ND=1/2 MDL)	1.9E-01	0.14	5.0E-08	9.9E-08		--	--	1.3E-09	8.3E-09	2.0E+00	3E-09	2E-08
2	TEQ-D/F/PCBs (ND=1/2 MDL)	5.2E-06	0.03	2.9E-13	5.6E-13	7.0E-10	4E-04	8E-04					
	Total Non-DL PCBs (ND=1/2 MDL)	2.9E-02	0.14	7.4E-09	1.4E-08		--	--	1.9E-10	1.2E-09	2.0E+00	4E-10	2E-09
4	TEQ-D/F/PCBs (ND=1/2 MDL)	2.5E-05	0.03	1.4E-12	2.7E-12	7.0E-10	2E-03	4E-03					
	Total Non-DL PCBs (ND=1/2 MDL)	1.1E-01	0.14	2.9E-08	5.6E-08		--	--	7.5E-10	4.8E-09	2.0E+00	2E-09	1E-08
5	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	0.03	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	0.14	--	--		--	--	--	--	2.0E+00	--	--
6	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	0.03	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	0.14	--	--		--	--	--	--	2.0E+00	--	--
7	TEQ-D/F/PCBs (ND=1/2 MDL)	2.5E-05	0.03	1.4E-12	2.7E-12	7.0E-10	2E-03	4E-03					
	Total Non-DL PCBs (ND=1/2 MDL)	1.1E-01	0.14	2.9E-08	5.6E-08		--	--	7.5E-10	4.8E-09	2.0E+00	2E-09	1E-08
8	TEQ-D/F/PCBs (ND=1/2 MDL)	4.2E-05	0.03	2.3E-12	4.6E-12	7.0E-10	3E-03	7E-03					
	Total Non-DL PCBs (ND=1/2 MDL)	1.0E+00	0.14	2.6E-07	5.1E-07		--	--	6.8E-09	4.3E-08	2.0E+00	1E-08	9E-08
9	TEQ-D/F/PCBs (ND=1/2 MDL)	1.0E-05	0.03	5.8E-13	1.1E-12	7.0E-10	8E-04	2E-03					
	Total Non-DL PCBs (ND=1/2 MDL)	3.3E-02	0.14	8.5E-09	1.7E-08		--	--	2.2E-10	1.4E-09	2.0E+00	4E-10	3E-09
11	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	0.03	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	0.14	--	--		--	--	--	--	2.0E+00	--	--
12	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	0.03	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	0.14	--	--		--	--	--	--	2.0E+00	--	--
13	TEQ-D/F/PCBs (ND=1/2 MDL)	3.8E-06	0.03	2.1E-13	4.1E-13	7.0E-10	3E-04	6E-04					
	Total Non-DL PCBs (ND=1/2 MDL)	1.5E-02	0.14	3.8E-09	7.5E-09		--	--	1.0E-10	6.3E-10	2.0E+00	2E-10	1E-09
14	TEQ-D/F/PCBs (ND=1/2 MDL)	3.0E-05	0.03	1.7E-12	3.3E-12	7.0E-10	2E-03	5E-03					
	Total Non-DL PCBs (ND=1/2 MDL)	6.7E-02	0.14	1.7E-08	3.4E-08		--	--	4.5E-10	2.8E-09	2.0E+00	9E-10	6E-09
15	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	0.03	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	0.14	--	--		--	--	--	--	2.0E+00	--	--
16	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	0.03	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	0.14	--	--		--	--	--	--	2.0E+00	--	--
17	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	0.03	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	0.14	--	--		--	--	--	--	2.0E+00	--	--
18	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	0.03	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	0.14	--	--		--	--	--	--	2.0E+00	--	--
19	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	0.03	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	0.14	--	--		--	--	--	--	2.0E+00	--	--
22	TEQ-D/F/PCBs (ND=1/2 MDL)	2.6E-05	0.03	1.5E-12	2.9E-12	7.0E-10	2E-03	4E-03					
	Total Non-DL PCBs (ND=1/2 MDL)	1.0E-01	0.14	2.7E-08	5.2E-08		--	--	7.0E-10	4.4E-09	2.0E+00	1E-09	9E-09
23	TEQ-D/F/PCBs (ND=1/2 MDL)	5.9E-07	0.03	3.3E-14	6.4E-14	7.0E-10	5E-05	9E-05					
	Total Non-DL PCBs (ND=1/2 MDL)	6.9E-03	0.14	1.8E-09	3.5E-09		--	--	4.7E-11	3.0E-10	2.0E+00	9E-11	6E-10

APPENDIX D. DETAILED RISK CALCULATIONS

Population **Current/Hypothetical Future Commercial/Industrial W**
Exposure Area **Random 20-acre grids across OU2**
Medium **Surface Soil**
Exposure Route **Incidental Ingestion**

Summed risks across COPCs TEQ-D/F/DL-PCBs (ND=1/2 MDL) and Total Non-DL PCBs

Grid	Non-Cancer		Cancer	
	HI		Total Risk	
	CTE	RME	CTE	RME
1	3E-03	6E-03	2E-08	1E-07
2	2E-03	4E-03	3E-09	2E-08
4	7E-04	2E-03	1E-08	7E-08
5	--	--	--	--
6	--	--	--	--
7	6E-04	1E-03	1E-08	7E-08
8	5E-03	1E-02	1E-07	6E-07
9	5E-03	1E-02	3E-09	2E-08
11	--	--	--	--
12	--	--	--	--
13	2E-03	5E-03	1E-09	9E-09
14	1E-02	3E-02	6E-09	4E-08
15	--	--	--	--
16	--	--	--	--
17	--	--	--	--
18	--	--	--	--
19	--	--	--	--
22	8E-03	2E-02	1E-08	6E-08
23	1E-04	3E-04	7E-10	4E-09

APPENDIX D. DETAILED RISK CALCULATIONS

Population **Current/Hypothetical Future Commercial/Industrial W**
Exposure Area **Random 20-acre grids across OU2**
Medium **Surface Soil**
Exposure Route **Dermal Contact**

Summed risks across COPCs TEQ-D/F/DL-PCBs (ND=1/2 MDL) and Total Non-DL PCBs

Grid	Non-Cancer		Cancer	
	HI		Total Risk	
	CTE	RME	CTE	RME
1	1E-03	2E-03	3E-09	2E-08
2	4E-04	8E-04	4E-10	2E-09
4	2E-03	4E-03	2E-09	1E-08
5	--	--	--	--
6	--	--	--	--
7	2E-03	4E-03	2E-09	1E-08
8	3E-03	7E-03	1E-08	9E-08
9	8E-04	2E-03	4E-10	3E-09
11	--	--	--	--
12	--	--	--	--
13	3E-04	6E-04	2E-10	1E-09
14	2E-03	5E-03	9E-10	6E-09
15	--	--	--	--
16	--	--	--	--
17	--	--	--	--
18	--	--	--	--
19	--	--	--	--
22	2E-03	4E-03	1E-09	9E-09
23	5E-05	9E-05	9E-11	6E-10

APPENDIX D. DETAILED RISK CALCULATIONS

Population — **Current/Hypothetical Future Commercial/Industrial Workers**
Exposure Area — **Random 20-acre grids across OU2**
Medium — **Surface Soil**

Exposure Unit	Exposure Route	TEQ-DF (ND=1/2MDL) & Aroclor-1254				TEQ-D/F/PCB (ND=1/2MDL) & Total non-DL PCBs			
		Non-cancer HI		Excess cancer Risk		Non-cancer HI		Excess cancer Risk	
		CTE	RME	CTE	RME	CTE	RME	CTE	RME
Grid 1	Incidental Ingestion	5E-03	1E-02	1E-08	9E-08	3E-03	6E-03	2E-08	1E-07
	Dermal Contact	2E-03	4E-03	9E-09	5E-08	1E-03	2E-03	3E-09	2E-08
	Total	8E-03	2E-02	2E-08	1E-07	4E-03	8E-03	2E-08	1E-07
Grid 2	Incidental Ingestion	2E-03	5E-03	2E-09	2E-08	2E-03	4E-03	3E-09	2E-08
	Dermal Contact	6E-04	1E-03	2E-09	9E-09	4E-04	8E-04	4E-10	2E-09
	Total	3E-03	6E-03	4E-09	2E-08	2E-03	5E-03	3E-09	2E-08
Grid 4	Incidental Ingestion	1E-03	3E-03	3E-09	2E-08	7E-04	2E-03	1E-08	7E-08
	Dermal Contact	5E-04	1E-03	2E-09	1E-08	2E-03	4E-03	2E-09	1E-08
	Total	2E-03	4E-03	5E-09	3E-08	3E-03	5E-03	1E-08	8E-08
Grid 5	Incidental Ingestion	5E-04	1E-03	2E-10	1E-09				
	Dermal Contact	1E-04	2E-04	1E-10	7E-10				
	Total	6E-04	1E-03	3E-10	2E-09				
Grid 6	Incidental Ingestion	1E-02	3E-02						
	Dermal Contact	2E-03	3E-03						
	Total	1E-02	3E-02						
Grid 7	Incidental Ingestion	1E-03	3E-03	3E-09	2E-08	6E-04	1E-03	1E-08	7E-08
	Dermal Contact	5E-04	1E-03	2E-09	1E-08	2E-03	4E-03	2E-09	1E-08
	Total	2E-03	4E-03	5E-09	3E-08	3E-03	5E-03	1E-08	8E-08
Grid 8	Incidental Ingestion	1E-02	3E-02	4E-08	3E-07	5E-03	1E-02	1E-07	6E-07
	Dermal Contact	6E-03	1E-02	3E-08	1E-07	3E-03	7E-03	1E-08	9E-08
	Total	2E-02	4E-02	7E-08	4E-07	8E-03	2E-02	1E-07	7E-07
Grid 9	Incidental Ingestion	5E-03	1E-02	2E-09	1E-08	5E-03	1E-02	3E-09	2E-08
	Dermal Contact	9E-04	2E-03	1E-09	6E-09	8E-04	2E-03	4E-10	3E-09
	Total	6E-03	1E-02	3E-09	2E-08	6E-03	1E-02	4E-09	2E-08
Grid 11	Incidental Ingestion	2E-03	4E-03	5E-10	3E-09				
	Dermal Contact	3E-04	6E-04	3E-10	2E-09				
	Total	2E-03	4E-03	8E-10	5E-09				
Grid 12	Incidental Ingestion	2E-03	4E-03						
	Dermal Contact	3E-04	5E-04						
	Total	2E-03	4E-03						
Grid 13	Incidental Ingestion	2E-03	5E-03	5E-10	3E-09	2E-03	5E-03	1E-09	9E-09
	Dermal Contact	4E-04	8E-04	4E-10	2E-09	3E-04	6E-04	2E-10	1E-09
	Total	3E-03	6E-03	9E-10	6E-09	2E-03	5E-03	2E-09	1E-08
Grid 14	Incidental Ingestion	1E-02	3E-02	1E-08	6E-08	1E-02	3E-02	6E-09	4E-08
	Dermal Contact	3E-03	6E-03	7E-09	4E-08	2E-03	5E-03	9E-10	6E-09
	Total	2E-02	4E-02	2E-08	1E-07	1E-02	3E-02	7E-09	5E-08
Grid 15	Incidental Ingestion	8E-04	2E-03	3E-10	2E-09				
	Dermal Contact	1E-04	3E-04	2E-10	1E-09				
	Total	1E-03	2E-03	5E-10	3E-09				
Grid 16	Incidental Ingestion	3E-03	6E-03						
	Dermal Contact	4E-04	8E-04						
	Total	3E-03	7E-03						
Grid 17	Incidental Ingestion	1E-03	2E-03						
	Dermal Contact	2E-04	3E-04						
	Total	1E-03	3E-03						
Grid 18	Incidental Ingestion	4E-03	8E-03						
	Dermal Contact	5E-04	1E-03						
	Total	4E-03	9E-03						
Grid 19	Incidental Ingestion	2E-03	4E-03						
	Dermal Contact	2E-04	5E-04						
	Total	2E-03	4E-03						
Grid 22	Incidental Ingestion	8E-03	2E-02	2E-09	2E-08	8E-03	2E-02	1E-08	6E-08
	Dermal Contact	1E-03	3E-03	2E-09	9E-09	2E-03	4E-03	1E-09	9E-09
	Total	1E-02	2E-02	4E-09	2E-08	1E-02	2E-02	1E-08	7E-08
Grid 23	Incidental Ingestion	2E-04	5E-04	5E-10	3E-09	1E-04	3E-04	7E-10	4E-09
	Dermal Contact	9E-05	2E-04	3E-10	2E-09	5E-05	9E-05	9E-11	6E-10
	Total	3E-04	7E-04	8E-10	5E-09	2E-04	4E-04	8E-10	5E-09

APPENDIX D. DETAILED RISK CALCULATIONS

Population **Hypothetical Future Construction Workers**
Exposure Area **Random 20-acre grids across OU2**
Medium **Surface + Subsurface Soil**
Exposure Route **Incidental Ingestion**

Grid	COPC	EPC	RBA	Non-Cancer					Cancer				
				DI (mg/kg-d)		RfD	HQ		DI (mg/kg-d)		oSF	Risk	
		mg/kg		CTE	RME	mg/kg-d	CTE	RME	CTE	RME	(mg/kg-d)-1	CTE	RME
1	TEQ-D/F (ND=1/2 MDL)	5.2E-06	1.00	1.8E-12	7.2E-12	7.0E-10	3E-03	1E-02					
	Aroclor-1254	1.4E-01	1.00	4.9E-08	2.0E-07	2.0E-05	2E-03	1E-02	3.5E-10	2.8E-09	2.0E+00	7E-10	6E-09
2	TEQ-D/F (ND=1/2 MDL)	3.3E-06	1.00	1.2E-12	4.6E-12	7.0E-10	2E-03	7E-03					
	Aroclor-1254	2.5E-02	1.00	8.7E-09	3.5E-08	2.0E-05	4E-04	2E-03	6.2E-11	4.9E-10	2.0E+00	1E-10	1E-09
4	TEQ-D/F (ND=1/2 MDL)	1.2E-06	1.00	4.2E-13	1.7E-12	7.0E-10	6E-04	2E-03					
	Aroclor-1254	3.1E-02	1.00	1.1E-08	4.3E-08	2.0E-05	5E-04	2E-03	7.6E-11	6.1E-10	2.0E+00	2E-10	1E-09
5	TEQ-D/F (ND=1/2 MDL)	9.2E-07	1.00	3.2E-13	1.3E-12	7.0E-10	5E-04	2E-03					
	Aroclor-1254	2.1E-03	1.00	7.2E-10	2.9E-09	2.0E-05	4E-05	1E-04	5.2E-12	4.1E-11	2.0E+00	1E-11	8E-11
6	TEQ-D/F (ND=1/2 MDL)	1.8E-05	1.00	6.5E-12	2.6E-11	7.0E-10	9E-03	4E-02					
	Aroclor-1254	4.6E-03	1.00	1.6E-09	6.4E-09	2.0E-05	8E-05	3E-04	1.2E-11	9.2E-11	2.0E+00	2E-11	2E-10
7	TEQ-D/F (ND=1/2 MDL)	1.1E-06	1.00	3.8E-13	1.5E-12	7.0E-10	5E-04	2E-03					
	Aroclor-1254	3.1E-02	1.00	1.1E-08	4.3E-08	2.0E-05	5E-04	2E-03	7.6E-11	6.1E-10	2.0E+00	2E-10	1E-09
8	TEQ-D/F (ND=1/2 MDL)	8.4E-06	1.00	3.0E-12	1.2E-11	7.0E-10	4E-03	2E-02					
	Aroclor-1254	3.9E-01	1.00	1.4E-07	5.5E-07	2.0E-05	7E-03	3E-02	9.9E-10	7.9E-09	2.0E+00	2E-09	2E-08
9	TEQ-D/F (ND=1/2 MDL)	8.9E-06	1.00	3.1E-12	1.3E-11	7.0E-10	4E-03	2E-02					
	Aroclor-1254	1.6E-02	1.00	5.7E-09	2.3E-08	2.0E-05	3E-04	1E-03	4.1E-11	3.2E-10	2.0E+00	8E-11	6E-10
11	TEQ-D/F (ND=1/2 MDL)	2.5E-06	1.00	8.9E-13	3.6E-12	7.0E-10	1E-03	5E-03					
	Aroclor-1254	1.3E-02	1.00	4.7E-09	1.9E-08	2.0E-05	2E-04	9E-04	3.3E-11	2.7E-10	2.0E+00	7E-11	5E-10
12	TEQ-D/F (ND=1/2 MDL)	3.1E-06	1.00	1.1E-12	4.4E-12	7.0E-10	2E-03	6E-03					
	Aroclor-1254	6.2E-02	1.00	2.2E-08	8.7E-08	2.0E-05	1E-03	4E-03	1.6E-10	1.2E-09	2.0E+00	3E-10	2E-09
13	TEQ-D/F (ND=1/2 MDL)	3.8E-06	1.00	1.3E-12	5.3E-12	7.0E-10	2E-03	8E-03					
	Aroclor-1254	5.7E-03	1.00	2.0E-09	8.0E-09	2.0E-05	1E-04	4E-04	1.4E-11	1.1E-10	2.0E+00	3E-11	2E-10
14	TEQ-D/F (ND=1/2 MDL)	2.0E-05	1.00	6.9E-12	2.8E-11	7.0E-10	1E-02	4E-02					
	Aroclor-1254	9.9E-02	1.00	3.5E-08	1.4E-07	2.0E-05	2E-03	7E-03	2.5E-10	2.0E-09	2.0E+00	5E-10	4E-09
15	TEQ-D/F (ND=1/2 MDL)	1.2E-06	1.00	4.3E-13	1.7E-12	7.0E-10	6E-04	2E-03					
	Aroclor-1254	2.8E-03	1.00	1.0E-09	4.0E-09	2.0E-05	5E-05	2E-04	7.1E-12	5.7E-11	2.0E+00	1E-11	1E-10
16	TEQ-D/F (ND=1/2 MDL)	5.3E-06	1.00	1.9E-12	7.4E-12	7.0E-10	3E-03	1E-02					
	Aroclor-1254	no data	1.00	--	--	2.0E-05	--	--	--	--	2.0E+00	--	--
17	TEQ-D/F (ND=1/2 MDL)	2.0E-06	1.00	7.1E-13	2.8E-12	7.0E-10	1E-03	4E-03					
	Aroclor-1254	no data	1.00	--	--	2.0E-05	--	--	--	--	2.0E+00	--	--
18	TEQ-D/F (ND=1/2 MDL)	5.7E-06	1.00	2.0E-12	8.0E-12	7.0E-10	3E-03	1E-02					
	Aroclor-1254	5.6E-03	1.00	1.9E-09	7.8E-09	2.0E-05	1E-04	4E-04	1.4E-11	1.1E-10	2.0E+00	3E-11	2E-10
19	TEQ-D/F (ND=1/2 MDL)	3.9E-06	1.00	1.4E-12	5.5E-12	7.0E-10	2E-03	8E-03					
	Aroclor-1254	5.0E-03	1.00	1.7E-09	6.9E-09	2.0E-05	9E-05	3E-04	1.2E-11	9.9E-11	2.0E+00	2E-11	2E-10
22	TEQ-D/F (ND=1/2 MDL)	1.5E-05	1.00	5.1E-12	2.1E-11	7.0E-10	7E-03	3E-02					
	Aroclor-1254	2.5E-02	1.00	8.8E-09	3.5E-08	2.0E-05	4E-04	2E-03	6.3E-11	5.0E-10	2.0E+00	1E-10	1E-09
23	TEQ-D/F (ND=1/2 MDL)	2.6E-07	1.00	9.1E-14	3.6E-13	7.0E-10	1E-04	5E-04					
	Aroclor-1254	5.0E-03	1.00	1.7E-09	6.9E-09	2.0E-05	9E-05	3E-04	1.2E-11	9.9E-11	2.0E+00	2E-11	2E-10

APPENDIX D. DETAILED RISK CALCULATIONS

Population — **Hypothetical Future Construction Workers**
Exposure Area — **Random 20-acre grids across OU2**
Medium — **Surface + Subsurface Soil**
Exposure Route — **Dermal Contact**

Grid	COPC	EPC	ABSd	Non-Cancer					Cancer				
				DAD (mg/kg-d)		RfD	HQ		DAD (mg/kg-d)		oSF	Risk	
		mg/kg		CTE	RME	mg/kg-d	CTE	RME	CTE	RME	(mg/kg-d)-1	CTE	RME
1	TEQ-D/F (ND=1/2 MDL)	5.2E-06	0.03	1.2E-13	7.0E-13	7.0E-10	2E-04	1E-03					
	Aroclor-1254	1.4E-01	0.14	1.5E-08	8.9E-08	2.0E-05	7E-04	4E-03	1.1E-10	1.3E-09	2.0E+00	2E-10	3E-09
2	TEQ-D/F (ND=1/2 MDL)	3.3E-06	0.03	7.4E-14	4.5E-13	7.0E-10	1E-04	6E-04					
	Aroclor-1254	2.5E-02	0.14	2.6E-09	1.6E-08	2.0E-05	1E-04	8E-04	1.8E-11	2.2E-10	2.0E+00	4E-11	4E-10
4	TEQ-D/F (ND=1/2 MDL)	1.2E-06	0.03	2.7E-14	1.6E-13	7.0E-10	4E-05	2E-04					
	Aroclor-1254	3.1E-02	0.14	3.2E-09	1.9E-08	2.0E-05	2E-04	1E-03	2.3E-11	2.7E-10	2.0E+00	5E-11	5E-10
5	TEQ-D/F (ND=1/2 MDL)	9.2E-07	0.03	2.1E-14	1.2E-13	7.0E-10	3E-05	2E-04					
	Aroclor-1254	2.1E-03	0.14	2.2E-10	1.3E-09	2.0E-05	1E-05	7E-05	1.5E-12	1.9E-11	2.0E+00	3E-12	4E-11
6	TEQ-D/F (ND=1/2 MDL)	1.8E-05	0.03	4.2E-13	2.5E-12	7.0E-10	6E-04	4E-03					
	Aroclor-1254	4.6E-03	0.14	4.8E-10	2.9E-09	2.0E-05	2E-05	1E-04	3.4E-12	4.1E-11	2.0E+00	7E-12	8E-11
7	TEQ-D/F (ND=1/2 MDL)	1.1E-06	0.03	2.5E-14	1.5E-13	7.0E-10	4E-05	2E-04					
	Aroclor-1254	3.1E-02	0.14	3.2E-09	1.9E-08	2.0E-05	2E-04	1E-03	2.3E-11	2.7E-10	2.0E+00	5E-11	5E-10
8	TEQ-D/F (ND=1/2 MDL)	8.4E-06	0.03	1.9E-13	1.1E-12	7.0E-10	3E-04	2E-03					
	Aroclor-1254	3.9E-01	0.14	4.1E-08	2.5E-07	2.0E-05	2E-03	1E-02	2.9E-10	3.5E-09	2.0E+00	6E-10	7E-09
9	TEQ-D/F (ND=1/2 MDL)	8.9E-06	0.03	2.0E-13	1.2E-12	7.0E-10	3E-04	2E-03					
	Aroclor-1254	1.6E-02	0.14	1.7E-09	1.0E-08	2.0E-05	8E-05	5E-04	1.2E-11	1.5E-10	2.0E+00	2E-11	3E-10
11	TEQ-D/F (ND=1/2 MDL)	2.5E-06	0.03	5.7E-14	3.4E-13	7.0E-10	8E-05	5E-04					
	Aroclor-1254	1.3E-02	0.14	1.4E-09	8.4E-09	2.0E-05	7E-05	4E-04	1.0E-11	1.2E-10	2.0E+00	2E-11	2E-10
12	TEQ-D/F (ND=1/2 MDL)	3.1E-06	0.03	7.0E-14	4.2E-13	7.0E-10	1E-04	6E-04					
	Aroclor-1254	6.2E-02	0.14	6.5E-09	3.9E-08	2.0E-05	3E-04	2E-03	4.7E-11	5.6E-10	2.0E+00	9E-11	1E-09
13	TEQ-D/F (ND=1/2 MDL)	3.8E-06	0.03	8.5E-14	5.1E-13	7.0E-10	1E-04	7E-04					
	Aroclor-1254	5.7E-03	0.14	6.0E-10	3.6E-09	2.0E-05	3E-05	2E-04	4.3E-12	5.1E-11	2.0E+00	9E-12	1E-10
14	TEQ-D/F (ND=1/2 MDL)	2.0E-05	0.03	4.4E-13	2.7E-12	7.0E-10	6E-04	4E-03					
	Aroclor-1254	9.9E-02	0.14	1.0E-08	6.2E-08	2.0E-05	5E-04	3E-03	7.4E-11	8.9E-10	2.0E+00	1E-10	2E-09
15	TEQ-D/F (ND=1/2 MDL)	1.2E-06	0.03	2.7E-14	1.6E-13	7.0E-10	4E-05	2E-04					
	Aroclor-1254	2.8E-03	0.14	3.0E-10	1.8E-09	2.0E-05	1E-05	9E-05	2.1E-12	2.6E-11	2.0E+00	4E-12	5E-11
16	TEQ-D/F (ND=1/2 MDL)	5.3E-06	0.03	1.2E-13	7.2E-13	7.0E-10	2E-04	1E-03					
	Aroclor-1254	no data	0.14	--	--	2.0E-05	--	--	--	--	2.0E+00	--	--
17	TEQ-D/F (ND=1/2 MDL)	2.0E-06	0.03	4.6E-14	2.7E-13	7.0E-10	7E-05	4E-04					
	Aroclor-1254	no data	0.14	--	--	2.0E-05	--	--	--	--	2.0E+00	--	--
18	TEQ-D/F (ND=1/2 MDL)	5.7E-06	0.03	1.3E-13	7.6E-13	7.0E-10	2E-04	1E-03					
	Aroclor-1254	5.6E-03	0.14	5.8E-10	3.5E-09	2.0E-05	3E-05	2E-04	4.2E-12	5.0E-11	2.0E+00	8E-12	1E-10
19	TEQ-D/F (ND=1/2 MDL)	3.9E-06	0.03	8.9E-14	5.3E-13	7.0E-10	1E-04	8E-04					
	Aroclor-1254	5.0E-03	0.14	5.2E-10	3.1E-09	2.0E-05	3E-05	2E-04	3.7E-12	4.4E-11	2.0E+00	7E-12	9E-11
22	TEQ-D/F (ND=1/2 MDL)	1.5E-05	0.03	3.3E-13	2.0E-12	7.0E-10	5E-04	3E-03					
	Aroclor-1254	2.5E-02	0.14	2.6E-09	1.6E-08	2.0E-05	1E-04	8E-04	1.9E-11	2.2E-10	2.0E+00	4E-11	4E-10
23	TEQ-D/F (ND=1/2 MDL)	2.6E-07	0.03	5.8E-15	3.5E-14	7.0E-10	8E-06	5E-05					
	Aroclor-1254	5.0E-03	0.14	5.2E-10	3.1E-09	2.0E-05	3E-05	2E-04	3.7E-12	4.5E-11	2.0E+00	7E-12	9E-11

APPENDIX D. DETAILED RISK CALCULATIONS

Population	**Hypothetical Future Construction Workers**
Exposure Area	**Random 20-acre grids across OU2**
Medium	**Surface + Subsurface Soil**
Exposure Route	**Inhalation of particulates in air**

Grid	COPC	Csoil EPC mg/kg	PEF m^3/kg	Non-Cancer EC (mg/m^3) CTE	RME	RfC mg/m^3	HQ CTE	RME	Cancer EC (ug/m^3) CTE	RME	iUR $(ug/m^3)^{-1}$	Risk CTE	RME
1	Aroclor-1254	1.4E-01	4.4E+08	1.8E-11	3.6E-11	--	--	--	1.3E-10	5.2E-10	5.7E-04	7E-14	3E-13
2	Aroclor-1254	2.5E-02	4.4E+08	3.2E-12	6.4E-12	--	--	--	2.3E-11	9.1E-11	5.7E-04	1E-14	5E-14
4	Aroclor-1254	3.1E-02	4.4E+08	3.9E-12	7.9E-12	--	--	--	2.8E-11	1.1E-10	5.7E-04	2E-14	6E-14
5	Aroclor-1254	2.1E-03	4.4E+08	2.7E-13	5.3E-13	--	--	--	1.9E-12	7.6E-12	5.7E-04	1E-15	4E-15
6	Aroclor-1254	4.6E-03	4.4E+08	5.9E-13	1.2E-12	--	--	--	4.2E-12	1.7E-11	5.7E-04	2E-15	1E-14
7	Aroclor-1254	3.1E-02	4.4E+08	3.9E-12	7.9E-12	--	--	--	2.8E-11	1.1E-10	5.7E-04	2E-14	6E-14
8	Aroclor-1254	3.9E-01	4.4E+08	5.1E-11	1.0E-10	--	--	--	3.6E-10	1.4E-09	5.7E-04	2E-13	8E-13
9	Aroclor-1254	1.6E-02	4.4E+08	2.1E-12	4.2E-12	--	--	--	1.5E-11	6.0E-11	5.7E-04	8E-15	3E-14
11	Aroclor-1254	1.3E-02	4.4E+08	1.7E-12	3.4E-12	--	--	--	1.2E-11	4.9E-11	5.7E-04	7E-15	3E-14
12	Aroclor-1254	6.2E-02	4.4E+08	8.0E-12	1.6E-11	--	--	--	5.7E-11	2.3E-10	5.7E-04	3E-14	1E-13
13	Aroclor-1254	5.7E-03	4.4E+08	7.3E-13	1.5E-12	--	--	--	5.2E-12	2.1E-11	5.7E-04	3E-15	1E-14
14	Aroclor-1254	9.9E-02	4.4E+08	1.3E-11	2.6E-11	--	--	--	9.1E-11	3.7E-10	5.7E-04	5E-14	2E-13
15	Aroclor-1254	2.8E-03	4.4E+08	3.7E-13	7.3E-13	--	--	--	2.6E-12	1.0E-11	5.7E-04	1E-15	6E-15
16	Aroclor-1254	no data	4.4E+08	--	--	--	--	--	--	--	5.7E-04	--	--
17	Aroclor-1254	no data	4.4E+08	--	--	--	--	--	--	--	5.7E-04	--	--
18	Aroclor-1254	5.6E-03	4.4E+08	7.1E-13	1.4E-12	--	--	--	5.1E-12	2.0E-11	5.7E-04	3E-15	1E-14
19	Aroclor-1254	5.0E-03	4.4E+08	6.4E-13	1.3E-12	--	--	--	4.5E-12	1.8E-11	5.7E-04	3E-15	1E-14
22	Aroclor-1254	2.5E-02	4.4E+08	3.2E-12	6.4E-12	--	--	--	2.3E-11	9.2E-11	5.7E-04	1E-14	5E-14
23	Aroclor-1254	5.0E-03	4.4E+08	6.4E-13	1.3E-12	--	--	--	4.6E-12	1.8E-11	5.7E-04	3E-15	1E-14

APPENDIX D. DETAILED RISK CALCULATIONS

Population	**Hypothetical Future Construction Workers**
Exposure Area	**Random 20-acre grids across OU2**
Medium	**Surface + Subsurface Soil**
Exposure Route	**Incidental Ingestion**

Summed risks across COPCs TEQ-D/F (ND=1/2 MDL) and Aroclor-1254

Grid	Non-Cancer		Cancer	
	HI		Total Risk	
	CTE	RME	CTE	RME
1	5E-03	2E-02	7E-10	6E-09
2	2E-03	8E-03	1E-10	1E-09
4	1E-03	5E-03	2E-10	1E-09
5	5E-04	2E-03	1E-11	8E-11
6	9E-03	4E-02	2E-11	2E-10
7	1E-03	4E-03	2E-10	1E-09
8	1E-02	4E-02	2E-09	2E-08
9	5E-03	2E-02	8E-11	6E-10
11	2E-03	6E-03	7E-11	5E-10
12	3E-03	1E-02	3E-10	2E-09
13	2E-03	8E-03	3E-11	2E-10
14	1E-02	5E-02	5E-10	4E-09
15	7E-04	3E-03	1E-11	1E-10
16	3E-03	1E-02	--	--
17	1E-03	4E-03	--	--
18	3E-03	1E-02	3E-11	2E-10
19	2E-03	8E-03	2E-11	2E-10
22	8E-03	3E-02	1E-10	1E-09
23	2E-04	9E-04	2E-11	2E-10

APPENDIX D. DETAILED RISK CALCULATIONS

Population | **Hypothetical Future Construction Workers**
Exposure Area | **Random 20-acre grids across OU2**
Medium | **Surface + Subsurface Soil**
Exposure Route | **Dermal Contact**

Summed risks across COPCs TEQ-D/F (ND=1/2 MDL) and Aroclor-1254

Grid	Non-Cancer		Cancer	
	HI		Total Risk	
	CTE	RME	CTE	RME
1	9E-04	5E-03	2E-10	3E-09
2	2E-04	1E-03	4E-11	4E-10
4	2E-04	1E-03	5E-11	5E-10
5	4E-05	2E-04	3E-12	4E-11
6	6E-04	4E-03	7E-12	8E-11
7	2E-04	1E-03	5E-11	5E-10
8	2E-03	1E-02	6E-10	7E-09
9	4E-04	2E-03	2E-11	3E-10
11	2E-04	9E-04	2E-11	2E-10
12	4E-04	3E-03	9E-11	1E-09
13	2E-04	9E-04	9E-12	1E-10
14	1E-03	7E-03	1E-10	2E-09
15	5E-05	3E-04	4E-12	5E-11
16	2E-04	1E-03	--	--
17	7E-05	4E-04	--	--
18	2E-04	1E-03	8E-12	1E-10
19	2E-04	9E-04	7E-12	9E-11
22	6E-04	4E-03	4E-11	4E-10
23	3E-05	2E-04	7E-12	9E-11

APPENDIX D. DETAILED RISK CALCULATIONS

Population	**Hypothetical Future Construction Workers**
Exposure Area	**Random 20-acre grids across OU2**
Medium	**Surface + Subsurface Soil**
Exposure Route	**Incidental Ingestion**

Grid	COPC	EPC	RBA	Non-Cancer					Cancer				
				DI (mg/kg-d)		RfD	HQ		DI (mg/kg-d)		oSF	Risk	
		mg/kg		CTE	RME	mg/kg-d	CTE	RME	CTE	RME	(mg/kg-d)-1	CTE	RME
1	TEQ-D/F/PCBs (ND=1/2 MDL)	1.4E-05	1.00	1.8E-12	7.2E-12	7.0E-10	3E-03	1E-02					
	Total Non-DL PCBs (ND=1/2 MDL)	1.9E-01	1.00	4.9E-08	2.0E-07		--	--	4.9E-10	3.9E-09	2.0E+00	1E-09	8E-09
2	TEQ-D/F/PCBs (ND=1/2 MDL)	5.2E-06	1.00	1.2E-12	4.6E-12	7.0E-10	2E-03	7E-03					
	Total Non-DL PCBs (ND=1/2 MDL)	2.9E-02	1.00	8.7E-09	3.5E-08		--	--	7.1E-11	5.7E-10	2.0E+00	1E-10	1E-09
4	TEQ-D/F/PCBs (ND=1/2 MDL)	2.3E-05	1.00	4.2E-13	1.7E-12	7.0E-10	6E-04	2E-03					
	Total Non-DL PCBs (ND=1/2 MDL)	1.1E-01	1.00	1.1E-08	4.3E-08		--	--	2.7E-10	2.1E-09	2.0E+00	5E-10	4E-09
5	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	1.00	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	1.00	--	--		--	--	--	--	2.0E+00	--	--
6	TEQ-D/F/PCBs (ND=1/2 MDL)	1.4E-07	1.00	6.5E-12	2.6E-11	7.0E-10	9E-03	4E-02					
	Total Non-DL PCBs (ND=1/2 MDL)	4.8E-04	1.00	1.6E-09	6.4E-09		--	--	1.2E-12	9.5E-12	2.0E+00	2E-12	2E-11
7	TEQ-D/F/PCBs (ND=1/2 MDL)	2.3E-05	1.00	3.8E-13	1.5E-12	7.0E-10	5E-04	2E-03					
	Total Non-DL PCBs (ND=1/2 MDL)	1.1E-01	1.00	1.1E-08	4.3E-08		--	--	2.7E-10	2.1E-09	2.0E+00	5E-10	4E-09
8	TEQ-D/F/PCBs (ND=1/2 MDL)	4.0E-05	1.00	3.0E-12	1.2E-11	7.0E-10	4E-03	2E-02					
	Total Non-DL PCBs (ND=1/2 MDL)	9.7E-01	1.00	1.4E-07	5.5E-07		--	--	2.4E-09	1.9E-08	2.0E+00	5E-09	4E-08
9	TEQ-D/F/PCBs (ND=1/2 MDL)	1.0E-05	1.00	3.1E-12	1.3E-11	7.0E-10	4E-03	2E-02					
	Total Non-DL PCBs (ND=1/2 MDL)	3.3E-02	1.00	5.7E-09	2.3E-08		--	--	8.2E-11	6.5E-10	2.0E+00	2E-10	1E-09
11	TEQ-D/F/PCBs (ND=1/2 MDL)	3.9E-06	1.00	8.9E-13	3.6E-12	7.0E-10	1E-03	5E-03					
	Total Non-DL PCBs (ND=1/2 MDL)	1.0E-01	1.00	4.7E-09	1.9E-08		--	--	2.5E-10	2.0E-09	2.0E+00	5E-10	4E-09
12	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	1.00	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	1.00	--	--		--	--	--	--	2.0E+00	--	--
13	TEQ-D/F/PCBs (ND=1/2 MDL)	3.6E-06	1.00	1.3E-12	5.3E-12	7.0E-10	2E-03	8E-03					
	Total Non-DL PCBs (ND=1/2 MDL)	1.4E-02	1.00	2.0E-09	8.0E-09		--	--	3.5E-11	2.8E-10	2.0E+00	7E-11	6E-10
14	TEQ-D/F/PCBs (ND=1/2 MDL)	2.9E-05	1.00	6.9E-12	2.8E-11	7.0E-10	1E-02	4E-02					
	Total Non-DL PCBs (ND=1/2 MDL)	6.3E-02	1.00	3.5E-08	1.4E-07		--	--	1.6E-10	1.3E-09	2.0E+00	3E-10	3E-09
15	TEQ-D/F/PCBs (ND=1/2 MDL)	4.5E-07	1.00	4.3E-13	1.7E-12	7.0E-10	6E-04	2E-03					
	Total Non-DL PCBs (ND=1/2 MDL)	1.2E-03	1.00	1.0E-09	4.0E-09		--	--	3.1E-12	2.5E-11	2.0E+00	6E-12	5E-11
16	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	1.00	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	1.00	--	--		--	--	--	--	2.0E+00	--	--
17	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	1.00	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	1.00	--	--		--	--	--	--	2.0E+00	--	--
18	TEQ-D/F/PCBs (ND=1/2 MDL)	1.2E-07	1.00	2.0E-12	8.0E-12	7.0E-10	3E-03	1E-02					
	Total Non-DL PCBs (ND=1/2 MDL)	2.6E-04	1.00	1.9E-09	7.8E-09		--	--	6.5E-13	5.2E-12	2.0E+00	1E-12	1E-11
19	TEQ-D/F/PCBs (ND=1/2 MDL)	8.9E-08	1.00	1.4E-12	5.5E-12	7.0E-10	2E-03	8E-03					
	Total Non-DL PCBs (ND=1/2 MDL)	4.8E-05	1.00	1.7E-09	6.9E-09		--	--	1.2E-13	9.6E-13	2.0E+00	2E-13	2E-12
22	TEQ-D/F/PCBs (ND=1/2 MDL)	2.6E-05	1.00	5.1E-12	2.1E-11	7.0E-10	7E-03	3E-02					
	Total Non-DL PCBs (ND=1/2 MDL)	1.0E-01	1.00	8.8E-09	3.5E-08		--	--	2.6E-10	2.1E-09	2.0E+00	5E-10	4E-09
23	TEQ-D/F/PCBs (ND=1/2 MDL)	5.7E-07	1.00	9.1E-14	3.6E-13	7.0E-10	1E-04	5E-04					
	Total Non-DL PCBs (ND=1/2 MDL)	6.6E-03	1.00	1.7E-09	6.9E-09		--	--	1.7E-11	1.3E-10	2.0E+00	3E-11	3E-10

APPENDIX D. DETAILED RISK CALCULATIONS

Population **Hypothetical Future Construction Workers**
Exposure Area **Random 20-acre grids across OU2**
Medium **Surface + Subsurface Soil**
Exposure Route **Dermal Contact**

Grid	COPC	EPC	ABSd	Non-Cancer					Cancer				
				DI (mg/kg-d)		RfD	HQ		DI (mg/kg-d)		oSF	Risk	
		mg/kg		CTE	RME	mg/kg-d	CTE	RME	CTE	RME	(mg/kg-d)-1	CTE	RME
1	TEQ-D/F/PCBs (ND=1/2 MDL)	1.4E-05	0.03	3.0E-13	1.8E-12	7.0E-10	4E-04	3E-03					
	Total Non-DL PCBs (ND=1/2 MDL)	1.9E-01	0.14	2.0E-08	1.2E-07		--	--	6.8E-11	5.5E-10	2.0E+00	1E-10	1E-09
2	TEQ-D/F/PCBs (ND=1/2 MDL)	5.2E-06	0.03	1.2E-13	7.0E-13	7.0E-10	2E-04	1E-03					
	Total Non-DL PCBs (ND=1/2 MDL)	2.9E-02	0.14	3.0E-09	1.8E-08		--	--	1.0E-11	8.0E-11	2.0E+00	2E-11	2E-10
4	TEQ-D/F/PCBs (ND=1/2 MDL)	2.3E-05	0.03	5.3E-13	3.2E-12	7.0E-10	8E-04	5E-03					
	Total Non-DL PCBs (ND=1/2 MDL)	1.1E-01	0.14	1.1E-08	6.7E-08		--	--	3.7E-11	3.0E-10	2.0E+00	7E-11	6E-10
5	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	0.03	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	0.14	--	--		--	--	--	--	2.0E+00	--	--
6	TEQ-D/F/PCBs (ND=1/2 MDL)	1.4E-07	0.03	3.2E-15	1.9E-14	7.0E-10	5E-06	3E-05					
	Total Non-DL PCBs (ND=1/2 MDL)	4.8E-04	0.14	5.0E-11	3.0E-10		--	--	1.7E-13	1.3E-12	2.0E+00	3E-13	3E-12
7	TEQ-D/F/PCBs (ND=1/2 MDL)	2.3E-05	0.03	5.3E-13	3.2E-12	7.0E-10	8E-04	5E-03					
	Total Non-DL PCBs (ND=1/2 MDL)	1.1E-01	0.14	1.1E-08	6.7E-08		--	--	3.7E-11	3.0E-10	2.0E+00	7E-11	6E-10
8	TEQ-D/F/PCBs (ND=1/2 MDL)	4.0E-05	0.03	9.1E-13	5.4E-12	7.0E-10	1E-03	8E-03					
	Total Non-DL PCBs (ND=1/2 MDL)	9.7E-01	0.14	1.0E-07	6.1E-07		--	--	3.4E-10	2.7E-09	2.0E+00	7E-10	5E-09
9	TEQ-D/F/PCBs (ND=1/2 MDL)	1.0E-05	0.03	2.3E-13	1.4E-12	7.0E-10	3E-04	2E-03					
	Total Non-DL PCBs (ND=1/2 MDL)	3.3E-02	0.14	3.4E-09	2.1E-08		--	--	1.1E-11	9.1E-11	2.0E+00	2E-11	2E-10
11	TEQ-D/F/PCBs (ND=1/2 MDL)	3.9E-06	0.03	8.8E-14	5.3E-13	7.0E-10	1E-04	8E-04					
	Total Non-DL PCBs (ND=1/2 MDL)	1.0E-01	0.14	1.0E-08	6.3E-08		--	--	3.5E-11	2.8E-10	2.0E+00	7E-11	6E-10
12	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	0.03	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	0.14	--	--		--	--	--	--	2.0E+00	--	--
13	TEQ-D/F/PCBs (ND=1/2 MDL)	3.6E-06	0.03	8.1E-14	4.8E-13	7.0E-10	1E-04	7E-04					
	Total Non-DL PCBs (ND=1/2 MDL)	1.4E-02	0.14	1.5E-09	8.9E-09		--	--	4.9E-12	4.0E-11	2.0E+00	1E-11	8E-11
14	TEQ-D/F/PCBs (ND=1/2 MDL)	2.9E-05	0.03	6.5E-13	3.9E-12	7.0E-10	9E-04	6E-03					
	Total Non-DL PCBs (ND=1/2 MDL)	6.3E-02	0.14	6.6E-09	4.0E-08		--	--	2.2E-11	1.8E-10	2.0E+00	4E-11	4E-10
15	TEQ-D/F/PCBs (ND=1/2 MDL)	4.5E-07	0.03	1.0E-14	6.1E-14	7.0E-10	1E-05	9E-05					
	Total Non-DL PCBs (ND=1/2 MDL)	1.2E-03	0.14	1.3E-10	7.7E-10		--	--	4.3E-13	3.4E-12	2.0E+00	9E-13	7E-12
16	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	0.03	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	0.14	--	--		--	--	--	--	2.0E+00	--	--
17	TEQ-D/F/PCBs (ND=1/2 MDL)	no data	0.03	--	--	7.0E-10	--	--					
	Total Non-DL PCBs (ND=1/2 MDL)	no data	0.14	--	--		--	--	--	--	2.0E+00	--	--
18	TEQ-D/F/PCBs (ND=1/2 MDL)	1.2E-07	0.03	2.7E-15	1.6E-14	7.0E-10	4E-06	2E-05					
	Total Non-DL PCBs (ND=1/2 MDL)	2.6E-04	0.14	2.7E-11	1.6E-10		--	--	9.1E-14	7.3E-13	2.0E+00	2E-13	1E-12
19	TEQ-D/F/PCBs (ND=1/2 MDL)	8.9E-08	0.03	2.0E-15	1.2E-14	7.0E-10	3E-06	2E-05					
	Total Non-DL PCBs (ND=1/2 MDL)	4.8E-05	0.14	5.0E-12	3.0E-11		--	--	1.7E-14	1.3E-13	2.0E+00	3E-14	3E-13
22	TEQ-D/F/PCBs (ND=1/2 MDL)	2.6E-05	0.03	5.9E-13	3.6E-12	7.0E-10	8E-04	5E-03					
	Total Non-DL PCBs (ND=1/2 MDL)	1.0E-01	0.14	1.1E-08	6.5E-08		--	--	3.6E-11	2.9E-10	2.0E+00	7E-11	6E-10
23	TEQ-D/F/PCBs (ND=1/2 MDL)	5.7E-07	0.03	1.3E-14	7.6E-14	7.0E-10	2E-05	1E-04					
	Total Non-DL PCBs (ND=1/2 MDL)	6.6E-03	0.14	6.9E-10	4.2E-09		--	--	2.3E-12	1.9E-11	2.0E+00	5E-12	4E-11

APPENDIX D. DETAILED RISK CALCULATIONS

Population — **Hypothetical Future Construction Workers**
Exposure Area — **Random 20-acre grids across OU2**
Medium — **Surface + Subsurface Soil**
Exposure Route — **Inhalation of particulates in air**

Grid	COPC	Csoil EPC mg/kg	PEF m^3/kg	Non-Cancer EC (mg/m^3) CTE	Non-Cancer EC (mg/m^3) RME	Non-Cancer RfC mg/m^3	Non-Cancer HQ CTE	Non-Cancer HQ RME	Cancer EC (ug/m^3) CTE	Cancer EC (ug/m^3) RME	Cancer iUR $(ug/m^3)^{-1}$	Cancer Risk CTE	Cancer Risk RME
1	Total Non-DL PCBs (ND=1/2 MDL)	1.9E-01	4.4E+08	2.5E-11	5.0E-11	--	--	--	1.8E-10	7.2E-10	5.7E-04	1E-13	4E-13
2	Total Non-DL PCBs (ND=1/2 MDL)	2.9E-02	4.4E+08	3.7E-12	7.3E-12	--	--	--	2.6E-11	1.0E-10	5.7E-04	1E-14	6E-14
4	Total Non-DL PCBs (ND=1/2 MDL)	1.1E-01	4.4E+08	1.4E-11	2.7E-11	--	--	--	9.7E-11	3.9E-10	5.7E-04	6E-14	2E-13
5	Total Non-DL PCBs (ND=1/2 MDL)	no data	4.4E+08	--	--	--	--	--	--	--	5.7E-04	--	--
6	Total Non-DL PCBs (ND=1/2 MDL)	4.8E-04	4.4E+08	6.1E-14	1.2E-13	--	--	--	4.4E-13	1.7E-12	5.7E-04	2E-16	1E-15
7	Total Non-DL PCBs (ND=1/2 MDL)	1.1E-01	4.4E+08	1.4E-11	2.7E-11	--	--	--	9.7E-11	3.9E-10	5.7E-04	6E-14	2E-13
8	Total Non-DL PCBs (ND=1/2 MDL)	9.7E-01	4.4E+08	1.2E-10	2.5E-10	--	--	--	8.9E-10	3.5E-09	5.7E-04	5E-13	2E-12
9	Total Non-DL PCBs (ND=1/2 MDL)	3.3E-02	4.4E+08	4.2E-12	8.4E-12	--	--	--	3.0E-11	1.2E-10	5.7E-04	2E-14	7E-14
11	Total Non-DL PCBs (ND=1/2 MDL)	1.0E-01	4.4E+08	1.3E-11	2.6E-11	--	--	--	9.2E-11	3.7E-10	5.7E-04	5E-14	2E-13
12	Total Non-DL PCBs (ND=1/2 MDL)	no data	4.4E+08	--	--	--	--	--	--	--	5.7E-04	--	--
13	Total Non-DL PCBs (ND=1/2 MDL)	1.4E-02	4.4E+08	1.8E-12	3.6E-12	--	--	--	1.3E-11	5.2E-11	5.7E-04	7E-15	3E-14
14	Total Non-DL PCBs (ND=1/2 MDL)	6.3E-02	4.4E+08	8.2E-12	1.6E-11	--	--	--	5.8E-11	2.3E-10	5.7E-04	3E-14	1E-13
15	Total Non-DL PCBs (ND=1/2 MDL)	1.2E-03	4.4E+08	1.6E-13	3.2E-13	--	--	--	1.1E-12	4.5E-12	5.7E-04	6E-16	3E-15
16	Total Non-DL PCBs (ND=1/2 MDL)	no data	4.4E+08	--	--	--	--	--	--	--	5.7E-04	--	--
17	Total Non-DL PCBs (ND=1/2 MDL)	no data	4.4E+08	--	--	--	--	--	--	--	5.7E-04	--	--
18	Total Non-DL PCBs (ND=1/2 MDL)	2.6E-04	4.4E+08	3.4E-14	6.7E-14	--	--	--	2.4E-13	9.6E-13	5.7E-04	1E-16	5E-16
19	Total Non-DL PCBs (ND=1/2 MDL)	4.8E-05	4.4E+08	6.2E-15	1.2E-14	--	--	--	4.4E-14	1.8E-13	5.7E-04	3E-17	1E-16
22	Total Non-DL PCBs (ND=1/2 MDL)	1.0E-01	4.4E+08	1.3E-11	2.7E-11	--	--	--	9.5E-11	3.8E-10	5.7E-04	5E-14	2E-13
23	Total Non-DL PCBs (ND=1/2 MDL)	6.6E-03	4.4E+08	8.5E-13	1.7E-12	--	--	--	6.1E-12	2.4E-11	5.7E-04	3E-15	1E-14

Population **Hypothetical Future Construction Workers**
Exposure Area **Random 20-acre grids across OU2**
Medium **Surface + Subsurface Soil**
Exposure Route **Incidental Ingestion**

Summed risks across COPCs TEQ-D/F/DL-PCBs (ND=1/2 MDL) and Total Non-DL PCBs

Grid	Non-Cancer		Cancer	
	HI		Total Risk	
	CTE	RME	CTE	RME
1	3E-03	1E-02	1E-09	8E-09
2	2E-03	7E-03	1E-10	1E-09
4	6E-04	2E-03	5E-10	4E-09
5	--	--	--	--
6	9E-03	4E-02	2E-12	2E-11
7	5E-04	2E-03	5E-10	4E-09
8	4E-03	2E-02	5E-09	4E-08
9	4E-03	2E-02	2E-10	1E-09
11	1E-03	5E-03	5E-10	4E-09
12	--	--	--	--
13	2E-03	8E-03	7E-11	6E-10
14	1E-02	4E-02	3E-10	3E-09
15	6E-04	2E-03	6E-12	5E-11
16	--	--	--	--
17	--	--	--	--
18	3E-03	1E-02	1E-12	1E-11
19	2E-03	8E-03	2E-13	2E-12
22	7E-03	3E-02	5E-10	4E-09
23	1E-04	5E-04	3E-11	3E-10

APPENDIX D. DETAILED RISK CALCULATIONS

Population **Hypothetical Future Construction Workers**
Exposure Area **Random 20-acre grids across OU2**
Medium **Surface + Subsurface Soil**
Exposure Route **Dermal Contact**

Summed risks across COPCs TEQ-D/F/DL-PCBs (ND=1/2 MDL) and Total Non-DL PCBs

Grid	Non-Cancer		Cancer	
	HI		Total Risk	
	CTE	RME	CTE	RME
1	4E-04	3E-03	1E-10	1E-09
2	2E-04	1E-03	2E-11	2E-10
4	8E-04	5E-03	7E-11	6E-10
5	--	--	--	--
6	5E-06	3E-05	3E-13	3E-12
7	8E-04	5E-03	7E-11	6E-10
8	1E-03	8E-03	7E-10	5E-09
9	3E-04	2E-03	2E-11	2E-10
11	1E-04	8E-04	7E-11	6E-10
12	--	--	--	--
13	1E-04	7E-04	1E-11	8E-11
14	9E-04	6E-03	4E-11	4E-10
15	1E-05	9E-05	9E-13	7E-12
16	--	--	--	--
17	--	--	--	--
18	4E-06	2E-05	2E-13	1E-12
19	3E-06	2E-05	3E-14	3E-13
22	8E-04	5E-03	7E-11	6E-10
23	2E-05	1E-04	5E-12	4E-11

APPENDIX D. DETAILED RISK CALCULATIONS

Population Hypothetical Future Construction Workers
Exposure Area Random 20-acre grids across OU2
Medium Surface + Subsurface Soil

Exposure Unit	Exposure Route	TEQ-DF (ND=1/2MDL) & Aroclor-1254				TEQ-D/F/PCB (ND=1/2MDL) & Total non-DL PCBs			
		Non-cancer HI		Excess cancer Risk		Non-cancer HI		Excess cancer Risk	
		CTE	RME	CTE	RME	CTE	RME	CTE	RME
Grid 1	Incidental Ingestion	5E-03	2E-02	7E-10	6E-09	3E-03	1E-02	1E-09	8E-09
	Dermal Contact	9E-04	5E-03	2E-10	3E-09	4E-04	3E-03	1E-10	1E-09
	Inhalation (particulates)			7E-14	3E-13			1E-13	4E-13
	Total	6E-03	3E-02	9E-10	8E-09	3E-03	1E-02	1E-09	9E-09
Grid 2	Incidental Ingestion	2E-03	8E-03	1E-10	1E-09	2E-03	7E-03	1E-10	1E-09
	Dermal Contact	2E-04	1E-03	4E-11	4E-10	2E-04	1E-03	2E-11	2E-10
	Inhalation (particulates)			1E-14	5E-14			1E-14	6E-14
	Total	2E-03	1E-02	2E-10	1E-09	2E-03	8E-03	2E-10	1E-09
Grid 4	Incidental Ingestion	1E-03	5E-03	2E-10	1E-09	6E-04	2E-03	5E-10	4E-09
	Dermal Contact	2E-04	1E-03	5E-11	5E-10	8E-04	5E-03	7E-11	6E-10
	Inhalation (particulates)			2E-14	6E-14			6E-14	2E-13
	Total	1E-03	6E-03	2E-10	2E-09	1E-03	7E-03	6E-10	5E-09
Grid 5	Incidental Ingestion	5E-04	2E-03	1E-11	8E-11				
	Dermal Contact	4E-05	2E-04	3E-12	4E-11				
	Inhalation (particulates)			1E-15	4E-15				
	Total	5E-04	2E-03	1E-11	1E-10				
Grid 6	Incidental Ingestion	9E-03	4E-02	2E-11	2E-10	9E-03	4E-02	2E-12	2E-11
	Dermal Contact	6E-04	4E-03	7E-12	8E-11	5E-06	3E-05	3E-13	3E-12
	Inhalation (particulates)			2E-15	1E-14			2E-16	1E-15
	Total	1E-02	4E-02	3E-11	3E-10	9E-03	4E-02	3E-12	2E-11
Grid 7	Incidental Ingestion	1E-03	4E-03	2E-10	1E-09	5E-04	2E-03	5E-10	4E-09
	Dermal Contact	2E-04	1E-03	5E-11	5E-10	8E-04	5E-03	7E-11	6E-10
	Inhalation (particulates)			2E-14	6E-14			6E-14	2E-13
	Total	1E-03	6E-03	2E-10	2E-09	1E-03	7E-03	6E-10	5E-09
Grid 8	Incidental Ingestion	1E-02	4E-02	2E-09	2E-08	4E-03	2E-02	5E-09	4E-08
	Dermal Contact	2E-03	1E-02	6E-10	7E-09	1E-03	8E-03	7E-10	5E-09
	Inhalation (particulates)			2E-13	8E-13			5E-13	2E-12
	Total	1E-02	6E-02	3E-09	2E-08	6E-03	2E-02	6E-09	4E-08
Grid 9	Incidental Ingestion	5E-03	2E-02	8E-11	6E-10	4E-03	2E-02	2E-10	1E-09
	Dermal Contact	4E-04	2E-03	2E-11	3E-10	3E-04	2E-03	2E-11	2E-10
	Inhalation (particulates)			8E-15	3E-14			2E-14	7E-14
	Total	5E-03	2E-02	1E-10	9E-10	5E-03	2E-02	2E-10	1E-09
Grid 11	Incidental Ingestion	2E-03	6E-03	7E-11	5E-10	1E-03	5E-03	5E-10	4E-09
	Dermal Contact	2E-04	9E-04	2E-11	2E-10	1E-04	8E-04	7E-11	6E-10
	Inhalation (particulates)			7E-15	3E-14			5E-14	2E-13
	Total	2E-03	7E-03	9E-11	8E-10	1E-03	6E-03	6E-10	5E-09
Grid 12	Incidental Ingestion	3E-03	1E-02	3E-10	2E-09				
	Dermal Contact	4E-04	3E-03	9E-11	1E-09				
	Inhalation (particulates)			3E-14	1E-13				
	Total	3E-03	1E-02	4E-10	4E-09				
Grid 13	Incidental Ingestion	2E-03	8E-03	3E-11	2E-10	2E-03	8E-03	7E-11	6E-10
	Dermal Contact	2E-04	9E-04	9E-12	1E-10	1E-04	7E-04	1E-11	8E-11
	Inhalation (particulates)			3E-15	1E-14			7E-15	3E-14
	Total	2E-03	9E-03	4E-11	3E-10	2E-03	8E-03	8E-11	6E-10
Grid 14	Incidental Ingestion	1E-02	5E-02	5E-10	4E-09	1E-02	4E-02	3E-10	3E-09
	Dermal Contact	1E-03	7E-03	1E-10	2E-09	9E-04	6E-03	4E-11	4E-10
	Inhalation (particulates)			5E-14	2E-13			3E-14	1E-13
	Total	1E-02	5E-02	6E-10	6E-09	1E-02	5E-02	4E-10	3E-09
Grid 15	Incidental Ingestion	7E-04	3E-03	1E-11	1E-10	6E-04	2E-03	6E-12	5E-11
	Dermal Contact	5E-05	3E-04	4E-12	5E-11	1E-05	9E-05	9E-13	7E-12
	Inhalation (particulates)			1E-15	6E-15			6E-16	3E-15
	Total	7E-04	3E-03	2E-11	2E-10	6E-04	3E-03	7E-12	6E-11
Grid 16	Incidental Ingestion	3E-03	1E-02						
	Dermal Contact	2E-04	1E-03						
	Inhalation (particulates)								
	Total	3E-03	1E-02						
Grid 17	Incidental Ingestion	1E-03	4E-03						
	Dermal Contact	7E-05	4E-04						
	Inhalation (particulates)								
	Total	1E-03	4E-03						
Grid 18	Incidental Ingestion	3E-03	1E-02	3E-11	2E-10	3E-03	1E-02	1E-12	1E-11
	Dermal Contact	2E-04	1E-03	8E-12	1E-10	4E-06	2E-05	2E-13	1E-12
	Inhalation (particulates)			3E-15	1E-14			1E-16	5E-16
	Total	3E-03	1E-02	4E-11	3E-10	3E-03	1E-02	1E-12	1E-11
Grid 19	Incidental Ingestion	2E-03	8E-03	2E-11	2E-10	2E-03	8E-03	2E-13	2E-12
	Dermal Contact	2E-04	9E-04	7E-12	9E-11	3E-06	2E-05	3E-14	3E-13
	Inhalation (particulates)			3E-15	1E-14			3E-17	1E-16
	Total	2E-03	9E-03	3E-11	3E-10	2E-03	8E-03	3E-13	2E-12
Grid 22	Incidental Ingestion	8E-03	3E-02	1E-10	1E-09	7E-03	3E-02	5E-10	4E-09
	Dermal Contact	6E-04	4E-03	4E-11	4E-10	8E-04	5E-03	7E-11	6E-10
	Inhalation (particulates)			1E-14	5E-14			5E-14	2E-13
	Total	8E-03	3E-02	2E-10	1E-09	8E-03	3E-02	6E-10	5E-09
Grid 23	Incidental Ingestion	2E-04	9E-04	2E-11	2E-10	1E-04	5E-04	3E-11	3E-10
	Dermal Contact	3E-05	2E-04	7E-12	9E-11	2E-05	1E-04	5E-12	4E-11
	Inhalation (particulates)			3E-15	1E-14			3E-15	1E-14
	Total	3E-04	1E-03	3E-11	3E-10	1E-04	6E-04	4E-11	3E-10

APPENDIX D. DETAILED RISK CALCULATIONS

Population **Hypothetical Future Residents**
Exposure Area **OU2**
Medium **Groundwater**
Exposure Route **Ingestion as drinking water**
COPC **Total Manganese**

	Non-Cancer HQ Based on Total Recoverable Manganese					
	EPC	DI (mg/kg-d)		RfD	HQ	
Exposure Area	ug/L	CTE	RME	mg/kg-d	CTE	RME
EU1	966	1.3E-02	3.3E-02	4.7E-02	3E-01	7E-01
EU2	2,820	3.7E-02	9.7E-02	4.7E-02	8E-01	2E+00
EU3	212	2.8E-03	7.3E-03	4.7E-02	6E-02	2E-01

Pink shading indicates a non-cancer HQ > 1.

Population **Hypothetical Future Workers**
Exposure Area **OU2**
Medium **Groundwater**
Exposure Route **Ingestion as drinking water**
COPC **Total Manganese**

		Non-Cancer				
	EPC	DI (mg/kg-d)		RfD	HQ	
Exposure Area	ug/L	CTE	RME	mg/kg-d	CTE	RME
EU1	966	4.5E-03	1.0E-02	4.7E-02	1E-01	2E-01
EU2	2,820	1.3E-02	3.0E-02	4.7E-02	3E-01	6E-01
EU3	212	9.9E-04	2.3E-03	4.7E-02	2E-02	5E-02

APPENDIX D. DETAILED RISK CALCULATIONS

Population **Hypothetical Future Residents**
Exposure Area **OU2**
Medium **Groundwater [HQ for EU] + Surface Soil [Max HI for grid within GW EU]**

	Groundwater		Surface Soil		Total	
	HQ		HI		HI	
Exposure Area	CTE	RME	CTE	RME	CTE	RME
EU1/Grid 8	3E-01	7E-01	2E-02	7E-02	3E-01	8E-01
EU2/Grid 11	8E-01	2E+00	7E-03	2E-02	8E-01	2E+00
EU3/Grid 14	6E-02	2E-01	5E-02	1E-01	1E-01	3E-01

Pink shading indicates a non-cancer HQ > 1.

Population **Hypothetical Future Workers**
Exposure Area **OU2**
Medium **Groundwater [HQ for EU] + Surface Soil [Max HI for grid within GW EU]**

	Groundwater		Surface Soil		Total	
	HQ		HI		HI	
Exposure Area	CTE	RME	CTE	RME	CTE	RME
EU1/Grid 8	1E-01	2E-01	8E-03	2E-02	1E-01	2E-01
EU2/Grid 11	3E-01	6E-01	2E-03	4E-03	3E-01	7E-01
EU3/Grid 14	2E-02	5E-02	1E-02	3E-02	3E-02	8E-02