US Army Corps of Engineers®

Seattle District

FINAL REMEDIAL INVESTIGATION AND BASELINE RISK ASSESSMENT REPORT

Remedial Investigation/ Feasibility Study

Moses Lake Wellfield Superfund Site

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LIST OF ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
ASG	active soil gas
AST	Above ground storage tank
ASTM	American Society for Testing and Materials
AT	Averaging Time
ATSDR	Agency for Toxic Substances and Disease Registry
AW	Alluvial Well
BBCC	Big Bend Community College
bgs	Below Ground Surface
BLM	Bureau of Land Management
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
BUTL	Background Upper Tolerance Limit
BW	a-Basalt Well
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COPC	chemical of potential concern
COPEC	Chemical of Potential Ecological Concern
cPAH	Carcinogenic Poly-Aromatic Hydrocarbon
CSF	Cancer Slope Factor
CSM	Conceptual Site Model
CV	Coefficient of Variation
Diesel – Dx	Total Petroleum Hydrocarbons Diesel Extended Analysis
DNAPL	Dense Non-Aqueous Phase Liquid
DO	Dissolved Oxygen
DoD	Department of Defense
DQI	Data Quality Indicator
DQO	Data Quality Objective
DSHS	Department of Social and Health Services
Eco SSL	Ecological Soil Screening Level
EDMS	Environmental Data Management System
E & E	Ecology and Environment
EF	Exposure Frequency
EM	Electromagnetometry
EMLL	Electromagnetic Line Locating
EPC	Exposure Point Concentration
ERA	Ecological Risk Assessment
FCR	Field Change Request
FPXRF	Field Portable X-ray Fluorescence
FS	Feasibility Study
FSP	Field Sampling Plan
GC	Gas Chromatography
GDMS	Geographic Data Management System
GIS	Geographic Information System
GMA	Growth Management Act
GPR	Ground Penetrating Radar
GPS	Global Positioning System

LIST OF ACRONYMS
(Continued)

Gro-Gx	Total Petroleum Hydrocarbons Gasoline Extended Analysis
HDG	Hydrogen Dissolved Gas
HEAST	Health Effects Assessment Summary Tables
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
IEUBK	Integrated Exposure Uptake Biokinetic
IRA	Interim Remedial Action
IRIS	Integrated Risk Information System
IWTF	Industrial Waste Treatment Facility
JAL	Japan Airlines
LAFB	Larson Air Force Base
LOAEL	lowest-observed-adverse-effects-levels
LOX	Liquid Oxygen
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
MHz	Megahertz
MNA	monitored natural attenuation
MR	Microcontgens
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MSL	Mean Sea Level
MTCA-A	Model Toxicity Control Act - Level A
NAD27	1927 North American Datum
NAVD88	North American Vertical Datum, 1988 Adjustment
NCEA	National Center for Environmental Assessment
NFC	No Further Characterization
NGVD29	National Geodetic Vertical Datum of 1929
NOAEL	No Observable Adverse Health Effect Level
NTU	Nephelometric Turbidity Units
Oilm-Dx	Total Petroleum Hydrocarbons in the Oil Range
ORP	Oxygen Reduction Potential
PAH	Polyaromatic Hydrocarbon
PARCC	Precision, accuracy, representativeness, completeness and comparability
PCB	Polychlorinated Biphenyl
PFID	Preliminary Field Investigation Data
PID	Photoionization Detector
PPB	Parts Per Billion
PPBV	Parts Per Billion by Volume
PQL	Practical Quantitation Limit
PRG	Preliminary Remediation Goal
PSA	Potential Source Area
PVC	Poly-Vinyl Chloride

LIST OF ACRONYMS
(Continued)

QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
QCSR	Quality Control Summary Report
RCP	Reinforced Concrete Pipe
RfD	Reference Dose
RI	Remedial Investigation
ROE	Right of Entry
SAP	Sampling and Analysis Plan
SARA	Superfund Amendment and Reauthorization Act
SBSR	Site Background Summary Report
SCTM	Site Characterization Technical Memorandum
SDG	Sample Data Group
SOP	Standard Operating Procedure
SPCS	State Plane Coordinate System
SVOC	Semi Volatile Organic Compound
TBC	To Be Considered
TCE	Trichloroethene
TEF	Toxicity Equivalency Factor
TEL	Tetraethyl Lead
TL1	terrestrial plants
TL2	terrestrial invertebrates
TPH	Total Petroleum Hydrocarbons
TPH-Dx	Total Petroleum Hydrocarbons Diesel Extended Analysis
TPH-Gx	Total Petroleum Hydrocarbons Gasoline Extended Analysis
TRV	toxicity reference values
TRW	Technical Review Workgroup
UCL	Upper Confidence Limit
UF	Uncertainty Factor
UGA	Urban Growth Area
USACE	U.S. Army Corps of Engineers
USAF	United States Air Force
USEPA	Environmental Protection Agency
USGS	United States Geological Survey
UST	Underground Storage Tank
VFw	Volatility Factor for Water
VOC	Volatile Organic Compound
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WRATS	Water Rights Application Tracking System
WWTP	Waste Water Treatment Plant

LIST OF DEFINITIONS

a-basalt –	The shallowest interval of the Wanapum Basalt, which consists of weathered, porous and fractured basalt.
Alluvium	A general term for clay, silt, sand and gravel or similar unconsolidated material that was deposited during relatively recent geologic time by a stream or other body of running water.
Aphanitc -	Said of the texture of an igneous rock in which the crystalline components are not distinguishable by the unaided eye.
Aphyric -	Said of the texture of a fine-grained or aphanitc igneous rock that lacks phenocrysts.
Aquifer test –	A test involving the withdrawal of measured quantities of water or solid slug from, or addition of water to, a well and measurement of the resulting changes in water level in the formation both during and after the period of discharge or addition.
Aquitard –	A geologic unit that retards, but does not prevent, the flow of water to or from an adjacent aquifer. It does not readily yield water to wells or springs but may serve as a storage unit for groundwater.
b-basalt -	The second interval within the Wanapum Basalt, which is characterized by a fine grained, dark gray basalt with minor fracturing and vesicular zones.
Breccia	A coarse-grained rock composed of angular, broken rock fragments held together by a mineral cement or a fine grained matrix.
Brecciation	Formation of a breccia.
Caliche	A reddish-brown to buff or white calcareous material of secondary accumulation, commonly found in layers on or near the surface of soils in arid and semi-arid regions.

LIST OF DEFINITIONS
(Continued)

Change in storage -	Change in amount of water retained in an aquifer as represented by changes in water levels measured in a well or wells.
Colonnade	In columnar jointed volcanic rocks (basalt) the lower zone that typically has well formed columns.
Columbia River Basalt Group -	Miocene basalts of central and southern Washington and northern Oregon. Consists of over 300 individual flows.
Conceptual Site Model -	A conceptual model that identifies the pathways and exposure routes between sources of contamination and living organisms.
Conceptual Hydrogeologic Model -	A model that describes the hydrostratigraphy, structural and hydraulic features of the subsurface materials at a site.
Conductivity (Hydraulic)	A coefficient of proportionality describing the rate at which water can move through a permeable medium.
Contact -	A surface separating two types or ages of rock.
Contaminant transport modeling -	A model that describes the rate and transport processes associated with movement of a contaminant in the environment.
Dip –	The angle that a structural surface, e.g. a bedding or fault plane, makes with the horizontal; measured perpendicular to the strike of the structure and in the vertical plane.
Entablature	In columnar jointed volcanic rocks (basalt) the upper zone that has thinner and less regular columns that the lower zone, or colonnade.
Escarpment -	A continuous cliff or relatively steep slope facing in one general direction, breaking the continuity of the land by separating two level or gently sloping surfaces, and produced by erosion or faulting. The cliff between Cascade Valley and the Skyline district is a good example of an escarpment.

LIST OF DEFINITIONS
(Continued)

Ferrous Iron -	Iron that exists in the reduced (+2) valence state.
Fluvial	Of or pertaining to a river or rivers
Formation	A formal body of rock identified by rock type characteristics and vertical position within the total series of rock.
Glacial Lake Missoula -	An ancient lake formed during the last period of glaciation, about 10,000 years ago, that catastrophically drained during Pleistocene times creating the scabland topography evident in much of eastern Washington.
Glomerocryst	An aggregate of crystals of the same mineral.
Glomerophyric -	Said of the texture of an igneous rock that contains clusters of crystals.
Head -	Water level elevation in a well.
Hydraulic gradient -	The change in total head with a change in distance in the direction, which yields the maximum rate of change in head.
Hydrographs -	A graph that shows some property of groundwater or surface water (e.g. water level) as a function of time.
Hydrostratigraphic units –	Geologic units with similar hydraulic properties are grouped into hydrostratigraphic units to develop a conceptual hydrogeologic model.
Interfluve	The area between rivers, especially the relatively un-eroded upland or ridge between to river valleys containing streams flowing in the same general direction.
Isopach -	A contour line drawn on a map through points of true thickness of a designated stratigraphic unit or group of stratigraphic units.

LIST OF DEFINITIONS
(Continued)

Low-flow sampling -	A method of sampling that induces laminar (non-turbulent) flow in the immediate vicinity of the sampling pump intake, thus drawing fresh groundwater directly from the aquifer and minimizing disturbance in the well and in the aquifer.
Major ions -	The chemical components that describe the largest fraction of the dissolved solutes (i.e. calcium, sodium, chloride, bicarbonate, sulfate, potassium and chloride).
Olivine	A common rock-forming mineral that is typically olive-green, grayish-green or brown.
Outcrop –	That part of a geologic formation or structure that appears at the surface of the earth; also, bedrock that is covered only by thin surficial deposits such as Pleistocene sediments.
Packer tests –	An aquifer test preformed in an open borehole: the segment of the borehole to be tested is sealed off from the rest of the borehole by inflating seals, called packers, both above and below the segment. Packer tests were preformed in the a- and b-basalt in order to measure hydraulic conductivity.
Paleochannel	A remnant of a stream channel cut in older rock and filled in with sediments of younger overlying rock; a buried stream channel.
Phenocryst -	Relatively large conspicuous crystals in a porphyritic rock.
Phyric -	A textural term for basaltic rocks meaning to contain phenocrysts
Pinch-out	The gradual thinning of a geologic unit to the point of absence along a lateral boundary.
Plagioclase	A common rock-forming mineral that consists of numerous subspecies and is typically whitish-gray or gray.

Pleistocene –	A segment of geologic time that began two to three million years ago and lasted until the start of the Holocene some 8,000 years ago. The Pleistocene is an epoch within the Quaternary Period.
Pleistocene sediments -	Sediments deposited during the Pleistocene. At the site, they represent the uppermost stratigraphic unit encountered in the study area, which consisted of unconsolidated sand to boulder-sized material. Subrounded basalt clasts make up approximately 95 percent of the coarse material within the sediments. The remaining 5 percent of the coarse material consists of subrounded clasts of granitic rock and medium to coarse sand.
Plunge	The inclination of a fold axis or other linear geologic feature.
Porphyritic -	Said of the texture of an igneous rock that consists of larger crystals (phenocrysts) set in a finer grained groundmass, which may be crystalline or glassy or both.
Potentiometric surface maps -	A contour map of the surface that represents the level to which water will rise in tightly cased wells. The water table is the particular potentiometric surface for an unconfined aquifer.
Priest Rapids Member -	The upper member of the Wanapum Basalt present within the study area.
Proglacial flooding -	Flooding caused by a break an ice dam, which contained a lake, e.g., Glacial Lake Missoula.
Quaternary -	A geologic period of time consisting of the Pleistocene and Holocene epochs. It began two to three million years ago up to the present time.
Quincy Basin -	One of a series of basins that formed during development of the Columbia Plateau.
Roza Member -	The lower member of the Wanapum Basalt

Ringold Formation -	Plio-pleistocene sediments consisting of medium sand to clay with some caliche. These sediments underlie the Pleistocene sediments over most of the study area.
Scabland	An elevated area underlain by flat-lying basalt flows with a thin soil cover and sparse vegetation and usually with deep, dry channels scoured into the surface.
Storage coefficient –	The volume of water an aquifer releases from or takes into storage per unit surface area of the aquifer per unit change in head. It is equal to the product of specific storage and aquifer thickness. In an unconfined aquifer, the storativity is equivalent to the specific yield.
Syncline	A fold of which the core contains the younger rocks and is generally concave upward.
Wanapum Basalt Formation –	The Miocene basalt formation of that is part of the Columbia River Basalt Group located above the Vantage Member and below the Saddle Mountains Basalt.
Water table -	The surface in an unconfined aquifer or confining bed at which the pore pressure is atmospheric. It can be measured by installing a shallow well extending a few feet into the zone of saturation and measuring the water level in the well.
Well completion logs -	A diagram that is used to describe the rock types encountered and the construction details of a well.
Zeolites -	A family of hydrous, silicate minerals. Zeolites are common alteration products found in the vesicles of basalts.

EXECUTIVE SUMMARY

This report provides the results of Remedial Investigations and Baseline Human Health and Ecological Risk Assessments conducted at the Moses Lake Wellfield Superfund Site. A Feasibility Study will be conducted following the completion of the Remedial Investigations. This report has been prepared in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act, U.S. Environmental Protection Agency guidelines and the requirements of the U.S. Army Corps of Engineers' Hazardous, Toxic and Radioactive Waste program.

The purpose of this report is to document data collection and analysis for Remedial Investigations and groundwater sampling conducted between June 1999 and January 2003. This report also provides results from the Baseline Human Health and Ecological Risk Assessments. The information provided in this document will be used to support the Feasibility Study.

The Grant County Airport was initially developed in November 1942 as the Moses Lake Army Air Base. During the 1940s, it was used for training pilots and testing aircraft. In 1950, it was renamed Larson Air Force Base and served as a Tactical Air Command base, a Military Air Transport Service facility, a Strategic Air Command base and for testing of the Boeing B-52. In 1964, the Department of Defense announced that Larson Air Force Base would be excessive to their needs. In 1966, the Grant County Port District acquired a major portion of the property and began operating the former base as the Grant County Airport. As of 1994, the Port of Moses Lake owned approximately 4,667 acres contiguous to and near the airport.

Based on the site history and the results of the Remedial Investigations, a total of 41 PSAs were identified, 13 of which were categorized as No Further Characterization sites. "No Further Characterization" is the term agreed upon by the U.S. Army Corps of Engineers and the Environmental Protection Agency indicating that the Remedial Investigations are likely complete for a specific portion of the Moses Lake Wellfield. The remaining 28 PSAs were grouped into three categories: 1) landfills; 2) open pits, ditches and drains; and 3) surface discharge areas.

Investigative and analytical methods used during the Remedial Investigations are listed below.

- Reviewing of historical information and aerial photographs
- Personnel interviewing
- Field reconnaissance and mapping
- Geophysical surveying
- Landfill trenching
- Geologic and hydrogeologic analysis
- Surface soil sampling and analysis
- Active soil gas sampling and analysis
- Installation, sampling and analysis of monitoring wells

- Domestic well sampling and analysis

The upper geologic units within the study area are alluvial sediments consisting of unconsolidated fluvial gravel and flood sediments of the Hanford Formation, underlain by sand, silt and clay of the Ringold Formation. The Ringold Formation is absent in the eastern portion of the study area and, like the overlying Hanford Formation, increases in thickness westward.

These alluvial sediments are underlain by basaltic bedrock of the Wanapum Basalt. The Wanapum Basalt consists of four members, two of which were investigated during the Remedial Investigations (the Priest Rapids and Roza Members). The Roza Member is divided into three flows (Roza 1, Roza 2 and Roza 3), with Roza 1 Flow situated on top. Three features characterize the Priest Rapids and the vesiculated portion of the Roza 1 Flow (formerly called the a-basalt): dense fracturing and local brecciation, mineral alteration and/or the presence of vesicles.

The lower, entablature-colonnade portion of the Roza 1 Flow is a fine grained, dark gray unit, but fracturing and vesicular zones are minor. Features that might create transmissive fluid pathways were not evident and little mineral alteration was observed.

The water table generally occurs within the Hanford Formation in the southern to central portions of the study area and then crosses the contact with the Ringold Formation. The water table is therefore within the Ringold Formation in the northern portion of the study area. Groundwater levels in the alluvium (Hanford and Ringold Formations) generally indicate south to southwest lateral groundwater flow with some areas of westerly flow. Groundwater levels in the basalt generally indicate south to southwest flow. Groundwater flow directions vary seasonally by as much as 35 to 40 degrees.

The alluvium and basalt exhibit similar water levels in the northern and eastern portions of the study area where the Ringold Formation is absent. In the southern portion of the study area, where the Ringold Formation is present, water levels in the basalt are lower by a few to more than 15 feet than in the alluvium. These differences are most pronounced in the summer and fall and are a response to seasonal pumping from the aquifer for irrigation. These pumping effects are most dominant in the basalt aquifer.

The former Liquid Oxygen Generating Plant was a potential source area located in the northeastern portion of the study area to the east of the Grant Count Airport runways. Reconnaissance of the site during the 2000 RI revealed the presence of two concrete sumps on-site. The first sump was a rectangular, buried, concrete tank with its top flush to the ground surface. The second was a small square concrete sump approximately 100 feet from the first one. Both sumps contained liquids, which were sampled and found to contain 210,000 parts per billion trichloroethylene (smaller sump) and 260,000 parts per billion trichloroethylene (larger sump). The tanks, associated piping and obviously contaminated soils were subsequently removed.

Three phases of soil gas sampling were conducted at the Liquid Oxygen Generating Plant in 2000, 2001 and 2002. The 2000 sampling event was conducted prior to removal of the

sumps; the 2001 sampling event was conducted about three weeks after removal of the sumps; and the 2002 sampling event was conducted approximately one year after removal of the sumps. The results of the soil gas sampling revealed the following:

- 2000 - Up to 7,200 parts per billion trichloroethylene
- 2001 - Up to 120,000 parts per billion trichloroethylene
- 2002 - Up to 7,300 parts per billion trichloroethylene

The highest concentrations of trichloroethylene were generally found near the larger of the two sumps. Some of the soil gas sampling was conducted at multiple depths to a maximum of 40 feet below ground surface. In some boreholes, trichloroethylene concentrations increased with depth suggesting that higher concentrations may be present below the deepest samples collected.

In 2001, well 01-BW01 was installed within the top 15 feet of basalt downgradient of the Liquid Oxygen Generating Plant to evaluate potential impacts from this site. The well has been sampled twice in May 2001 and October 2002 and analyzed for volatile organic compounds. Trichloroethylene was non-detect during both sampling events.

The distribution of trichloroethene in groundwater monitoring wells and domestic wells exhibits a considerable amount of spatial variation throughout the study area. However, the concentrations reported in each well have been relatively consistent between sampling events. These factors are controlled by the hydrostratigraphy and hydrogeologic characteristics of the site. The alluvium wells generally contained trichloroethene concentrations that were less than in basalt wells throughout the site, with maximum concentrations considerably less (up to 5.1 µg/L versus up to 61 µg/L since November 1999). Domestic wells exhibited similar concentrations as the alluvium wells although some domestic wells have historically reported trichloroethene as high as 28 µg/L. The observed higher concentrations (greater than 5.0 µg/L) occurred in two general areas. The first area was in the central portion of the study area (e.g., just south of the runways), and the second area was in the southern portion of the study area (e.g., in the vicinity of the Skyline neighborhood).

Baseline Human Health and Ecological Risk Assessments were conducted to evaluate potential risks to human health and the environment from chemicals present in, or released from, media associated with the site. Media and site characterization data evaluated in the human health and ecological risk assessments included soil and soil gas sampling results collected from PSAs and groundwater monitoring data collected from the alluvium and basalt monitoring wells. These data were screened to identify chemicals of potential concern and chemicals of potential ecological concern for evaluation in the Baseline Human Health and Ecological Risk Assessments, respectively.

The sampling data collected at the site were found to meet U.S. Environmental Protection Agency data usability criteria and were forwarded to the screening phase. The screening phase consisted of an evaluation of the sampling data against a second set of U.S. Environmental Protection Agency criteria for the identification of site-specific chemicals

of potential concern and chemicals of potential ecological concern. These screening criteria were as listed below.

- Frequency of chemical detection
- Essential nutrient status
- Comparison of chemical detections to laboratory and field blanks
- Comparison of chemical concentrations to background levels
- Comparison of chemical concentrations to Applicable or Relevant and Appropriate Requirements, To Be Considered criteria, and other risk-based criteria

Screening for human health chemicals of potential concern was conducted separately for PSAs and groundwater. Data collected from the PSAs were further segregated into soil and soil gas sampling results for purposes of screening. The media-specific screening criteria that were used in the selection of chemicals of potential concern for evaluation in the Human Health Risk Assessment are listed below.

- Soil samples: U.S. Environmental Protection Agency Region 9 Preliminary Remediation Goals (October, 2002) and amended (February 12, 2001) Model Toxics Control Act—Method A Cleanup Levels for Industrial Soils
- Soil gas samples: U.S. Environmental Protection Agency Region 9 Preliminary Remediation Goals for Ambient Air (October, 2002)
- Groundwater samples: U.S. Environmental Protection Agency Region 9 Tap Water Preliminary Remediation Goals (October, 2002) and amended (February 12, 2001) Model Toxics Control Act-Method A Groundwater Cleanup Levels

Consistent with U.S. Environmental Protection Agency Region 10 policy, maximum detected concentrations of carcinogenic chemicals in each medium were evaluated based on a chemical-specific target risk level. The chemical-specific target risk level was 1.0×10^{-6} (i.e., equal to the above carcinogenic screening criteria). Non-carcinogenic chemicals were evaluated using a target hazard quotient of 0.1 (i.e., one-tenth of the above non-carcinogenic screening criteria). In concurrence with EPA, the current federal primary drinking water standard and MTCA-A Groundwater Clean-up Level of 5 µg/L was selected as the screening level for TCE in groundwater. This level is higher than the 10^{-6} risk level associated with the Region IX PRG of 1.6 µg/L. Based upon human health risk screening, Sites 8 and 31 were found to have no analyte concentrations above chemical of potential concern screening levels and were not further evaluated in the Baseline Human Health Risk Assessment. For Sites 14, 15 and 33, soil sampling results were below chemical of potential concern screening criteria, but soil gas sampling results exceeded chemical of potential concern screening criteria. These three PSAs were further evaluated in the Baseline Human Health Risk Assessment, along with the remaining

PSAs, for which chemical concentrations exceeded chemical of potential concern screening criteria based on soil and/or soil gas sampling results.

The identification of potentially exposed populations for evaluation of PSAs in the Baseline Human Health Risk Assessment was based on current and future land uses for the site, as defined in the Grant County Master Plan. Consistent with the Grant County Master Plan, PSAs were segregated into those associated with a future "commercial/industrial" land use area, comprised of the Grant County Airport and associated industrial facilities, and a future "residential" land use area comprised of residential, rural agricultural, and commercial areas located south of the former Larson Air Force Base. These functional land use categories were also used to evaluate exposures to groundwater by future residential and future commercial/industrial receptors. Consistent with Model Toxicity Control Act - Level A regulations and U.S. Environmental Protection Agency Region 10 policy, however, all groundwater in the State of Washington is considered a potential drinking water resource. Therefore, a hypothetical unrestricted drinking water scenario was also evaluated for all land use areas.

Exposure point concentrations were developed for all chemicals of potential concern identified in PSAs or groundwater. Exposure point concentrations for PSAs were based on the maximum or 95 percent upper confidence limit on the mean concentrations of chemicals of potential concern detected in soil or soil gas samples collected to a maximum depth of 15 feet below ground surface. Exposure point concentrations for groundwater were based on the maximum or 95 percent upper confidence limit on the mean concentrations of chemicals of potential concern detected in individual wells, or well clusters, representing the Hanford and Ringold Formation, or the Priest Rapids Member and the Roza 1 Flow. Well clusters were identified for grouped monitoring wells that appear to represent contamination from a common source of trichloroethene and/or share common transport pathways. Three well clusters were identified as follows: Priest Rapids Cluster #1 (99-BW18 and 99-BW10); Roza 1 Flow Cluster #1 (91-BW03, 92-BW01, 99-BW01, 99-BW15 and 02-BW02); and Drinking Water Supply Well Cluster #1 (WP-15E and WP-15W). In addition, Roza Cluster #1 was further segregated into Roza Cluster #1a (91-BW03, 92-BW01 and 99-BW01) and Roza Cluster #1b (99-BW15 and 02-BW-02) and evaluated in the Baseline Human Health Risk Assessment because of uncertainties regarding potential sources and transport mechanisms in the vicinity of Roza Cluster #1.

These well clusters were identified based upon the updated hydrologic conceptual model and a hypothesis that the Priest Rapids and Roza 1 Flow represent separate hydrologic units. An alternate hypothesis is that the Priest Rapids and Roza 1 Flow function as a single hydrologic unit. To assess risks associated with this hypothesis, well clusters or individual wells were merged into a combined Priest Rapids/Roza 1 Flow hydrologic unit. Exposure point concentrations for well clusters were based on the maximum, or 95 percent upper confidence limit on the mean, concentrations of trichloroethene for the grouped data. Exposure point concentrations for individual wells were based on maximum detected concentrations of trichloroethene or other chemicals of potential concern.

Exposure doses (i.e., chemical intakes) were calculated for each receptor population identified for a given PSA and monitoring well, or well cluster, based upon methods and assumptions representing the "reasonable maximum exposure" case, consistent with U.S. Environmental Protection Agency Region 10 guidance. The following PSAs were associated with carcinogenic risk and non-carcinogenic hazard estimates below the U.S. Environmental Protection Agency's acceptable risk range of 10^{-6} to 10^{-4} and hazard index equal to 1.0: Sites 2, 3a, 3b, 3c, 4a, 4b, 5, 9, 14, 16, 19b, 20, 23, 33, and 35. Sites 6a and 6b, 17, 18, and 19 were associated with carcinogenic risk and non-carcinogenic hazard estimates within the U.S. Environmental Protection Agency's acceptable risk range of 10^{-6} to 10^{-4} and hazard index equal to 1.0. No PSAs, including the LOX Plant, exceeded risk or hazard criteria based on the results of soil gas sampling. For Sites 6a and 6b, the estimated cancer risk of 2.8×10^{-5} exceeds the Model Toxics Control Act acceptable risk criterion of 1.0×10^{-5} due to the presence of arsenic in soils at a maximum concentration of 94 mg/kg. Site 22 was associated with a total hazard index in excess of the U.S. Environmental Protection Agency and Model Toxics Control Act acceptable hazard criterion of 1.0 due to the presence of Aroclor 1254 in soils at a maximum detected concentration of 8.4 mg/kg. In addition, the results of the Baseline Human Health and Ecological Risk Assessment indicated that lead concentrations in Site 22 soils might pose a potential hazard to future construction workers potentially exposed to site soils. Although carcinogenic risk and noncarcinogenic hazard estimates for Sites 11 and 35 were below the U.S. Environmental Protection Agency's acceptable risk range of 10^{-6} to 10^{-4} and hazard index equal to 1.0, concentrations of petroleum hydrocarbons exceeded Model Toxics Control Act - Method A Cleanup Levels for Soils – Protection of Groundwater Quality criteria. Concentrations of Oilm-Dx up to 14,000 mg/kg in soils at Site 11 exceeded the Model Toxics Control Act - Method A Cleanup Levels for Soils – Protection of Groundwater Quality criterion of 2,000 mg/kg. Concentrations of Gro-Gx up to 110 mg/kg, Diesel-Dx up to 16,000 mg/kg, and Oilm-Dx up to 31,500 mg/kg in soils at Site 35 exceeded Model Toxics Control Act - Method A Cleanup Levels for Soils – Protection of Groundwater Quality criteria of 100 mg/kg, 2,000 mg/kg and 2,000 mg/kg, respectively.

The results of screening for chemicals of potential concern in groundwater indicated that trichloroethene concentrations measured in the Hanford and Ringold Formations were below the screening criterion of 5.0 µg/L. One exception to this is in monitoring well 00-AW11 located in the central portion of the study area, which was slightly above the screening criterion. Other chemicals exceeding screening criteria in alluvium groundwater included two trihalomethanes (bromodichloromethane and dibromochloromethane) in monitoring well 91-AW14 and two petroleum-related compounds (1,2,4-trimethylbenzene and 1,3,5-trimethylbenzene) in monitoring well 91-AW15. The two trihalomethanes, bromodichloromethane and dibromochloromethane, were detected in drinking water well WP-13E at concentrations above their respective screening criteria. Maximum concentrations of trichloroethene exceeded its screening criterion in four wells screened in the Priest Rapids Member (i.e., 99-BW10, 99-BW15, 99-BW18 and 00-BW12). Other chemicals exceeding screening criteria in the Priest Rapids Member included benzene (00-BW11), manganese (00-BW02, 00-BW12 and 00-BW13), and methy tert-butyl ether (00-BW18). Maximum concentrations of trichloroethene exceeded its screening criterion in seven wells screened in the Roza

Member (i.e., 91-BW03, 92-BW01, 99-BW01, 99-BW15, 99-BW16, 02-BW01 and 02-BW02). Maximum concentrations of MTBE (92-BW02) and acetone (02-BW02) in wells screened in the Roza Member also exceeded their respective screening criteria.

Data from wells screened in the Priest Rapids and Roza Members were also combined. Since chemical of potential concern screening was performed on a well-specific basis, however, screening results for this combined unit are the same as those described above for the Priest Rapids and Roza Member wells.

Stratigraphic intervals for drinking water wells are generally not known. Therefore, drinking water wells were not assigned to a groundwater stratigraphic unit. Maximum concentrations of trichloroethene exceeded the screening criterion in drinking water wells WP-14, WP-15E and WP-15W. However, there are exceptions for wells WP-15E and WP-15W, which are adjacent to the skyline replacement well. As such, the "screened" lithology can be more accurately determined than for other domestic wells. Based on the Skyline Replacement well, well WP-15E appears to be open to the Ringold Formation, the Priest Rapids Member and the Roza 1 Flow. Well WP-15W appears to be open to the Roza 1 and Roza 2 Flows and possibly the Priest Rapids Member

All groundwater stratigraphic units were further evaluated in the Baseline Human Health Risk Assessment because they contained trichloroethene and other chemicals of potential concern. For all monitoring wells or well clusters evaluated in the Baseline Human Health Assessment, with the exception of monitoring well 02-BW02, carcinogenic risk and non-carcinogenic hazard estimates were within the U.S. Environmental Protection Agency's acceptable risk range of 10^{-6} to 10^{-4} and had a hazard index equal to 1.0. In addition, these risk and hazard estimates were below the Model Toxics Control Act risk and hazard criteria of 1×10^{-5} and 1.0, respectively. The estimated non-cancer hazard index (18) for monitoring well 02-BW02 was attributable to the presence of acetone at a concentration of 19 µg/L. Acetone is a common laboratory contaminant; however, confirmation samples confirmed that the maximum detected concentration of 19 µg/L is an accurate measurement of acetone in well 02-BW02. The potential source of acetone in 02-BW02 is not currently known, but this chemical has not previously been identified as a significant contaminant in groundwater associated with the site.

Based upon the above results, concentrations of trichloroethene detected in groundwater associated with the site are not anticipated to pose a significant risk to human health. It should be noted, however, that concentrations of trichloroethene in numerous wells associated with the site exceed the federal and State drinking water standard of 5.0 µg/L, which is a recognized Applicable or Relevant and Appropriate Requirement. Evaluation of the compliance of trichloroethene and other chemicals with Applicable or Relevant and Appropriate Requirements will be conducted during the Feasibility Study. Chemicals and media that are not in compliance with Applicable or Relevant and Appropriate Requirements as a result of this evaluation will be considered further in the Feasibility Study as part of the Remedial Measures Study. Appropriate remedial decisions concerning such chemicals and media will be made based upon the results of this study.

An Ecological Risk Assessment was conducted to evaluate the potential impacts of contaminants released from the site on ecological habitats and receptors (i.e., plants or wildlife). The study area for the Ecological Risk Assessment included PSAs located within and adjacent to the boundaries of the former Larson Air Force Base and areas hydraulically downgradient of the former Larson Air Force Base that might have been impacted by chemicals of potential concern. The Ecological Risk Assessment included an assessment of the biological resources located in the vicinity of the site and the selection of assessment and measurement endpoints for evaluation of potential impacts to ecological habitats and receptors. Based on the nature of the contaminants, the results of the hydro-stratigraphic model, and the low likelihood that significant concentrations of contaminants will migrate to surface water bodies in the vicinity of the site, aquatic and riparian receptors inhabiting or using Crab Creek or Moses Lake were not quantitatively evaluated in the ecological risk assessment. Potential uncertainties associated with these assumptions were identified and discussed in the qualitative portion of the Ecological Risk Assessment. The quantitative Ecological Risk Assessment focused on terrestrial receptors potentially inhabiting or using the PSAs.

The following PSAs contain no usable habitat and were not further evaluated in the Ecological Risk Assessment: Sites 2, 3a, 3b, 3c, 4a, 4b, 5, 9, 12, 14, 16, 18, 19b, 23 and 25. For the remaining PSAs, the Ecological Risk Assessment included a comparison of soil sampling results to chemical of potential ecological concern screening criteria. The quantitative Ecological Risk Assessment included the development of hazard index estimates for each of the five indicator receptors potentially exposed to each PSA. The hazard index estimates were based on the specific chemicals of ecological concern identified for each PSA and their measured concentrations in soil. Site-specific chemicals of potential ecological concern were identified for each PSA based on a comparison of soil sampling results to protective screening criteria. Consistent with U.S. Environmental Protection Agency Region 10 policy, screening criteria for chemicals of potential ecological concern consisted of Model Toxics Control Act—Method A Soil Cleanup Levels for Plants, Soil Biota, and Wildlife. Screening was conducted using a target hazard quotient of 0.1 (i.e., one-tenth of the applicable screening criteria).

Based upon the highly conservative nature of the screening process, screening criteria were exceeded for one or more chemicals at all PSAs, with the exception of Site 11. For Site 11, the maximum concentrations of soil analytes were below available screening criteria. However, ecological screening criteria were unavailable for Oilm-Dx, and this petroleum-related substance was detected in soils at concentrations up to 14,000 mg/kg. Based on the nature of this site as a former burn pit, the relatively high concentrations of Oilm-Dx detected, and the presence of stressed vegetation at this site, Site 11 was retained for evaluation in the ecological risk assessment.

Ecological hazard index estimates were calculated for all remaining PSAs. With the exception of Sites 6a and 6b, all receptor-specific hazard index estimates were below the U.S. Environmental Protection Agency and Model Toxics Control Act acceptable ecological hazard criterion of 1.0. The ecological hazard criterion of 1.0 was slightly exceeded by hazard index estimates for the Washington ground squirrel, Great Basin pocket mouse, and sage sparrow at Sites 6a and 6b. Metals in soil that contributed to

excess hazard index estimates for these indicator receptors were arsenic, chromium, copper, nickel and zinc. Maximum detected concentrations of these inorganic chemicals were elevated above typical levels observed in western United States soils. Consequently, Sites 6a and 6b were proposed for further evaluation in the Feasibility Study in regard to potential ecological concerns. Site 11 was also proposed for further evaluation in the Feasibility Study due to the presence of Oilm-Dx and obvious signs of stressed vegetation at this site. In addition, Site 35 was proposed for further evaluation in the Feasibility Study due to concentrations of Gro-Gx up to 110 mg/kg, Diesel-Dx up to 16,000 mg/kg, and Oilm-Dx up to 31,500 mg/kg in soils. All remaining PSAs were proposed for No Further Characterization in regard to ecological concerns.

Potential impacts of trichloroethene concentrations in groundwater on ecological receptors associated with Moses Lake were qualitatively evaluated. The Ecological Risk Assessment concluded that potential impacts of trichloroethene in groundwater on ecological receptors using Moses Lake are unlikely, given the volatility of this chemical, the tendency of trichloroethene to be metabolized by plants and animals, and its low potential for bioaccumulation. However, uncertainties exist regarding hydrological conditions in the northwestern portion of the site and the lack of monitoring wells in this area. Therefore, conclusions regarding potential exposures of ecological receptors inhabiting or using Moses Lake to trichloroethene cannot be made at this time.

In general, the objectives of the Remedial Investigations were as follows:

- Identify the nature and vertical and lateral extent of the plume and future movement of the plume.
- Locate potential source(s) of trichloroethene contamination.
- Determine exposure to trichloroethene.
- Determine whether current (or potentially future) exposures to radionuclide contamination exist in site soil, groundwater or air.
- Determine whether current (or potentially future) exposures to tetraethyl lead contamination exist in site soil, groundwater or air.
- Determine whether current (or potentially future) exposures to heavy metals and chlorinated pesticides at landfills exist in site soil, groundwater, or air.
- Characterize geologic and hydrogeologic conditions within the study area to support development of the conceptual and numeric hydrogeologic models.

Although the investigations conducted to date have in general met the objectives of the Remedial Investigations, the information available will not answer all possible questions regarding potential source locations, the vertical distribution of TCE below the upper Roza 1 flow and fate and transport issues within and near the study area. Additional vadose zone and groundwater investigations will be performed at the Moses Lake

Wellfield Superfund Site to resolve uncertainties regarding potential sources and fate and transport issues within and near the site.

With respect to contaminated groundwater, the distribution of trichloroethene in alluvium, the Priest Rapids Member and upper Roza 1 flow has been delineated, but deeper portions of the Roza Member were not investigated. Analytical data from the skyline replacement well suggest that deeper portions of the Roza Member (e.g., the Roza 1/Roza 2 interflow zone) may be contaminated. A major, current source at the Liquid Oxygen Generating Plant was identified and removed, and numerous empty 55-gallon drums were removed. Historical sources of contamination (e.g., landfills) might have existed, but direct evidence of these sources is no longer present.

The Environmental Protection Agency (Comments on Draft Final Remedial Investigation Report, April 2003) has indicated to the U.S. Army Corps of Engineers that in their judgement the objective of finding potential sources of contamination at the Moses Lake Wellfield Superfund Site has been completed. Based on the results of the Remedial Investigations, no current sources of TCE contamination to groundwater were found, that would explain the long-term, low concentration large-scale TCE plume observed at the site. The only possible exception to this is the Liquid Oxygen Generating Plant, discussed above. Furthermore, the Environmental Protection Agency believes that it is unlikely that additional investigations and/or remedial actions that may be conducted at the site will ever find or remove existing sources at the site.

1.0 INTRODUCTION

This report provides the results of Remedial Investigations (RIs) and a Baseline Human Health and Ecological Risk Assessment, conducted at the Moses Lake Wellfield Superfund Site. This report has been prepared in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), U.S. Environmental Protection Agency (USEPA) guidelines (USEPA, 1988) and with the requirements of the U.S. Army Corps of Engineers (USACE), Hazardous, Toxic and Radioactive Waste program (USACE, 1994, 1996, 1997, 1998a and 1998b). A Feasibility Study will be conducted following the completion of the Remedial Investigations.

The site is located in central Washington State in the City of Moses Lake approximately 100 miles west of Spokane, Washington. The location of the site is shown in Figure 1-1, *General Location Map,* and a map of the site is shown in Figure 1-2, *Site Map*.

1.1 OBJECTIVES OF THE REMEDIAL INVESTIGATIONS

This report documents data collection and analysis for the RIs conducted between June 1999 and February 2003. The RIs include the following:

- 1999 RI
- 2000 RI
- 2000 8-Place Hangar Expedited Investigation
- 2001 Liquid Oxygen Generating Plant (LOX Plant) Expedited Investigation
- 2002 RI

The scope of work was designed to meet the objectives of the RIs, which are consistent with the Interagency Agreement. These objectives are listed in Table 1.1, *Objectives of the Remedial Investigations.* This report also provides results from the Baseline Human Health and Ecological Risk Assessments. The information provided in this document will be used to support the Feasibility Study (FS).

1.2 REPORT ORGANIZATION

This report is organized into the following nine sections.

Section 1.0—Introduction
Section 2.0—Investigative Techniques
Section 3.0—Physical Characteristics of the Study Area
Section 4.0—Nature of Contamination
Section 5.0—Contaminant Fate and Transport
Section 6.0—Human Health Risk Assessment
Section 7.0—Baseline Ecological Risk Assessment
Section 8.0—Conclusions
Section 9.0—References

A list of tables, figures, appendices, acronyms and definitions are included at the end of the Table of Contents. Tables are located after Section 9.0. Figures are presented in Volume 2. Appendices are presented in Volumes 3 through 5.

1.3 SITE HISTORY

The description of the site history included in this section is adapted from the *Site Background Summary Report* (SBSR; Montgomery Watson, 1999a) with additional information included based on the results of the RIs. During development of the SBSR, extensive use was made of the institutional knowledge of the USEPA and USACE to obtain data and archives of information relevant to the site. The sources of information are listed below.

- USACE records and documents
- Records from work conducted by previous USACE contractor (Dames & Moore)
- City of Moses Lake personnel and documents
- Washington State Department of Social and Health Services (DSHS) records
- USEPA personnel and documents
- Reports from USEPA contractors (Ecology and Environment, Inc. and URS Greiner)
- Washington State Department of Ecology records
- Reports from an ecological contractor (Science Applications International Corporation)
- Grant County Department of Community Development personnel
- Port of Moses Lake personnel and records
- Reports prepared by other contractors (Golder Associates, George Maddox and Associates and Woodward-Clyde)
- Interviews with site personnel

Existing information regarding site use is provided in the Corplan Associates (1966) economic development report, Dames & Moore (1993 and 1995) Phase I RI reports and the Golder Associates (1991a) report to the City of Moses Lake. Additional data exist in the 1989, 1990 and 1992 background data reports from Ecology and Environment (E & E, 1989, 1990 and 1992) and the USEPA Potentially Responsible Party Search Information report (USEPA, 1994a). Land use planning documents were obtained from the Port of Moses Lake and Grant County.

1.3.1 Airport History

The Grant County Airport was initially developed in November 1942 as the Moses Lake Army Air Base to provide a temporary training center for B-17 pilots and crews. From March 1944 to September 1945, the base was used for the training of P-38 and P-39 pilots. At the end of 1945, the base was placed on caretaker status. Between 1945 and 1948, Boeing Corporation used the base to test B-47 and B-50 aircraft, and the base was reopened in November 1948 under the USAF Air Defense Command. In May 1950, it was renamed Larson Air Force Base (LAFB) and served as a Tactical Air Command base from 1952, a Military Air Transport Service facility from 1957 and finally a Strategic Air Command base from 1960. The base provided numerous support facilities, including a hospital, barracks, fueling depots, hangars, schools, a wastewater disposal plant and conventional weapons storage areas. In April 1952, the USAF started testing the Boeing B-52 at the base. The following year, an extensive building program was initiated, including a new 1,000-foot deep well.

The construction of the Boeing Flight Center was initiated in 1954. Between 1954 and 1962, Boeing site operations included contract work for the USAF on the B-52 and KC-135 aircraft programs. Work on the B-52 program involved preparing aircraft for delivery, which included testing, maintaining, fueling, cleaning, painting and, on occasion, stripping aircraft. From 1962 to 1963, Boeing's primary operations involved work on the B-52 fuel cell modification program, including metal fatigue testing.

In January 1960, Strategic Air Command assumed command of the base, moving crews and aircraft of the 327th Bombardment Squadron from Fairchild Air Force Base. Numerous structures were built, including additional flight operation facilities, housing, schools, waste and water systems, weapons storage and Titan I missile support facilities. Construction work on the Titan I missile support facilities was completed in March 1962, at which point the USACE Site Activation Task Force turned the facilities over to the USAF. In 1963, Boeing vacated their operations at LAFB.

On November 19, 1964, the Department of Defense (DoD) announced that the LAFB would be excessive to the needs by June 30, 1966. On March 31, 1965, the 568th Strategic Missile Squadron was deactivated.

In 1966, the Grant County Port District No. 10 acquired approximately $25 million worth of property and began operating the former base as the Grant County Airport. Family housing was sold to the Grant County Housing Authority. The Columbia Basin Job Corps Center, established on the base in 1965, was transferred from USAF ownership. Other non-operational land and buildings (dormitories, commercial and recreational facilities and three hangars) were transferred to Big Bend Community College. As of 1994, the Port of Moses Lake owned approximately 4,667 acres contiguous to the airport property and near the airport.

In 1968, Boeing resumed operations at the Grant County Airport, purchasing approximately 130 acres at the site, which included the present 3-Place Hangar. After purchase of the property, Boeing Commercial Airplane Company used the facility for tool storage. On January 1, 1985, custodianship of the facility was transferred to Boeing

Military Airplane Company, which is now Boeing Advanced Systems. At present, the Boeing facility includes the 3-Place Hangar and three acres, which are leased from the Port of Moses Lake. The facility is used for flight-testing, crew training, airplane tool storage and a Boeing proprietary non-production operation.

1.3.2 Aerial Photographs

Historical aerial photographs were reviewed as part of the background study (Montgomery Watson, 1999a). Aerial photographs of the site vicinity were reviewed for the years 1949, 1955, 1961, 1969, 1973, 1986 and 1989. The observations presented in this section are based on review of these photographs. The presence and absence of structures on site, as well as developmental trends in the area, were noted during review of the aerial photographs.

The photographs dated 1949 show the airfield and surrounding land. The airfield consisted of the northwest-southeast runway (now designated as Runway 14L/32R), the southwest-northeast runway (Runway 3/21), two taxiways, a parking apron and associated support buildings south of the parking apron. A bunker complex was located east of the airfield. A wastewater facility with a circular lagoon was located southeast of the airfield. Three areas of disturbance were noted. One area, approximately 3,000 feet southeast of the northwest-southeast runway, appeared to be scraped off, with small areas of accumulated unknown material. The second area, northeast of the intersection of 19th Avenue and Bolling Street, appeared to have a pond with accumulations of unknown material. The third area, adjacent to a railway, consisted of mounded dark material, which appeared to be asphalt. Areas south of the airfield appeared to consist largely of farmland or undeveloped land.

The photographs dated 1955 indicate significant changes since 1949. A large hangar was constructed between the south edge of the northwest-southeast runway and the airfield support area. A large aircraft apron and an unfinished building (3-Place Hangar) were observed between the east taxiway and the bunker complex. In addition, a residential area was noted on the south edge of the airfield. The numbers of disturbed areas were noted to be larger than the areas observed on the 1949 photographs. A majority of these areas appeared to be borrow areas, but two potential environmental release areas were noted. One area, approximately 3,500 feet southeast of the northwest-southeast runway, appeared to be scraped and several trenches were noted. This area was an extension of the disturbed area observed in the 1949 photograph and was located south of the Randolph Road right-of-way. The second area, east of 19th Avenue between the intersections of Bolling and Chanute Streets, appeared to have several large areas of staining, and possible standing liquid and numerous accumulations of unknown material.

In the 1961 photographs, significant additions to the airfield infrastructure were located in the southeast portion of the airfield. These additions include the 8-Place Hangar and the aircraft standby parking areas. Noted in the 1955 photographs, numerous disturbed areas were again observed around the perimeter of the airfield. The area east of the intersection of 19th Avenue and Bolling Street appeared to be disturbed with several stockpiles of unknown material. The areas south and north of this disturbance appeared to be used for earthen disposal and material storage. Numerous pits were noted in the areas east of the

northwest-southeast runway. Several pits appeared to be used for gravel extraction. Two dark-toned areas were noted immediately west of the west taxiway. These are probably burn areas. In addition, three disturbances were noted in the open areas adjacent to and east of the rail spur located on the south end of the airfield property.

For the 1973, 1986 and 1989 photographs, an analysis was conducted as a separate report by the USEPA Environmental Monitoring Systems Laboratory in an attempt to identify additional disposal sites that could be potential sources of trichloroethene (TCE) contamination. In general, the photographic analysis identified little change in site conditions between 1973 and 1989. No areas were identified that could be specifically associated with hazardous waste disposal. However, several potential disposal areas were identified throughout the site.

1.3.3 Potential Source Areas

Based on the site history and the results of the RIs, a total of 41 Potential Source Areas (PSAs) were identified, 13 of which were categorized as No Further Characterization (NFC) sites as shown in Figure 1-3, *Locations of Potential Source Areas*. "No Further Characterization" is the term agreed upon by the USACE and the USEPA indicating that the remedial investigations are likely complete for a specific portion of the Moses Lake Wellfield. Sufficient data were considered to have existed for the NFC sites to satisfy the objectives of the RIs, such that additional investigation was not warranted (Montgomery Watson, 2000c). "No Further Characterization" is a term that the USACE agreed upon to indicate that the RI for a site (portion of the Moses Lake Wellfield Superfund Site) is complete and represents a recommendation by the USACE. The other PSAs were grouped into three general categories, based on the principal form of the potential disposal activities associated with the PSA.

- Landfills
- Open pits, ditches and drains
- Surface discharge areas

The following subsections describe each of these PSAs, including NFC sites and their locations, as shown in Figure 1-3.

1.3.3.1 Landfills

Base Closure Landfill (Site 6a) - This area was used for disposal of general refuse during LAFB operations from the early 1960s to closure. During the base closure, there may have been small quantities of solvents disposed at this landfill.

Dumpster Wash Area (Site 6b) - Dumpsters associated with the Base Closure Landfill (Area Site 6a) reportedly were washed at this location. Currently no written or photographic evidence exists to support this report.

Randolph Road Base Dump (Site 8) - Early aerial photographs show large areas of disturbed or excavated soil and stained soil. Reportedly, this area was used largely for the disposal of refuse during the early to mid-1950s.

South Base Dump (Site 20) - This landfill is approximately located in the southeast quarter of Section 4, Township 19 North, Range 28 East. The current landowner is CMC Heartland Partners, which reportedly plans to develop the property as an industrial park. Based on 1973 and earlier (i.e., pre-1969) aerial photographs, this area is discernible by disturbed ground. Scrap metal and concrete can be observed in this area. No interviews or written information indicated the disposal of liquid wastes at the South Base Dump. However, facilities of similar type were known to have solvent disposal during the same time period.

19th Avenue Base Dump (Site 31) - This was the main disposal area at the former LAFB from the mid-1950s to the early 1960s. Dumpsters were emptied into shallow trench pits. Reportedly, the debris in the pits was burned to reduce the waste mass. This information was supported by interviews (Montgomery Watson, 1999a).

1.3.3.2 Open Pits, Ditches and Drains

Aircraft Wash Rack and Discharge Areas (Sites 3a, 3b and 3c) - The aircraft wash rack area is located in the southwest quarter of Section 28, Township 20 North, Range 28 East. The current owner is the Grant County Port District. The wash rack itself (Site 3a) is considered a surface discharge area but is part of the two drains (Sites 3b and 3c) and so is discussed here.

Prior to 1954, an aircraft wash rack area was operated near the current location of the Japan Airline (JAL) hangar, but waste disposal methods at that time were not known during investigations. In 1954, the wash rack area was moved north of the present JAL hangar area. Based on USAF drawings, a disposal area was located north-northwest of the then-proposed wash rack area (USAF, 1954). At that time, untreated wash rack liquids were discharged to a buried 42-inch diameter culvert, which directed flows to the southeast to an open ditch approximately 500 feet southeast of the present JAL Hangar (USAF, 1956).

In 1956, an industrial waste treatment plant (Building No. 4014) was constructed to reclaim wash solvents and to reduce the threat of explosions. The industrial waste treatment plant included a pump suction tank and a scum oil remover. The exact composition of wash rack discharge is unknown, but aircraft reportedly were washed with a flammable mixture of seven parts Stoddard solvent and one part "gunk" (a residual solvent mix). Reportedly, the USAF switched to an alkaline water base type cleaner in 1958. This wash solution apparently contained TCE (USEPA, 1994).

Treated wastewater discharges were directed along the buried 42-inch culvert, which was modified to discharge to a short open channel that directed flows to a buried 48-inch diameter culvert (USAF, 1961). The inlet to the 48-inch diameter culvert was located approximately 600 feet east-southeast of the JAL Hangar. Flows in the 48-inch diameter culvert were then directed to the bomber ready area tarmacs located south of the 8-Place Hangar.

The Port of Moses Lake and its tenants, principally JAL, used the wash rack starting in the mid-1960s when USAF activities at the former base were terminated. JAL used the wash rack area to clean aircraft until approximately 1974. Reportedly, soap and water were used as the cleaning agents. Wastewater and stormwater from the wash rack area continued to be drained into the storm drain system until 1990 when JAL blocked and sealed the drains. At this time, aircraft washing by JAL at the airport was terminated.

Gravel Pit (Site 9) - The gravel pit area is located west of the runways and the Fire Training Area Burn Pit B (Site 11). This area includes a series of excavations that reportedly were used as disposal areas for construction debris and miscellaneous refuse from the base. Old 55-gallon drums were observed in this area in the late 1980s. In addition, the Port of Moses Lake used the northern portion of this area for the disposal of construction debris.

Fire Training Area Burn Pit B (Site 11) - This area was used by the USAF followed by the Port of Moses Lake for fire fighting training. This activity continued until approximately 1975. The training area used turbine fuel and jet fuel (JP-4) to simulate plane crash fires. This area was littered with drum bungs and the burn pits are visible in aerial photographs. The area is approximately 500 feet by 1,000 feet with the long axis oriented approximately northeast-southwest. This area is surrounded by a containment ditch approximately one foot in depth. Dark staining was observed in aerial photographs near the center of the area.

Motor Pool Drain (Site 12) - Floor cleaners were reportedly dumped into the drains at the motor pool. In addition, waste oil and other liquid wastes generated at the motor pool were also discharged (USEPA, 1994a). The terminus end of the drain line is reportedly still intact and remains as an 8-foot deep trench. The Port of Moses Lake has partially filled the hole with concrete rubble. The motor pool also was serviced by a septic and drain field system (USEPA, 1994a).

The current use of the drain was unknown at the time of site assessments in 1992. According to USEPA documentation, the Columbia Basin Job Corps operated an automotive training facility at the motor pool in 1994.

8-Place Hangar Ditch (Site 15) - Stormwater from the 8-Place Hangar (Site 14) is discharged into a U-shaped ditch east of the hangar. In addition, the ditch received stormwater flows collected from the south perimeter of the Paint Hangar (Site 18). Both facilities were considered potential sources of TCE releases.

Paint Hangar Leach Pit (Site 22) - Prior to 1980, industrial wastewaters from the Paint Hangar (Site 18) were collected in large concrete tanks designed to function as water clarifiers. Untreated wastewater from the jet fuel storage area and the fuel control building were also discharged to the leach pit located northeast of the hangar. Treated wastewater was also discharged to a leach pit.

1.3.3.3 Surface Discharge Areas

Big Bend Community College Hangar (Site 2) - Thirty-five underground storage tanks (USTs) were associated with the Big Bend Community College facilities (Ecology, 1992). Twenty-six USTs were used for heating oil; ten of these tanks were reported closed as of 1993. The other nine tanks were used for the storage of aviation fuel, kerosene, leaded and unleaded gasoline and used oil. As of 1993, only two used oil tanks were operational; the other tanks were either classified as temporarily out of use or unresolved. In addition, a 500-gallon UST, used as an oil-water separator at the Auto Shop, was identified (USEPA, 1994a). The drains to and from the oil-water separator were reportedly cut off. Drainage from the Big Bend Community College hangars discharged pressure wash, cleaning and degreasing tanks water into an open ditch north of the apron in front of the hangars (USEPA, 1994a). Reportedly, solvents that were used in the two or three years prior to 1994 were naphthalene and a corrosive cleaning liquid. In the engine maintenance and rebuild classes, Stoddard solvent was reportedly used.

Tarmac Areas (Sites 4a and 4b) - Reportedly, TCE was frequently dumped on the tarmac areas and was allowed to volatilize in aircraft parking areas near the hangars and Boeing facility. In addition, the Big Bend Community College hangars discharged pressure wash, cleaning and degreasing tanks water into an open ditch north of the apron in front of the hangars (USEPA, 1994). Reportedly, solvents that were in use in the two or three years prior to 1994 were naphthalene and a corrosive cleaning liquid. In the engine maintenance and rebuild classes, Stoddard solvent was reportedly used. Approximately 30 drums of 1,1,1-trichloroethane and two drums of TCE were stored on-site prior to disposal in 1992 (USEPA, 1994a).

Japan Airlines (JAL) Hangar Area and Tarmac (Site 5) - This hangar was completed in 1955 and was originally designed and constructed as a general purpose base flight facility. The building was equipped with an oil-fired boiler. According to USEPA interviews, TCE might have been dumped over the edge of the apron near the JAL hangar location and along the approach to the northwest-southeast runway prior to JAL occupancy in 1968 (USEPA, 1994a). Interviews with former JAL employees indicated discharges and disposal of waste south of the hangar as early as 1969. Reportedly, TCE has not been used by JAL, but solvents containing 1,1,1-trichloroethane have been used. These solvents were collected in a drum for disposal three or four times a year, except one solvent type, Magnusol 729, was disposed of at Fire Training Area Burn Pit B (Site 11). Magnusol 729 might have also entered the hangar drains during the cleaning of aircraft wheels.

In 1973 or 1974, JAL transferred aircraft washing activities from the Aircraft Wash Rack (Site 3) to the hangar area. Soapy wastewater in the hangar area was directed to the floor drains. Wash activities continued until 1990 when JAL stopped this practice at the airport. JAL also engaged in deicing activities using products containing ethylene glycol, diethylene glycol and propylene glycol. The location of deicing activities is unknown.

8-Place Hangar (Site 14) - This building was the largest Air Force facility at the former base and was designed to accommodate eight B-52 bombers. It was built in 1956 and covers approximately 427,000 square feet. Based on 1954 blueprints, the 8-Place Hangar

was the location of a former leaching pit for the fuel tank storage facility, which is located north of the Paint Hanger (USEPA, 1994a). Utility connections at the time of construction included storm sewers (five 21-inch diameter, three 24-inch diameter, and one 36-inch diameter) and two sanitary sewers (8-inch diameter). Stormwater from the 8-Place Hangar is discharged into a U-shaped ditch east of the hangar.

In the early 1960s, the hangar was converted to a Titan I missile support plant and an addition was constructed on the east end of the hangar. The 8-Place Hangar was referred to as the Combined Guided Missile Assembly Building and Technical Supply Facility.

Based on as-built construction drawings, underground tanks consisted of four tanks: a 550-gallon chloroethene catch tank, a 550-gallon TCE catch tank, a 2,000-gallon acid tank, and a 7,500-gallon neutralization tank (USAF, 1962). The contents of the two solvent tanks were reportedly "polluted." A 2,500-gallon vat was reportedly used by Dow Industrial Service, a contractor to the USAF, for degreasing operations (USEPA, 1994a). In addition, TCE was stored in the propulsion, hydro-pneumatic and electronics shops. Reportedly, TCE was used extensively for the removal of dirt and hydrocarbons in pipe, couplings, valves and other equipment in contact with liquid oxygen (LOX) (USEPA, 1994a).

Engine Rebuilding Facility, Building 2203 (Site 16) - Little information was available regarding this facility, but engine rebuilding facilities are known users of TCE, at least historically.

3-Place Hangar, Building 5801 (Site 17) - This site is also known as the Boeing facility. Originally built in 1956 to accommodate three B-52 bombers, the hangar was used to house maintenance shops in early 1960s. Stormwater from the south portion of the site perimeter was discharged to an open ditch near Randolph Road via a 36-inch diameter buried culvert. Stormwater from the north end of the facility was discharged to a stormwater collection system that directed flows to the north and ultimately to an open ditch. This collection system also collected flows from a storage building and flight apron to the northwest.

In February and March 1990, Boeing removed one underground diesel fuel tank, two Bunker C fuel storage tanks and one below-grade waste oil sump (Landau Associates, 1991). The tanks were located adjacent to the southern end of the eastern side of building 8-02. The waste oil sump was located just to the north between building 8-02, 8-03, and 8-15. No cracks, evidence of leakage or evidence of release were observed. Three soil samples were collected from the excavation and analyzed for total petroleum hydrocarbons, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals and polychlorinated biphenyls. TCE was not detected.

In February 1998, Boeing installed five groundwater monitoring wells within or near the Boeing property (Woodward-Clyde, 1998). Most of the wells were greater than 1,000 feet from the 3-Place Hangar and the solvent pit. However, one of the wells was 800 feet to the northwest of the solvent pit adjacent to the northwest corner of the 3-Place Hangar. Another well was approximately 700 feet southwest (roughly downgradient) of the solvent pit. The wells were screened across the water table with total depths between 73 and 79

feet below ground surface (bgs) within alluvium. The wells were subsequently sampled twice in February and March 1998 and analyzed for VOCs by USEPA Method 8260. The results indicated that TCE and other chlorinated hydrocarbons were non-detect during both sampling rounds. The wells have since been abandoned.

Paint Hangar, Building 5825 (Site 18) - This building was constructed in 1957 and was designed to house painting activities of large aircraft. Approximately 252 B-52 bombers and 500 KC-135 tanker aircraft were painted at the hangar from 1955 to 1960. In addition, temporary protective coatings were stripped from the aircraft by first applying a stripping material and rinsing the airplanes with steam. Stormwater from the Paint Hangar was discharged to an open ditch to the east. This ditch directed flows to the south and ultimately to a U-shaped ditch used for stormwater infiltration for the 8-Place Hangar.

Liquid Oxygen Generating Plant, Building 5102 (Site 19) - In the early 1960s, the 8-Place Hangar (Site 14) was converted to a Titan I missile support plant. To support the missile plant, the LOX Plant (Site 19) was built east of the Degreaser Facility and adjacent to Tyndall Road. Storage tanks for 28,000 gallons of liquid oxygen and liquid nitrogen were also built in an area north of the Degreaser Facility.

Reportedly, large quantities of TCE were used to clean the LOX Plant equipment, and spent solvent was disposed to the ground (USEPA, 1994a). A septic system used at the LOX Plant was classified as an industrial waste treatment facility; the system used a 2,500-gallon septic tank and a drain field. Stormwater from the plant perimeter was directed to a 40-foot diameter pit located adjacent to the east side of the plant.

LOX Disposal Site (Site 19b) - The area is a small, rectangular pit on the ground surface with berms on three sides with a sign indicating that it was a waste disposal area for the LOX Plant. Written documentation of the use of this facility was not found.

Engine Buildup Facility, Building 2113 (Site 23) - According to former base personnel, the USAF used TCE in a vapor degreaser in this facility. The vapor degreaser was used in the 1950s and earlier because of the predominance of piston-driven aircraft engines. Reportedly, the USAF stopped using TCE around 1960 to1961 due to its hazard (USEPA 1994).

Building 408 (Site 25) - Sonico, Inc. conducted aircraft component maintenance starting in 1987. The company was thought to have used TCE at the site and generated approximately 1,600 pounds of waste solvent that was used for parts cleaning. However, written records indicate no usage of TCE; only 1,1,1-trichloroethane and products containing trichloroethane were apparently used.

Landfill at the End of Runway 32 (Site 33) - The Landfill at the End of Runway 32 is located in the southeast portion of the airfield. Prior to the construction of the fighter alert pads, aerial photographs showed a tanker truck discharging liquids to the ground surface in this area. Soil staining was also observed in the area.

Stained Soil Area (Site 35) - The stained soil area appears as a dark area in the 1949, 1955, 1961, 1969, 1973, 1986 and 1989 aerial photographs located south of Randolph Road

between 22nd Avenue and former 19th Avenue. It is unknown what the historic use of this area was and if it was used as a discharge area. Based on observations made during the RIs, the area could have been an unloading and stockpile area for coal.

Skyline Auto Wrecking Yard (Site 36) - This site has apparently been an automobile wrecking yard since the 1940s. There is abundant trash at the site including 55-gallon drums, oil cans, miscellaneous scrap metal and automobile bodies. There was also an automobile service island and a UST at the site at one time.

1.3.3.4 No Further Characterization Sites

This section provides background information on the NFC sites. Table 1.2, *Remedial Investigation Findings Supporting No Further Characterization for NFC Sites*, provides the rational for classifying each of these sites as NFC.

Liquid Waste Disposal Site (Site 1) - Site 1 is located in the far northwest corner of the site in Section 17, Township 20 North, Range 28 East. The current owner of this property is the Grant County Port District Site 10. In the 1900s, this site was observed to be a 45-foot by 25-foot area that was fenced with barbed wire and marked with two signs stating "Danger." There were two roughly circular excavations: one approximately two feet deep; the other approximately ten feet deep. Based on aerial photographs, liquid wastes might have been disposed of directly into the two circular excavations as early as 1949.

Rock Landfill (Site 7) - Waste liquids and debris reportedly were historically discharged at the Rock Landfill, but no documentation of these activities could be found. The landfill was included in the investigation of the Randolph Road Base Dump (Site 8).

Fire Training Area Burn Pit A (Site 10) - A pit where solvents and other wastes were disposed of is located south of the Gravel Pit (Site 9). Aerial photos of this site show dark stained soil. Evidence of earth movement was observed during the RIs.

Rock Drain Area (Site 13) - The rock drain area is located west of the Base Closure Landfill (Site 6a). Based on field observations, it consisted of structural remnants consisting of a concrete slab, wood debris and a small sump filled with gravel. The structure was located along the old access road to the Base Closure Landfill and may have been a guard house or inspection point for vehicles hauling waste to the landfill. No evidence of dumping activities was observed in the area.

Larson Municipal Waste Treatment Plant (Site 21) - The waste treatment plant is located in the northwest quarter of Section 34, Township 20 North, Range 28 East. The current owner is the City of Moses Lake. In 1966, the City of Moses Lake obtained title to the former LAFB sanitary sewage treatment plant and infrastructure. The sewer system consists of the sewage treatment plant, four lift stations, sewer mains and easements. According to a 1986 USEPA inspection report, the sewage plant consists of two aeration basins, two sedimentation ponds and three leaching ponds. During the 2002 RI, the facility appeared to be undergoing expansion.

Reportedly, the principal type of industrial waste discharged to the plant was electronic and high-technology plant wastewater with an estimated flow of 30,000 gallons per day (gpd) (USEPA, 1986). Identified industrial dischargers were Boeing, Moses Lake Industries and Sundstrand Data Control, Inc. According to a 1956 Washington Pollution Control Commission discharge permit for the Boeing facilities, approximately 200 gallons of solvent waste per year were estimated to be discharged to the treatment plant. The 1956 permit was renewed in 1961 and 1967.

Building 2802 (Site 24) - Building 2802 was originally included as a PSA since there were possible historical uses of chemical of potential concern (COPCs) within the building. However, no documentation was found and only possible use of TCE was suggested by interviewees during the background study.

Conventional Ammunition Storage Bunkers (Site 26) - Conventional ammunition was stored at the former LAFB in bunkers located in the western half of Section 22, Township 20 North, Range 28 East. Based on known practices, these facilities might have stored solvent materials. However, no interviewees or written information indicated the storage or disposal of liquid wastes.

Tetraethyl Lead Disposal Site (Site 27) - Site 27 is adjacent to Site 4a immediately north of the Aircraft Wash Rack (Site 3a). The current owner is the Grant County Port District Site 10. A chain-link fence surrounds the pumphouse and the associated UST area. During the 1900s, there was a sign stating "Danger, Materials Containing Tetraethyl Lead Buried Here, Do Not Uncover". The location of the buried tetraethyl lead (TEL) to which the "Danger" sign was referring was not known, and historical documents do not refer to the use of TEL during former LAFB operations. No visible signs of burial were observed.

Tetraethyl Lead Disposal Site (Site 28) - Site 28 is located in the southwest quarter of Section 33, Township 20 North, Range 28 East. The current site owner is the Grant County Port District Site 10. During the RIs, the site was the location of a 1.1 million-gallon above ground storage tank. The tank area is surrounded by containment berms and a chain-link fence. On the chain-link fence, there was a sign stating "Danger, Materials Containing Tetraethyl Lead Buried Here, Do Not Uncover." The location where TEL was buried was not visible or indicated in any historical documents or aerial photographs.

Low-Level Radioactive Medical Waste Disposal Site (Site 29) - Site 29 is located in the northwest quarter of Section 4, Township 19 North, Range 28 East. The landowner was CMC Heartland Partners at the time of RIs. Site 29 consisted of a small circular feature, approximately 50 feet in diameter, which was previously enclosed by a barbed wire fence. Based on interviews, the site was used for the disposal of low-level radioactive medical waste, and a sign was posted that radioactive materials were disposed of in the area. During a site visit in November 1980, the USACE scanned the area with a Geiger counter; however, no levels of radioactivity above background levels were found.

Bunker Disposal Area (Site 30) - Solvents or other compounds that may have contained COPCs were considered to have been stored at this site. Disturbed areas at this site are visible on the 1949 and 1955 aerial photographs. However, no documentation or confirmation from interviewees could be found during the background study.

South Burn Pit (Site 32) - This site is located south of the airfield and straddles what is now Patton Boulevard near the City of Moses Lake water storage tank tower number 4. The site was a PSA since it appeared in the aerial photographs to be similar to a burn pit. Upon further review of the aerial photographs and a field inspection during the RIs, it was determined that the dark area seen in the photographs was actually a shadow from the adjacent City of Moses Lake water tower.

Patton Park Landfill (Site 34) - This area is located near the South Burn Pit (Site 32) area in a field bounded by 21st Street to the north, a gas station and Harris Road to the south, railroad tracks to the east and Patton Boulevard to the west. A nearby resident reported to the RI teams that solvents had historically been discharged and/or drums had been buried at this site. The resident showed the field team the approximate location of the landfill to focus the field investigation. Neither field reconnaissance nor a geophysical survey revealed any indication of a landfill or disturbed area. Since no other historic evidence or records of a landfill or other disturbances in the area were identified, the site was listed as an NFC Site.

These sites characterized as NFC were considered PSAs, but based on the known history of the sites and/or field reconnaissance, were considered to be unlikely current or historical sources of contamination. These sites were characterized based on existing data. The data collected during the 1999 and 2000 RIs along with any other relevant pre-existing data, were evaluated as appropriate to characterize these sites.

1.3.4 Previous Investigations

Past Moses Lake Wellfield Superfund Site investigations and actions are shown in Table 1.3, *Summary of Previous Investigations*. Brief summaries of these investigations and actions are also listed on the table.

In addition to the individual documents, more detailed summaries of the results of these investigations can be found in the documents listed below.

- Historical Summary - *Site Background Summary Report*, Moses Lake Wellfield Superfund Site (Montgomery Watson, 1999a).

- 1999 RI - *Final Site Characterization Technical Memorandum, Remedial Investigation/Feasibility Study Moses Lake Wellfield Superfund Site* (Montgomery Watson, 2000a).

- 2000 RI - *2000 Site Characterization Technical Memorandum, Remedial Investigation/Feasibility Study Moses Lake Wellfield Superfund Site* (Montgomery Watson, 2001b).

- RIs Summary - *Site Characterization Summary Report*, *Remedial Investigation/ Feasibility Study Moses Lake Wellfield Superfund Site* (Montgomery Watson, 2001a).

The 1999 RI field program was completed in early December 1999. The *Final Site Characterization Technical Memorandum* (Montgomery Watson, 2000a) was developed using available data, which included geologic data from well bores, water level data collected through November 1999, results from the radiological survey at the Low-Level Radioactive Medical Waste Disposal Site (Site 29), results from sampling of domestic drinking water wells and water quality data from groundwater sampling conducted in 1999. The report presents geologic and hydrogeologic conceptual models for the site and interpretations of the results of water quality sampling. These data results were used to evaluate potential flow and contaminant transport pathways and to evaluate the spatial extent of possible groundwater contamination. In addition, the 1999 water quality data were compared with historic concentrations to evaluate possible trends and to determine if significant changes in water quality had occurred since previous investigations at the site.

Subsequent to the 1999 RI, an expedited investigation of the 8-Place Hangar (Site 14) and 8-Place Hangar Ditch (Site 15) was conducted (Montgomery Watson, 2000b). The expedited investigation was conducted in conjunction with the closure of USTs that were apparently located adjacent to the 8-Place Hangar. Interim Remedial Actions (IRAs) were conducted at two areas on the north and south sides of the 8-Place Hangar (Montgomery Watson, 2001a) where the USTs were thought to be located. The area on the south side was excavated to a depth of nine feet bgs. No USTs were found, but a concrete valve box was located in the eastern portion of the excavation. Pipes associated with the former USTs were also found in the excavation. Confirmation soil samples were collected from the bottom of the excavation for chemical analysis. The excavation was then backfilled with the removed material and compacted (Bay West, 2000). The area on the north side of the building was also excavated and an UST was found. The UST was cleaned out and abandoned in-place. Prior to closing the UST in-place, holes were cut in the bottom of the UST and confirmation samples were collected for chemical analysis (Bay West, 2000).

The 2000 RI field program was completed in November 2000. The *2000 Site Characterization Technical Memorandum* (Montgomery Watson, 2001b) was developed using data from borehole logs, water-level measurements, geophysical surveys and results from a Field Portable X-ray Fluorescence (FPXRF) meter, surface soil and active soil gas (ASG) sampling. Water quality data from November 1999 and March, June and September 2000 were included, as well as water level data. These data were used to evaluate potential flow and contaminant transport pathways, evaluate the locations and nature of PSAs and to identify COPCs in soil and groundwater. In addition, the recent water quality data were compared to historic concentrations to evaluate possible trends and to determine if significant changes in water quality had occurred since previous investigations at the site.

Subsequent to the 2000 RI, water quality data were collected from selected site monitoring wells (January and February 2001) and an expedited investigation of the LOX Plant (Site 19) was conducted in January and May 2001 (Montgomery Watson, 2001a). ASG samples were collected at the LOX Plant in 2000; 13 of the samples reported elevated concentrations of TCE. As a result of high concentrations of TCE found in these samples, an expedited investigation was conducted at the LOX Plant. As part of the expedited investigation, an IRA was conducted that consisted of removing two vaults and associated piping. Prior to the removal, samples were collected from trenches located on

the sides of the vaults. Additionally, samples of liquids found in the vaults were collected and found to contain high levels of TCE. After the sampling, the vaults were removed including approximately ten feet of soil beneath the vaults. Prior to backfilling the excavation, MWH collected confirmation soil samples from the base of the excavation (Montgomery Watson, 2000a), as described in Section 4.1.4.10.

2.0 INVESTIGATIVE TECHNIQUES

This section describes the investigative and analytical methods used during the 1999, 2000 and 2002 RIs, as well as during the 1999 and 2000 Expedited Investigations of the 8-Place Hangar and LOX Plant, respectively. These methods were used in accordance with the *Management Plan* (Montgomery Watson, 1999b), the *Management Plan Addendum* (Montgomery Watson, 2000c) and the *Supplemental Management Plan* (MWH, 2001a). A summary of the investigative methods is included in Table 2.1, *Summary of Investigative and Analytical Methods: Tool Box.*

2.1 INVESTIGATION PROGRAM AND STRATEGY

The source area investigations were developed for the following PSA categories at the site.

- Landfills
- Open Pits, Ditches and Drains
- Surface Discharge Areas

A total of 25 PSAs were characterized following the sampling strategies presented in the *Management Plan Addendum* (Montgomery Watson, 2000c) and the *Supplemental Management Plan* (MWH, 2001a). The Low-Level Radioactive Medical Waste Disposal Site (Site 29) was investigated during the 1999 RI, as described in Section 2.5 in accordance with the *Management Plan* (Montgomery Watson, 1999b). The locations of the PSAs are shown in Figure 1-3. The revised PSA locations and boundaries were defined based on the results of the PSA investigation methods described in the following sections. Criteria used to characterize the PSAs and revise their boundaries are listed below.

- Historical information
- Field reconnaissance and mapping results (i.e., visual disturbances, stained soil and debris)
- Geophysical survey results (i.e., anomalies, buried debris and buried pipes)
- Landfill trenching results
- Surface soil analytical results
- ASG analytical results
- Expedited Investigations results
- Downgradient groundwater monitoring sampling and analysis results

Some of the PSA boundaries were revised based on the presence of one or more of these criteria.

The first step in the characterization program consisted of evaluating each PSA based on historical information and using standard field reconnaissance and mapping methods. The subsequent investigation techniques used to characterize each PSA were dependent upon PSA classification, historical site information and results of the field reconnaissance.

This section provides a detailed description of the field investigation activities performed during the RIs including the following.

- Field reconnaissance and mapping
- Geophysical surveying
- Radiological surveying
- FPXRF testing
- Landfill trenching
- Surface soil sampling
- ASG sampling
- Miscellaneous (e.g., drum or tank removals)

Additional details, plus field techniques for drilling and monitoring well installation, are presented in the *Management Plan* (Montgomery Watson, 1999b).

Additional investigation was not performed at the NFC sites, which are described in more detail in Section 4.0 and discussed in the *Management Plan Addendum* (Montgomery Watson, 2000c). The Low-Level Radioactive Medical Waste Disposal Site (Site 29) was investigated in 1999 and became an NFC site in 2000.

2.2 FIELD RECONNAISSANCE AND MAPPING

The investigation team performed an initial field reconnaissance to determine if the field program was adequate to meet the objectives of the investigation and to collect information necessary to scope specific activities. Refinements to the field program were made, if necessary, based on site-specific information collected during the reconnaissance and documented in approved Field Change Requests (FCRs).

Reconnaissance consisted of a sequence of nine individual tasks to further understand each PSA being investigated. The information gained from each of the tasks was compiled in the field and used to delineate a study area for each site. The site-specific study area was used to focus further reconnaissance and investigation activities. However, the study area did not preclude the investigation team from performing activities beyond its boundaries, if warranted. The nine reconnaissance tasks are listed below.

- Accessing property

- *Site Background Summary Report* review

- Aerial photograph review
- Construction drawing review
- Interviewing personnel
- Walking the site
- Addressing immediate potential environmental concerns (e.g., removal and Expedited Investigation)
- Mapping visual disturbances
- Reviewing aerial photographs

Accessing Property: Since its closure in 1966, the former LAFB property has been subdivided and purchased by several individuals and organizations including the Port of Moses Lake, Aerospace-Port International Group and others. The investigation team worked with the USACE real estate group to identify each landowner and obtain a right-of-entry to access each property.

Site Background Summary Report Review: Prior to initiating work in the field for a particular site, the investigation team reviewed sections in the *Site Background Summary Report* (Montgomery Watson, 1999a) relevant to the site. The purpose of each facility and its function during operation of the former LAFB was used to select potentially impacted locations. This information was used, in part, to select biased sampling locations for subsequent investigation activities, such as geophysical surveys, surface soil sampling and ASG sampling.

Aerial Photograph Review: Aerial photographs of the former LAFB were taken in 1949, 1955, 1961, 1969, 1973, 1986 and 1989. These photographs were originally used to aid in identifying PSAs for the *Site Background Summary Report* (Montgomery Watson, 1999a) and *Management Plan Addendum* (Montgomery Watson, 2000c). A 1996 aerial photograph was also used during the field investigations. During the field investigations, the photographs were consulted to identify disturbed areas, re-create traffic patterns, locate landfills and/or identify construction facilities. The photographs were compared with LAFB construction drawings and used to date disturbed areas. When possible, the aerial photographs were reviewed simultaneously to provide a three-dimensional view.

Construction Drawing Review: The investigation team obtained relevant and available LAFB drawings stored in the basement of the Port of Moses Lake terminal building and at the Big Bend College Maintenance Building. With permission from the Port of Moses Lake, selected drawings were removed from the basement and copied for use in the field. All original drawings were returned to the Port of Moses Lake. The drawings were reviewed throughout reconnaissance activities to further understand LAFB activities and facilities that no longer existed. Similarly to the photographs, the drawings provided information relating to the function of each LAFB facility including areas where COPCs were used and locations of waste disposal areas. The drawings also revealed subsurface

features such as storm water drainage systems, french drains, ditches, waste disposal areas and industrial waste septic systems. Some of the facilities were abandoned or covered and, therefore, would not have been located without the drawings. This information was used to assist in determining biased locations for geophysical surveys and surface soil sampling and ASG sampling points.

Interviewing Personnel: Several former LAFB personnel were interviewed during the preparation of the *Site Background Summary Report* (Montgomery Watson, 1999a). These interviews were documented in the report and used during the reconnaissance. Additional personnel including long-term employees at the Port of Moses Lake and landowners such as the Aero-Space Port International Group and KDK, Inc. were interviewed, which provided information relating to previous site activities. The results of several investigations performed in recent years by private property owners were also discovered during the reconnaissance. One such investigation was a geophysical survey performed at the South Base Dump (Site 20). Another consisted of soil sampling and a test pit investigation program provided by the Aero-Space International Group near the Aircraft Wash Rack Discharge Area (Site 3c).

Walking the Site: Once the information described in the proceeding paragraphs was assembled and thoroughly reviewed, the investigation team walked the PSA. The team consisted of three to four people spaced at approximately 50-foot intervals. The team continued to walk until evidence of relevant activities at a particular site were no longer observed in the field, on construction drawings or aerial photographs. The *Site Background Summary Report* (Montgomery Watson, 1999a), construction drawings, and aerial photographs were used in the field to provide a comparison of disturbances identified in previous documents to what existed during the 2000 and 2002 RIs. After the site was walked, the study area was physically delineated using ten-foot high flagpoles that could be easily seen from a distance as a reference. These points were later mapped using a handheld global positioning system (GPS) unit adjusted for differential correction.

Team members carried lathes and flagging for marking possible evidence of past waste disposal activities including areas of stressed vegetation, soil staining, debris, mounds, subsidence, general disturbance, roads, storm drains and structures. The locations of these features were mapped using the GPS. If the PSA included a structure, such as a hangar, the owner was notified and the facility was walked through in a similar process as the open areas. Both the interior and exterior of the structures were examined for evidence of COPC handling or waste disposal activities. Any drawings available for a particular structure were reviewed. Some of the occupants of the facilities were interviewed as well. The site walks included over 1,000 acres of land and building interiors.

Addressing Immediate Potential Environmental Concerns: Potentially imminent environmental concerns identified during field reconnaissance were immediately reported to the USACE. Immediate environmental concerns included 55-gallon steel drums, concrete vaults with liquids or other abandoned containers containing waste liquids. The USACE promptly addressed each of these concerns.

Mapping Visual Disturbances: After the initial field reconnaissance, visual disturbances and features such as roads, pits, debris and structures were mapped using a handheld GPS

unit. In addition to the location, attribute information, including descriptions, dimensions, type of feature (i.e., pits, stressed vegetation or debris) and any markings on drums or other debris, were recorded in the field book. The GPS data and information from the field book were downloaded daily into the on-site geographic data management system (copies of field notes can be found in the *Site Characterization Technical Memorandum* [Montgomery Watson, 2000a]).

Photographs: Over 1,000 digital photographs were taken during the investigations. Each photograph was logged and downloaded to the central field computer. Information including the date, time and description of the photograph was recorded in a photograph journal. Digital photographs were provided to the USACE on compact disk under separate cover.

2.3 GEOGRAPHIC DATA MANAGEMENT SYSTEM

A geographic data management system (GDMS) was developed specifically for the Moses Lake Wellfield Superfund Site. The GDMS was located on-site and was comprised of various information technology equipment and computer software including a geographic information system (GIS), GPS tools and a project-specific web site. It was developed to meet the objectives shown below.

- Display and present preliminary field investigation data
- Update sampling and spatial information based on field mapping
- Review of field sampling decisions
- Receive off-site feedback from the USACE and USEPA
- Provide a permanent record of the spatial investigation data

The GDMS provided the knowledge base for data collected during the field investigation. Data collected during the field reconnaissance, sample locations, proposed groundwater monitoring well locations and FPXRF test results were documented. Each document provided a snapshot in time illustrating the particular PSA of interest and data collected, along with electronic aerial photographs for geographical reference. Critical time-sensitive decisions, such as proposed groundwater monitoring well locations, were illustrated along with potentiometric surfaces, existing monitoring wells and the most recent field investigation results to enable the project team to make informed decisions in a timely manner. These documents were referred to as Preliminary Field Investigation Data reports (PFIDs) and are described in Section 2.3.5.

A streamlined communication process was established by the investigation team to ensure issues and concerns were quickly addressed. This process consisted of using a project specific web site as a central location for storing and retrieving field documentation, including PFIDs, FCRs and selected photographs. Once a field document was uploaded to the web site, email notification was sent to the project team indicating documents available for review and actions that might have been required. The purpose of the web-based system was to provide real-time information and communicate the progress of field activities throughout the RIs to those individuals from the USACE and USEPA not at the site.

2.3.1 Global Positioning System

A Trimble GeoExplorer GPS unit was used to provide rapid geographic positioning of data collected in the field. The GPS recorded latitude and longitude values in reference to the 1927 North American Datum (NAD 27). The GPS unit received a signal from up to 24 satellites and was capable of recording the geographical coordinates of points, lines and areas. Data acquisition occurred in less than 15 seconds during optimal conditions. The GPS unit stored coordinate information in (rover) files until the data were downloaded at the GIS workstation.

Field mapping with the GPS unit went beyond exclusively recording geographic coordinates. Attribute information was recorded either automatically by the GPS unit or in some cases, entered manually into the database at the GIS workstation. A data dictionary was designed to meet the specific needs of the project. Settings in the data dictionary determined the attribute information recorded with the collected data. A data dictionary is comparable to a form used in the field, providing information (e.g., type of feature mapped, time and date collected, area, accuracy, sample number, precision and PSA) that was entered into the database. Comments and descriptions about features mapped in the field were recorded in field books and then entered into the GIS database.

2.3.2 Differential Correction

The accuracy of the GPS unit varied depending on a variety of circumstances. With natural interference and the removal of selective availability (intentional randomization of the signals), the GPS unit was capable of estimating locations within a range of approximately 30 to 70 feet. To reduce error, raw (uncorrected) data collected with the GPS unit were downloaded and corrected using specialized software. The software corrected the location of features mapped in the field by referencing a designated base data provider with known geographic coordinates. By using the base station and collecting multiple points at a site, a differential correction was applied to the GPS output, reducing the geographic offset to 6 to 15 feet. Once differential correction was accomplished, the data were converted to a GIS file (shapefile) and exported to a designated computer folder for storage. A shapefile is Environmental Systems Research Institute's format for storing the location, shape and attribute information of geographic features.

2.3.3 Land Surveying

All new monitoring wells were surveyed by surveyors licensed in the State of Washington. Each point was surveyed to determine its map coordinates (horizontal) with reference to the State Plane Coordinate System (SPCS), based on North American Datum, 1983 Adjustment (NAD 83) and converted to NAD 27, as needed. The surveys were connected to SPCS by third order, Class II control surveys in accordance with the Standards and Specifications for Geodetic Control Networks. All points have a horizontal accuracy of at least ±0.1 foot.

The elevation of a designated point on the top of the polyvinyl chloride (PVC) well casing (not protective casing) and the survey cap on the well apron were also surveyed for each

monitoring well. The elevations were surveyed to within ±0.01 foot and referenced to the National American Vertical Datum, 1988 Adjustment (NAVD 88) and converted to the National Geodetic Vertical Datum of 1929 (NGVD 29), as needed.

2.3.4 Geographic Information System

A desktop GIS was created for field operations using standard GIS software (ArcView 3.2). The project GIS was capable of integrating information from several data sources. Field mapping, geophysical data, aerial imagery and AutoCAD files could be viewed in unison, creating an increased understanding of geospatial data at the site. The project GIS was used during the 2000 RI to develop maps presented in the PFIDs and to analyze spatial information, such as concentrations and site attributes. The GIS database system and project web site were also used to propose and communicate the status of FCRs.

2.3.5 Preliminary Field Investigation Data Reports

Findings from field reconnaissance and proposed sample locations for ASG and surface soil samples were presented to the project team as PFIDs. A PFID summarized the results of the field reconnaissance and mapping, presented geophysical results and presented proposed locations for sample collection. Items included in the PFIDs included task descriptions, data collected, personnel involved, location maps and photographs. These data summarized the initial field reconnaissance program for each PSA.

The investigation team developed over 70 PFIDs throughout the investigations. Each document followed a general format consisting of task descriptions, types of data collected, investigation personnel, location maps and photographs. The PFIDs typically included the following information.

Text document: This one-or-two-page document provided a description of task conducted on-site, information concerning personnel involved, samples and data collected, weather conditions, problems faced in the field and relevant comments.

Location map: The one-page location map showed a map legend with the geographic location (i.e., township, range and section) of field activities and one or more enlarged section illustrating the location of the study area and surrounding features.

Detail map: The one-or-two-page map provided a detailed view of the study area and data collected.

Photographs: Digital photographs were selected from the photograph library to represent the data discussed within the PFIDs. Initially, the photographs were included with the PFID document, but were later made into individual electronic files to shorten the document download time.

Name designations for PFID documents consisted of the following five elements:

- A three-digit site alphanumeric location identifier based on PSA location

- A two-digit year designation
- A three-letter project site destination: MLW for Moses Lake Wellfield
- A unique three-digit sequential number assigned to each PFID starting with 001, 002, etc.
- The four-letter data set code: PFID

The PFIDs discussed in Section 4.0 follow this naming convention.

2.4 GEOPHYSICAL SURVEYS

After study area boundaries were identified based on reconnaissance and field mapping, geophysical surveys were performed at sixteen PSAs. A standard non-intrusive electromagnetometry (EM) terrain conductivity system and ground penetrating radar (GPR) were used to survey the areas. The EM surveys were performed with an EM31-DL terrain conductivity meter and the GPR surveys were performed using a Geophysical Survey Systems, Inc., SIR 2000 Subsurface Interface Radar System equipped with a 300 or 500 megahertz antenna.

The objective of the geophysical surveys was to define, to the extent practicable, the horizontal and vertical limits of the landfills and any anomalies that could potentially represent buried debris. Results from geophysical surveys were used to strategically locate groundwater monitoring wells for determining if the main mass of metallic debris in a landfill was a continuing source of groundwater contamination. The geophysical surveys were also used to identify surface soil sampling, FPXRF testing and trench locations. An overview of the geophysical survey process is described in the subsequent paragraphs.

In addition to landfill PSAs, EM and GPR were used at surface discharge and open pit, ditch and drain PSAs to locate buried pipes or debris and other potential anomalies. The data from the EM and GPR surveys was compiled on-site and downloaded into the GDMS. The results were illustrated in PFIDs and uploaded onto the USACE's project web site throughout the investigation shortly after the data were collected.

The 2000 investigation team included a full-time on-site geophysicist and technician from a subcontractor. Geophysical data acquisition consisted of the tasks listed below.

- Determining geophysical coverage area
- Developing grid system and horizontal control
- Data collection
- Data analysis
- Data reporting

Based on the information collected during the reconnaissance, an area for the initial geophysical survey was selected using the study area boundary markers as a reference. The geophysicist and other investigation team personnel worked closely together to

evaluate the geophysical data and adjust the geophysical survey areas to accurately identify the lateral limits of any anomalies. The study area was expanded if anomaly trends appeared to continue outside of the initial geophysical coverage area. A buffer area was surveyed around detected EM anomalies of at least 200 feet to provide background data of undisturbed ground to compare with disturbed areas.

The geographical sections for EM coverage were divided into cells 200 by 200 feet. The northwest corner of each cell node was labeled with a unique alphanumeric identifier using the section number, letters A to Z from west to east and the numbers 1 to 26 from north to south. Wooden lathes labeled with the identifier marked each node location in the coverage area. Each cell was then further divided up into traverse lines spaced 15 feet apart. The geophysicists recorded subsurface electrical conductivity data every ten feet along a traverse line creating an effective grid size of 15 feet wide by ten feet long. GPR data were collected continuously along traverse lines spaced at a minimum distance of 15 feet. After surveying approximately 100 acres, the EM traverse line spacing was increased to 30 feet, as it was determined that a closer spacing was not necessary to collect sufficient data.

The EM and GPR data were collected electronically and processed by the investigation team on-site on a daily basis. The EM data were processed to generate preliminary electromagnetic terrain conductivity and in-phase component contour maps. Radar signatures from the GPR surveys were reviewed in a similar fashion. The investigation team closely examined the maps to determine evidence of physical variations in the subsurface that could be related to buried debris or other anomalies. If necessary, adjustments to the coverage area were made prior to resuming the survey. The preliminary terrain conductivity maps were electronically added to the GDMS and illustrated in PFIDs throughout the field investigation.

The first landfill investigated, Base Closure Landfill (Site 6a), was used to evaluate if the EM and/or GPR tools could provide useful data for site characterization. The results of the first EM survey were able to produce good electrical conductivity of the subsurface to an average depth of 15 feet bgs. The EM terrain conductivity and in-phase component contour maps were able to identify anomalies and delineate the boundaries of buried debris. Several GPR profiles were performed at Site 6a. Based upon site-specific conditions, including depth of penetration and presence of surficial debris, the results ranged from conclusive to inconclusive. At the South Base Dump (Site 20), the geophysical data collected during the 2000 RI were supplemented with geophysical data also collected at Site 20 (Golder Associates, 1998).

2.5 RADIOLOGICAL SURVEY

During the 1999 RI, a radiological survey was performed at the Low-Level Radioactive Medical Waste Disposal Site (Site 29). The survey was performed using a calibrated Ludlum Model 3 (µR meter). Background external radiation levels for off-site areas and objects were established. A preliminary random survey was conducted of the entire site and vicinity with the µR meter to identify any radiation anomalies. Debris, animal burrows, plants and other potentially contaminated items were also surveyed individually.

A grid with ten by ten meter cells was established over the portion of the site containing most of the surface debris and the suspected posted area purportedly used for the disposal of radioactive waste. The grid encompassed an area of 110 meters by 130 meters. Static radiation measurements (µR/hr) were made and recorded at the center of each cell.

No radiation anomalies were identified during the walk-over survey or as the result of the static grid site measurements. It was concluded that if any radioactive materials were disposed of at the Low-Level Radioactive Medical Waste Disposal Site, the radioactivity most likely decayed or was initially so low in concentration that it was undetectable.

2.6 X-RAY FLUORESCENCE SCREENING

Four landfills, one open pit and one surface discharge area were screened for the presence of lead in soil using an FPXRF meter. The results of the FPXRF analyses were used as a screening tool only and not for quantitative assessments. The total number of FPXRF samples analyzed was 320 (242 in-situ locations and 78 prepared samples). Within landfill study areas, the features mapped during field reconnaissance and results from geophysical surveys were used to identify FPXRF sample locations. Areas with geophysical anomalies or visual disturbances (e.g., stained soil, stressed vegetation, debris piles or pits) were selected for biased FPXRF sampling locations. At selected locations, prepared samples were collected at the same location as in-situ samples. Unprepared samples were measured in-situ by the instrument without modification (i.e., without disturbing the sample), while prepared samples were subjected to grinding, homogenization and drying to improve detection limits and precision. Analytical procedures are described in Section 2.14.

The results of the FPXRF screening were used to select biased surface soil sample locations for fixed-laboratory metals analysis. The eight highest FPXRF readings from each site were selected for biased sample locations. Both the in-situ and prepared data were considered during the evaluation. PFID documents containing FPXRF results and proposed soil sample locations for fixed-laboratory metals analysis were presented to the project team for review prior to collecting the surface soil samples.

2.7 LANDFILL TRENCHING

Investigation of the landfills during the 2002 RI was conducted in accordance with the *Supplemental Management Plan* (MWH, 2001a). While non-intrusive methods were used during the 2000 RI (e.g., site reconnaissance, surface geophysics and x-ray fluorescence testing), intrusive methods were used during the 2002 RI (e.g., trenching and ASG sampling using a direct-push drill rig).

Trenches were excavated between 25 and 300 feet long at the locations of selected geophysical anomalies. Trenching was conducted in accordance with the site-specific Ordnance Avoidance Plan (MWH, 2003). On-site Ordnance and Explosives E personnel were approved by the USACE, Huntsville. The locations were chosen to investigate the strongest geophysical anomalies and/or those that appeared to be representative of the material that was buried at each landfill. The trenches were excavated with a backhoe fitted with a bucket four feet wide. The trenches were advanced to the base of the

landfills (i.e., to native soil), which was never more than 15 to 20 feet bgs. The trenches were dug continuously for their entire target length.

During the course of trenching, the contents of the trenches were evaluated. Any indicators of current or historic releases of COPCs, such as soil staining, elevated readings on a photoionization detector (PID), or containers (e.g., 55-gallon drums), were examined in detail. Drums were evaluated for their current condition and contents. The trenches were described (e.g., soil type, stains, odors and waste material) and photographed by a qualified geologist.

Once each trench was completed and soil sampling had been conducted, the excavated material was placed back into the excavation. The backfilled areas were then recompacted with the excavator so that a direct-push drill rig and support vehicle could operate safely on top of the trenched area. The compaction was not engineered or tested but was performed in a qualitative manner to ensure safe operation of the direct-push rig for a limited amount of time.

2.8 SOIL SAMPLING

During the 2000 RI, biased surface soil sampling locations were selected based on the results of field reconnaissance and FPXRF testing. The locations were marked with a stake or flag bearing the sample identification number. Soil samples were collected from approximately 60 locations at landfills, surface discharge areas, open pits, ditches and drains during the 2000 RI. Locations such as stained soil, burn areas, culvert discharge points, ditches and areas with high FPXRF readings were selected. The proposed locations of these samples were presented to the project team as PFIDs.

Before surface soil sampling, the immediate area was cleared of debris and volcanic ash. Samples were collected using a stainless-steel spoon. A two-to-three-inch diameter hole approximately two-to-six-inches deep was excavated below the ash layer. Areas with staining, odors or obvious disturbance were preferentially collected for a biased sample. If no signs of contamination were present, a sample was collected from the entire six-inch profile. In addition to completing the labels on the containers, the field team recorded the information below in the field book.

- GPS location
- Sample identification
- Analytes
- Preservation
- Sample container
- Date and time

The samples were placed in glass containers, packed and shipped according to the procedures presented in the *Management Plan* (Montgomery Watson, 1999b).

During the 2002 RI, surface and trench grab soil sampling was conducted in accordance with the *Management Plan* (Montgomery Watson, 1999b) and the *Supplemental Management Plan* (MWH, 2003). Samples were collected at locations most likely to be

contaminated, based on the presence of staining, results from a PID, information from site personnel or historical data. If no such indications were observed, then no samples were collected. The location of each sample was recorded in the field book kept by the field personnel. In order to ensure that fresh, relatively undisturbed samples were collected from the trenches, the samples were collected directly from each trench (when it was less than 4 feet deep). Surface and trench samples were collected utilizing USEPA Method 5035.

2.9 ACTIVE SOIL GAS SAMPLING

ASG methods were used to evaluate the presence of VOCs in the vadose zone. Based on the information collected during the field reconnaissance, two to five biased ASG locations were selected at each site, unless the number of samples was modified by an approved FCR. Additional samples were collected at selected sites during Expedited Investigations and the 2002 RI.

Soil gas samples were collected at locations, such as former vaults or USTs, stained soil, stressed vegetation, burn areas, culvert discharge points, pits and ditches. The proposed locations of these samples were presented to the project team as PFIDs. Following approval of these locations, ASG samples were collected in accordance with ASTM Standard D 5314-93.

Each sample location was cleared of underground utilities prior to intrusive activities. Sample locations were chosen, if appropriate, that did not require coring of asphalt or concrete.

A direct-push rig was used to collect the samples. The direct-push rig was a hydraulically driven soil-vapor probe constructed of a one-inch outside diameter steel tube and a hardened drop-off steel tip. Listed below are the steps involved in the sampling process.

1. Position the direct-push rig over the sampling point and set up.

2. Drive the soil vapor probe to the desired depth.

3. Retract the soil vapor probe to expose the vapor sampling port and insert the sample tubing.

4. Purge the tubing.

5. Measure the total VOCs using the PID.

6. Connect a pre-vacuumed Summa canister to the sample tube and collect the soil gas sample.

7. Remove the tubing and retract the vapor probe.

8. Fill the hole with bentonite and hydrate with potable water.

9. Decontaminate the equipment and move to the next sampling location.

Once the rig was backed over the sampling point, the sampler was raised and four-foot-long rods were attached to the drive system. The rods were then driven to the desired depth by using a hydraulic hammer. The depth of sampling depended on subsurface conditions encountered. Naturally occurring subsurface materials consisted of coarse sediments that included gravel, cobbles and boulders and limited the ability to place soil gas samplers at precise depths with the direct-push tool. Consequently, attempts were made to advance the borehole to the desired depth (five to ten feet bgs) and then place the soil gas sampler. A five-foot minimum depth was desired because of the potential for short-circuiting of the soil gas with ambient air, which is especially likely in coarse sediments. It was necessary to locate the soil gas sampler at two feet bgs when refusal was met in only one soil gas boring located at the Aircraft Wash Rack Discharge Area (Site 3c).

Once at the desired depth, the probe retracted approximately three inches, leaving the drop-off steel tip in place and exposing a vapor sampling port. For shallow samples (less than ten feet bgs), bentonite powder was added to the top of the borehole to seal off the hole from ambient air that could dilute the sample. A one-eight-inch inside diameter nylon tube was then inserted through the center of the rod and threaded into a gas-tight fitting just above the tip. At the ground surface, a 60 cc syringe was attached to the tubing using a three-way valve to purge the nylon tube.

A minimum of 1200 cc (approximately three tube volumes) of air was purged from the tube using the syringe and three-way valve. Ambient, ground surface and sampling depth VOC concentrations were then measured using a PID meter and recorded in the field book.

To collect the soil gas sample, a six-liter pre-vacuumed Summa canister was connected to the three-way valve, and soil gas was allowed to flow into the canister. After sampling, the Summa canister valve was closed, an end cap screwed onto the valve fitting, the canister labeled, placed back in shipping boxes and sealed. In addition to completing the labels on the canister, the information below was recorded in the field book.

- Sample identification
- Sample location
- Canister number
- Sample depth
- Sample time
- Vacuum pressure in the canister prior to and after filling

Decontamination procedures consisted of cleaning the reusable soil gas sampling port using Alconox, rinsing using potable water and allowing it to air dry. The nylon tubing was discarded after each sample was collected.

The Summa canisters were prepared at the laboratory and pressurized to a vacuum of approximately 25 inches of mercury (Hg). Prior to sampling, each Summa canister was checked at the site to ensure that it registered with a pressure of at least 25 inches of Hg.

Canisters that did not have the required vacuum were returned to the laboratory empty. After sampling, approximately one inch of Hg vacuum was left in the canister to ensure that the canister did not leak during shipments.

At the end of each day, the filled and boxed Summa canisters were placed in larger shipping boxes holding four canisters and sealed with a completed Chain-of-Custody (COC) form. The samples were submitted to the laboratory and analyzed for VOCs by USEPA Method TO-14A.

2.10 HYDROGEOLOGIC INVESTIGATIONS

Hydrogeologic investigations were conducted during the RIs, as well as the Expedited Investigation conducted at the LOX Plant in 2001. New monitoring wells installed during the 1999, 2000 and 2002 RIs, along with pre-existing wells, were used to develop the site hydrogeologic conceptual model. These wells were also used to evaluate site-wide distribution of organic and inorganic chemicals. The locations of monitoring wells relative to the PSAs is shown in Figure 2-1, *Locations of Monitoring Wells and Surface Water Sampling Locations.*

Starting in November 1998, water levels were measured in all available wells on a quarterly basis until April 2000. Water levels were then measured quarterly until December 2000. Water levels were also measured in May and October of 2002.

During the RIs, 17 alluvium wells and 34 basalt wells were installed (there were 19 alluvium and seven basalt wells installed during previous investigations). These wells were installed at key locations for evaluating the following.

- Nature and extent of COPCs
- Site stratigraphy
- Water levels and groundwater flow directions
- Groundwater chemistry (e.g., metals and natural attenuation parameters)
- Numerical and contaminant transport modeling data

The subsurface at the site consists of alluvium underlain by basalt, as described in Section 3.0. All wells were designated as either basalt wells (BW) or alluvial wells (AW). Wells designated as BW (i.e., 99-BW01) were screened within the upper ten feet of relatively competent basalt. An exception occurred during the 2002 RI, when two wells (02-BW01 and 02-BW02) were screened in a deeper portion of the basalt, as described in Section 3.0. Wells designated as AW (i.e., 99-AW01) were within the alluvium. The number preceding the well type designation indicates the year of installation.

Wells that were installed in 1999, 2000, 2001 and 2002 drilled were constructed in accordance with the *Drilling and Well Installation Plan* included in Appendix A of Volume II of the *Management Plan* (1999b). Details concerning installation of earlier wells can be found in the Dames & Moore reports (Dames & Moore, 1993 and 1995). Drilling methods used included a combination of air percussion and air rotary for the alluvium and rotary for the basalt. All wells were constructed of four-inch diameter PVC casing. Schedule 40 casing was used for wells less than 150 feet deep, while schedule 80

casing was used for wells greater than 150 feet deep, with the exception of 99-AW10, which was constructed using Schedule 40 casing. All wells were screened with ten feet of 0.020-inch machine slotted screen, with the exception of 99-BW17, which was used for the pump test. This well was screened with 20 feet of 0.020-inch wire wrap screen. All wells have a filter pack, which extends to at least three feet above the top of the screened interval. Above the filter pack, each well has a bentonite seal plug at least 2 feet thick and an annular seal of high-solids bentonite grout or bentonite chips extending to the surface. Each well is completed with either above ground or flush-mount protective casing. The above ground protective casing consists of steel, eight-inch diameter cylinders approximately two and a half feet above the ground surface. Each above ground protective casing is locked by an USACE key-alike lock. Bollards are evenly spaced around each protective casing for additional protection. Flush-mount surface completions consist of a 12-inch diameter steel casing and are secured with a locking cap. The caps are locked with specially fitted bolts and a key wrench.

While drilling through the alluvial deposits, the team collected samples using a split-spoon sampler where possible. In coarser alluvium, sampling was attempted every 20 feet. Split-spoon samples were attempted every five feet in well 01-BW01 between five and 92 feet bgs. Samples of the drill cuttings were collected at sites where split-spoon sampling was not practical. Within finer-grained deposits (silt), split-spoon samples were collected every five to ten feet depending on drilling conditions. Split-spoon sampling was done with a three-inch diameter sampler driven by a 140-pound hammer. Samples were logged and then placed in plastic bags for storage.

In borings that advanced into the basalt, continuous sampling was attempted with a wire-line coring system (in most cases, only partial recovery occurred). The core sampler was advanced while drilling, generally in five-foot increments. Each interval of the core was logged and placed in a core box in a manner that retained as much of the original structure as possible.

During drilling, the on-site geologist logged both alluvial materials and rock core. Logs of the alluvial materials include depth, soil classification (using the Unified Soil Classification System), angularity, color (using the Munsell Soil Color Chart) and lithology. Rock core logs included color, lithology, discontinuity data, Rock Quality Designation and percent recovery.

2.11 GROUNDWATER SAMPLING

2.11.1 Domestic Well Monitoring Program

This section presents methods and techniques used during the sampling of domestic wells. Domestic wells were sampled and analyzed to evaluate the potential risk to humans from drinking water from the upper hydrostratigraphic unit. Some wells were also sampled to supplement data from the monitoring wells to evaluate the distribution of TCE in groundwater.

2.11.1.1 Domestic Well Inventory Procedures

Domestic wells were evaluated during the RIs as wells to be sampled and/or wells to be added to the domestic well database. Domestic well sampling occurred in 1999, 2000, 2001 and 2002. The USEPA and/or USACE proposed the initial lists of domestic wells to be sampled based on those most likely to be impacted by the plume and/or system wells servicing multiple residential or multiple industrial connections. In some cases, individual well owners requested that their wells be sampled. The actual list of wells sampled was generally a subset of the initial list based on access and rights-of-entry. In some cases, nearby wells were sampled instead.

A database of all known and/or permitted domestic water supply wells within the study area was developed and maintained during the RIs. The primary purpose of maintaining this database was to provide data describing the use of groundwater as a drinking water source within areas potentially affected by contamination associated with the Moses Lake Wellfield Superfund Site. Development of the database was accomplished by incorporating data from the sources listed below.

- An initial inventory of domestic wells in the project area that was contained in historical reports: Golder Associates (1991), Dames & Moore (1993), URS Greiner (1998)
- Original well completion logs
- Information provided by the USACE and USEPA
- Data collected during field investigations
- A database of Group A System wells (greater than 25 connections) and Group B System wells (2 to 24 connections) maintained by Grant County
- The Washington State Department of Health water supply well database (SADIE)
- The Washington State Department of Ecology Water Rights Application Tracking System (WRATS) database
- A report entitled *Domestic Well Sampling Site Information and Update for Rights-of-Entry Field Report from Grant County Assessor's Office, 12 May 1999 and 13 May 1999* received from the USACE. This report contained "old name" and "new name" information for domestic wells to be sampled.
- Individual well owners

Based on these sources of information, numerous wells were identified within the study area during the RIs and added to the Domestic Well Database. The information contained in this database is limited by the following:

- Some wells in the study area were not documented or were old enough that the documentation was not available

- Many well completion logs are incomplete or incorrect
- The wells and associated properties have changed ownership, in some cases several times, making it difficult to associate the correct documentation with a particular well

2.11.1.2 Domestic Well Sampling Procedures

Sampling points for domestic well sampling were determined at the time of sampling and located at the cold-water tap closest to the pump. Faucet aerators were removed if possible before sampling. The water tap was then turned on for at least 30 minutes or until the temperature stabilized to flush stagnant water from the system, unless the water tap was directly adjacent to the well head; then the water was allowed to run for no less than ten minutes or until the temperature stabilized before the samples were collected. Prior to collecting a sample, the flow rate was reduced to approximately 100 milliliters per minute (ml/min). Sample containers were filled with water directly from the tap. Components of the plumbing system were noted to assist in data interpretation. General sketch maps showing the flow systems from well head to sampling point were made for each sampled well, when appropriate. Otherwise, written descriptions of each system were prepared. Detailed sketch maps, and in some cases coordinates based on a GPS, were recorded to facilitate accurate presentation of the results and potential future sampling. Other available and pertinent data were documented including the following.

- House address
- Person interviewed
- Home owner (if different from person interviewed)
- Well description (date installed, total depth, casing length, casing diameter, screened interval, screen type, unique well identification, etc.)
- Pump description (type, depth and maximum pumping rate)
- Components of plumbing system
- Residents comments regarding water quality (taste and odor)

Domestic well samples were submitted to the project laboratory for analysis of VOCs by USEPA Method 8260B and for Hydrocarbon Dissolved Gasses (HDGs) by USEPA Method RSK 175. Additionally, the compound 1,4-dioxane was also analyzed in domestic well water during the 2002 RI, because it is considered concomitant with TCE, since it has been used as a stabilizer for chlorinated solvents. It is also considered a probable human carcinogen by the EPA.

2.11.2 Groundwater Monitoring Well Sampling

This subsection presents procedures followed for sampling both existing and newly installed groundwater monitoring wells. Groundwater was purged from each monitoring well using the procedures described in the *Management Plan* (Montgomery Watson, 1999b) and *Supplemental Management Plan* (MWH, 2003). Low-flow (minimal drawdown) groundwater purging and sampling was used at each well location. Data generated during groundwater purging and sampling were recorded on field note forms. The sampling described in this section includes the following sampling events.

- November 1999
- March 2000
- June 2000
- September 2000
- February 2001
- May 2001 (01-BW01 only)
- October 2002
- January 2003 (02-BW01, 02-BW02, 00-BW14 and 91-AW15 only)

Forty-five wells were sampled during the November 1999, March 2000 and June 2000 events. Of these wells, 25 were drilled during the fall of 1999. An additional 23 wells were installed and sampled during the 2000 RI. The newly installed wells were added to the sampling program during the September 2000 and February 2001 sampling events. Another well was installed during the LOX Plant Expedited Investigation and was sampled in May 2001. A reduced sampling event was conducted in October and November 2002 that consisted of 36 wells, and four wells were sampled in January 2003. Not all of the wells considered background wells, as discussed in Section 2.13, were sampled every event. Wells 99-BW04 and 99-BW06 were sampled only twice. To simplify the discussion, 01-BW01 sampled in May 2001 is considered part of the February 2001 event, and wells sampled in January 2003 are considered part of the October 2002 event. The locations of all the wells are shown in Figure 2-1.

2.11.3 Groundwater Purging Procedures

Groundwater was purged from each monitoring well during the 2002 sampling event using the procedures described in the following sections. Low-flow (minimal drawdown) groundwater purging and sampling was used at each well location. These methods are a slight revision to previous methods used for low-flow sampling. The methods used for sampling events conducted prior to 2002 are included in the *Management Plan* (Montgomery Watson, 1999b). Data generated during groundwater purging and sampling were recorded on sampling forms.

Pre-Purge

The depth to water was measured and recorded.

Low-Flow (Minimal Drawdown) Groundwater Purging

Purging proceeded at a rate of approximately 0.1 to 0.5 liter per minute, not exceeding 0.5 liter per minute. If possible, the purging rate was adjusted downward (minimum flow rate of 100 ml/min) so that a total drawdown of less than 0.3 foot occurred. Specific conductance, temperature, pH, dissolved oxygen (DO), turbidity and oxygen reduction potential (ORP) were measured during purging using a water quality meter with a flow-through cell. Measurements were collected at intervals of approximately two to five minutes and recorded with the groundwater elevations on the sampling forms.

If a total drawdown of 0.3 foot or less was achieved, purging ceased when the water quality parameters stabilized. The stabilization criterion that was used on three successive readings within ±0.1 for pH, ±3 percent for specific conductance, ±0.3 mg/L for DO, ±10 mV for oxidation-reduction potential, and ±10 percent for turbidity if a turbidity reading of ten nephelometric turbidity units (NTUs) or less could not be achieved after stabilization of all other water quality parameters. If the indicator parameters did not stabilize while maintaining a total drawdown of 0.3 foot or less, purging was discontinued after 45 minutes had elapsed, and samples were then collected.

If a drawdown of 0.3 foot or less could not be achieved at a purge rate of 100 ml/min or greater, the following contingency procedures were followed. First, stabilization of the water level at a total drawdown of greater than 0.3 foot was attempted. A stabilized water level was defined as a water level that remained the same or increased (the pump rate was sufficiently low to allow an equal or greater amount of water to recharge the well) over at least three successive readings.

If the water level stabilized, purging was discontinued when the water quality parameters also stabilized and samples were collected. If the water level stabilized but indicator parameters did not stabilize, purging ceased after 45 minutes had elapsed and samples were then collected.

If a stabilized water level could not be achieved at a 100 ml/min or greater purge rate, purging continued until the well ran dry or 45 minutes had elapsed. If the well ran dry, the well was allowed to recharge and samples were collected. If the well did not run dry after 45 minutes of sampling, purging was discontinued and samples were collected.

The conditions under which the samples were collected were noted on the sampling forms and in the reporting of the data. The conditions were as follows:

- Less than 0.3 foot total drawdown with stabilized water quality parameters
- Less than 0.3 foot total drawdown with water quality parameters not stabilized
- Greater than 0.3 foot total drawdown, but a stabilized water level and water quality parameters
- Greater than 0.3 foot total drawdown and a stabilized water level, but water quality parameters not stabilized

- Greater than 0.3 foot total drawdown and water level not stabilized
- Well runs dry

During and after purging, field parameters were measured as discussed in Section 2.14.4. Results were recorded on the field sampling forms. The flow-through cell was then disconnected and groundwater samples were collected in laboratory-supplied sample containers directly from the end of the pump discharge tubing. After sample collection was complete, a final water level was measured and recorded on the field groundwater sampling data sheet.

2.11.4 Groundwater Sample Collection

Samples were not collected from new wells until a minimum of 14 days after well development. Prior to sample collection, the samplers put on clean, phthalate-free protective gloves. The project laboratories supplied pre-cleaned sampling containers with preservative added, as appropriate. Groundwater samples were collected from monitoring wells using dedicated stainless-steel and Teflon™ bladder pumps to prevent cross-contamination. Dedicated bladder pumps and associated tubing were purged of standing water prior to sample collection. Sample containers were filled directly from the Teflon™-lined bladder pump discharge line. Sample volumes were collected in the following order (only pertinent analyses are mentioned here).

1. HDGs
2. VOCs
3. DO
4. Dissolved metals
5. Major ions and other analyses

VOC and HDG (methane, ethane and ethene) sample containers were carefully filled at a low flow rate (i.e., less than 500 ml/min) to minimize agitation. VOC vials were immediately sealed and visually inspected to verify that no headspace was present (i.e., no bubbles). If a sample vial contained bubbles, it was discarded and the sample recollected. During sample collection, a physical description of samples, sample time, containers and analyses were recorded on the sampling forms.

Alkalinity, carbon dioxide, hardness, pH, ferrous iron and DO were analyzed in the field because the analysis holding time (24 hours) did not permit sample shipment to a fixed-laboratory.

Samples for field measured parameters were collected in a non-preserved disposable sample jar and analyzed with a Hach field titration test kit. Analyte concentration was colorimetrically determined by color wheels and titration calculations. Information was recorded in sampling forms.

An additional two to three times the sample volume was collected for those wells requiring a matrix spike (MS) and matrix spike duplicate (MSD) sample. Two different well locations per day were chosen for the collection of the MS/MSD samples and for the

duplicate samples. The MS/MSD samples were collected for all analytes and duplicate samples were collected only for HDGs and VOCs. Specific wells were chosen for MS/MSD and duplicate samples using historical data in order to obtain a range of TCE concentrations (low to high). One trip blank set accompanied every cooler of environmental samples sent to the project laboratory for analysis of VOCs and HDGs in water. Trip blanks were analyzed for VOCs at the laboratory in conjunction with associated field samples.

2.12 SURFACE WATER SAMPLING

Surface water sampling was conducted during the 1999 RI from one seep (WS-01) and three Crab Creek locations (WC-01 through WC-04), as shown in Figure 2-1.

One objective of surface water sampling was to determine the presence and extent of TCE in groundwater seeps and springs emerging near Moses Lake. Samples from identified springs were analyzed for field parameters and selected samples were sent to the laboratory for analysis of organic and inorganic constituents. A second objective of the surface water sampling was to determine the relevance of the springs in the regional hydrogeologic system (i.e., the major ion chemistry was used to determine if the springs were part of the regional flow system).

Additionally, surface water chemistry data were collected to assist in the hydrogeologic evaluation of the interaction between groundwater and Crab Creek. These data included water quality samples that were analyzed for major ions. All surface water sampling was completed within two days during a period without significant rainfall.

2.12.1 Sampling Locations

Two springs were identified in the study area and one spring was sampled, as shown in Figure 2-1. The other spring was not sampled due to access restrictions. No other seeps were identified during a reconnaissance made by both boat and land. Crab Creek surface water sampling locations were installed as close as possible to monitoring wells 99-BW04, 99-BW06 and 99-BW08, as shown in Figure 2-1.

2.12.2 Sampling Procedures

Field personnel surveyed the entire Moses Lake shore boundary within the study area and located seeps or springs with a GPS or location sketch. Seep and spring samples were collected by digging a small hole in the seep, placing a disposable one-liter sample container free of chemical preservatives in the hole, and allowing it to fill with water for transfer to the non-disposable sampling container. Samples for the VOCs were collected directly from the seep to minimize agitation. The major ion samples were transferred to sampling containers and filtered with the use of a peristaltic pump.

Flow rate was estimated by collecting a known volume of seep discharge into a calibrated container (e.g., five-gallon container) over a specific time interval. Sufficient time was allowed in order to achieve accurate flow rate measurements. Results were recorded in gallons per minute (gpm). The flow rates were calculated using recorded time and

volume measurements. Field data was also collected at the seep including pH, temperature, conductivity and DO.

The samples collected from the four Crab Creek locations were composite samples. Three grab samples were collected horizontally across the creek in disposable one-liter sample containers free of chemical preservatives at equidistant locations. The containers were filled at approximately 1.5 feet below the surface of the water. The measurements of water quality parameters of DO, pH, temperature, conductivity, turbidity and ORP were made on each aliquot of the horizontal composite and on the composite itself. The grab samples were combined into a clean, five-gallon container, and the composite samples were transferred into sampling containers and filtered with the use of a peristaltic pump.

2.13 BACKGROUND GROUNDWATER SAMPLING

Groundwater samples were collected for analysis of dissolved metals from well locations believed to represent background conditions. Three basalt wells and three alluvium wells were sampled, as listed below.

- 99-BW05, 99-BW17 and 91-BW01
- 91-AW01, 91-AW02 and 91-AW03

Dedicated low-flow bladder pumps were installed in these background wells; the wells were then sampled using low-flow sampling methods, as described in the *Management Plan* (Montgomery Watson, 1999b). Samples were collected and analyzed for dissolved metals from these wells in November 1999, June 2000, October 2000 and January 2001.

2.14 ANALYTICAL PROCEDURES

2.14.1 FPXRF Correlation Information

Both prepared and unprepared samples were collected in accordance with USEPA Method 6200. A Niton XL-309 spectrum analyzer was used to analyze both in-situ and prepared samples for lead concentrations. Unprepared samples were measured in-situ by the instrument without modification (i.e., without disturbing the sample), while prepared samples were subjected to grinding, homogenization and drying to improve detection limits. The first set of samples collected were used to determine the FPXRF reading time required to achieve acceptable detection limits. FPXRF readings were recorded at 30 nominal second intervals for up to 180 nominal seconds. A nominal second is a weighted unit of time based on the decaying cadmium source utilized by the XL-309 during analysis. The data were evaluated based on the percentage change in detection limit for each time interval. The average percent change for the 120 nominal second time interval was the most optimal and time-effective. A reading length of 120 nominal seconds was used for all FPXRF samples throughout the site.

Prior to sampling, the immediate area was cleared of debris and volcanic ash. For in-situ samples, the XL-309 was placed in direct contact with the ground surface. The soil was tamped down and made as smooth as possible. This required some leveling of the surface

with a stainless-steel spoon. Each sample location was marked with a flag bearing the identification number. The information below was recorded in the field book.

- Sample identification
- Sample GPS location
- FPXRF reading
- Sample date
- Sample time

For prepared FPXRF samples, 50 to 100 grams of sample were collected with a stainless-steel spoon and placed in a clean plastic bag. In areas with a predominance of gravel and cobbles, only the fine-grained matrix material was collected. At locations with in-situ and prepared samples, the location was marked with one flag bearing both identification numbers. The bags were labeled with the sample identification number and collection date and were stored until the sample was prepared and analyzed.

Prepared samples were sieved with a #10 (2 millimeters) mesh stainless-steel sieve to remove larger particles and debris. The samples were then dried in a microwave for two to three minutes. At least ten grams of sample were then passed through #60 (250 micrometers) and #120 (125 micrometers) mesh stainless-steel sieves. The resulting sample was mixed and placed in FPXRF sample cups. The bottom of the sample cup was labeled with the sample identification number and analyzed for 120 nominal seconds. A record of the sample identification number, time and date analyzed, lead concentration and any other relevant comments were recorded in a field book. The sample locations, FPXRF readings, date and time, and relevant comments were then input into the database. The results of the prepared FPXRF analyses were used to evaluate the accuracy of the unprepared FPXRF results.

2.14.2 Soil Analytical Methods

Soil samples were collected from over 60 locations at the PSAs during the 2000 and 2002 RIs. Soil samples were analyzed for VOCs, metals, total petroleum hydrocarbons (TPH), or polychlorinated biphenyls (PCBs) based on historical site information, experience at other military installations, field reconnaissance results, or allowing additional assessment of site-specific release and exposure models and pathways. A list of the methods that were used is included in Table 2.2, *Sample Analytes and Methods for Soil and Soil Gas.*

2.14.3 Soil Gas Analytical Methods

ASG samples were analyzed for VOCs using method TO-14A, as shown in Table 2.2.

2.14.4 Groundwater Analytical Methods

A list of groundwater analytical methods is included in Table 2.3, *Sample Analytes and Methods for Groundwater.*

Monitoring well samples collected in November 1999 and March 2000 were analyzed for the following parameters.

- Natural attenuation parameters and cations – all new and existing wells

- HDGs – all new and existing wells

- VOCs – all new and existing wells

- Metals (Sb, As, Be, Cd, Cr, Cu, Pb, Hg, Mn, Ni, Se, Ag, Tl and Zn) – wells 91-BW01, 91-AW01, 91-AW02, 91-AW03, 99-AW10, 99-BW04, 99-BW05 and 99-BW17 only

- Alkalinity, carbon dioxide, hardness, pH, ferrous iron and DO (Hach field titrations) – all new and existing wells (November 1999 samples were only analyzed for ferrous iron)

The *Management Plan Addendum* (Montgomery Watson, 2000c) presented a revised groundwater sampling program that was initiated during the June 2000 sampling event. Based on preliminary PSA boundaries, existing monitoring well locations were evaluated to determine if they could be used to characterize a particular site. At sites adequately characterized by existing wells, groundwater samples were analyzed for site-specific parameters based on the Conceptual Site Model provided in the *Management Plan Addendum* (Montgomery Watson, 2000c).

Monitoring well samples collected in June and September 2000 and February and May 2001 were analyzed for all of the parameters mentioned above plus the site-specific parameters listed below.

- Semi-volatile organic compounds (SVOCs) – wells 91-AW16, 91-AW19, 92-BW01, 92-BW02, 00-AW11, 00-AW14, 00-BW01, 00-BW02, 00-BW12 and 00-BW13 only

- Chlorinated pesticides – wells 91-AW16, 91-AW19, 92-BW01, 92-BW02, 00-AW11, 00-AW14, 00-BW01, 00-BW02, 00-BW12 and 00-BW13 only

- Metals – wells 91-AW03, 91-AW16, 91-AW19, 91-BW01, 92-BW01, 92-BW02, 99-BW05, BML-4, 00-AW11, 00-AW14, 00-BW01, 00-BW02, 00-BW04, 00-BW05, 00-BW07, 00-BW09, 00-BW12 and 00-BW13 only

- TPH – wells 91-AW16, 91-AW19, 92-BW01, 92-BW02, 00-AW11, 00-AW14, 00-BW01, 00-BW02, 00-BW04, 00-BW05, 00-BW07, 00-BW09, 00-BW12 and 00-BW13

- Glycol ethers – wells 91-AW14 and 99-BW16 only during the September 2000 event.

Three wells on the Inflation Systems, Inc. property, which is located just north of the Grant County Airport runways, were sampled and analyzed for perchlorate in January 2001.

The existing wells sampled in October and November 2002 and January 2003 were analyzed for VOCs and the field parameters ORP, DO, pH, conductivity, temperature and turbidity. The new wells sampled in January 2003 were analyzed for those same parameters plus the field parameters: ferrous iron, alkalinity, CO_2 and hardness.

2.14.5 Data Validation Methods

RI analytical laboratory data collected in 1999, 2000, and 2001 were reported following USEPA SW-846 documentation packages that provide the same level of detail as USEPA Contract Laboratory Program (CLP) Level III. SW-846 is explained in *USEPA SW-846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Third Edition* (USEPA, 1986). The CLP program is explained in *OLM02.1, USEPA Contract Laboratory Program Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration* (USEPA, 1990a) and *OLM03.0, USEPA Contract Laboratory Program Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration* (USEPA, 1990b).

Raw data was provided for samples from 1999, 2000 and 2001 that were analyzed by gas chromatography (GC) methods. Approximately 90 percent of the 2002 RI data was reported as Level III and the remaining ten percent of this data set was reported as Level IV. The Level IV data reports included raw sample and quality control (QC) data. Analytical data packages included the following:

- A cross-reference for laboratory and field sample identifications
- A case narrative discussion for non-compliant data
- Cooler receipt form(s)
- Results for sample analyses
- Reporting of internal QC results (e.g., laboratory blanks, surrogate spike samples, matrix spike samples, laboratory duplicates and/or matrix spike duplicate pairs, laboratory control standards, and calibration data)

Analytical data packages for RI data collected in 1999, 2000, and 2001 were verified and validated in compliance with the requirements of SOP-NW-18.1, “Data Validation” (included in Appendix II-C) of the *Management Plan* (Montgomery Watson, 1999b). At a minimum, data package verification for RI data collected in 1999, 2000, and 2001 included evaluation of sampling documentation and/or representativeness, technical holding time, instrument calibration and tuning, field and lab blank sample analyses, method QC sample results, field duplicates, the presence of any elevated detection limits, and a summary of qualified data. Analytical RI data collected in 2002 were validated in compliance with Tables E-4.12 through E-4.16 from the *Supplemental Management Plan* (MWH, 2003) and the *USACE Shell for Analytical Chemistry Requirements* (USACE, 2001). All data have been flagged with appropriate qualifiers.

2.14.5.1 Validation and Verification Methods

The data validation and verification methods presented in SOP-NW-18.1 (Montgomery Watson, 1999b) address the minimum requirements, which are modified from USEPA Contract Laboratory Procedure validation protocols (USEPA, 1994b and 1994c) for use with SW-846 analytical methods. The procedures contained in SOP-NW-18.1 required the following:

- An initial review or verification of the completeness of individual data packages for each sample data group (SDG)
- Validation of the data using guidelines tailored to the type of analyses performed (i.e., organics, inorganics, or radiochemical)
- Resolution of data discrepancies, where possible, by liaison with the responsible laboratory
- Qualification of data by flagging with appropriate codes, with emphasis on data usability for decision-making purposes
- Preparation of SDG data assessment summaries and a narrative report

The narrative sections of the validation method was used to form Quality Control Summary Reports (QCSRs). All validated data packages, including the data assessment summaries and QCSRs, were subject to independent technical review as noted in Section 4.1 of the *Management Plan* (Montgomery Watson, 1999b) prior to any direct submittals to USACE and USEPA and prior to incorporation of results into the reports.

2.14.5.2 Reconciliation with User Requirements

The validated analytical data from the RIs and all other reviewed and approved data in the project Environmental Data Management System (EDMS) database were evaluated against the intended uses of the data, as stated in the project Work Plan and Sampling and Analysis Plan (SAP). The results of the evaluation, any noted data gaps, and other questionable results were identified and discussed in the *Site Characterization Technical Memorandum* (Montgomery Watson, 2000a).

2.14.6 Data Quality

Data quality objectives (DQOs) developed for the RIs were consistent with the USEPA's *Data Quality Objectives for Remedial Response Activities: Development Process* (USEPA, 1987). DQOs were statements made by decision-makers to guide collection of data to meet the decision-maker's needs. DQOs included performance criteria for environmental sample collection, chemical analysis and data evaluation that ultimately governed data usability. The sample collection, analytical procedures and data review methods used for the RI data were specified in the *Management Plan* (Montgomery Watson, 1999a). Any adjustments to field or analytical procedures and data validation procedures used for the 2002 RI have been documented in the *Supplemental Management Plan* (MWH, 2003).

Comparisons of the resultant data to risk-based values were used to confirm the COPCs for inclusion in the baseline risk assessment. Method sensitivity is one of the parameters used to gauge the adequacy of sampling results to meet these goals. In addition to method sensitivity, specified Data Quality Indicators (DQIs) (i.e., PARCC parameters: precision, accuracy, representativeness, completeness, and comparability) were reviewed to ensure that the sampling data was suitable. Tolerable limits of uncertainty are also identified as part of the DQO process.

For purposes of evaluating the adequacy of the soil sampling analytical methods, soil Practical Quantitation Limits (PQLs) and Method Detection Limits (MDLs) were compared to Washington State MTCA Method A Soil Cleanup Levels (WAC 173-340-740) and USEPA Region 9 Preliminary Remediation Goals (PRGs) for soil (USEPA, 1999). The PQLs and MDLs for water methods were compared to Washington State Maximum Contaminant Level (MCLs), federal MCLs, Washington State MTCA Method A Water Cleanup Levels, and USEPA Region 9 tap water PRGs to evaluate the adequacy of the selected water methods used for the RI.

3.0 PHYSICAL CHARACTERISTICS OF THE STUDY AREA

This section provides a comprehensive summary the following topics:

- Physiography and topography
- Current and future land use
- Utilities and infrastructure
- Climate and surface water hydrology
- Geology and hydrogeology

3.1 PHYSIOGRAPHY AND TOPOGRAPHY

The Moses Lake Wellfield Superfund Site is located within part of a 63,000 square-mile region of south central Washington, western Idaho and northeastern Oregon referred to as the Columbia Plateau. The boundaries of the study area are shown in Figure 1-2. It is bound on the north and northwest by open land zoned for private use (mainly ranching and farming); Crab Creek on the east; Lewis Horn and Parker Horn on the south; and State Route 17 and Moses Lake on the west to southwest. The study area encompasses approximately 15 square miles (9,607 acres).

The land surface in the study area slopes on average 10 to 20 feet per mile toward the south and has a slope of 30 to 40 feet per mile to the east. An approximately 100-foot-high escarpment is present along the eastern shore of Moses Lake. The elevation of the site ranges from approximately 1,200 feet above mean sea level (MSL) on the escarpment east of Moses Lake to approximately 1,100 feet above MSL near Crab Creek (U.S. Geological Survey, 1978), as shown in Figure 1-2.

The topography of the general area is characterized by elevated upland areas incised by wide coulees with up to 200 feet of vertical relief. These features are interpreted to be several levels of river terraces and relic dunes (USEPA, 1989a). The upland areas typically have surficial soils with isolated patches of basalt rock outcroppings. The coulees are typically more rocky than the upland areas (Golder Associates, 1991a).

3.2 CURRENT AND FUTURE LAND USE

Information regarding present land use was obtained from the City of Moses Lake Growth Management Plan, the Port of Moses Lake District No. 10 and Grant County Department of Community Development. Since deactivation, a variety of private, federal, state, county and other city entities have acquired portions of the former LAFB. Currently, the Grant County Port District owns the majority of the site, a large portion of which is operated by the Grant County Municipal Airport. Other principal landowners of the former LAFB property include Boeing, CMC Heartlands Partners, Inc., the Washington State Board for Community College Education and the Grant County Housing Authority.

Land use planning has been conducted by Grant County, the Port of Moses Lake and the City of Moses Lake. The Grant County Comprehensive Plan/Draft Environmental Impact Statement (1999) covers the Grant County Municipal Airport and the unincorporated land.

The plan incorporates the State of Washington Growth Management Act (GMA) requirements by providing:

- A 20-year population forecast
- Identification of urban growth areas (UGAs)
- Plans for land use, transportation, housing, utilities, capital facilities and rural elements

The Grant County Airport Master Plan (Grant County, 1994) provides guidelines for future airport development while incorporating GMA planning efforts by the County. This plan forecasts expected growth of airport-related and non-airport-related activities on Port of Moses Lake property over a 20-year period and provides an implementation plan based on a best-selected alternative.

Figure 3-1, *Current Zoning Map* and Figure 3-2, *Future Land Use Map* incorporate information provided by the Grant County Planning Department. The information was provide as electronic maps on a compact disk and included the following:

- Grant County Zoning Designations
- Grant County Comprehensive Plan Designations
- Moses Lake Urban Growth Boundary (UGB)

3.2.1 Current Land Use

In general, the areas north and east of the subject site consist of unimproved open lands used for rural residences, agriculture and rangeland. Land use in the southern portion and south of the site consists of residential subdivisions, apartments, mobile home parks and commercial areas. Moses Lake is used for recreation and irrigation.

Within the Port of Moses Lake District property, land use includes aviation-related and non-aviation related activities. Existing aviation-related facilities include runways, taxiways, aprons, lighting systems and navigational aids. The runways, aprons and taxiway systems of the airport were constructed of massive concrete construction and surfaced with hot mixed asphalt. The original pavement construction in 1942 and 1943 was completed with panels that consisted of six-inch thick concrete pavement with 8-inch thickened edges. Prior to 1966, the runways were strengthened, rehabilitated, extended and modified. Two runways are designed for large aircraft (Runway 14L/32R and Runway 3/12) and two runways are available for smaller aircraft (Runways 18/36 and 14R/32L). Big Bend Community College (BBCC) uses Runway 18/36 for flight training. In addition to the runways, eight taxiways and six expansive apron areas are currently in operation. Taxiway and apron layouts are shown in Figure 1-2. External navigational aids and runway lighting provide assistance with approaches and landing at the Grant County Airport. Runway 14L/32R is equipped with an instrument landing system that consists of a localizer, glideslope and two marker beacons. The marker beacons are installed on the approach path. The outer marker, the Pelly non-directional beacon, is

located 5.8 miles out on the approach to Runway 14/L32R. The middle marker is located 2,600 feet from the threshold of Runway 14/L32R.

Two areas are developed within the Port of Moses Lake property. An industrial park apron exists near Taxiway B on the southeast edge of the airport. A terminal and adjacent areas occur on the south edge of the airport. There are over 40 buildings in these two areas, which house commercial and industrial facilities. As of 1994, the five largest employers at the Grant County Airport were as shown below.

- Sundstrand Data Control, Inc. (electronics manufacturing)
- Sonico, Inc. (aircraft component repair)
- Inflation Systems Inc. (formerly Rocket Research, automotive component propellants)
- Inland Materials (steel fabrication)
- Japan Airlines (flight crew training)

The Port of Moses Lake leases approximately 820 acres of airport land. The majority of the leases, totaling about 580 acres, are used for agriculture on undeveloped land in the north portion of the airport. Along the center of the northwest edge of the Port of Moses Lake District property, the Port of Moses Lake leases approximately 102 acres of land for irrigated agriculture. This land consists of two fields, irrigated by half-circle center pivot systems (Cascade Earth Sciences, 1998). Other large land leases include:

- 100 acres to Inflation Systems Inc. adjacent to the northeast corner of the airport
- 88 acres to Vanley Systems for a proposed foreign trade zone
- 15 acres for a recreational firing range on the southwest edge of the airport

Unincorporated areas of Grant County bound the former LAFB. These areas are depicted in Figure 3-1. Areas zoned Industrial are present on the northeast and east sides of the Port of Moses Lake District boundaries; smaller industrial and commercial properties are located along the south edge of the Port of Moses Lake. Properties zoned Agriculture are located east and southeast of the Port of Moses Lake District. Other agricultural areas, zoned Orchard, are located to the northwest of the Port of Moses Lake. Vacant or unimproved lands bound the west, northwest, northeast and south-central portions of the Port of Moses Lake District boundaries. Unimproved lands are also located east of the industrial properties on the east side of the Port of Moses Lake.

Residential areas used for single family residences and duplexes are located in the former LAFB housing complex, immediately south of the BBCC campus, which is located on the southwest edge of the Port of Moses Lake District boundaries. This residential area is bounded by State Route 17 on the west side and Patton Boulevard on the east. One area located west of State Route 17 is zoned Industrial and is currently used as a gravel pit.

Other residential properties are located south of the former LAFB housing complex and are intermixed with agricultural, public and commercial properties.

Approximately one mile south of the south end of the Port of Moses Lake District boundary is the City of Moses Lake corporate boundary, shown in Figure 3-1. Based on a 1998 City of Moses Lake zoning map, land use areas south of vacant county land that is south of the Port of Moses Lake District are zoned Multi-Family Residential (R-3) and General Commercial and Business (C-2). Further south and bordering State Route 17 are Single Family and Two Family Residential properties and General Commercial and Business (C-2). Properties south of Valley Road to the edge of Parker Horn are zoned Single Family Residential (R-1). In addition, two parcels of the former base are incorporated into the City of Moses Lake. These parcels are the Larson Sewage Plant and the former firing range (City of Moses Lake, 1998).

3.2.2 Future Land Use

Within the Port of Moses Lake property, the first priority for land use is air operations. The second priority is for activities directly related to aviation such as rescue and fire fighting, fueling, aircraft maintenance and storage and terminal activities. The third priority is assigned to businesses that have some dependence upon air transport. The following categories designate the proposed land uses for airport property according to the 1994 Grant County Airport Master Plan:

- Air Operations
- Aviation Support
- Aviation-Related Industrial
- Aviation-Compatible Industrial
- Commercial
- Industrial
- Open or Agricultural

The Air Operations land use is defined primarily by runway orientations, dimensional criteria and obstruction free areas (Port of Moses Lake, 1994). This area is reserved for airfield-related development such as runways, taxiways, aprons and navigational aids. No other development is permitted. Open or Agricultural areas are situated on the ends of Runway 32R/14L and the northeast end of Runway 3/12. A strip of Open/Agricultural land extends along the northern end of Runway 32R/14L. These areas are shown in Figure 3-2.

Aviation support areas include the airline terminal building and parking area, public safety building, fire fighting training area, hangars, fixed base operator, aviation fuel storage and airfield maintenance. The main support area is located along the terminal apron.

Aviation-related industry includes fabrication, assembly and activities that rely on aviation for the movement of products or people. Aviation-compatible industry includes industrial activities that do not interfere with aircraft operations. Excluded activities include manufacturing that emits smoke or electromagnetic radiation, attracts birds or produces glare. Aviation-compatible industry requires highway or rail access and includes transport

terminals, laboratories, warehouses, distribution centers, general manufacturing, parts assembly and cold storage.

Commercial use includes general office space and retail trade. The area on the northeast corner of State Route 17 and Chanute Street is proposed for commercial use. Examples of commercial activities include retail, food service, professional services and general office space. One institutional property, the proposed Washington Army National Guard Armory located south of the proposed commercial zone on State Route 17 and Chanute Street, will be located on Port of Moses Lake property.

Future land use designations in Grant County near Moses Lake are separated into the following categories:

- Residential
- Commercial/Industrial
- Public
- Irrigated
- Commercial Freeway Service
- Rural Remote
- Urban Growth Boundary (UGB)

Rural areas are characterized by low-density residential housing, concentrated mixed-use areas, isolated commercial and industrial uses, farms, forest, mining areas and other open-space activities. Rural Remote lands are not suitable for intensive farming and are generally not attractive for residential development. The maximum density is one dwelling per ten acres. Rural Remote land will be located west of the northwest corner of the Port of Moses Lake District boundaries.

The UGB extends the city boundary northward to include Port of Moses Lake areas, excluding the air operation areas. Zoning within the proposed UGB are shown in Table 3.1, *Proposed Zoning*.

Based on a population growth by the year 2018 of 8,337 additional people within the UGA, land demand will exceed the available supply. Therefore, other unincorporated land might be included in the UGA for urban residential use. The most promising adjacent land for this use is property within Cascade Valley area.

The Port of Moses Lake District area has 1,400 acres available for industry inside the UGA. The City of Moses Lake estimates that adequate land appears to be available near the airport and to the south and east and has designated these properties as Industrial Light and Industrial Heavy. However, areas west of the airport that are designated as Industrial Light are anticipated to have infrastructure problems due to the lack of utility connections.

3.3 UTILITIES AND INFRASTRUCTURE

Utilities and infrastructure include water lines and water distribution systems, the electrical distribution system, sewer lines, roads and railways.

3.3.1 Current Utilities and Infrastructure

Water at the Grant County Airport is obtained from the former LAFB water supply and distribution system and is part of the northern distribution system of the City of Moses Lake. This system is designated the Larson Zone and serves approximately 5,000 people. Water from this zone is obtained from a system of deep wells. Six wells (ML-21, ML-22, ML-23, ML-24, ML-28 and ML-29) had a combined potential capacity of 7,850 gallons per minute in 1991(Metcalf and Eddy, 1991). Well ML-28 was abandoned in 1998. Storage is provided on line by five elevated storage tanks with a total of 1.625 million gallons (City of Moses Lake, 1994a). In the southern portion of the study area, water is supplied by over 300 private drinking water supply wells, and as many as 120 irrigation wells occur.

The sewage system consists of shallow concrete pipes that collect and direct wastewater from the residential and commercial areas of the Grant County Airport to a lift station south of the Larson Wastewater Treatment Plant. The treatment plant is located in the northwest quarter of Section 34, Township 20 North, Range 28 East. Sewage from the Boeing facilities located on the eastern edge of the airport is also directed to the treatment plant by a shallow concrete pipe. A lift station is located south of the 3-Place Hangar. It is not known if facilities in the northeast portion of the airport are serviced by this wastewater system. The treatment plant uses aerated lagoons for treatment, then discharges effluent to the underlying shallow aquifer via three leaching ponds. The average design flow was 600,000 gpd with a peak design flow of 1.2 million gpd as of 1986 (USEPA, 1986).

Electrical power in Grant County is provided by the Grant County Public Utility District. During 1997, the electrical system in Grant County operated 3,729 miles of power lines and 41 substations. A transmission power line right-of-way is located along the northwest edge of the Grant County Airport.

As of 1966, approximately 41 miles of paved road and about 14 miles of unpaved road existed on the former LAFB (Corplan, 1966). These figures have most likely increased in subsequent years. Typically, roads are constructed with a 6-inch thick crushed rock subgrade with a 2-inch thick layer of asphalt or concrete. In addition, a railway spur line with a turn around and six sidings is located on Grant County Airport property.

Two companies dispense fuel on airport property: Jett-Aero and Executive Flight. Fuel is stored in above ground storage tanks; no fuel USTs are currently used at the airport. Jet fuel is stored in five tanks in three areas. The Exxon tank farm, located south of Randolph Road near 19th Avenue, consists of two large tanks with a total capacity of 3,429,209 gallons. Boeing has two tanks with a total capacity of 431,443 gallons, but these tanks are unused. Gasoline used for aviation and automobiles is stored in five tanks. Jett-Aero operates two aviation gasoline tanks and two vehicle gasoline tanks, and Executive Flight

operates one aviation gasoline tank (10,126 gallons). Aircraft fuel is delivered to the airport via a six-inch diameter pipeline from the Yellowstone Pipeline Company terminal, which is located approximately one-half mile east of the airport on Stratford Road. Two branches of the pipeline enter airport property. The first is near the intersection of Randolph Road and Graham Road. This branch line serves a former LAFB fuel storage area on Boeing property between Site 17 and Site 18 and is no longer in use. The second branch enters Port of Moses Lake property near the end of Runway 32R. It served a former LAFB fuel storage area located at Randolph Road and 21st Avenue.

3.3.2 Future Utilities and Infrastructure

The Port of Moses Lake developed a land application system in the agricultural area in the northwest corner of the Port of Moses Lake District for its current and future industrial customers. The project consists of a gravity sewer constructed along Randolph Road, a lift station, a force main along the north edge of the Port of Moses Lake District boundary, a storage lagoon and irrigation half-circles. The total system acreage is approximately 300 acres of irrigated land for a total flow of 1.0 million gpd (Cascade Earth Sciences, 1997).

Proposed improvements to the Port of Moses Lake do not include significant changes to the existing road system. The main approach to the airport terminal from the south will continue to be Patton Boulevard from State Route 17. A proposed realignment of the secondary access road from Chanute to Dover Street will route traffic south of Big Bend Community College. Other proposed road modifications include an extension of Dover Street east to Stratford Road and an extension of the 10 NE roadway from the north edge of the airport to State Route 17 that will improve truck access.

3.4 CLIMATE AND SURFACE WATER HYDROLOGY

The Moses Lake area exhibits features of both a maritime and continental climate. In regard to precipitation, the area is characteristic of a semi-arid to arid climate due to its location in the Cascade Range's rain shadow. The average annual total precipitation in the Moses Lake area was 7.9 inches between 1943 and 1979 (Washington Regional Climate Center Website) and the mean annual lake evaporation is 42 inches (Franklin and Dyrness, 1987 and Cascade Earth Sciences, 1998). Approximately 55 to 75 percent of the annual precipitation occurs during the period from October 1 to March 31. November, December and January are the wettest months with most of the precipitation occurring as snow (Cascade Earth Sciences, 1998).

Temperatures in the Moses Lake area are influenced by the Cascade Mountains to the west and the Rocky Mountains to the east. The Cascade Mountains act as a barrier to the continuous intrusion of coastal air to the area, which creates a wider range of diurnal air temperature fluctuations. The Rocky Mountains impede the intrusion of continental air masses, which results in a milder climate in comparison to the central United States. The mean annual temperature is 49.6 degrees Fahrenheit (°F). The average July and August temperatures are 71.5°F and 70.2°F, respectively. The average December and January temperatures are 29.0°F and 26.0°F, respectively (Cascade Earth Sciences, 1998).

Surface drainage is from north to south in the study area. The primary water bodies form the natural boundaries of the study area: Moses Lake to the west, Parker and Lewis Horns to the south and Crab Creek (a perennial stream) to the east. Other surface drainages in the area include a short intermittent stream west of the airport runways and several channels associated with agriculture in the eastern portion of the study area (USEPA, 1989a).

Surface flows in the study area are dictated largely by the Columbia Basin Irrigation Project. The project diverts water from the Columbia River below the Grand Coulee Dam through a series of irrigation canals and siphons. This water is distributed over approximately 70,000 acres for irrigation purposes. Some of the water flows into Moses Lake and Potholes Reservoir by Rocky Coulee Waterway and Crab Creek (Golder Associates, 1991b). U.S. Geological Survey (USGS) stream gauging data along Crab Creek east of the study area indicate that prior to commencement of irrigation from the Columbia Basin Irrigation Project, Crab Creek was an intermittent stream that went dry each summer.

3.5 GEOLOGY AND HYDROGEOLOGY

This section presents a summary of the regional geologic setting and the site-specific conceptual hydrogeologic model based on data collected during the RIs. Hydrogeologic characteristics that affect the model are presented, particularly with respect to features that influence groundwater flow and contaminant transport. The topics discussed in this section are as follows:

- Geologic setting
- Local geology
- Hydrostratigraphic units and their hydraulic properties
- Groundwater occurrence
- Hydrogeologic controls on groundwater flow and contaminant transport

3.5.1 Geologic Setting

The study area is characterized by gently undulating topography bounded to the east by Crab Creek and to the south and west by Moses Lake, as shown in Figure 1-2. The study area is bounded to the north and west by the boundaries of the former LAFB. A prominent escarpment exists in the southwestern portion of the study area that trends northwest-southeast and is located on the eastern side of Cascade Valley. The Crab Creek drainage is bounded to the east by another prominent escarpment with a north-northwest trend. The lower portion of Crab Creek drains into the Parker Horn of Moses Lake, which defines the southern extent of the study area. Another significant topographic feature within the study area is an elevated, north-trending terrace on the west side of Crab Creek that intersects with Cascade Valley Escarpment in the southern portion of the study area. This fluvial terrace defines the western extent of the valley that is currently occupied by Crab Creek.

The study area lies between two paleochannels that carried a large part of the Columbia River discharge during the late Pleistocene. Scabland topography that developed on the

basalt bedrock is now occupied in part by Crab Creek. The scabland area slopes gently to the south. Portions of this erosional topography (i.e., in the northern part of Crab Creek) have recently become swampy due to discharge from springs and seeps along the base of the escarpment east of Crab Creek. These localized groundwater discharge areas are apparently due to irrigation on the highlands upgradient and to the north and east of the study area.

The interfluve between Crab Creek and Moses Lake slopes gently to the east through a succession of fluvial terraces. The terraces that abruptly terminate at the escarpment east of Moses Lake are partially obscured by abandoned stream channels filled with long bars of basaltic gravel. The highest terraces, located east of Crab Creek and west to northwest of the former Larson Air Force Base, reflect the earliest stream stages. The terraces on the lower portion of the interfluve reflect a period of proglacial stream flow with abundant gravel loads. Only minor changes in topography have occurred since the late Pleistocene, and the surface exposure is dominated by outcrops of Pleistocene and Quaternary fluvial deposits.

Geologic formations present in the subsurface include, from youngest to oldest:

- Hanford Formation (Pleistocene)
- Ringold Formation (Pleistocene to Pliocene)
- Wanapum Basalt (Miocene)

Other basalt formations exist above and below the Wanapum Basalt (Swanson, et al., 1979) within the Columbia River Basalt Group (e.g., the Saddle Mountains Basalt and the Grande Ronde Basalt, respectively). The overlying Saddle Mountains Basalt is not present in the study area. The Grande Ronde Basalt underlies the Wanapum Basalt and is not the focus of this RI.

The term Hanford Formation is a locally used term to describe Pleistocene deposits of outburst floods from Glacial Lake Missoula. The deposits regionally consist of fluvial gravel (boulders to fine sand) primarily composed of rounded basalt, but also include some erosional fragments of the underlying Ringold Formation, granitic and metamorphic rocks and caliche (Gulick, 1990).

The Ringold Formation is a Late Miocene to Early Pliocene sequence consisting of coarse-to-fine fluvial clastics, tuffaceous sand and silt, buff clay to silt and fine sand with numerous thin caliche layers (Gulick, 1990). The surface of the Ringold Formation has been dissected by Pleistocene glacial meltwater streams.

The Wanapum Basalt is predominantly olivine-bearing and slightly to moderately plagioclase phyric. It is divided into four members of which only three have been encountered in the study area: the Priest Rapids Member, the Roza Member and the Frenchman Springs Member (Swanson, et al., 1979). The Priest Rapids Member consists of up to four flows and is approximately 200 feet thick at its type locality. However, only one of its flows is typically present over most of its extent. It typically consists of small olivine and plagioclase phenocrysts, and occasional glomerocrysts of olivine and plagioclase. It can also be aphyric and coarse grained.

The Roza Member consists of up to four flows (Reidel and Hooper, 1989) and is plagioclase-phyric. Single crystals predominate over glomerocrysts, typically make up five to eight percent of the rock mass and are greater than five millimeters long. Within the Moses Lake area, there are reportedly three Roza flows present as observed in the new Skyline Replacement well, which is currently in the process of being completed. The thickness of the Roza Member is approximately 250 feet thick.

The Roza and Priest Rapids Members are separated by the Quincy Diatomite Bed (Swanson, et al, 1979), also referred to as the Quincy interbed. The term Quincy interbed is used in an informal sense. In some places the Quincy interbed is intermixed with the Roza Member (peperite). The Quincy interbed is considered contemporaneous with the Roza Member.

Small outcrops of the Priest Rapids and Roza Members can be observed in the northeast corner of the study area (Gulick, 1990) along Stratford Road. These are presumably the same members that underlie the study area. Other than Quaternary alluvium and Pleistocene glacial outburst flood deposits, no other outcrops exist within the study area. Available geologic data suggest that the Moses Lake area is within the larger Quincy Basin. The structural association of the local geology to the overall basin was not defined as part of this investigation. Structural data are lacking for the study area, but at least one plunging syncline has been inferred (Drost and Whiteman, 1986), the axis of which plunges to the south-southwest through the Moses Lake area.

3.5.2 Local Geology

The local stratigraphy of the site is described based on the results of drilling during the 1999, 2000 and 2002 RIs, as well as previous investigations, as described in Section 1.0. All boring logs developed during the Remedial Investigations are included in Appendix A, *Boring Logs and Well Construction Diagrams.* A generalized stratigraphic column is shown in Figure 3-3, *Generalized Stratigraphy*. The locations of monitoring wells relative to the PSAs are shown in Figure 2-1.

Surficial deposits include recent volcanic ash deposits, various undifferentiated and unconsolidated eroded sediments and soil. As shown in Figure 3-3, the subsurface geology in the study area is largely comprised of unconsolidated fluvial gravel and flood sediments of the Hanford Formation underlain by sand, silt and clay of the Ringold Formation. The Ringold Formation is underlain by the Wanapum Basalt.

The stratigraphic model used in this report is a revision of the model used in previous reports and is based on regionally recognized stratigraphic units of the Columbia River Basalt Group. As seen in Figure 3-3 and consistent with the discussion included in Section 3.5.1, the stratigraphy is divided into, from youngest to oldest, the Hanford Formation, the Ringold Formation and the Priest Rapids and Roza Members of the Wanapum Basalt.

The focus of the RIs has been on the Hanford Formation, the Ringold Formation, the Priest Rapids Member and the upper Roza flow (Roza 1). Deeper portions of the Wanapum Basalt were not investigated as part of the RIs. However, deeper portions of

the Wanapum were encountered and logged during drilling of the Skyline replacement well. The log for this well is included in Appendix A1.

The stratigraphic unit that each well is screened in, as well as structural data from each well boring (e.g., depths to stratigraphic contacts) is shown in Table 3.2, *Summary of Geologic Data from Boreholes*. The uppermost stratigraphic unit encountered in all borings was unconsolidated alluvial and/or glaciofluvial strata consisting of sand-, cobble- and small boulder-sized material of the Hanford Formation. Subrounded basalt clasts make up approximately 95 percent of the Hanford Formation. The remaining five percent of coarse material consists of subrounded granitic clasts and medium-to-coarse-grained sand. Caliche was occasionally observed in the lower portion of the Hanford Formation near the contact with the underlying Ringold Formation.

The stratigraphic data collected from the well borings during the drilling were used to generate unit thickness (isopach) and structural (elevation) contour maps. The thickness of the Hanford Formation is shown in Figure 3-4, *Hanford Formation Isopach Map*, which shows that the Hanford Formation occurs throughout the study area with the exception of the Crab Creek drainage. Hanford Formation sediments encountered while drilling across the site ranged in thickness from zero feet near Crab Creek to 138 feet near Moses Lake. Alluvial sediments encountered during drilling near Crab Creek are thought to be associated with recent fluvial processes, as opposed to proglacial flooding.

Geologic features within the Hanford Formation that likely affect groundwater flow and contaminant transport include the following:

- Coarse, permeable texture, which allows rapid groundwater movement
- Heterogeneous hydraulic conductivity (both horizontal and vertical)
- Variations in the base elevation of the unit that locally result in unsaturated conditions throughout the vertical profile

The extent of saturation within the Hanford Formation varies throughout the site and is controlled by a number of factors. These factors include the slope of the regional water table and the base elevation of the formation. The slope of the water table is less than the dip of the base of the Hanford Formation, such that the water table crosses into the Ringold Formation, because of this geometric relationship. In general, the base of the Hanford Formation intersects the water table farther to the south in the western portion of the study area (i.e., near Moses Lake) compared to the eastern extent of saturation toward Crab Creek.

The Hanford Formation is underlain by the Ringold Formation across most of the study area. The Ringold Formation consists of unconsolidated fluvial sediments of medium-to-fine sand, silt and minor clay, with some caliche. The Ringold Formation is absent in the east and northeastern portion of the study area and, like the overlying Hanford Formation, increases in thickness westward. The Ringold Formation reaches a maximum observed thickness of greater than 95 feet near the northwest property boundary (monitoring well 99-AW10), as shown in Figure 3-5, *Ringold Formation Isopach Map*.

The Ringold Formation isopach map suggests localized areas of increased thickness. Three such areas are evident in Figure 3-5, as listed below.

- In the south-central portion of the study area near 91-BW04 and 00-BW13. This corresponds to a localized area where the Hanford Formation is seasonally unsaturated, as observed in 91-AW19.
- In the west-central portion of the study area near 00-BW11. This appears to be a relatively small area.
- In the northwestern portion of the study area near 99-AW10. This represents an area where the elevation of the top of the Ringold Formation is higher than elsewhere, as can be seen in Figure 3-6, *Top of Ringold Formation.* In this area, the base of the Hanford Formation is also elevated above the regional water table resulting in the water table occurring within the Ringold Formation, as discussed in Section 3.5.3.

The eastern extent of the Ringold Formation represents a unit pinch-out, identified by the zero thickness contour shown in Figure 3-5. The stratigraphy east of the Ringold Formation pinch-out includes Hanford Formation directly overlying Wanapum Basalt or exposed basalt within the Crab Creek drainage. The pinch-out line is deflected to the south and west in Sections 33 and 34, defining an embayment in the pinch-out line. This area corresponds to a bedrock high near 00-BW02, 00-BW04, 00-BW09 and 00-BW14 (see discussion below) and/or may represent an erosional feature or a facies change (i.e., thinning of the unit).

Geologic features within the Ringold Formation that affect groundwater flow and contaminant transport are its finer texture and lower hydraulic conductivity compared to the Hanford Formation and basalt (i.e., locally it may act as a semi-confining layer). Where the Ringold Formation is present, it acts as an aquitard between the Hanford Formation and the Wanapum Basalt. However, as discussed above, the Ringold Formation surface has been eroded in places and is locally variable in texture or absent. For instance, the Ringold Formation might have a more sandy texture in some areas, as seen in the well logs from 00-BW05, 00-BW11 and 00-BW08.

The absence of the Ringold Formation beneath contaminant sources (i.e., east of the pinch-out line) may also influence the vertical movement of water and contaminants. In these areas or in areas where the Ringold Formation has a more sandy texture, the formation does not act as a vertical barrier to groundwater flow and could allow contaminants to migrate more readily into the basalt.

As discussed above, both the Priest Rapids Member and Roza 1 unit were encountered in the drill holes from the RIs. Isopach contours of the Priest Rapids Member are shown in Figure 3-7, *Priest Rapids Isopach Map*. This map shows that the Priest Rapids Member ranges in thickness from absent to over 20 feet within the study area. The pinch-out lines are located both on the east and west sides of the study area. The areas of maximum thickness occur in two areas: (1) around 99-BW14 and near the South Base Dump (Site 20) and (2) around 00-BW07 and 00-BW09 and near the 8-Place Hangar (Site 14).

Between these two areas, the Priest Rapids is between 10 and 15 feet thick (around the Randolph Road Base Dump, Site 31). The orientation and location of this thinner area coincides with an apparent structural feature observed in the bedrock surface, as discussed in the following paragraphs.

Relatively unaltered or unweathered sections of the Priest Rapids Member or Roza 1 unit that were encountered during drilling were fine-grained and typically dark gray. Three common features characterize these sections: dense fracturing and local brecciation, mineral alteration and the presence of vesicles. Fracturing ranges from zones of multiple flat fractures with minor secondary iron oxide (FeOx) + clay + silica ± carbonate mineral alteration to highly dissected zones that have experienced intense secondary alteration. In these dissected zones, modern or ancient fluid movement plus attendant alteration have destroyed any evidence of a fracture or fault pattern. Alteration in these zones is predominantly FeOx + clay + minor silica, although a white-to-buff-colored, non-plastic very fine-grained alteration product (perhaps clay) fills some large fractures and void spaces.

The flow interior of the Roza 1 unit (entablature zone formerly called the b-basalt, Figure 3-3) is also a fine-grained and dark gray unit, but fracturing and vesicular zones are minor. Features that may create transmissive fluid pathways are not evident, and little mineral alteration was observed. The most common alteration products observed within the unit are epidote + chlorite ± silica ± pyrite. Unlike chlorite and epidote, pyrite and silica are fracture controlled and indicate that historic fluid movement has occurred through this low-permeability rock.

Sufficient geologic data are not available to generate an isopach map for the Roza 1 unit. It is important to note, however, that outside of the area where the Priest Rapids is present (east and west of the pinch-out lines), the top of Roza 1 is likely an erosional surface. Where the Priest Rapids is present, the top of Roza 1 is a true structural surface. The elevation of the top of the basalt is shown in Figure 3-8, *Top of Bedrock*. The top of Roza 1 is shown in Figure 3-9, *Top of Roza Member*. Cross sections showing unit thicknesses are shown Figure 3-10, *Hydrogeologic Cross Sections.* The locations of these cross sections are shown in Figures 3-6 and 3-8. Outside of the area where the Priest Rapids is present, these two surfaces are the same. Within the area where the Priest Rapids is present, bedrock and Roza surfaces are separated by the thickness of Priest Rapids. There are several notable features on these maps, as listed below.

- The prominent flexure in both surfaces in the central portion of the study area that trends northwest-southeast. This flexure may be the expression of a fold (monocline) or fault.
- The shallow apparent dip of the surfaces to the northeast versus the steeper apparent dips to the southwest.
- Coincidence between the ridge trending northeast-southwest with the embayment in the thickness of the Ringold Formation with the same trend, as shown in Figure 3-5.

Bedrock highs, such as in the northwestern, and possibly northeastern, portion of the study area, as shown in Figure 3-8, result in the base of the Hanford Formation being above the water table. The absence of the upper hydrostratigraphic unit along most of Crab Creek also limits the extent of saturation.

The main geologic features affecting groundwater and contaminant movement within the basalt are:

- The relatively high hydraulic conductivity of the weathered and/or fractured portions (e.g., Priest Rapids and upper Roza 1)
- The relatively unfractured and low-permeability nature of the unweathered and unfractured portions (e.g., the lower Roza 1)
- The geometry of the bedrock surface
- The presence of the Quincy interbed
- Possible local differences in hydraulic conductivities both between and within the Priest Rapids and upper Roza 1

3.5.3 Hydrostratigraphy

The focus of the Remedial Investigations included the Hanford Formation (alluvium), the Ringold Formation (alluvium), the Priest Rapid Member of the Wanapum Basalt and the upper flow of the Roza Member of the Wanapum Basalt (Roza 1 basalt flow). In general, the Hanford Formation has the highest hydraulic conductivities at the site, while the lower Roza 1, followed by the Ringold Formation, have the lowest.

Previously, the Wanapum Basalt was divided into the a-, b-, c- and d-basalts (Golder, 1991b), here referred to as the Golder nomenclature. Figure 3-3 shows the relationship between the previous model and the one used in this report. The a-basalt consisted of the Priest Rapids Member, where present, and/or the vesiculated portion of the upper flow of the Roza Member (upper Roza 1). The b-basalt consisted of the flow interior and bottom of Roza 1 and may have also included the middle Roza Member flow (Roza 2). The c-basalt most likely consisted of all the hard and broken intervals below the b-basalt, down to the base of the Wanapum. The change in nomenclature came about during preparation of the Draft Final RI report. This change has come about as in further analyzing site hydrogeologic data that organizing hydrostratigraphy into a-, b-, c- and d-basalts (Golder nomenclature) was not allowing an adequate understanding of the occurrence and flow of impacted groundwater. Furthermore, correlation between the a-, b-, c- and d-basalts with the formally established stratigraphy of the Columbia River Basalt Group (CRBG) (Swanson, et al, 1979) was not easily accomplished for a variety of reasons. Therefore, it was decided that elimination of the use of the Golder nomenclature in favor of the CRBG nomenclature would allow for a more robust and defensible hydrostratigraphic model.

A summary of the hydrogeologic properties of the units encountered during drilling is included in Table 3.3, *Summary of Hydrogeologic Parameters*. The Hanford Formation

has a particularly high hydraulic conductivity (1.0 to 10 cm/s) that is mostly one to several orders of magnitude higher than the other units encountered during drilling.

Where it is present, the Ringold Formation semi-confines underlying groundwater within the basalt, as it has a relatively low hydraulic conductivity (6.3×10^{-6} to 6.0×10^{-4} cm/s). However, variability in grain size and thickness (or absence) of the Ringold Formation locally alters the effectiveness of this unit as an aquitard. Sandy areas within the Ringold Formation might have conductivities as high as 0.01 cm/s.

Fractures, and to some degree weathering, result in the highly permeable nature of the Priest Rapids and upper Roza 1 (0.01 to 10 cm/s). In contrast, the lower Roza 1 is dense, relatively unfractured, has an extremely low hydraulic conductivity and acts as an aquitard. Packer tests conducted in the lower Roza 1 (possibly Roza 2) showed no discernible flow. The variable hydraulic properties between the Priest Rapids/upper Roza 1 and the lower Roza 1 are primarily due to the changes in fracture density between these two units and are the basis for placing them in separate hydrostratigraphic units.

It is possible that portions of the Priest Rapids are also dense and relatively unfractured. However, the Priest Rapids observed during drilling appear to be part of the entablature-colonnade section. Although, this has not been observed in wells that penetrate 20 or more feet of the Priest Rapids (e.g., 99-BW14, 00-BW07 and 00-BW09), which is probably a function of weathering. If portions of the Priest Rapids are dense and unfractured as the lower Roza 1, then they would act as a confining layer between weathered sections of the Priest Rapids higher up in the section and the upper Roza 1.

3.5.4 Groundwater Occurrence

3.5.4.1 Groundwater Flow Directions

The elevations of the monitoring wells are shown in Table 3.4, *Well Coordinates and Elevations*. Groundwater Elevations are shown in Table 3.5, *Groundwater Elevations*. Water level maps have been prepared using October 2002 data.

The water table (alluvial potentiometric surface) generally occurs within the Hanford Formation in the southern and central portions of the study area, as shown in Figure 3-11, *Alluvium Potentiometric Surface Map – Average for May and October 2002*. In the northern portion of the study area, the water table intersects the Hanford Formation and Ringold Formation contact and is within the Ringold Formation. Groundwater flow directions in the alluvium are variable, as follows:

- South-southeast in the eastern portion of the study area, based on limited data
- Southwest in the central and southwestern portions of the study area
- Southwest to north-northwest in the area north of Moses Lake where the water table occurs within the Ringold Formation

Groundwater flow directions can change by as much as 35 to 40 degrees from season to season (Montgomery Watson, 2001a).

Horizontal hydraulic gradients within the alluvium are typically 0.004 to 0.005 foot per foot (ft/ft) over most of the site, as shown in Figure 3-11. In the central portion of the study area between Site 20 and Site 31, gradients are approximately 0.001 ft/ft.

As discussed in Section 3.5.2, the factors controlling the extent of saturation in the Hanford Formation include the following:

- The slope of the regional water table compared to the dip of the geologic units
- Localized highs in the top of the Ringold Formation and bedrock
- The spatial extent of the upper hydrostratigraphic unit

Water levels within the basalt are shown on three separate maps, as follows:

- Figure 3-12, *Priest Rapids Potentiometric Surface – Average for May and October 2002*

- Figure 3-13, *Roza Potentiometric Surface Map – Average for May and October 2002*

- Figure 3-14, *Priest Rapids and Roza Potentiometric Surface Map – Average for May and October 2002*

As seen on these maps, groundwater flow directions are generally similar between the Priest Rapids and upper Roza 1. Groundwater typically flows to the southwest based on the October 2002 data, but with some west-southwest flow in the west-central portion of the study area and a southerly flow in the south-central and southeast portions of the site. Groundwater flow directions within these units can change by as much as 35 to 40 degrees from season to season (Montgomery Watson, 2001a). Hydraulic gradients are on the order of 0.002 to 0.004 ft/ft in the central portion of the study area, as measured in Figure 3-14. Based on available data, hydraulic gradients are as low as 0.001 in the northern portion of the study area, and in the southeastern portion they are as high as 0.009 ft/ft.

A comparison of the potentiometric surfaces between the Priest Rapids and Roza reveals some differences. However, these differences might be artificially created by the contouring method and lack of data in some areas. Consequently, Figure 3-14 was created under the hypothesis that the Priest Rapids and upper Roza 1 act as one hydraulic unit.

It can be seen in comparing Figures 3-11 and 3-14 that there is divergence in lateral flow between the alluvial and basalt groundwater flows in the southeastern portion of the study area (i.e., south to southeast). This flow pattern may be the result of both the thinning of the Hanford Formation to the east and hydraulic connection between groundwater and the Lewis and Parker Horns to the east-southeast.

It can also be seen on the piezometric maps that in some cases water levels in two nearby wells appear to be reversed. In other words, the well, which is supposedly downgradient

based on the site-wide piezometric maps, has a higher water level than the other well. This occurs in several areas of the site. These apparently reversed water levels are likely the result of different hydraulic conductivities between the screened intervals of the two different wells and/or that the two wells are screened in stratigraphically different vertical intervals of the same unit. It is also possible that there are local sources of recharge, but this has not been observed during field investigations.

3.5.4.2 Vertical Hydraulic Gradients

In general, water levels between the Hanford Formation and basalt are near-equal (northern and central portions of the study area), or there is a downward hydraulic gradient. A comparison of potentiometric surfaces between alluvium (Figure 3-11) and basalt (Figure 3-14) in October 2002 (see also Table 3.5) reveals that in the northern portion of the study area water levels were within 0.5 foot. In the southern portions of the study area, groundwater levels diverge. At the location of 91-BW04 (just north of Site 20), water levels were approximately four feet apart. At the most southern pairs of wells (see 99-BW11, 99-BW09 and 00-BW10), water levels were approximately 9 to 14 feet lower in the basalt than in the alluvium. These differences are consistent with historical water levels, in which seasonal differences in the southern portion of the study area vary from less than one foot to over 15 feet, as shown in Table 3.5. The greatest differences primarily occur in the summer and fall.

The degree of hydraulic connection between the two stratigraphic units is a function of the relative hydraulic conductivities, as well as the grain size and thickness of the Ringold Formation. These differences are also the result of groundwater withdrawal from water supply wells, especially the larger domestic system wells and agricultural wells.

Groundwater elevations were measured at paired basalt wells screened in the Priest Rapids and upper Roza 1. Descriptions of the differences in their groundwater elevations as measured in November 2002 are listed below.

- Well 99-BW15 (1075.85 ft msl) is paired with 02-BW02 (1073.76 ft msl). Well 99-BW15 is screened in the Priest Rapids and upper Roza 1, while 02-BW02 is screened at the base of the upper Roza 1. The groundwater elevations in these two wells exhibit a difference of 2.09 feet suggesting that there may be a hydraulic difference between these two zones. However, these water levels were taken at a time of year when transitory affects of pumping may still be occurring and so may not be that meaningful. As well 02-BW02 is screened at the base of the upper Roza 1 and 99-BW15 is screened in both the Priest Rapids Member and the top of the upper Roza 1, it is uncertain why these wells exhibit such different water levels. However, it may be that the one foot of Roza that 99-BW15 is screened in has a different hydraulic conductivity (i.e., low hydraulic conductivity) than the base of the upper Roza 1.

- Well 91-BW03 (1072.21 ft msl) is paired with 99-BW01 (1072.56 ft msl). Well 91-AW03 is screened at the base of the upper Roza 1 and 99-BW01 is screened at the top of the upper Roza 1. Groundwater levels in these wells are 0.35 feet apart

(effectively the same) indicating that they are screened in the same hydrologic zone.

- Well 99-BW10 (1042.29 ft msl) is paired with 02-BW01 (1044.06 ft msl). Well 99-BW10 is screened in the Priest Rapids Member, while 02-BW02 is screened at the base of the upper Roza 1. Groundwater levels in these wells are 1.77 feet apart suggesting that they may be in separate hydrologic zones. Again, these water levels were taken during a transitory period.

These data suggest that at some locations, the Priest Rapids and upper Roza 1 are hydraulically distinct. However, it is important to note that head differences are just one indication of hydrologic separaton, but are not themselves conclusive, especially during a transiting period.

3.5.4.3 Seepage Velocities

Values for seepage velocities were calculated using the minimum and maximum hydraulic conductivity values shown in Table 3.3. The values for seepage velocities were calculated using the minimum and maximum hydraulic values using the following equation (Freeze and Cherry, 1979).

$$v = -\frac{Ksat}{f_{effective}}\frac{dh}{dl}$$

In the above equation, the symbol *?* represents the seepage velocity and has units of length per time, *Ksat* represents hydraulic conductivity with units of length per time, $f_{effective}$ represents the effective porosity (no units) and *dh/dl* represents the hydraulic gradient (no units). It should be noted that the seepage velocity shown in the equation represents the average velocity of fluid elements through the pore space (McWhorter and Sunada, 1977). The effective porosity represents that portion of the pore space that participates in flow and is generally less than the total porosity. Minimum and maximum effective porosity values of 0.01 and 0.1 were used in the calculations. It should be noted that the minimum effective porosity value was used to calculate the maximum seepage velocity and the maximum effective porosity value was used to calculate the minimum seepage velocity. Average seepage velocities were calculated using average values for hydraulic gradient, effective porosity and hydraulic conductivity.

Calculation of these seepage velocities resulted in the following values:

- Hanford Formation-5 to 600 ft/dy
- Ringold Formation - 6 x 10^{-5} to 0.17 ft/dy
- Priest Rapids and upper Roza 1 – 0.1 to 25, 500 ft/dy

These values illustrate the wide range of flow conditions that can occur within the study area.

3.5.4.4 Groundwater Recharge and Discharge

The primary sources of groundwater recharge to the upper hydrostratigraphic unit are listed below.

- Precipitation
- Subsurface groundwater from upgradient portions of the basalt
- Groundwater injection from the Larson Waste Water Treatment Plant (WWTP)
- Infiltration of irrigation water

One of the primary sources of groundwater recharge is precipitation. As presented in Section 3.4, the Moses Lake area is characteristic of a semi-arid to arid climate. The average annual total precipitation is approximately 6 to 10 inches. Approximately 55 to 75 percent of the annual precipitation occurs during the period from October 1 to March 31 (Franklin and Dyrness, 1987).

Groundwater recharge to the Hanford Formation from the Larson WWTP was reportedly estimated at 350,000 to 400,000 gpd (390 to 450 ac-ft/year; Mr. Tony Pfluger, City of Moses Lake Wastewater Division, personal communication, 2000). The Larson WWTP is approximately five acres in size in the northwest quarter of Section 34 and is surrounded by four site-specific monitoring wells (MW-1, MW-2, MW-3 and MW-4).

Another source of recharge to the Hanford Formation is irrigation water during the growing season (approximately mid-April to November). The source of this water might be pumped groundwater or imported water (i.e., the Columbia River). An accurate value for the amount of recharge to the Hanford Formation, particularly with respect to the amount of imported water versus pumped water, was not readily available. However, this value might be as much as 0.8 ac-ft/ac/year (Ms. Marcia Knadle, USEPA, personal communication, 2003).

The primary sources of groundwater discharge from the upper hydrostratigraphic unit (both the Hanford Formation and the basalt) are the irrigation wells and larger public water supply wells. There may also be some discharge to Moses Lake, Lewis Horn and Parker Horn. Over 300 drinking water supply wells and as many as 100 irrigation wells occur in the southern portion of the study area. An accurate calculation of the total daily or annual groundwater withdrawal rates is not available. However, based on available data, it appears that the drinking water supply wells account for approximately 1.0×10^6 to 1.0×10^8 gallons per year of discharge from the system. The agricultural wells might account for an additional 1.0×10^9 gallons per year of discharge from the system. The data provided for the drinking water wells was a combination of personal communication with two of the water system operators (Hillcrest Water Users Association and Basin Water Sources, 2000) and the Grant County water system database. The amount of water used annually by these two systems was used to estimate an average value of water usage per connection to the system. This value was then multiplied by the number of connections listed in the Grant County database to estimate a discharge value per known drinking water well in the study area.

The data provided for the agricultural wells are from the Washington State Department of Ecology's Water Rights Application Tracking System (WRATS) database, which only documents maximum allowable usage per permit application. The location of each well was indicated by quarter section or in some cases only by section. The database does not document well construction data (such as depth of withdrawal) nor does it indicate whether a well was actually permitted and constructed at the location indicated. Consequently, this database provides only an approximate estimate of the discharge rate and location of irrigation wells within the study area.

3.5.5 Hydrogeologic Controls on Groundwater Flow and Contaminant Transport

There are several important hydrogeologic controls affecting groundwater flow and contaminant transport in the study area. The following subsections summarize these features within sub-regions of the study area. It should be noted that the boundaries of these regions are somewhat artificial and approximate. While the exact boundaries of each area are not definite, discussing groundwater flow in this manner facilitates development of a general picture of groundwater flow and contaminant transport within different portions of the study area. This discussion of how contaminant transport mechanisms might vary within the study area is not meant to imply that separate groundwater flow systems exist within the upper hydrostratigraphic unit.

3.5.5.1 Northeastern Study Area

The northeastern study area is bounded by Crab Creek to the east and the Ringold Formation pinch-out line to the west and extends south to Sections 2 and 3, as shown in Figure 3-5. The absence of Ringold Formation sediments in the northeastern portion of the study area is well documented and has several implications for groundwater flow and contaminant transport.

Several wells were drilled in the area that did not encounter Ringold Formation. These wells included 99-BW04, 99-BW06, 00-BW01, 00-BW02, 00-BW03, 00-BW04, 00-BW07, 00-BW09, 00-BW12, 00-BW14 and 01-BW01. These wells are associated with a high in the basalt surface that might have prevented or limited deposition of Ringold Formation sediments. Water levels in the Hanford Formation and the Priest Rapids and upper Roza 1 are approximately the same in this region due to thinning or absence of the Ringold Formation. This suggests that the alluvium and basalt might function as a hydrogeologic unit in this area.

Due to the coarse nature of the Hanford Formation and the thin-to-absent Ringold Formation sediments, contaminants released in this area can migrate rapidly to the underlying basalt. Once contaminants reach the saturated basalt, migration pathways would be to the south to southwest depending on localized gradients and potential preferential flow pathways. Because hydraulic gradients are relatively low in this area, small-scale changes in the surface of the basalt, as shown in Figure 3-8, may influence contaminant migration.

Within this area, the Priest Rapids varies from absent to over 15 feet thick. The areas where the Priest Rapids is absent roughly correspond to where the Ringold Formation is

absent. Therefore, any contaminants released in this area would readily migrate into the upper Roza 1. In the western portion of this area, the Priest Rapids is as thick as 16 or 17 feet and is separated from the Roza Member by the Quincy interbed. This relationship might tend to impede the flow of groundwater into the Roza 1 and cause preferential groundwater flow and contaminant transport into and through the Priest Rapids.

3.5.5.2 Central Study Area

The central study area is bounded by the Ringold Formation pinch-out line to the east; the limit of saturation within the Hanford Formation to the west and northwest; and the area just north of Site 20 to the south, as shown in Figures 3-5 and 3-11. This region is characterized by thickening of the Ringold Formation from east to west. It is also characterized by water level differences between the Hanford Formation and the basalt of one to eight feet, depending on the actual area and the season. This suggests that the Hanford Formation and basalt function as separate hydrogeologic units separated by an aquitard in this area. Horizontal hydraulic gradients are primarily southwest with some more southerly to southeasterly flow on the eastern side of the area. The surface of the basalt generally dips to the southwest.

There is an embayment in the surface of the Ringold Formation at the location of, and northeast of, Site 31 that trends to the southwest. Just to the south of this feature, there is a valley in the surface of the Ringold Formation trending southwest from Site 31. These two features are likely both related to erosion from Pleistocene glacial meltwater streams, as discussed in Section 3.5.1. Although, as discussed in Section 3.5.2, the embayment in the Ringold Formation thickness might also be related to a bedrock high in this area. This feature may also influence subsurface contaminant movement.

Within this area, the Priest Rapids varies in thickness from close to 20 feet to less than ten feet. As discussed in Section 3.5.4.1, in the areas where the Priest Rapids is thickest, it might tend to impede the flow of groundwater into the Roza and cause preferential groundwater flow and contaminant transport into and through the Priest Rapids. However, where the Priest Rapids is thinner (and likely heavily weathered), contaminants might more readily migrate into the Roza 1.

3.5.5.3 Northwestern Study Area

This area is located northwest of the extent of saturation within the Hanford Formation and east of Moses Lake, as shown in Figure 3-9. The main distinguishing feature in this area is that the water table occurs within the Ringold Formation, which thickens to the west. This would tend to limit the vertical and lateral movement of contaminants due to the lower permeability of Ringold Formation (relative to the Hanford Formation).

Hydraulic gradients are west to southwest and water levels in the Ringold Formation and basalt are at approximately the same elevation. Seasonal water level changes are generally less pronounced than in the central region and in some cases are non-existent further west and north (e.g., 91-AW13 and 99-AW10).

Northeast of Moses Lake (e.g., 91-AW17, 91-AW18, 99-BW16 and 00-BW06), the top of the Ringold Formation is 25 or more feet above the lake's water level. The top of the basalt appears to be on the order of 20 or more feet below the lake's water level. If the lake, including potentially permeable lake sediments, is 25 or more feet deep, the top of the basalt might be very close (within 5 to 10 feet) to the base of the lake. If this is the case, the basalt could be in partial hydraulic communication with the lake. Without better control on the geometry of the hydrostratigraphic units west of the shoreline, it is difficult to predict how they intersect the lake. The relationship is additionally complicated by significant differences in thickness of the Ringold Formation. The thickness of the Ringold Formation is greater than 95 feet at 99-AW10 and approximately 40 feet thick south of the Grant County International Airport Terminal.

The potentiometric surface of the basalt (Roza 1 in this area) might be above the base of Moses Lake in this area. In October 2002, the water level in 00-BW06, which is 2,400 feet northeast of the eastern lake shoreline, was at 1,053.2 feet above msl, whereas the lake level is at approximately 1,045 feet above msl (±5 feet). This would suggest an upward vertical gradient between the basalt and the lake. However, if the basalt and lake are in hydraulic communication, then the upper Roza 1 water level could be equal to the lake level. If this is the case, a significantly steeper hydraulic gradient of the basalt piezometric surface must exist between 00-BW06 and the lake shoreline.

The exact relationship between water levels in the lake and the basalt are not known and, therefore, vertical gradients and recharge relationships are difficult to ascertain. If the lake is recharging the basalt, it could cause a mounding of the piezometric surface and cause groundwater flow to be deflected in directions other than the average west-to-southwest flow.

For the most part, the Priest Rapids is absent to very thin in this area and so has no impact on groundwater flow and contaminant transport.

3.5.5.4 Southern Study Area

This area is located east of Moses Lake, west of Crab Creek and from Site 20 to Lewis Horn. The main distinguishing features in this region include more-pronounced seasonal changes in water levels (due in part to increased pumping) and differences in hydraulic head between the Hanford Formation and basalt of over 15 feet. Vertical gradients are downward and the Ringold Formation is 10 to 50 feet thick. Groundwater flow directions vary from south to southeast on the eastern side of the site to southwest on the western side of the site.

Water levels are likely equal between these two units east of the Ringold Formation pinch-out, assuming steady-state conditions. Consequently, water levels between the two units converge at the pinch-out, which results in a southeastern gradient in the Hanford Formation on the east side of this area.

Important geologic controls on groundwater flow and contaminant transport might include large amounts of groundwater withdrawal due to pumping that could locally influence groundwater flow and contaminant transport patterns. The high transmissivities of the

Hanford Formation and basalt limits drawdown from individual wells, but localized changes in flow patterns are likely to occur near the larger wells. The cumulative effect of all the pumping wells might lower water levels across a large portion of the southern study area. Other geologic controls on groundwater flow and contaminant transport in this region include a Ringold Formation high near 91-AW19 that causes the Hanford Formation to become locally unsaturated and might influence groundwater flow patterns.

South of the northern end of Cascade Valley escarpment, the apparent dip of the basalt projects the surface of the basalt below the base of Moses Lake. The estimated surface elevation of the basalt is approximately 950 feet above msl, and the estimated confining head in the basalt is on the order of 30 to 40 feet. This places the basalt piezometric surface below the base of the lake (the bottom of the lake appears to be at about 1,030 feet msl). This would result in a downward hydraulic gradient between the lake and the basalt in this area. These observations suggest that, in the southern portion of the study area, hydraulic communication between the basalt and lake is non-existent or limited. This also suggests that groundwater in the basalt flows beneath and to the west of Moses Lake. However, if there were hydraulic communication between the two, the lake would be recharging the basalt due to the downward vertical gradient.

Within this area, the Priest Rapids varies in thickness from close to 20 feet to absent. As discussed in Section 3.5.4.1, in the areas where the Priest Rapids is thickest, it may tend to impede the flow of groundwater into the Roza and cause preferential groundwater flow and contaminant transport into and through the Priest Rapids. However, where the Priest Rapids is thinner (and likely heavily weathered), contaminants might more readily migrate into the Roza.

3.5.5.5 Summary of Hydrogeologic Controls on Groundwater Flow and Contaminant Transport

Hydrogeologic features or parameters that have the greatest impact on local groundwater flow and contaminant transport are summarized below.

- The coarse nature of the Hanford Formation allows rapid movement of water and contaminants.

- The thickness and distribution of underlying hydrogeologic units locally control the extent of saturation in overlying sediments. High points in the basalt and Ringold Formation result in locally variable saturation within the Hanford Formation.

- Vertical and lateral changes in hydraulic conductivity cause deflections in the groundwater flow lines between the hydrostratigraphic units. This is most pronounced across the top and bottom Ringold Formation contacts and across the line along which the northern extent of the Hanford Formation becomes unsaturated.

- The presence or absence of Ringold Formation affects the potential for downward migration of contaminants. In areas where the Ringold Formation is absent, the Hanford Formation and basalt are in direct hydraulic connection and contaminants

are more readily transported into the basalt. Sandy areas within the Ringold Formation may also result in a more complete hydraulic connection between the basalt and Hanford Formation.

- The absence of the Ringold Formation in the northeast allows direct hydraulic connection between the Hanford Formation and basalt in areas with several PSAs plus the LOX Plant (a known TCE source).

- The thinning of the Hanford Formation and Ringold Formation to the east prevents direct hydraulic contact with Crab Creek.

- The presence of the Priest Rapids, separated from the Roza by the Quincy interbed, might tend to impede the flow of groundwater into the Roza and cause preferential groundwater flow and contaminant transport into and through the Priest Rapids. In areas where the Priest Rapids is thinner (or absent), contaminants might more readily migrate into the Roza.

- Fracturing, differential erosion and the paleotopography of the basalt might provide preferential pathways for the movement of contaminants and deflect groundwater flow. These preferential flow pathways could result in non-matrix flow (e.g., fracture flow) patterns that could affect the distribution of contaminants in the subsurface.

- There appears to be a lack of direct hydraulic connection between the basalt and Moses Lake in the southern study area due to the geometric relationship between the two features. However, the basalt (Roza Member) might be close to being in hydraulic communication with the lake at the northern end of the lake.

- Water supply wells pumping mostly from the southern study area withdraw significant volumes of water from the upper hydrostratigraphic unit and at least locally deflect groundwater flow lines and increase seepage velocities toward the individual wells.

- Recharge to the Hanford Formation from the Larson WWTP and irrigation might also locally and seasonally affect groundwater flow lines.

3.5.6 Geochemistry

Trilinear diagrams were prepared to assess the major ion chemistry of the shallow Hanford Formation and basalt groundwater, as are shown in Appendix B, *Trilinear Diagrams*. The diagrams provide a visual representation of water type and demonstrate that samples from the Hanford Formation, Ringold Formation and basalt wells plot in similar locations. These data suggest that groundwater within the Hanford Formation, Ringold Formation and basalt (Priest Rapids and upper Roza 1) have similar geochemical characteristics. This supports the concept that a hydraulic connection exists between these units and that they form a single hydrostratigraphic unit. The inorganic chemistry of the groundwater beneath the site is discussed in more detail in Section 4.3.1.

4.0 NATURE OF CONTAMINATION

As discussed in Section 2.0, there were three primary aspects to the RIs, as listed below.

- Hydrogeologic investigations
- PSAs investigations
- Expedited site-specific investigations

The first RI was conducted in 1999, the second RI was conducted in 2000 and 2001 (2000 RI) and the third RI was conducted in 2002 and 2003 (2002 RI). The results of the hydrogeologic investigations are included in Section 3.0. This section describes the results of the PSA investigations and expedited investigations including results of groundwater sampling and analysis.

4.1 POTENTIAL SOURCE AREAS

Data collected as part of the RIs were used to identify COPCs at each of the PSAs, as well as update PSA background information reported in the *Site Characterization Background Report* (Montgomery Watson, 1999a). Based on the information provided in the *Site Background Summary Report* (Montgomery Watson, 1999a), 11 PSAs were categorized as NFC sites at the outset of the 1999 RI and two additional PSAs were categorized as NFC during the 2000 RI. The updated list of NFC sites is shown in Table 4.1, *No Further Characterization Sites* and is discussed in Section 4.1.1 of this document. As stated in Section 1.3.3, "No Further Characterization" is a term that the USACE agreed upon to indicate the RI for a site (portion of the Moses Lake Wellfield Superfund Site) is complete and represents a recommendation by the USACE. At the beginning of the 2000 RI, PSAs were divided into three categories: landfills; open pit, ditches and drains; and surface discharge areas. Surface discharge areas were based on the potential disposal technique used at each site. The investigation tools and corresponding PFIDs utilized to present findings at each of the three types of PSAs are summarized in Table 4.2, *Landfill Source Area Investigation Summary*, Table 4.3, *Open Pit, Ditch and Drain Source Area Investigation Summary* and Table 4.4, *Surface Discharge Source Area Investigation Summary*.

As discussed in Section 2.0, the types of data collected during PSA investigations included field reconnaissance and mapping, geophysical surveys, FPXRF testing, surface soil sampling, soil gas sampling, groundwater sampling, trenching and trench grab soil sampling. The field reconnaissance and mapping, geophysical surveys, and FPXRF testing were screening tools and were used to optimize the locations of soil, ASG and groundwater samples, as well as landfill areas to be trenched. During the 2002 RI, ground-truth (GT) areas identified in the report *Photo-Interpretation for Moses Lake Wellfield Superfund Site* (Walker, 2002) were evaluated to determine whether these GT areas should be considered PSAs.

The results of the investigations conducted at each PSA were initially documented in the PFIDs included in Appendix C, *Field Reports.* Additionally, detailed results of the geophysical surveys and the radiological survey (Site 29 only) are also included in Appendix C. Summaries of these results are shown graphically in Figures 4-1 through 4-

15. Figure 4-1, *Summary of Potential Source Area Investigations* shows the methods and quantities of investigation tools used at each PSA. Figures 4-2 through 4-9 divide the study area into eight subsections and show the results of the reconnaissance, field mapping, soil and soil gas sampling and trench locations at each PSA, as listed below.

- Figure 4-2, *Subsection A (Sites 9 and 11)*
- Figure 4-3, *Subsection B (Sites 4b, 14, 15, 17, 18, 19 and 22)*
- Figure 4-4, *Subsection C (Sites 2, 3a, 4a, 12, 16, 23 and 25)*
- Figure 4-5, *Subsection D (Sites 3a, 3b, 3c, 5, 12, 14, 23, 26, 31 and 33)*
- Figure 4-6, *Subsection E (Sites 8, 20, 34 and 35)*
- Figure 4-7, *Subsection F (Sites 6a, 6b, 14, 15, 18, 19b and 22*)
- Figure 4-8, *Subsection G (Site 19)*
- Figure 4-9, *Skyline Auto Wrecking Yard Soil and Soil Gas Results (Site 36)*

Additional site characterization results are shown in the figures listed below.

- Figure 4-10, *Geophysical Survey Results*
- Figure 4-11, *TCE Concentrations – Alluvial Groundwater-2002*
- Figure 4-12, *TCE Concentrations – Priest Rapids and Roza Groundwater-2002*
- Figure 4-13, *TCE Concentrations – Priest Rapids Groundwater-2002*
- Figure 4-14, *TCE Concentrations – Roza Groundwater-2002*
- Figure 4-15, *TCE Concentrations – Domestic Wells*

Statistical summaries of analytical results are included in Table 4.5, *Summary of Surface Soil Detections* and Table 4.6, *Summary of Soil Gas Detections*. Complete validated analytical results for all media sampled between November 1999 and February 2003 are included in Appendix D.

Comparison of surface soil maximum-detected concentrations to generic benchmark level was performed in order to develop a preliminary indication of COPCs for the PSAs and to determine whether or not a PSA should be forwarded to the FS. This comparison is presented in Table 4.5. Generic benchmark levels equal the USEPA Region 9 Industrial Soil PRGs except for TPH. TPH levels are compared to the 2001 amendments to the Washington Model Toxics Control Act – Method A (MTCA-A), cleanup levels for Industrial Soils, Cleanup Regulation Chapter 173-340 WAC, effective August 15, 2001 (WAC 173-340, amended). MTCA-B levels do not exist for TPH. Both cPAHs and PCBs were compared with the USEPA Region 9 PRGs for individual constituents. These comparisons were not intended to screen out chemicals or media at any site. A screening assessment for COPCs was conducted in accordance with USEPA Region 10 screening risk assessment guidelines and is presented in Section 6.0 of this document.

A site-specific screening level (SSL) of 7,300 ppbv TCE in soil gas was developed to determine whether TCE contamination was delineated at a site. This soil vapor SSL was developed because MTCA-B levels for soil are based on mass concentrations (i.e., in units of mg/kg) and cannot be directly compared to soil vapor sampling results, which are volume-based (i.e., in units of ppbv). Derivation of a soil vapor SSL for TCE was based on the assumption that soil concentrations of a volatile compound are in equilibrium with

soil vapor. Uncertainties in the assumption of equilibrium are described in Section 6.6.1. The lower of the MTCA-B Soil Levels for Unrestricted Land Use or Concentration for Protection of Groundwater was assumed as a protective soil SSL, in units of mg/kg. The MTCA-B Soil Level for Protection of Groundwater was identified as the lower of these two criteria. The soil vapor SSL for TCE (in unit of ppbv) was calculated based on the MTCA-B Soil Level for Protection of Groundwater (in units of mg/kg) using the Johnson Ettinger Model and the upper bound risk estimate soil parameters described in Section 6.3.5.1. The resulting soil vapor SSL of 7300 ppbv was used solely for purposes of comparison to soil vapor sampling results, and was not used for risk assessment or risk management purposes. Because soil vapor SSLS have not been published by USEPA or the Corps, the soil vapor SSL for TCE is considered site-specific and should be used with caution.

4.1.1 No Further Characterization Sites

Thirteen sites were categorized as NFC sites at the outset of the 2000 R1, as shown in Table 4.1. Additional investigations were not performed at the NFC sites. Existing data were evaluated, as appropriate, to characterize these sites during the RIs. Table 4.1 lists the NFC sites and provides rationale for no further characterization at these locations. Two of the NFC sites were identified during the 2000 RI (South Burn Pit, Site 32 and Patton Park Landfill, Site 34).

The South Burn Pit (Site 32) became a NFC site during the 2000 field reconnaissance. During reconnaissance, it was noted that the area believed to be the burn pit was a dark shadow of a water tower on aerial photographs.

The approximate location of Patton Park Landfill (Site 34) was identified in 1955 aerial photographs and an interview with a Moses Lake resident. The resident believed that waste materials had been buried at the site. The resident identified a depressed area in the field during the 1999 RI. The probable location, as shown in the *Management Plan* (Montgomery Watson, 1999b), was moved from the location of this depression based on input from the USEPA and review of aerial photographs during development of the *Management Plan Addendum* (Montgomery Watson, 2000c). During field reconnaissance, a small depression containing rocks was observed in the location that the resident had identified. No evidence of excavations or buried material was evident at either location.

An EM survey was performed at Site 34 that was centered on the small depression identified by the resident. The survey area was devoid of geophysical anomalies, as shown on Figure 4-10. The EM contour values were consistent with background values obtained in other areas. This was interpreted as a lack of buried metallic debris within the Site 34 study area. Complete results from the geophysical surveys at Site 34 are presented in Appendix C3.

PFIDs of the field reconnaissance and geophysical reports were presented to the project team. No surface soil sampling, ASG sampling or groundwater monitoring was performed at Sites 32 and 34. Both Sites 32 and 34 were categorized as NFC sites subsequent to the approval of an FCR.

Several of the sites evaluated during the 2002 RI are recommended for NFC based on site characterization as follows:

- Skyline Auto Wrecking Yard (Site 36)
- All of the GT areas
- The LOX Disposal Site (Site 19b)
- Sites 8, 20 and 31

Detailed results and justification for recommending these sites as NFC are described in the following subsections. However, a brief overview of the results is included here.

- During the 2002 RI, there did not appear to be any evidence of hazardous waste disposal or any areas of potential concern requiring further investigation at any of the GT areas. Therefore, these sites were recommended for NFC.

- The LOX Disposal site (Site 19b) was recommended for NFC based on the 2002 field reconnaissance and soil gas sampling results. Soil gas TCE results were all non-detect, except for one sample that detected a low concentration of TCE at 0.084 ppbv.

- The former Skyline Auto Wrecking Yard (Site 36) was recommended for NFC based on 2002 field reconnaissance, soil sampling and soil gas sampling results. Analytical results were non-detect for TCE in all soil and soil gas samples.

- Landfill Sites 8, 20 and 31 were recommended for NFC because existing data were adequate for site characterization. Existing data include reconnaissance, geophysics, FPXRF results, trenching results, soil, soil gas and groundwater sampling and analysis results.

4.1.2 Landfills

Seven PSAs were investigated as landfills, as shown in Table 4.2. The beginning of this section provides a brief overview of the results. Detailed results for each landfill are included in the following subsections. Potential landfill boundaries were originally delineated based on the extent of visible surface disturbance and debris in aerial photographs. Revised landfill boundaries, which are illustrated in Figures 1-3 and 2-1, were delineated based on the extent of buried debris, visual disturbances, surface soil detections and the results of the geophysical surveys. Landfill investigations conducted in 2000 included field reconnaissance and mapping, geophysical surveys, FPXRF screening, surface soil sampling and groundwater sampling. Additional investigations conducted in 2002 included trenching, trench grab soil sampling and ASG sampling. The Dump at the End of Runway 32 (Site 33) was re-categorized as a surface discharge area during the 2000 RI. As stated above, the Patton Park Landfill (Site 34) was determined to be a NFC site during the 2000 RI.

A total of 210 *in-situ* locations were tested for lead using FPXRF methods. The results of the FPXRF testing were used to select the locations for biased surface soil metals

analyses. Thirty-two biased soil samples were collected from the landfills and analyzed for the following metals: silver, arsenic, beryllium, cadmium, chromium, copper, mercury, nickel, lead, antimony, selenium, thallium and zinc. This list of metals was based on historical site information, experience at other military installations and field reconnaissance results. Lead and arsenic exceeded USEPA Region 9 PRGs in some soil samples.

New and existing groundwater monitoring wells were used to evaluate COPCs in groundwater downgradient of landfill PSAs. These parameters included semi-volatile organic compounds (SVOCs), chlorinated pesticides, metals, TPH, volatile organic compounds (VOCs) and hydrogen dissolved gasses (HDGs). Groundwater monitoring results from up to six sampling events were used for the evaluation, which represents approximately 50 percent of the total length of trench-like anomalies. Most trench-like anomalies had at least some portion of it trenched.

Trenching consisted of approximately 2,620 feet of trenching at five of the seven landfills. The objective was to determine if any of the sites were ongoing or obvious historical sources of TCE to groundwater. Trench locations were based on the results of the 2000 geophysical surveys. The excavations were advanced to the base of the landfills (i.e., to native material).

As discussed in Section 2.0, an Ordnance Avoidance plan was developed and followed during trenching at the landfills. Furthermore, the USACE received documentation that certain areas of the site were cleared for the presence of ordnance, as indicated in Appendix C4.

A total of 52 ASG samples plus associated quality assurance samples were collected from five of the seven landfills, which represents approximately 50 percent of the total length of trench-like anomalies and most trench-like anomalies had at least some portion of it trenched. A frequency of one borehole for every 50 feet of trench was used to determine the general location and number of samples collected. One sample was collected per borehole at a depth of 5 to 10 feet below the base of the landfill.

Observations made in the excavations and the results of soil and soil gas analyses indicate there are no existing sources of TCE in the landfills. However, many rusted and empty 55-gallon drums were found. Investigation results for individual landfill PSAs are described in further detail in the following subsections and the PFIDs included in Appendix C1.

4.1.2.1 Site 6a – Base Closure Landfill and Site 6b – Dumpster Wash Area

A small pit to the west of the Base Closure Landfill (Site 6a) was identified. For the purpose of the characterization, the main pit located within the original Site 6 boundaries, as defined in the *Management Plan Addendum* (Montgomery Watson, 2000c), is referred to as Site 6a. The small pit to the west of Site 6a will be referred to as the Dumpster Wash Area (Site 6b). Site 13, the site previously referred to as the Dumpster Wash Area, is now referred to as the Rock Drain Area (Site 13) and was determined to be a NFC site.

Field Reconnaissance

The location of Site 6a was identified in 1973 and 1996 aerial photographs. Field reconnaissance of the landfill covered 89.95 acres. The visible boundaries of exposed pits were delineated along with other areas of surface disturbance, old access roads and debris. The main landfill consisted of a pit approximately 50 feet deep located in the southeast corner of the study area, which contained two areas of debris. Minimal debris or landfill activity was visible in the open pits north of Site 6a. A smaller pit, Site 6b, was discovered northwest of Site 6a. The pit at Site 6a trended north-south and was approximately 30 feet deep with mounds of soil pushed up on its east and west sides. The remainder of the study area was mainly comprised of mounds of soil ranging from 10 to 40 feet in diameter and one to four feet high.

Geophysical Surveys

Geophysical surveys consisted of electromagnetic EM, EMLL and GPR. Both EM and GPR surveys were performed at the main pits associated with site 6a and 6b. Only GPR and EMLL were utilized at the visual disturbance points (i.e., soil mounds).

The anomalies indicate a large area of buried debris within Site 6a. Due to the large amount of debris occupying the base of the landfill area, it was impossible to separate out individual anomalies within the interpreted landfill boundary. The results indicated the presence of buried metal within the zone of buried debris. The relatively low magnitude of the background responses on the north, south and east sides of the interpreted boundary indicated that the survey completely defined the lateral limits of the landfill. Two GPR profiles were located across the interpreted landfill boundaries and were able to penetrate to a depth of four to six feet. The GPR data were inconclusive with regard to the lateral limits of the landfill and the data did not show any reflective horizons within the effective depth range that could be interpreted as the base of the landfill. This could indicate that the base of the landfill occurs at a depth greater than about four to six feet.

The EM survey at the Site 6b identified three anomalies interpreted to be zones of buried debris. Two of these anomalies were located in the pit area between the soil mounds and measured approximately 80 by 60 feet and 50 by 130 feet, respectively. A third anomaly existed to the east of the pit and was smaller than the other two, measuring approximately 30 by 30 feet. The tight spacing of the contours suggested that these anomalies were at least partly due to metallic sources. A pair of GPR traverses was performed over each anomaly. The profiles penetrated to a depth of five to seven feet and confirmed the EM results. Strong discontinuous reflections began and ended at the boundaries of the interpreted zones of buried debris between the mounds. The GPR data also indicated an excavation to a depth of at least five feet bgs at the north end of the pit.

Four visual impact points were investigated with GPR traverses west of the Site 6a pit. The points consisted of three mounds identified during field reconnaissance, approximately three to five feet high and approximately 40 feet in diameter and one small, shallow pit. Visual inspection of these areas suggested the possibility of man-made disturbances. Two GPR traverses and an EMLL scan were performed over each visual point. No evidence of buried debris, metal objects or excavations were detected.

FPXRF Testing

A total of 54 in-situ FPXRF surface soil locations were analyzed for lead within the study area of Sites 6a and 6b. At 13 of the in-situ sample locations, samples were collected and prepared prior to ex-situ analysis. Of the 67 readings, 44 of the analyses (66 percent) were reported below the detection limit. The detection limits for the FPXRF locations ranged from 49 mg/kg to 210 mg/kg. The FPXRF readings ranged from 64 mg/kg to 3,590 mg/kg with a mean of 324 mg/kg and an average precision error of 63 mg/kg.

The high FPXRF readings within Site 6a were located in stained soil areas or near metallic debris. Within Site 6b, the high FPXRF readings were located within darkly stained soil areas above identified geophysical anomalies. The range of FPXRF readings for the selected surface soil sample locations was 114 mg/kg to 3,590 mg/kg. The results from the FPXRF screening at this site and the selected sample locations for fixed-laboratory metals analyses are presented in the PFIDs included in Appendix C2.

Surface Soil Sampling

A total of eight biased surface soil samples were collected at Site 6a and Site 6b for metal analyses, as described in the *Management Plan Addendum* (Montgomery Watson, 2000c). The six highest FPXRF readings within Site 6a were selected for biased surface soil samples. Four locations within Site 6b reported lead readings greater than detection limits. Due to the small distances between these four samples, two of the locations were chosen for laboratory analysis.

Two samples collected at Site 6a and Site 6b reported lead concentrations of 940 and 1,900 (00MLW001SS007S06) mg/kg, respectively, exceeding the USEPA Region 9 PRG of 750 mg/kg. This sample was collected from an area of darkly stained soil at the bottom of the pit and geophysical surveys indicated the presence of buried metallic debris below the sample.

Sample 00MLW001SS001S06 was located in a darkly stained soil area below a dumping area and reported the 940 mg/kg of lead and 94 mg/kg of arsenic, exceeding the USEPA Region 9 PRGs of 750 mg/kg and 1.6 mg/kg for lead and arsenic, respectively. Four other samples reported arsenic between 1.7 and 3.0 mg/kg.

Groundwater Sampling

Groundwater monitoring wells, 00-BW01 and 00-BW14 were installed to evaluate groundwater downgradient of Sites 6a and Site 6b, respectively. Monitoring well 00-BW01 was sampled for the original suite of COPCs, which included VOCs and HDGs, as wells as some additional parameters including, SVOCs, chlorinated pesticides, metals and TPH in October 2000, for VOCs and HDGs only in January 2001 and for VOCs only in October 2002. Monitoring well 00-BW14 was sampled for VOCs and HDGs only in October 2000 and January 2001 and for VOCs only in January 2003. Concentrations were below detection limits in both wells for all parameters listed above during the indicated sampling events.

Trenching

At Site 6a, four anomalies were excavated to a depth of approximately 10 to 12 feet. Each trench was approximately 50 feet long. Excavated material from the four trenches generally included miscellaneous construction debris (wood, metal, concrete, plaster, etc.), glass bottles and plastics. One empty fire extinguisher was observed in anomaly 6AGA01. There were no liquids of any kind and no evidence of release of contaminants of potential concern, therefore, no trench grab soil samples were collected.

At Site 6b, three anomalies were excavated to a depth of approximately 12 to 15 feet. The trench lengths ranged from 35 to 125 feet with a total of 235 feet. Excavated material from the three trenches generally included miscellaneous construction debris (metal, concrete, tar paper, congealed tar, etc.), pieces of ceramic and glass bottles. Crushed, rusted, and empty metal drums were observed in the excavated material from one of the anomalies. There were no liquids of any kind and no evidence of releases of TCE, therefore, no trench grab soil samples were collected.

Soil Gas Sampling

At Site 6a, four primary ASG samples were collected, one from each anomaly. Two samples detected TCE at 3.3 and 5.5 ppbv. At Site 6b, five ASG samples were collected from two of the three anomalies. Anomaly 6BGA03 was not sampled because almost nothing was found during excavation, only two small pieces of rusty scrap metal. Four of the ASG samples detected TCE ranging from 0.1 to 0.99 ppbv with an average of 0.46 and a standard deviation of 0.38.

4.1.2.2 Site 8 – Randolph Road Base Dump

Historical information indicated that the Randolph Road Base Dump (Site 8) extended to the north and south of Randolph Road. However, during field reconnaissance of the landfill areas, the northern portion of the Randolph Road Base Dump and the 19th Avenue Base Dump (Site 31) were indistinguishable. Therefore, the northern portion of the Randolph Road Base Dump was included in Site 31. Site 8 will only refer to the south side of Randolph Road.

Field Reconnaissance

The location of Site 8 was determined based on 1955 and 1961 aerial photographs. Field reconnaissance of the site covered 164.8 acres. Mounds of soil, debris piles and linear depressions characterized the northern potion of the study area. Several linear depressions contained visible scrap metal. East of the Grant County Job Corps buildings were several shallow depressions adjacent to mounds of soil, areas of scattered debris and a concrete pad containing a small service trench and piping. Stressed vegetation and shallow excavations characterized the southeast portion of the study area. Several visual disturbance points and areas including depressions, metallic debris and stressed vegetation were mapped during field reconnaissance within the area. A pit containing debris and concrete stairs was discovered in the southern portion of the study area. The pit was approximately 50 feet in diameter and approximately ten feet deep.

Geophysical Surveys

The area of the EM investigation included 30 acres directly south of Randolph Road and a small pit in the southern portion of the study area. Four interpreted anomalies within the area could not be attributed to surface features or buried utilities. One anomaly was located to the east of the building, the second anomaly was along the fenceline of Randolph Road and the third anomaly was centered around the concrete apron. The contour variations within approximately 30 feet of the concrete apron may be attributed to the construction of the facility. The fourth anomaly was interpreted to be a landfill trench due to its linear shape and observed subsidence. The trench was located directly to the east and to the north of the two largest anomalies.

The second EM survey was performed in the area of a small pit in the southern portion of the study area. The EM survey did not indicate evidence of substantial amounts of debris; however, the survey did define an area to the northeast of the pit that appeared to be a small zone of buried debris. The zone measured 30 by 45 feet and coincided with a small mound of soil.

FPXRF Testing

A total of 47 in-situ FPXRF surface soil locations were analyzed for lead within the study area of Site 8. At 18 of the in-situ locations, samples were collected and prepared prior to ex-situ analysis. Of the 65 readings, 52 of the analyses (80 percent) were reported below the detection limit. The detection limits for all of the FPXRF locations ranged from 52 mg/kg to 140 ppm. The FPXRF readings ranged from 64 ppm to 166 ppm with a mean of 100 ppm and an average error precision of 53 ppm. The range of FPXRF readings for the 18 surface soil sample locations selected for ex-situ analysis was 64.1 ppm to 96 ppm.

Surface Soil Sampling

Sample locations for off-site metal analyses were selected at the eight locations reporting the highest FPXRF readings within the Site 8 study area. Two of the highest FPXRF locations were located in areas of visual soil disturbances. Four locations reported high FPXRF readings above geophysical anomalies. One location reported high FPXRF readings near interpreted buried debris within a pit located in the southern portion of the site. The eighth location was next to a former service pit. One sample exceeded the USEPA Region 9 PRG of 1.6 mg/kg for arsenic at 2.1 mg/kg (00MLW001SS005S08).

Groundwater Sampling

Groundwater monitoring wells 92-BW01, 92-BW02 and 00-AW11 were used to evaluate groundwater COPCs. All monitoring wells were initially sampled for the original suite of COPCs, including VOCs and HDGs, as wells as some additional parameters, including SVOCs, chlorinated pesticides, metals and TPH. Various subsets of the original suite of COPCs were sampled during subsequent sampling events. When metals were sampled, arsenic was detected in 92-BW01 and 92-BW02 and manganese was detected in 00-AW11. TCE has consistently been detected in all of the monitoring wells when sampled. TCE concentrations ranged from 22.0 to 30.0 µg/L in 92-BW01. TCE concentrations

ranged from 2.0 to 5.1 µg/L in 92-BW02 and 00-AW04. No other COPCs (SVOCs, chlorinated pesticides and TPH) were detected in any of the monitoring wells.

In addition, monitoring wells 91-AW09, 91-BW03, and 99-BW01 were also used to evaluate groundwater COPCs and are located further downgradient than the previously mentioned monitoring wells. The monitoring wells were sampled for VOCs and HDGs, as well as some additional natural attenuation parameters and major ions during the six sampling events. The TCE concentrations in 91-AW09 ranged from non-detect to 0.78 µg/L during the six sampling events. TCE concentrations ranged from 42 to 61 µg/L in 91-BW03 and from 39 to 55 µg/L in 99-BW01 during the six sampling events.

Trenching

Six anomalies were excavated to a depth of approximately 10 to 15 feet. The trench lengths ranged from 35 to 100 feet with a total of 385 feet. Excavated material from the six trenches generally included miscellaneous construction debris (wood, metal, concrete, pipes, etc.), and glass bottles. Several rusted and empty fire extinguishers were observed in anomaly 08GA06. Most of the scrap metal observed in anomaly 08GA01 was ordnance-related scrap (ORS) and was determined not to pose a risk by MWH UXO technicians because it was scrap and not able to explode. Crushed, rusted and empty metal drums were observed in the excavated material of three of the anomalies. There were no liquids of any kind and no evidence of releases of TCE, therefore, no trench grab soil samples were collected. Additional information can be found in PFID No. S0802MLWPFID003 located in Appendix C1

Soil Gas Sampling

Eight ASG samples were collected from five of the six anomalies. No ASG samples were collected from anomaly 08GA01 due to safety concerns. All eight samples detected TCE ranging from 1.0 to 17 ppbv with an average of 6.97 and a standard deviation of 6.34.

4.1.2.3 Site 20 – South Base Dump

Field Reconnaissance

The location of South Base Dump (Site 20) was determined based on 1961 and 1969 aerial photographs. Reconnaissance of the site covered 30.3 acres. The dump was located at the intersection of Road I NE and the railroad tracks that run northwest and southeast. Linear depressions, pits and sinkholes characterized most of the area. Partially buried debris, scrap metal and wood were observed in some areas.

Geophysical Surveys

An EM survey covered an area west of the main dirt road running through the site and east of the railroad tracks. Geophysical results for the adjacent area northeast of the dirt road were provided by a report prepared by Golder Associates (1998) during a previous investigation. Four anomalies were identified during the 2000 RI. One anomaly corresponded with a linear anomaly detected by the previous survey and was probably

associated with a former landfill trench. Two smaller anomalies coincided with observed surface metal. However, the size of the contour anomalies in comparison to the surface metal debris suggested that there might be additional buried objects in the same locations. The fourth anomaly occurred at the northern boundary of the survey and was located in an area of some metallic debris, ground subsidence and stressed vegetation. The northern anomaly was not entirely bounded by the geophysics survey. However, the contours were beginning to close, which indicated that the survey included a majority of the anomaly.

Golder (1998) identified three linear anomalies trending northeast/southwest beginning at the north side of the main dirt road that divides Site 20. One of the anomalies appeared to cross the road since it corresponds to an anomaly discovered during the geophysical survey performed during the 2000 RI. The anomalies on the north side of the road were wider and longer than the anomalies discovered during the 2000 investigation.

FPXRF Testing

A total of 45 in-situ FPXRF surface soil locations were analyzed for lead within the study area of Site 20. At 17 of the in-situ locations, samples were collected and prepared prior to ex-situ analysis. Of the 62 readings, 47 of the analyses (76 percent) were below the detection limit. The detection limits for all of the FPXRF locations ranged from 57 ppm to 140 ppm. The FPXRF readings ranged from 64 ppm to 2,900 ppm with a mean of 291 ppm and an average precision error of 64 ppm. The range of FPXRF readings for the 17 surface soil sample locations selected for ex-situ analysis was 64 ppm to 116 ppm.

Surface Soil Sampling

As indicated in the *Management Plan Addendum* (Montgomery Watson, 2000c), sample locations for off-site metal analyses were selected at the eight locations reporting the highest FPXRF readings within Site 20. Six of these proposed locations were located within or adjacent to visible trenches with distinct geophysical signatures. The highest FPXRF reading was located within a shallow depression with stained soil beneath the volcanic ash. The eighth proposed sample was located in an area of stressed vegetation.

One sample located southwest of the railroad tracks, reported concentrations of lead, and arsenic above USEPA Region 9 PRGs (00MLW001SS002S20). The reported concentrations of these constituents in this sample were 5,700 mg/kg lead, and 1.7 mg/kg arsenic. The USEPA Region 9 PRG for these metals were 750 mg/kg, and 1.6 mg/kg, respectively. This sample was collected from a shallow depression containing darkly stained soil beneath the volcanic ash. The depression is approximately five by ten feet and may have been a small burn area. Additionally, two samples (00MLW001SS003S20 and 00MLW001SS005S20)exceeded the USEPA Region 9 PRG for arsenic of 1.6 mg/kg at 1.7 and 1.9 mg/kg. No other samples at this site reported concentrations that exceeded the MTCA-A Soil Cleanup Levels or USEPA Region 9 PRGs.

Groundwater Sampling

Groundwater monitoring wells 91-AW19, 00-AW14 and 00-BW13 were used to evaluate groundwater COPCs. All monitoring wells were initially sampled for the original suite of

COPCs, which included VOCs and HDGs, as wells as some additional parameters including SVOCs, chlorinated pesticides, metals and TPH. Various subsets of the original suite of COPCs were sampled during subsequent sampling events. Arsenic was detected in monitoring well 91-AW19 (6 µg/L) in one of the three sampling events in which arsenic was sampled. Manganese was detected in 00-AW14 (15 to 45 µg/L) and manganese (93 to 175 µg/L) and zinc (370 to 420 µg/L) was detected in 00-BW13 during both sampling events in which metals were sampled. TCE was not detected in any of these wells during all sampling events. No other COPCs (SVOCs, chlorinated pesticides and TPH) were detected in any of the monitoring wells. It is important to note that TCE has been detected in both 99-BW18 and the Skyline Replacement well (undeepened), which are located downgradient of the Site 20 wells, as discussed in Section 4.3.2 and 4.3.4, respectively.

Excavations

Seven anomalies were excavated to a depth of approximately 4 to 15 feet. The trench lengths ranged from 50 to 300 feet with a total of 850 feet. Excavated material from the seven trenches generally included miscellaneous construction debris (wood, metal, concrete, asphalt, etc.), and glass bottles. Crushed, rusted and empty metal drums were observed in the excavated material from three of the anomalies. There were no liquids of any kind and no evidence of releases of TCE; therefore, no trench grab soil samples were collected.

Soil Gas Sampling

Fifteen ASG samples were collected from five of the seven anomalies. No ASG samples were collected from anomalies 20GA01 and 20GA03 because they were generated by a small amount of surficial scrap metal. Eleven samples detected TCE ranging from 0.1 to 57 ppbv, with an average of 11.32 ppbv and a standard deviation of 20.44.

4.1.2.4 Site 31 – 19th Avenue Base Dump

Field Reconnaissance

Aerial photographs from 1949 to 1996 were used to locate the 19th Avenue Base Dump (Site 31). Reconnaissance of the study area covered 138.48 acres. The eastern portion of the area predominantly consisted of small mounds of soil such as the ones found in the western section of Site 6a. The Aircraft Wash Rack Discharge Area (Site 3c) and the Aircraft Wash Rack (Site 3a) were also located in the eastern section of the site. The frequency of small pits containing debris was found to increase west of the paved landfill access road. Large areas of stressed vegetation littered with small pieces of scrap metal, glass and other debris were observed in the middle of the study area near the runway lights. Stockpiles of construction debris including asphalt, concrete, sand and scrap metal were found on the western side of the study area bordering 19th Avenue. Two partially buried 55-gallon drums were observed in the stockpiles. These unmarked drums were filled with concrete or were empty.

Sixty-four, 55-gallon drums were identified by the Port of Moses Lake at Site 31 in April 2000. The drums were removed by the USACE and soil sampled in May 2000. The drum removal actions were documented in PFID S3100MLW002PFID.

Geophysical Surveys

A total of 79 acres, during three phases of EM surveys, were investigated at Site 31. Several ground features such as large piles of construction debris and rock piles limited access on the west side of the study area. In the northern and southern portions of the site, air traffic signal lines, telecommunication lines and buried culverts were indicated by linear, closing contours. Five, small isolated anomalies were also located in the northern portion of the survey area. Only one of these anomalies appeared to be associated with buried metal. A zone of disturbed soil occurred between the culverts and a utility line. The anomaly was 170 by 100 feet wide and corresponded with a soil mound.

In the southern portion of the site, six anomalies were interpreted to be landfill trenches with four of the trenches trending north-south and two oriented east-west. All of the linear anomalies indicated the presence of buried metal. Eighteen other isolated anomalies were scattered throughout the southern portion of the site. A zone of interpreted debris coincided with metallic surface debris, primarily a pile of rusted one-gallon cans. The size of the anomaly in comparison to the size of the debris covered area suggested that there may be subsurface metallic debris as well. Several other small anomalies may have also contained buried metal.

An interpreted zone of disturbed soil also occurred in the southern portion of the survey area just east of 19th Avenue. This zone coincided with the former location of the Motor Pool Drain pit. Two buried debris anomalies were located within this disturbed soil zone. A large area covered with concrete debris was located in the southwest corner of the survey area.

FPXRF Testing

A total of 64 in-situ FPXRF surface soil locations were analyzed for lead at Site 31. At 19 of the in-situ locations, samples were collected and prepared prior to ex-situ analysis. Of the 83 readings, 58 of the analyses (70 percent) were reported below the detection limit. The detection limits for all of the FPXRF locations ranged from 55 ppm to 120 ppm. The FPXRF readings ranged from 64 ppm to 1,430 ppm with a mean of 326 ppm and an average precision error of 60 ppm. The range of FPXRF readings for the 20 surface soil sample locations selected for ex-situ analysis was 64 ppm to 732 ppm.

Surface Soil Sampling

Samples for laboratory metal analyses were selected at the eight locations reporting the highest FPXRF readings within Site 31. Three of the highest readings were located next to or beneath empty drums identified within the debris rock piles and removed by the USACE in May 2000. One location was beneath a crushed empty drum. Three FPXRF locations were located in an area of stained soil identified during sample collection. One location was above an identified geophysical anomaly with stressed vegetation. Five

samples reported arsenic concentrations (1.8 to 2.3 mg/kg) exceeding the USEPA Region 9 PRG of 1.6 mg/kg (00MLW001SS001S31-8, SS004, SS005, SS006 and SS08).

Groundwater Sampling

Groundwater monitoring well 00-BW02 was used to evaluate groundwater COPCs at Site 31. The monitoring well was initially sampled for the original suite of COPCs, which included VOCs and HDGs, as well as some additional parameters, including SVOCs, chlorinated pesticides, metals and TPH. Manganese was detected twice and zinc was detected once during the two sampling events in which metals were sampled. TCE was not detected during the September 2000 event. However, low concentrations of TCE were detected during the January 2001 and October 2002 sampling events. No other analytes (SVOCs, chlorinated pesticides and TPH) were detected in samples from this monitoring well. There are, however, other wells downgradient with higher concentrations of TCE (see Section 4.1.2.2)

Trenching

Eight anomalies were excavated to a depth of approximately 6 to 12 feet. The trench lengths ranged from 25 to 250 feet with a total of 950 feet. Excavated material from the eight trenches generally included miscellaneous construction debris (wood, metal, concrete, etc.) and glass bottles. Rusted and empty metal drums or cans were observed in the excavated material from six of the anomalies. While most of the drums were crushed, several empty drums were intact and were observed in the excavated material from anomaly 31GA01. There were no liquids of any kind (including the intact drums) and no evidence of releases of TCE. One trench grab soil sample was collected from beneath the intact drums located in anomaly 31GA01. TCE was not detected in the soil sample. However, chloromethane (CLME) was detected at 100 µg/kg and 2-butanone (MEK) was detected at 660 µg/kg. No other VOCs were detected.

Soil Gas Sampling

Twenty ASG samples were collected from the eight anomalies. Nineteen of these samples detected TCE ranging from 0.47 to 76 ppbv, with an average of 9.27 ppbv and a standard deviation of 17.

4.1.3 Open Pits, Ditches and Drains

Eight PSAs were investigated as open pits, ditches and drains, as shown in Table 4.3. The open pits, ditches and drains PSA investigations included field reconnaissance and mapping, geophysical surveys, FPXRF screening, surface soil sampling, ASG sampling and groundwater sampling. Not all methods listed were performed at each site. PSA boundaries were originally delineated based on visible surface disturbance and debris in aerial photos. The revised open pits, ditches and drains boundaries, illustrated in Figures 1-3 and 4-1, were delineated based on the extent of geophysical results, visual disturbances, surface soil detections and ASG detections.

Geophysical surveys were performed at three of these PSAs. FPXRF testing was performed at one PSA (Paint Hangar Leach Pit, Site 22). ASG samples were collected from seven PSA and analyzed for VOCs during the 2000 RI. Several ASG samples were collected during an Expedited Investigation (Montgomery Watson, 2000b) of the 8-Place Hangar Ditch (Site 15) in March 2000 and analyzed for VOCs.

Twelve soil samples were collected from three PSA and analyzed for metals, TPH, field pH and/or PCBs. Soil samples were analyzed for metals, TPH, cPAHs and/or PCBs based on historical site information, experience at other military installations, field reconnaissance results, or to allow additional assessment of site-specific release and exposure models and pathways. Four soil samples were collected during the Expedited Investigation (Montgomery Watson, 2000b) of Site 15 in March 2000 and analyzed for metals and VOCs. All samples analyzed for TPH during the 2000 RI were screened prior to performing extended analyses (e.g., carcinogenic poly-aromatic hydrocarbons [cPAHs]). The extended analyses included cPAHs when the TPH as diesel (TPH-Dx) concentrations exceeded 200 ppm in accordance with the *Management Plan Addendum* (Montgomery Watson, 2000c).

A comparison of the analyte concentrations to the generic benchmark level was performed for informational purposes only. The generic benchmark levels reference USEPA Region 9 PRGs for all parameters except TPH. TPH levels are compared to MTCA-A Soil Cleanup Levels (MTCA-B levels do not exist for TPH). This comparison is not intended to screen out chemicals or media at any site. A screening assessment for COPCs was conducted in accordance with USEPA Region 10 screening risk assessment guidelines and presented in Section 6.0 of this document. Several samples exceeded the benchmark level for arsenic, lead, PCB, TPH-Dx and/or TPH-Gx. Both cPAHs and PCBs were compared with the USEPA Region 9 PRGs for individual constituents.

The new and existing groundwater monitoring wells were used to evaluate COPCs in groundwater downgradient from PSAs. These wells were analyzed for various COPCs based on the Conceptual Site Model identified in Section 2.0 of the *Management Plan Addendum* (Montgomery Watson, 2000c). These parameters include metals, TPH, VOCs and HDGs.

4.1.3.1 Site 3b – Aircraft Wash Rack Discharge Area B

Field Reconnaissance

The approximate location of the Aircraft Wash Rack Discharge Area B (Site 3b) was identified using 1955 aerial photographs and 1954, 1956 and 1966 construction drawings. The study area covered 0.46 acres. The LAFB 1956 Topographic and Utility Drawings displayed a large drainage ditch approximately 50 feet wide at Site 3b. The drawings indicated that the drainage ditch was the collection point for stormwater runoff from the Port Tarmac Area (Site 4a) and possibly discharge from the Aircraft Wash Rack (Site 3a). The drawings indicated that the ditch started 600 feet south of the Japan Airlines Hangar and continued east approximately 3,200 feet. The cover to an existing manhole located near the area was removed to observe the piping entering and leaving the manhole. A concrete pipe approximately 42 inches in diameter was observed draining into the

manhole while two 48-inch diameter culverts were observed exiting the manhole toward Site 3c and the outfall of the two 48-inch diameter culverts.

Geophysical Surveys

Geophysical surveys were not conducted at this site.

Active Soil Gas Sampling

Three ASG samples were collected at Site 3b. A sample located at the manhole representing the previous outfall point of the storm water drainage pipe from Site 4a and Site 3a reported 39.0 ppbv TCE. Currently, the manhole connects to an underground piping system that trends southeast directing runoff to the outfall of the Aircraft Wash Rack Drain Area C (Site 3c) discharge ditch. A duplicate sample taken at the same location reported 7.6 ppbv TCE. Two samples collected east and west of the manhole were non-detect for TCE.

Surface Soil Sampling

Surface soil samples were not collected at this site.

Groundwater Sampling

Site-specific groundwater monitoring wells were not installed for this site.

4.1.3.2 Site 3c - Aircraft Wash Rack Discharge Area C

Field Reconnaissance

The existence of Site 3c was first noted during the site reconnaissance of Site 31. The study area for the site covered 20.19 acres. Reconnaissance of the site revealed the location of the buried storm drain outfall and drainage ditch believed to be connected to Sites 3a and 3b. The beginning of Site 3c was marked by the outfall of two 48-inch diameter culverts that discharge into a drainage ditch located in the southwest corner of Site 31. The ditch curves around the Alert Center Pads (southeast extension of the northwest-southeast trending runway) to the northeast and ends at an intersection with Randolph Road. Two 48-inch culverts that drain the Alert Center pad area are located in the northwest corner of the ditch. A culvert is also located beneath Randolph Road that drains runoff from the eastern side of the road to the ditch.

Geophysical Surveys

The area of the EM survey was located between the Alert Center Pads to the north of the culverts at Site 3C and the ditch to the south. The landfill was originally identified on construction drawings for the Alert Center aprons and confirmed by a preliminary environmental assessment report (Dames & Moore, 1996), which included 12 test pits in the area of the landfill. Dames & Moore concluded that the waste was associated with a former military hospital.

The results of the survey indicated numerous contour variations that corresponded to reinforced concrete, a chain link fence, an overhead line and subsurface utilities. The known features could not explain two anomalies. These zones may represent trenches, one trending east-west and one trending north-south. The north-south trending trench was approximately 225 by 75 feet wide and the east-west trending trench was 600 by 100 feet wide. The contour variations suggested the presence of buried metal within the east-west oriented zone.

Active Soil Gas Sampling

Three ASG samples were collected at Site 3c. One sample was collected in the bottom of the drainage ditch near two 48-inch culverts that are the outfall point for runoff from Site 3b. A second sample was taken at the inflection point of the ditch and a third near two culverts at the northeast end of a ditch that drains the Alert Center pads. All three samples reported a non-detect for TCE.

Surface Soil Sampling

Surface soil samples were not collected at this site.

Groundwater Sampling

Groundwater monitoring wells 00-BW03 and 00-AW03 were used to evaluate groundwater COPCs. The monitoring wells were sampled for the original suite of COPCs, which included VOCs and HDGs. Results from both wells were non-detect for VOCs and HDGs during the September 2000, January 2001 and October 2002 sampling events.

4.1.3.3 Site 9 – Gravel Pit

Field Reconnaissance

The location of the Gravel Pit (Site 9) was identified using 1955, 1961, 1969 and 1973 aerial photographs. Reconnaissance of the site covered 93.19 acres. The southern portion of the study area was marked by stressed vegetation. North of the stressed vegetation, piles of rock, sinkholes and partially exposed debris indicated landfill activity. Two large gravel pits were observed near the center of the study area. Several small excavations are located to the west of the pits. Areas of stressed vegetation and small excavations are also found to the north of the gravel pits.

Eighteen 55-gallon drums associated with apparent soil staining were located in March 2000. The USACE removed the drums and sampled the soil in April 2000.

Geophysical Surveys

Geophysical surveys were performed in both the central and southern portions of Site 9. Metallic debris was evident in sinkholes during field reconnaissance throughout both the central and southern portions of the site. An EM survey of the southern area identified an

anomaly interpreted as a zone of buried metallic debris approximately 75 by 150 feet wide. A larger zone of disturbed soil, where the soil may have been scraped, partially excavated, or reworked in some way, surrounded the buried debris anomaly. The disturbed soil zone generally correlated with an observed area devoid of vegetation. Other anomalies within the area were attributed to metallic surface debris.

The central survey area was located within the southern most gravel pit. The EM data was collected in two phases after the first phase indicated strong anomalies at the edges of the initial survey area. Both surveys identified a large zone of anomalous variations that was interpreted to be buried debris contained primarily within the pit, but also along the southwest side and top of the pit. The contours suggested the presence of metal debris throughout the portion of the survey zone that lies within the gravel pit.

Active Soil Gas Sampling

Seven ASG samples were collected at Site 9. Four of the seven samples reported detectable concentrations of TCE. A sample located at the lowest point of the south pit within the central portion of the study area reported 3.6 ppbv of TCE. A sample that was located next to buried debris in this same pit reported 1.8 ppbv of TCE.

A disturbed soil area was located near the southern-most edge of the north gravel pit. A sample that was collected in the northeast corner of this pit reported a concentration of 6.7 ppbv TCE. Another ASG sample was taken next to a second disturbed soil area located further south, but no detectable concentration of TCE was identified in this sample. A sample located in the north gravel pit near areas of stained soil reported a concentration of 2.2 ppbv TCE. The USACE removed eighteen 55-gallon drums adjacent to the stained soil area that were discovered during the initial reconnaissance of the site.

Surface Soil Sampling

Surface soil samples were not collected at this site.

Groundwater Sampling

Groundwater monitoring well 99-AW10 was used to evaluate groundwater COPCs in the northern portion of the site. The monitoring well was sampled for the original suite of COPCs, which included VOCs and HDGs as well as the additional parameter, TPH. TCE was consistently detected in 99-AW10 at concentrations ranging from 1.0 to 1.4 µg/L during the six sampling events. Other COPCs have not been detected in 99-AW10.

4.1.3.4 Site 11 – Fire Training Burn Pit B

Field Reconnaissance

The location of the Fire Training Burn Pit B (Site 11) was determined based on 1961, 1969 and 1973 aerial photographs. The site reconnaissance covered 10.3 acres. Several shallow, narrow ditches and other areas of general surface disturbance were observed south of a paved access road. No stressed vegetation appeared to be associated with the

ditches. The burn pit was clearly defined with a containment ditch, approximately two feet deep, surrounding the burn area. Two burn areas with stressed vegetation, stained soil and heat-stressed debris were observed inside the containment ditch. Several drum bungs and small pieces of metal debris were also observed in the area.

Geophysical Surveys

Geophysical surveys were not conducted at this site.

Active Soil Gas Sampling

Three ASG samples were collected at Site 11. A sample collected at the end of the fire containment ditch that encloses the burn areas reported a TCE concentration of 31.0 ppbv TCE. The other two samples located within the two main burn areas, enclosed by the ditch, reported non-detect for TCE.

Surface Soil Sampling

Three soil samples were collected at Site 11 and analyzed for TPH. Sample 00MLW001SS001S11, located at the end of two intersecting depressions in the burn area, reported a concentration of 1,600 mg/kg diesel fuel and 14,000 mg/kg oil. Sample 00MLW201SS002S11, located next to black ash/soil and metal debris in the smaller of two burn areas, reported a concentration of 1,400 mg/kg diesel fuel and 4,900 mg/kg oil. The MTCA-A Soil Cleanup Level for both TPH-Dx diesel and oil range is 2,000 mg/kg.

Sample 00MLW001SS003S11, located in an area of stressed vegetation with several drum bungs, reported estimated concentrations of 480 mg/kg diesel fuel and 1,200 mg/kg oil. Both results were flagged with a "J" to report they were estimated. Results are flagged as estimated based on the chemical validation procedures used. These procedures are described in Section 5.0, Group D Data Validation and Usability of Volume II of the *Management Plan* (Montgomery Watson, 1999b). Samples 00MLW201SS002S11 and 00MLW001SS003S11 also reported concentrations of cPAHs, but below the USEPA Region 9 PRGs.

Groundwater Sampling

Site specific groundwater monitoring wells were not sampled at this site.

4.1.3.5 Site 12 – Motor Pool Drain

Field Reconnaissance

The location of the Motor Pool Drain (Site 12) was determined based on aerial photographs and information from the Port of Moses Lake. The reconnaissance of the Site 12 covered 13.64 acres. The location of Site 12 is on the south side of Port of Moses Lake property at the intersection of Chanute Street and 19th Avenue NE. No buildings remained at the site, but a fence surrounded Site 12, much of which was previously used

as a maintenance area and parking for vehicles. A smaller paved area was enclosed by a fence in the northwest corner of Site 12.

The concrete foundation for the former Building 3206 was located at the northeast corner of the Site 12 study area. No remains of former Building 3207, which was located south of Building 3206, were found during the field reconnaissance. A concrete floor and foundation for former Building 3208 was identified in the northwest corner of the study area. A stained soil area was located southwest of former Building 3208.

A three-foot wide, fifteen-foot long concrete trench was identified at the location of the former Building 3208 and appeared to be a service pit for vehicle maintenance. The trench was filled with concrete, debris and soil at the time of reconnaissance and the depth of the trench was unknown.

According to the LAFB 1956 Topographic and Utility Map, two stormwater drains from the Site 12 area discharged into a ditch previously located east of 19th Avenue NE. Aerial photographs from 1996 and reconnaissance of the site suggested that the ditch had been filled with earth and debris. The location of the former discharge point and ditch was confirmed by obtaining coordinates from the 1956 Topographic and Utility Map. Stressed vegetation was observed on a mound of earth near the presumed outfall of the drain. The ditch was observed in the photographs dated 1949, 1955, 1961, 1969 and 1973. The ditch did not appear in the 1996 photograph.

An approximate six-foot wide and seventy-eight-foot long ground-level concrete structure was observed southwest of former Building 3208. A concrete pad with a 6-inch wide island was located at the northeast corner of Site 12, north of Chanute Street. Piping and conduit was found in the concrete island. According to the 1956 Topographic and Utility Map, a septic tank was situated adjacent to the concrete island and pad. A storm drain was found southeast of the concrete pad with a pipe exiting to the east. The pipe daylighted on the east side of 19th Avenue NE approximately fifty feet from the storm drain. An approximate three by five feet concrete-lined opening in the asphalt was discovered east of the former building 3208 and northeast of the stormwater drains. The opening was filled with dirt. Two capped pipes were approximately ten feet south of the concrete lined opening.

Geophysical Surveys

Geophysical surveys were not specifically performed at this site. However, as a result of the EM survey performed at Site 31 an interpreted zone of disturbed soil was located just east of Site 12 buildings. This zone coincided with the former location of the Site 12 seen in aerial photos. Two buried debris anomalies were located within this disturbed soil zone and are likely scrap metal.

Active Soil Gas Sampling

Five ASG samples were collected at Site 12. A sample located in the vicinity of the former building 3207 reported a concentration of 5.4 ppbv TCE. The other four samples did not result in any detectable TCE concentrations.

Surface Soil Sampling

Three soil samples were collected at Site 12 and analyzed for metals and TPH. Only one sample reported a detection above the MTCA-A Soil Cleanup Levels. Sample 00MLW001SS002S12, located in the middle of a stained soil area within the fenced area southwest of former Building 3208, reported a concentration of 4,600 mg/kg diesel fuel and 18,000 mg/kg oil. The MTCA-A Soil Cleanup Level for TPH-Dx diesel and oil range is 2,000 mg/kg. Several cPAH detections and one gasoline detection were also reported, but the results did not exceed the benchmark level, except for one cPAH result. One cPAH result reported an estimated concentration of benzo(a)pyrene (BZAP) of 250 mg/kg, which exceeded the USEPA Region 9 PRG of 210 mg/kg for BZAP. The size of the stained soil area was approximately three feet in diameter. Sample 00MLW001SS003S12, located within a concrete trench filled with soil, reported diesel fuel and oil detections below the MTCA-A Soil Cleanup Levels.

Groundwater Sampling

Site specific groundwater monitoring wells were not sampled at this site.

4.1.3.6 Site 15 – 8-Place Hangar Ditch

Subsequent to the 1999 RI, an Expedited Investigation of the 8-Place Hangar (Site 14) and 8-Place Hangar Ditch (Site 15) was conducted (Montgomery Watson, 2000b), as summarized in this section. The Expedited Investigation was conducted in conjunction with the closure of USTs that were apparently located adjacent to Site 14. The investigation included soil and soil gas sampling and analysis. These data were used to evaluate the locations and nature of PSAs and to identify COPCs in soil.

Field Reconnaissance

The results of reconnaissance are included in the above referenced document. Chemical analytical results from the investigation (soil and soil gas) are summarized in the following subsections.

Geophysical Surveys

Geophysical surveys were not conducted at this site.

Active Soil Gas Sampling

Three sample locations were selected from within Site 15, including two near storm pipe outlets and a third area near the topographically lowest point in the ditch. At each location, three soil gas samples were attempted. A total of seven soil gas samples were collected. TCE was detected in three of the samples. The detected concentrations ranged from 2.3 to 28.0 ppbv with a mean value of 16.4 ppbv. A further discussion of these results can be found in *Expedited Investigation Technical Memorandum* (Montgomery Watson, 2000d).

Surface Soil Sampling

Four soil samples were collected in March 2000 and analyzed for metals. Arsenic was detected above the USEPA Region 9 PRG of 1.6 mg/kg in all four of the samples. These arsenic concentrations ranged from 1.7 to 5.1 mg/kg. A further discussion of these results can be found in the document *Expedited Investigation Technical Memorandum* (Montgomery Watson, 2000d).

Groundwater Sampling

Groundwater monitoring well 00-BW04 was used to evaluated groundwater COPCs. The monitoring well was sampled for the original suite of COPCs, which included VOCs and HDGs, as wells as some additional parameters including metals and TPH. Arsenic was non-detect (less than 5 µg/L) in September 2000 and was 5 µg/L in January 2001. No other COPCs listed above were detected in the monitoring well.

4.1.3.7 Site 22 – Paint Hangar Leach Pit

Field Reconnaissance

The Paint Hangar Leach pit (Site 22) consisted of two separate leach pits within a 0.79-acre fenced enclosure. The northern leach pit was approximately 40 feet long by 23 feet wide and eight feet deep. An approximately 12-inch diameter corrugated steel culvert discharged into the north pit. According to the 1965 Master Storm Drainage Plan and the 1957 Storm & Sewer Drainage Plan for the Boeing area, two sumps inside the secondary containment berms for two Jet Fuel Storage Tanks drained to the northern leach pit. A catch basin near the berms also drained to the pit.

The south leach pit was approximately 160 feet long by 71 feet wide and 14 feet deep. An approximately 42-inch diameter reinforced concrete pipe (RCP) discharged into the south pit. Based on 1965 & 1957 drawings, four catch basins located near a fire suppression area (previously reported as a suspected wash rack area), two catch basins south of a fuel pump station and the Fuel Control Buildings drain into the south pit via the RCP. Deluge and treated waste from the basement of the Paint Hangar (Site 18) was also pumped into the RCP.

Geophysical Surveys

The leach pits bounded by a chain-link fence were investigated with EM and GPR. An EM survey was performed within the south pit. The fence surrounding the survey area precluded the use of EM in the areas surrounding the south pit. The results of the EM survey indicated the absence of detectable debris or effects caused by conductive material (e.g., sludge) at the bottom pit.

Within the south pit and the remainder of the survey area, GPR was utilized. The depth of penetration observed in the GPR data was approximately three to five feet. The GPR data did not indicate buried debris within or outside of the leach pits. The subsurface storm

drains entering each pit were detected. The GPR data did not show an abrupt reflection horizon that could be attributed to the base of leachate or sludge material.

FPXRF Testing

A total of 16 in-situ FPXRF surface soil locations were analyzed for lead within the north and south pits at Site 22. At six of the in-situ locations, samples were collected and prepared prior to ex-situ analysis. Of the 22 readings, 7 of the analyses (32 percent) were reported below the detection limit. The detection limits for all of the FPXRF locations ranged from 60 ppm to 98 ppm. The FPXRF readings ranged from 77 ppm to 3,790 ppm with an average precision error of 65 ppm and a mean of 443 ppm. The range of FPXRF readings for the six surface soil samples selected for ex-situ analysis was 366 ppm to 3,790 ppm.

Active Soil Gas Sampling

Five ASG samples and one duplicate sample were collected at Site 22. None of the samples reported detectable concentrations of TCE.

Surface Soil Sampling

Six soil samples were collected from Site 22. Three samples were analyzed for metals and three samples were analyzed for TPH, PCBs and field pH. Sample locations for off-site metal analyses were selected at three locations based on FPXRF results. The first site corresponded to the highest FPXRF reading from the north pit and was located at the outfall of the culvert. Two soil sample locations were selected near the locations with the elevated FPXRF readings in the south pit. One sample (00MLW001SS005S22) within the south pit reported a lead concentration (1,200 mg/kg) that exceeded the USEPA Region 9 PRG of 750 mg/kg.

One sample located at the outfall of a drainage pipe into the north leach pit reported a concentration (150 mg/kg) above the MTCA-A Soil Cleanup Level of 30.0 mg/kg gasoline fuel. Another sample located in the middle of the south leach pit reported an estimated concentration of 320 mg/kg diesel fuel. This detection was below the MTCA-A Soil Cleanup Level for diesel fuel of 2,000 mg/kg. The diesel fuel result was flagged with a “J” to report that it was estimated. Three samples exceeded the EPA Region 9 PRG for arsenic of 1.6 mg/kg and ranged from 3.1 to 3.8 mg/kg. One of the samples reported a PCB (Aroclor 1254) concentration of 8,100 µg/kg above the benchmark level of 740 µg/kg. This detection was above the USEPA Region 9 PRG of 740 µg/kg. Another sample reported Aroclor 1254 at 940 µg/kg, above the benchmark level of 740 µg/kg. Several other detections of oil, cPAHs and PCBs were also reported; however, these concentrations were below the MTCA-A Soil Cleanup Levels and USEPA Region 9 PRGs. All field pH results were reported within a neutral range.

Groundwater Sampling

Groundwater monitoring well 00-BW05 was used to evaluated groundwater COPCs. The monitoring well was sampled for the original suite of COPCs, which included VOCs and

HDGs, as wells as some additional parameters including, metals and TPH. None of the COPCs were detected in the monitoring well. In addition, monitoring well 00-BW04 was used to evaluate groundwater COPCs and is located further downgradient than 00-BW05. This monitoring well was sampled for the original suite of COPCs, which included VOCS and HDGs, as well as some additional parameters including metals and TPH. Arsenic was non-detect (less than 5.0 mg/L) in September 2000 and was 5.0 mg/L in January 2001. No other COPCs were detected in the monitoring well.

4.1.4 Surface Discharge Areas

Sixteen PSAs were investigated as surface discharge areas. The data collected during surface discharge PSA investigations included field reconnaissance and mapping, geophysical surveys, FPXRF screening, surface soil sampling, ASG sampling and groundwater sampling. Not all methods listed were performed at each site. PSA boundaries were originally delineated based on visible surface disturbance and debris. The revised surface discharge area boundaries illustrated in Figure 3-1 were delineated based on the extent of geophysical results, visual disturbances, surface soil detections and ASG detections.

Geophysical surveys were performed at five PSAs including: Big Bend Community College (Site 2); Aircraft Wash Rack (Site 3a); 8-Place Hangar (Site 14); Liquid Oxygen Generating (LOX) Plant (Site 19); and the Dump at the end of Runway 32 (Site 33). A total of 21 locations at one PSA (Stained Soil Area, Site 35) were tested for lead using FPXRF methods. The results of the FPXRF testing were used to select the locations for biased surface soil metals analyses.

During the 2000 RI, 13 soil samples were collected from three of the surface discharge PSAs. Soil samples were analyzed for metals, TPH, cPAHs and/or PCBs based on historical site information, experience at other military installations and field reconnaissance results. Soil samples collected from the 3-Place Hangar (Bldg. 5801, Site 17) were analyzed for metals, TPH, and PCBs. Soil samples collected from the Paint Hangar (Bldg. 5825, Site 18) were analyzed for metals and PCBs. Soil samples collected for the Stained Soil Area (Site 35) were analyzed for metals and TPH. Several soil samples were also collected during an Expedited Investigation (Montgomery Watson, 2000d and 2001b) of the 8-Place Hangar (Site 14) in March of 2000 and the LOX Plant (Site 19) in March 2001 and analyzed for metals, VOCs and TPH. Samples collected at Site 19 were also analyzed for SVOCs. All samples analyzed for TPH during the 2000 RI were screened prior to performing an extended analysis. The extended analyses included cPAHs when the TPH-Dx concentrations exceeded 200 ppm. During the 2002 RI, eight soil samples were collected from the former Skyline Auto Wrecking Yard (Site 36) and were analyzed for VOCs. Several soil samples from the above sampling events exceeded the benchmark level for arsenic, lead, cPAH, PCB, TPH-Gx and TPH-Dx .

ASG samples were collected from 12 PSAs and analyzed for VOCs during the 2000 RI. Numerous ASG samples were collected during the Expedited Investigations of Site 14 in March 2000 and Site 19 in March 2001 and analyzed for VOCs. During the 2002 R1, ASG samples were collected from Site 19, Site 19b and Site 36.

New and existing groundwater monitoring wells were used to evaluate COPCs in groundwater downgradient of PSAs. These wells were selected based on the conceptual hydrostratigraphic model described in Section 3.0. These parameters include glycol ethers, metals, TPH, VOCs and HDGs. Groundwater monitoring well results from up to six sampling events during the RIs were used for the evaluation.

4.1.4.1 Site 2 – Big Bend Community College Hangars

Field Reconnaissance

Reconnaissance of the Big Bend Community College Hangars (Site 2) included reviewing 1961 through 1996 aerial photographs, construction drawings and walking the exterior and interior of the hangar buildings. During the reconnaissance, the investigators also met with an instructor of Aviation Technology at Big Bend Community College (BBCC). The study area was delineated including areas such as storm drains, catch basins, out-falls, ditches, burn areas and floor drains. Reconnaissance covered 48.36 acres.

The 1953 LAFB construction drawings identified the hangars as multi-purpose buildings. The drawings show UST's located near the boiler rooms and floor drains located in each bay (four drains in each hangar building). The boiler rooms were not accessible during the reconnaissance to confirm the presence of the UST's. The drawings showed the floor drains connected to piping that drained south outside the hangars. It was unclear if the floor drains were connected to the storm drain system or the sanitary sewer system. The BBCC instructor indicated that the drains currently are connected to the sanitary sewer system. Only two of the floor drains appeared to be operational with the remaining ten drains plugged and sealed. Office buildings were located just south of the BBCC hangars. These buildings were labeled as "Organizational Buildings" on the LAFB construction drawings.

Site 2 consisted of Building 3300, Auto Mechanics Shop (7272 Andrews Street NE), Building 3200, Aircraft Maintenance and Storage (7340 Andrews Street NE) and Building 3100, Aviation Maintenance Technology (7356 Andrews Street NE). All buildings are used by BBCC primarily for educational purposes. The study area also included the tarmac area to the north of the hangars, the storm drainage system that discharges into a large unlined open channel, a field west of the hangars and open areas south of the hangar buildings.

A large trapezoidal stormwater drainage ditch, approximately ten feet deep and six feet wide, was observed southwest of the tarmacs and hangars. A portion of the ditch had been back filled with construction debris. The open portion appeared to collect stormwater from catch basins located on the BBCC tarmac based on observations during the reconnaissance and review of the LAFB Storm Drain Master Plan Drawings dated 1966. West of the hangars, several small burn areas and a small pit containing two drums were observed. These drums were later found to be empty and subsequently removed by the USACE in October 2000. South of the BBCC hangars were additional stormwater catch basins and a sanitary sewer system that included below ground oil/water separators that were reportedly installed by BBCC to remove oil products that may have entered the drain system inside the hangars. The oil/water separators were observed during the

reconnaissance and appeared to be functioning properly. The ground surface on the south side of the hangar buildings consisted of gravel and paved areas for parking and service roads. Rust-like material was observed that stained the outside of the Building 3300 boiler room and on the roof around the boiler exhaust vents.

Geophysical Surveys

The area of investigation included a small pit approximately four by 16 feet containing two drums just west of the BBCC hangars. The soil, presumably excavated from the pit, was piled to the south. Four GPR traverses were performed at the site. The review of the GPR records did not suggest any evidence of further excavation, other buried drums or debris in the immediate area. The EM method did not detect any evidence of buried metal.

Active Soil Gas Sampling

Five ASG samples and one duplicate sample were collected at Site 2. The only sample reporting a detectable concentration of TCE, 3.1 ppbv, was collected at the low point of a gravel discharge area between Buildings 3300 and 3200. The remaining samples reported non-detectable levels of TCE and were collected near the storm water drainage ditch at the north end of the tarmac, near a storm drain catch basin and near the pit investigated with the geophysical survey.

Surface Soil Sampling

Surface soil samples were not collected at this site.

Groundwater Sampling

Groundwater monitoring wells 00-BW06 and 91-AW13 were used to evaluate groundwater COPCs. The monitoring wells were sampled for the original suite of COPCs, which included VOCs and HDGs. None of the COPCs were detected in the monitoring wells.

4.1.4.2 Site 3a – Aircraft Wash Rack Area

Field Reconnaissance

The reconnaissance of the Aircraft Wash Rack (Site 3a) covered 3.56 acres. The study area included the main concrete pad (wash rack) area, the Industrial Waste Treatment Facility (IWTF), a pump house and the immediate surrounding area. Drains, ditches, catch basins and associated piping were also mapped.

A concrete vault (approximately 42 feet long by 15 feet wide) was located under the IWTF footprint. It is approximately 14 and 16 feet deep on the north and south end of the IWTF, respectively. The vault is divided into three chambers, each containing floor-level manhole grates and access ladders. Two of the three chambers were identified on the construction drawings as an “oil tank” and “dry pit.” The third, largest chamber was not

shown on the drawings. Other construction details can be found on the LAFB F.Y.'56 J468-000 Industrial Waste Treatment Plant Plan. The vault contained approximately 3 feet of liquid at the time of the reconnaissance. The liquid appeared to have an oily sheen.

One sample of liquid was collected from the concrete vault. The sample was collected in the southeast corner of the vault using a disposable bailer lowered through a grate on the floor. The sample was immediately analyzed with a photochemical Quick Test Volatile Organic Halides Water Test Kit system, manufactured by Envirol, Inc. An Envirometer™ analyzes for responses similar to a known TCE standard. The instrument reported a measurement corresponding to 4.9 ppb of the calibrant.

Four service racks containing hookups for water, air, solvents and electricity (LAFB Drawing Type A Washrack Mechanical Plans and Details, dated January 29, 1954) were located around the wash rack pad. Four catch basins (now sealed) drained the pad. It appeared that liquids collected on the concrete wash rack drained into the concrete vault located beneath the IWTF.

A service road and concrete apron were located next to the IWTF on the western side of the building at the north end. Labeling and identification tags on the pipes indicated that trucks and/or containers were parked on the apron and connected to discharge pipes for disposal of waste products generated during the treatment process. The apron was a topographic low area and drained south into a drainage ditch.

There was a 500-gallon septic tank connected to a restroom located inside the pump house (LAFB Drawing Type A Washrack Mechanical Plans and Details, dated January 29, 1954). The septic tank, located between the pump house and IWTF, drained into a leaching well approximately eight feet below the ground surface according to the drawings. Stressed vegetation was observed around the building and concrete pad areas.

Geophysical Surveys

The objective of the investigation at Site 3a was to determine the presence of storm drains that were suspected to connect the wash area catch basins and/or the pump house and the IWTF to the main storm system of the former LAFB. Several GPR traverses were performed based on the suspected locations of the storm drains from historical information and facility utility drawings. Several underground utilities were identified as listed below.

- An 8-inch concrete storm drain trending from the IWTF south toward the taxiway
- A water line and solvent supply utility line extending from the pump house to the spray nozzle rack located at the edge of the wash rack concrete pad
- A septic tank associated with the pump house bathroom
- An electric line

- An undifferentiated utility line in the southern part of the survey area trending northwest-southeast

Visual inspection of both utility plans and the catch basins indicated that the GPR profile collected within the concrete pad area should have crossed a catch-basin effluent concrete storm drain less than three feet deep. However, no drain line was detected in this area.

Active Soil Gas Sampling

Five ASG and one duplicate sample were collected at Site 3a. Only one sample reported detectable concentrations of TCE. This sample was located near a service box on the southwest corner of the wash rack concrete pad and reported a concentration of 2.6 ppbv TCE.

Surface Soil Sampling

Surface soil samples were not collected at this site.

Groundwater Sampling

Groundwater monitoring well 00-BW08 was used to evaluate groundwater COPCs. The monitoring well was sampled for the original suite of COPCs, which included VOCs and HDGs. None of the COPCs, except carbon disulfide, were detected in the monitoring well during the September 2000, January 2001 and October 2002 sampling events. Carbon disulfide was detected (0.33 µg/L) during the October 2002 sampling event, all other events reported non-detect (less than 10 µg/L) for carbon disulfide. Monitoring well 00-AW08 is also located at Site 3a, however, no results exist because the well has been dry since installation.

4.1.4.3 Site 4a – Port Tarmac Area A

Field Reconnaissance

Reconnaissance of Port Tarmac Area A (Site 4a) included 189.72 acres consisting mainly of asphalt and concrete pavement extending from the BBCC hangars east to the Japan Airline (JAL) hangar. LAFB 1956 Topographic and Utility maps were utilized to determine the location and function of the storm-water drain system for the area. Drainage features such as catch basins, storm drains and ditches were mapped.

The tarmac consisted of an aircraft parking apron to the south and a refueling apron covering the northern portion. The two sections were intersected by six oval depressions that collected storm-water runoff. The refueling apron sloped approximately 0.9 percent from west to east and was crested along its center directing runoff to storm drain catch basins on the north and south sides of the refueling apron. Runoff to the south drained into the oval shaped depressions then into catch basins. Runoff to the north drained off the northern edge of the apron into a gravel-lined ditch and eventually into catch basins approximately 50 feet from the apron.

Catch basins on the western side of the apron collected runoff from the western end of the apron. Based on the 1965 Larson Master Plan Storm Drainage System Drawings, the north, south and west catch basins connected to a buried concrete pipe that transferred stormwater to Site 3b and eventually discharged at the outfall of Site 3c.

The location of the aircraft parking apron was on the south side of the tarmac, north of the Grant County Airport Terminal building, hangar buildings and other airport structures. The tarmac sloped approximately 0.8 percent from west to east and was crested along its center. The slope directed runoff to the north into the oval shaped depressions and south into concrete-lined swales. The swales diverted runoff to catch basins at the southern edge of the apron. Observation during reconnaissance and the 1965 Larson Master Plan Storm Drainage System Drawings suggested that the southern catch basins were french drains.

Active Soil Gas Sampling

Nine ASG samples and one duplicate sample were collected at Site 4a. A sample collected next to a catch basin, that appeared to be connected to a french drain northeast of the Engine Buildup Facility (Site 23) reported a TCE detection of 2.0 ppbv. All other soil gas samples, which were collected in low areas and near catch basins around the tarmac area, reported non-detectable levels of TCE.

Surface Soil Sampling

Surface soil samples were not collected at this site.

Groundwater Sampling

Groundwater monitoring wells 91-AW14, 91-AW15, 99-BW16 and 00-BW11 were used to evaluate groundwater COPCs. The monitoring wells were initially sampled for the original suite of COPCs, which included VOCs and HDGs, as well as glycol ethers in 91-AW14 and 99-BW16. Low concentrations of TCE have been detected in 91-AW14 and 91-AW15 during all sampling events. The TCE concentrations in these wells ranged from 0.35 to 0.6 µg/L. TCE has also been detected in 99-BW16 ranging from 3.8 to 5.6 µg/L during the six quarterly sampling events.

TCE has not been detected in 00-BW11 during any sampling event, however several other VOCs have been detected including sec-butylbenzene, tert-butylbenzene, benzene, and chloromethane during the November 2002 sampling event. The VOC, sec-butylbenzene, has been detected consistently during the three sampling events. Sec-butylbenzene (7.5 to 13.0 µg/L), n-butylbenzene (1.6 to 3.3 µg/L), isopropylbenzene (1.0 to 2.5 µg/L), 1,2,4-trimethylbenzene (0.64 to 3.5 µg/L) and 1,3,5-trimethylbenzene (3.8 to 6.9 µg/L) have consistently been detected in 91-AW15 during the six sampling events. During the January 2003 sampling event, acetone (4.3 µg/L) bromomethane (0.67 µg/L), tert-butylbenzene (0.52 µg/L), benzene (0.28 µg/L) and chloromethane (0.3 µg/L) were detected in 91-AW15. Manganese was detected during the one sampling event in which metals were sampled in 99-BW16. In addition, several other VOCs including 1,2-dibromo-3-chloropropane, 2-hexanone, 4-methyl-2-pentanone, naphthalene and

chloroform were detected in 99-BW16 during the October 2002 sampling event. All other COPCs were reported below detection limits in all samples.

4.1.4.4 Site 4b – Port Tarmac Area B

Field Reconnaissance

Reconnaissance of the southern portion of Port Tarmac Area B (Site 4b), located on the east side of the airport property, covered 73.18 acres. The location and function of the stormwater drainage system was determined using the LAFB 1966 Master Storm Drainage System drawings. Drains, culverts, swales and other pertinent features were mapped.

The majority of Site 4b drained west to a series of stormwater catch basins and buried sub-drains in a swale along the west edge of the tarmac. The sub-drains consisted of washed rock buried in a trench along the edge of the tarmac extending south beyond the 8-Place Hangar. The sub-drains then turned east and trended along the southern edge of the tarmac on the south side of the 8-Place Hangar.

A fire suppression station, earlier suspected to be a aircraft wash area, was located in the northeast section of the study area. The Master Storm Drainage System drawings indicated that the liquids from the fire suppression area drained into catch basins that connected to a buried pipe that discharged into Site 22.

Active Soil Gas Sampling

Four ASG samples and one duplicate sample were collected at Site 4b. A sample collected along the west side of the tarmac, near a buried sub-drain system that drains the west side of the taxiway, reported a concentration of 2.0 ppbv TCE. All other ASG samples taken at this site were non-detect for TCE.

Surface Soil Sampling

Surface soil samples were not collected at this site.

Groundwater Sampling

Groundwater monitoring well 00-BW07 was used to evaluate groundwater COPCs. The monitoring well was sampled for the original suite of COPCs, which included VOCs and HDGs, as well as some additional parameters including metals and TPH. TCE was detected at 0.8 µg/L and 1.0 µg/L, and was non-detect (less than 0.5 µg/L) in this well during the September 2000, January 2001 and October 2002 sampling events, respectively. Manganese (48 µg/L) and zinc (20 µg/L) were also detected in this well during the September 2000 sampling event. However, all metals were reported as non-detect during the January 2001 sampling event. None of the other COPCs listed above were detected in the monitoring well during the three sampling events.

4.1.4.5 Site 5 – JAL Hangar Area and Tarmac (Building 3401)

Field Reconnaissance

Reconnaissance at the JAL Hangar Area and Tarmac (Site 5), located southeast of the parking/refueling apron tarmac, covered 25.81 acres. The study area included Building 3401, currently the JAL Hangar, and the surrounding Tarmac area. The stormwater system within and around Site 5 were mapped after review of the LAFB construction floor plans and drawings dated 1951, 1952 and 1969 and utility maps dated 1965.

Building 3401 was an aircraft hangar building with large sliding doors at the north and south ends. It consisted of three shops (Shop A, B and C), a utility room, a boiler room and aircraft parking areas. Shop A consisted of office space, Shop B consisted mainly of storage rooms and Shop C was where aircraft wheel cleaning and repair was conducted. According to the 1951 drawing titled Medium Bomber A/C (Expanded): Plumbing First Floor Plan, three air compressors were located in the utility room and air lines were located underneath the hangar floor. An expansion tank for the de-icing system was also located in the boiler room.

Four catch basins were located east of Building 3401 in the tarmac area. A review of the 1965 Master Plan Storm Drainage System indicated that these catch basins are connected to the same storm drain that leads to Sites 3a, 3b and 3c.

The 1951 drawing depicted floor drains located along the inside of the north and south hangar doors and throughout the hangar floor of Building 3401. Floor drains were also located in Shops A, B, and C, as well as the utility and boiler rooms. Two main storm sewer lines (20-inch diameter) collected water from all of the floor drains inside of Building 3401. These two lines drained to the east, possibly connecting to storm lines of Sites 3a and Sites 3b and 3c. JAL personnel and observations during site reconnaissance verified that all floor drains within Building 3401 have been sealed. A potential rock drain was also observed east of Building 3401 and the tarmac area. No evidence of buried pipes or other information was documented in the area around the potential rock drain.

Active Soil Gas Sampling

Three ASG samples and one duplicate sample were collected at Site 5. A sample collected next to the Jet Engine Test Stand Area reported a TCE concentration of 7.2 ppbv TCE. The other two samples, collected near the rock drain and the catch basin east of the JAL hangar, reported non-detectable levels of TCE.

Surface Soil Sampling

Surface soil samples were not collected at this site.

Groundwater Sampling

Site specific groundwater monitoring wells were not sampled at this site.

4.1.4.6 Site 14 – 8-Place Hangar

Subsequent to the 1999 RI, an Expedited Investigation of the 8-Place Hangar (Site 14) and the 8-Place Hangar Ditch (Site 15) was conducted (Montgomery Watson, 2000b). The Expedited Investigation was conducted in conjunction with the closure of USTs that were apparently located at Site 14. The investigation included soil and soil gas sampling and analysis. These data were used to evaluate the locations and nature of PSAs and to identify COPCs in soil.

Field Reconnaissance

This site was investigated separately as part of an Expedited Investigation (Montgomery Watson, 2000b). Results from the investigation are summarized in the following subsections.

Geophysical Surveys

MWH subcontracted a geophysical surveyor, who identified the emergency generator USTs, which was identified on construction drawings during the Expedited Investigation, located at the Northeast corner of Site 14 using GPR. At the industrial UST locations, the surveyor identified two features and the limits of an excavation, but did not positively identify a UST in the area. The first feature was believed to be a tightly spaced grouping of pipes. The second feature could not be identified, but was suspected to be a valve box.

Industrial UST Closure

After removing the concrete tarmac at the industrial UST location, the first buried feature encountered was a small diameter pipe that was removed by the excavator. After further excavating, additional pipes were encountered approximately two to three feet below the top of the concrete. The pipes extended north under the floor of Site 14 building and terminated approximately three to five feet to the south beyond the edge of the hangar. The pipes were empty and contained no detectable concentrations of VOCs based on measurements by a PID meter.

The second feature encountered was a small structure consisting of four concrete walls and open at the top. The box was filled with soil and suspected to be a valve box based on the as-built drawings. No valves or piping were encountered inside the box. The soils around the pipes concrete was comprised of brown silty fine-grained sand suspected to be from an off-site source.

After review of the Air Force as-built drawings, the USACE directed the tank removal subcontractor to excavate a trench from west to east along the edge of Site 14 building in the area of the past chemical catch tanks. At approximately eight feet below the top of the concrete tarmac, a concrete pad was encountered which was suspected to be the UST concrete hold-down pad.

The excavation proceeded east a short distance and encountered the suspected trichloroethene UST concrete hold-down pad at approximately eight feet below the top of

the concrete tarmac. The excavator was able to lift one end of the pad exposing the underlying soil that appeared to be natural alluvium material.

Three soil samples were collected from the bottom of the excavation and analyzed for metals and VOCs (Bay West, 2000). No VOCs were detected in these samples and all detected metals were below the benchmark levels, as presented in Tables 4.5 and Appendix D2.

Emergency Generator UST Closure

After removing the concrete, soil was excavated down to the top of the UST using an excavator. Once the tank was exposed, approximately 25 gallons of diesel fuel were pumped from the tank into 55-gallon drums and dry ice dumped into the tank to deplete the oxygen. Once the oxygen was depleted from the tank, the top was cut open to allow access inside the tank for collecting soil samples. A 6-inch diameter sampling port was cut in the bottom of the tank to allow access to the soils beneath it. A concrete pad was encountered beneath the tank and three sampling ports were cut through the sides of the tank for soil sampling. Three soil samples were collected from these ports and analyzed for TPH-HCID and TPH-Dex (Bay West, 2000). TPH-Dex was detected in two of the samples at 140 and 180 mg/kg, below the benchmark level of 2000 mg/kg. After collecting soil samples from each of the three sampling ports, the ports were closed using an expandable plug and the tank filled in-place with a flowable fill. Soil was then back-filled over the tank, compacted and the concrete repaired.

Active Soil Gas Sampling

Eight sample locations near the exterior perimeter of Site 14 building were evaluated. A total of 26 samples were selected to correspond to the exterior areas closest to chemical handling areas inside Site 14 building. At each of these eight areas, a minimum of three ASG samples (three to five feet apart) were collected.

A total of seventeen TCE detections occurred in samples collected at Site 14. The detected concentrations ranged from 0.98 to 42.0 ppbv with a mean value of 11.5 ppbv. These samples were located around the perimeter of Bay No. 4 along the eastern portion of Site 14 building and near the storm sewer outlet in the southern limb of Site 14.

Of the other parameters analyzed, detectable levels of acetone, benzene, 1,3 butadiene, carbon disulfide, chloromethane, dichloroethane, methylene chloride, 1,2,4 trimethylbenzene, toluene and xlyene were detected in several samples, as shown in Appendix D. Bromofluorobenzene, chloromethane, toluene and acetone were also detected in the ambient sample blanks and/or the equipment blanks. The source of contamination in the blanks is unknown. Several of the parameters detected in the samples were not measured in the blanks (e.g., TCE) and, therefore, these concentrations are considered accurate. This is also supported by the consistency of the TCE concentrations between the sub-samples at individual sampling sites.

Surface Soil Sampling

Four soil samples were collected in March 2000 and analyzed for metals, TPH and VOCs. The samples were collected from beneath the Industrial and Emergency Generator UST excavations. The samples analyzed for VOCs reported no detections. No concentration above the EPA Region 9 PRGs was reported for metals, except one sample that was at the USEPA Region 9 PRG of 1.6 mg/L for arsenic (00MLW002S0UST). Gasoline range hydrocarbons were not detected. Diesel range hydrocarbons were detected at 140 and 180 mg/kg, while hydrocarbons in the motor oil range (TPH-Dx extended) were detected at 350 and 1,300 mg/kg. The MTCA-A Soil Cleanup Level for both TPH-Dx and Oilm-Dx is 2,000 mg/kg.

Groundwater Sampling

Groundwater monitoring well 00-BW07 was used to evaluate groundwater COPCs. The monitoring well was sampled for the original suite of COPCs, which included VOCs and HDGs, as well as some additional parameters including metals and TPH. TCE was detected at 0.8 µg/L and 1.0 µg/L and was non-detect (less than 0.5 µg/L) in this well during the September 2000, January 2001 and October 2002 sampling events, respectively. This well also reported concentrations of manganese (48 µg/L) and zinc (20 µg/L) during the September 2000 sampling event. However, all metals were reported as non-detect during the January 2001 sampling event. None of the other COPCs listed above were detected in the monitoring well during the three sampling events.

4.1.4.7 Site 16 – Engine Rebuilding Facility (Building 2203)

Field Reconnaissance

Reconnaissance at the Engine Rebuilding Facility (Building 2203, Site 16) included reviewing the LAFB floor plan and construction drawings dated 1942, 1959 and 1960 to determine the floor drainage system and locate drains on the southeast end of the aircraft parking apron of Site 4a. Features were mapped such as drains and pertinent rooms within Building 2203.

The Engine Rebuilding Facility includes a hangar, offices, storage and work areas. The hangar portion includes hangar doors located at its east and west sides. Linear, floor grates ran along the inside of the hangar doors across both ends of the building. The floor grates covered a concrete channel approximately four feet wide and five feet deep. According to Port of Moses Lake maintenance personnel, the floor grates and the concrete channel were used to provide a warm air "curtain" while the hangar doors are open. A hole approximately two feet in diameter was observed in the floor of the concrete channel in the southeast section of the facility. Drawings from 1942 revealed eight floor drains in the hangar floor area and one floor drain in each restroom that appeared to connect to buried piping leading to Building 2204 south of Building 2203. Reconnaissance confirmed the location of the drains. The exact location of the buried piping could not be confirmed after looking down existing manholes.

Each corner of Building 2203 had a fan room. According to the 1942 drawings and maintenance personnel, these fan rooms heated the hangar with steam provided by a boiler at the west end of the building.

The north and south ends of the building were partitioned into offices, storage and work areas. A 1960 LAFB floor plan drawing titled "Ground Power Equipment" indicated the rooms along the north end of the building starting from west to east end included; a steam cleaning and wash rack room, an oil and lube room, and a sound proof run-up room. One floor drain was located in the former oil and lube room. These rooms were empty or used for storage by the current occupant of the building during the reconnaissance.

The south end of the building consisted of a degreaser shop according to the LAFB 1959 construction drawing titled "Hangar Building 2203". The drawing indicated that the degreaser shop consisted of the equipment listed below.

- Four degreaser tanks and vent hoods
- A vapor degreaser
- Rinse and miscellaneous tanks
- Large and small demagnetize
- Ceiling-mounted rail and hoist
- Floor drains
- Magnaflux

During reconnaissance, all equipment shown on the drawings had been removed except for the vent hoods, a ceiling-mounted rail and hoist, and the floor drainage system. The floor drainage system consisted of two small circular floor drains located on the south side of the degreaser shop and a rectangular floor drain approximately 0.5 foot wide by 18 feet long and 1.5 feet deep. The floor drain ran along the base of where the degreaser tanks had once stood and appeared to drain liquids into a concrete sump at the eastern end. The sump had a concrete base and was covered by a grate. Its dimensions were approximately two feet wide by two feet long and three feet deep. A drain pipe was located near the top of the sump approximately 1.5 feet above the sump floor. During reconnaissance, a small amount of potable water was injected into the drain from a garden hose to determine if it discharged into the nearby sanitary sewer. Water was observed to be flowing into the sanitary sewer indicating that the drain pipe had been connected to the existing sanitary Larson sewer system. It was unclear if this had been the original drain discharge point or if the system had been modified.

Directly outside the south end of the building (i.e., between Buildings 2203 and 2204), a manhole was observed during the reconnaissance. The manhole was constructed from brick and was approximately four feet in diameter and 12 feet deep. The manhole was located just southwest of the degreasing shop. A six-inch diameter clay pipe was observed as the only pipe in the manhole. It appeared to be sloped to drain liquids into the manhole and was orientated northeast in the direction of the degreaser shop. Dark colored soil was observed at the bottom of the manhole and the manhole was dry at the time of the reconnaissance. It is unclear what connected to the drainpipe or if the manhole had a constructed base.

Active Soil Gas Sampling

Three ASG samples were collected at this site. All three samples reported detectable concentrations of TCE. The highest concentration of 10.0 ppbv TCE was detected just south of the degreaser shop in the southeast corner of the building. The sample was located in the proximity of a sanitary sewer line that connected to the concrete sump and the former degreaser tanks inside the building. The second highest concentration of TCE was 7.4 ppbv and was detected in a sample taken near a possible 12-foot deep leaching well between Buildings 2203 and 2204.

A sample was collected near a buried pipe exiting the building at the northwest corner of the building. This pipe exited from between the Oil and Lube Room and Steam Cleaner and Wash Rack Room. This sample reported 2.1 ppbv TCE.

Surface Soil Sampling

Surface soil samples were not collected at this site.

Groundwater Sampling

Groundwater monitoring wells 91-AW15 and 00-BW11 were used to evaluate groundwater COPCs. The monitoring wells were sampled for the original suite of COPCs, which included VOCs and HDGs. Low concentrations of TCE have been consistently detected in 91-AW15. The TCE concentrations detected in this well ranged from 0.35 to 0.6 µg/L for the six sampling events except March 2000, which was non-detect (less than 1.0 µg/L).

TCE has not been detected in 00-BW11 during any sampling event, however several other VOCs have been detected including sec-butylbenzene, tert-butylbenzene, benzene, and chloromethane during the November 2002 sampling event. The VOC, sec-butylbenzene, has been detected consistently during the three sampling events.

Sec-butylbenzene (7.5 to 13.0 µg/L), n-butylbenzene (1.6 to 3.3 µg/L), isopropylbenzene (1.0 to 2.5 µg/L), 1,2,4-trimethylbenzene (0.64 to 3.5 µg/L) and 1,3,5-trimethylbenzene (3.8 to 6.9 µg/L) were consistently detected in 91-AW15 during the six sampling events. During the January 2003 sampling event, acetone (4.3 µg/L), bromomethane (0.67 µg/L), tert-butylbenzene (0.52 µg/L), benzene (0.28 µg/L) and chloromethane (0.3 µg/L) were detected in 91-AW15.

4.1.4.8 Site 17 – 3-Place Hangar (Building 5801) and Waste Lines

The 3-Place Hangar (Building 5801, Site 17) was investigated in 2000. The results of this investigation are included in this section. Additional, RI work was planned for 2002, as described in the *Supplemental Management Plan* (MWH, 2003). However, a right-of-entry was not available so this work was not conducted.

Field Reconnaissance

The 3-Place Hangar Area (Building 5801, Site 17) is located at the north end of Site 4b. The reconnaissance covered 341.41 acres and included the investigation of the surrounding Buildings 5802 and 5803, a fuel tank storage/transfer area and the stormwater drainage system for the area. Features such as buildings, ditches and drains were mapped during the reconnaissance. The LAFB floor plans and drawings dated 1954, 1955 and 1956, topographic and utility maps dated 1956 and master plan utility maps dated 1964, 1965 and 1966 were used to find facilities during the reconnaissance. Initially, reconnaissance was performed on property owned by the Port of Moses Lake on August 2 and 3, 2000. After resolving access issues, reconnaissance was performed on the privately owned portion of the property, including the interior of structures. This reconnaissance was performed on October 11, 2000 with participation by the USACE and the property owner's representative.

Building 5801 was originally built in 1956 to accommodate three B-52 bombers. According to the *Site Background Summary Report* (Montgomery Watson, 1999a), the hangar was used to house maintenance activities in the early 1960s. Large sliding hangar doors were located at the west end of the building. The eastern portion of Building 5801 consisted of office, storage and working rooms on two levels. The hangar portion consisted of hangar bays used for aircraft parking. The current owners of the building and surrounding property use the building for aircraft parts storage. The second level offices were vacant.

According to the LAFB 1954 drawing titled "Hangar, Shop and Office Unit, First Floor Plan" and observations made during reconnaissance, fourteen grated sumps were located at low points on the hangar floor in each of the three hangar areas. According to the building owner, the drains connected to the storm drain system that eventually discharged into ditches at the north and east sides of the building. Ten lines exited the east side and one line exited the south side of Building 5801, when connected to the sanitary sewer. The drains were observed during the reconnaissance and did not appear to be sealed. According to the owner, a vapor degreaser area was used in the Electrical Test and Armament Repair area located near the northwest corner of the building on the first level. During the reconnaissance, a concrete pit was observed, approximately 15 feet by 20 feet long and five feet deep was observed during the October 11, 2000 site visit. The pit was constructed with a concrete floor and walls with stairs leading down to the floor. Paint on some nearby equipment was observed to be pealing. A small drain was located at the bottom of the pit.

Building 5802, Service Building, was located directly east of Building 5801. The interior of Building 5802 consisted of office space, a cafeteria, storage, testing facilities, a boiler, a compressor, electrical, feed water equipment, fire station and tool rooms located primarily on two levels at both the north and south ends of the building, according to the 1954 First and Second Floor Plan drawings. Many of the offices and the cafeteria had been decommissioned and were no longer in use. The middle section of the building was a fabrication shop that included a painting room with exhaust hoods and monorail I-beams for electric hoists. The owner was using these areas primarily for storage purposes. Six vented, floor sumps were located on the east half of the fabrication shop along the east

wall shown on the drawings. The floor sumps were located during the reconnaissance and had been sealed with concrete. It is unknown what the sumps were used for. Fourteen floor drains were located throughout the fabrication shop, most of which appeared to be operational. A five by five feet drain pit was also located in the middle of the shop towards the west side directly below a ceiling hoist. This drain was also sealed with concrete.

Diesel oil, fuel oil and blow off storage tanks were located towards the south end of Building 5802 on the east side near the boiler room. The boiler and most of the equipment shown on the drawings were still being used during the reconnaissance. The drawings showed ten buried pipes exiting Building 5802 and connecting to a storm sewer pipe that ran east and discharged into an open ditch located near Randolph Road east of the building. The drawings also showed two buried pipes exiting the northwest corner of Building 5802 and connecting to the storm sewer pipe that drains to the ditch located northeast of the tarmac and building. In addition, the drawings showed nine additional buried pipes exiting the building and connecting to the sanitary sewer. The building is currently used by the owner to store aircraft parts and supplies.

Building 5803, Paint Storage Building, is located east of Building 5802. According to an untitled/undated drawing found with other LAFB drawings, the north end of Building 5803 was used for oil storage and the south end was used for bulk paint storage. According to the 1956 drawing titled "Storage Buildings and Service Building Alterations," two floor drains, a two by two feet and 3.5 feet deep steam pit, and an exhaust hood were located in Building 5803. The piping network of these floor drains and pit are unknown. The owner currently uses the building as a carpenter shop. The drains and exhaust hood were not observed during the reconnaissance. However, several stormwater grates were located directly west of the building. It appeared that one line exited Building 5803 to the west near the grates and connected to a storm sewer pipe that leads east. This pipe discharges into the ditch located near Randolph Road, according to the 1956 Topographic and Utility Map.

Other small structures on the property include Building 5816, a water storage tank and above ground bulk storage tanks. Building 5816 was used as a liquid oxygen storage area (Site 19) and is located north of Building 5801 and east of Site 4b. The water storage tank is located east of the south end of Building 5802 and has a capacity of 500,000 gallons. This water tank is believed to be part of the fire suppression system and is partially constructed below ground.

Two above ground fuel storage tanks are located south of Building 5802 in a fenced area. According to the 1964 Liquid Fuel System Master Plan, the fuel tanks had a capacity of 5,000 gallons. Each tank is surrounded by an earthen berm approximately four feet above the ground surface. A sump was located on the south side of both berms and connected to a buried pipe that discharged into the small north pit at Site 22. The tanks were supplied by a buried pipe from a fuel distribution facility located a few miles southeast at the intersection of Road 7 North and Stratford Road. The owner indicated that the tanks were empty and no longer in use. According to the owner, the underground fuel pipeline was disconnected in 1999. The tanks were last used sometime between 1998 and 1999. The pipe to the tanks was disconnected from the main pipeline near the Larson WWTP.

The tank area also consisted of a truck loading station, pump station building and a fuel control building located west of the bermed fuel tanks. A concrete tanker parking area was located north of the bermed fuel tanks. The concrete parking area was sloped to the north and appeared to collect in a depression/pit north of the tanker parking area. One catch basin was located at the west end of the tanker parking area and was connected to the storm sewer line that leads east and discharged into an open ditch located near Randolph Road.

West of the fuel tanks, a refueling area was located on the tarmac. A network of fire-suppression, spray-nozzles, housed in concrete structures were also observed during reconnaissance. Four catch basins were located within the refueling area and were connected to a storm sewer line that ran east to the south Site 22.

The north end of Site 4b was included in the reconnaissance of Site 17. The north end of the tarmac began at the refueling tarmac and extended north. Currently, the tarmac is used for storage of large aircraft parts. An approximate 30 by 30 feet long and 8 feet deep pit was located at the northeast corner of the tarmac. A debris area was located at the north end of the tarmac. This debris area consisted mainly of scrap metal and wood. The area was surrounded on three sides by an approximate three-foot soil berm.

Bunkers were located north of the northwest and northeast corners of the tarmac. An approximate 75 by 75 feet and 3 feet deep pit was located just south of the northeast bunker. The bunkers consisted of mounded soil. The bunkers may have been used as target backstops for a gun range. A debris area consisting mainly of scrap sheet metal and one transformer housing was located south of the bunker that was located north of the northeast corner of the tarmac.

A concrete pad with trenches was located just northwest of the northeast bunker. Piping was observed that connected to the trenches. Several trenches were covered with steel plates. A ground rail-track on a concrete foundation was located on both the north and south sides of the concrete pad and extended southwest past the end of the concrete pad. The purpose of this concrete pad and associated piping was unknown.

A construction debris landfill began at the north end of the private property, northeast of the west bunker. A small portion of the landfill appeared to be on the private property and the remainder appeared to be on Port of Moses Lake property. The landfill consisted mainly of concrete and asphalt debris. A pit, approximately 150 feet wide by 400 feet long and 8 feet deep, was located northeast of the west bunker according to the 1956 Topographic and Utility Map. The pit appeared to be mostly filled in with concrete debris based on observations during the reconnaissance.

According to the LAFB 1965 Storm Drainage System Master Plan, four catch basins located at the 2-place aircraft wash area and two catch basins west of the bermed fuel tanks connected to a storm sewer line that ran east and discharged into the south Leach Pit. Two sumps within the bermed tank area connected to a storm sewer line that ran east and discharged into the north Leach Pit.

Four catch basins located along the east side of the tarmac south of Building 5801 and one manhole located in the tanker parking area connected to a storm sewer line that ran east and discharged into an open ditch located near Randolph Road. Two catch basins and two manholes on the west side, two manholes on the south side, and one manhole on the east side of Building 5801 connected with a storm sewer line that ran east and discharged to the open ditch near Randolph Road. Six catch basins on the east side of Building 5802 also connected with the storm sewer line that ran east to the open ditch located near Randolph Road. During reconnaissance, some of the locations shown as manholes on the drawings appeared to have been converted into catch basins.

Two catch basins and two manholes on the west side, two manholes on the south side, and three catch basins and one manhole on the east side of Building 5801 connected with a storm sewer pipe that ran north and eventually discharged into an open ditch. Ten additional catch basins, along the east side of the tarmac north of Building 5801, connected with the storm sewer pipe that ran north and discharged into an open ditch north of the northeast corner of the tarmac.

A series of catch basins were located along the west side of the tarmac. Each catch basin led west and connected to a sub-drain running parallel to the west side of the tarmac. The north end of the sub-drain connected to an approximate 12-inch diameter corrugated steel culvert that led north and discharged into an open ditch located north of the northwest corner of the tarmac. The drawings show that these are french drains that allow water to directly infiltrate into the subsoils.

Review of historical documents concerning this site indicated that investigation activities have taken place. In February and March 1990, Boeing removed one underground diesel fuel tank, two Bunker C fuel storage tanks and one below-grade waste oil sump (Landau Associates, 1991). The tanks were located adjacent to the southern end of the eastern side of building 8-02. The waste oil sump was located just to the north between building 8-02 and 8-03/8-1. The tanks and sump were all removed. Six samples were collected beneath the former diesel fuel and analyzed for TPH. Four of the six samples detected TPH from 12 to 990 mg/kg. Three to four feet of soil were then removed and another sample was collected and analyzed for TPH. This sample contained 100 mg/kg.

After the waste oil sump was removed, three soil samples were collected from the excavation and analyzed for TPH, VOCs, SVOCs, metals (RCRA Priority Pollutant 8) and PCBs (Landau Associates, 1991). TCE was not detected. However, TPH was detected in one sample at 94 mg/kg. The PCBs Aroclor 1254 and Aroclor 1260 were detected up to 3,000 µg/kg. The SVOCs fluoranthene, pyrene and chrysene were detected in one sample up to 140 µg/kg. The only metal detected was barium at less than 00.2 mg/kg.

After the Bunker C tanks and two to three feet of soil were removed, four soil samples were collected from the excavation and analyzed for TPH (Landau Associates, 1991). Two of the samples contained TPH up to 35 mg/kg.

In February 1998, Boeing installed five groundwater monitoring wells within or near the Boeing property (Woodward-Clyde, 1998). Most of the wells were greater than 1,000 feet

from the 3-Place Hangar and the solvent pit. However, one of the wells was 800 feet to the northwest of the solvent pit adjacent to the northwest corner of the 3-Place Hangar. Another well was approximately 700 feet southwest (roughly downgradient) of the solvent pit. The wells were screened across the water table with total depths between 73 and 79 feet bgs within the Pleistocene sediments. The wells were subsequently sampled twice in February and March 1998 and analyzed for VOCs by EPA Method 8260. The results indicated that TCE and other chlorinated hydrocarbons were non-detect during both sampling rounds. The wells have since been abandoned.

Active Soil Gas Sampling

Five ASG samples and one duplicate sample were collected from approved locations at Site 17. A sample located adjacent to the outfall of a ditch northeast of the tarmac at Site 17 detected 2.0 ppbv TCE. No other TCE detections were reported.

Surface Soil Sampling

Four soil samples were collected from Site 17 and analyzed for metals, TPH and PCBs. Three of the samples (00MLW001SS001S17, SS003 and SS004) exceeded the USEPA Region 9 PRG for arsenic of 1.6 mg/kg. These samples ranged in concentration from 1.9 to 5.6 mg/kg and were collected from the ends of two discharge ditches trending northeast and east of the tarmac and inside a secondary containment berm surrounding the above ground fuel storage tank. This same sample also exceeded the benzo(a)pyrene and benzo(b)fluoranthene USEPA Region 9 PRG of 0.21 mg/kg and 2.1 mg/kg, respectively. The presence of PCBs was also reported from this sample, but not above the USEPA Region 9 PRGs. None of the samples reported TPH concentrations above the MTCA-A Soil Cleanup Levels.

Groundwater Sampling

Groundwater monitoring well 00-BW09 was used to evaluate groundwater COPCs. The monitoring well was initially sampled for the original suite of COPCs, which included VOCs and HDGs and additional parameters, metals and TPH. Various subsets of the original suite of COPCs were sampled during subsequent sampling events. None of the COPCs were detected in the monitoring well.

4.1.4.9 Site 18 – Paint Hangar

Field Reconnaissance

The Paint Hangar (Building 5825, Site 18) was located on the east side of Site 4b and north of Site 14. Reconnaissance of the site included touring the site, mapping the stormwater drainage system and reviewing LAFB floor plans and drawings dated 1956, 1957, and 1958 and the 1965 Master Utility Plan.

The Paint Hangar was a two-place aircraft hangar constructed in 1957 designed to house painting activities for large aircraft. Large sliding hangar doors were located on the south sides of the building. Each hangar area had a network of floor grates in the hangar area

and floor drains along the hangar doors. A private company currently occupies the building. The east hangar has been remodeled and the floor grates sealed by the current owner. The west hangar was in the process of being remodeled, but the floor grates were not yet sealed.

The floor grates drained to a network of concrete drainage gutters on the lower basement level below the main hangar floor. Liquids/substances from the main level flowed into the floor grates and into the drainage gutters. The drainage gutters directed flow to three drainage sumps and two concrete clarifier tanks with a skimmer pit. Each drainage sump consisted of two sump pumps and a large deluge sump pump. According to the 1958 drawing titled "Hangar Exhaust Plenum Plan" and the 1957 drawing titled "Composite of Storm & Sewer", all the sumps discharged into an industrial/storm drain pipe. The industrial/storm drain outfall was located at the south leach pit (Site 22), located northeast of Building 5825. According to the 1957 drawing, three smaller drain lines from Building 5825 connected to a storm drainpipe on the north side of the building. Five catch basins were located along this storm pipe. The outfall of the storm drain was at a ditch located at the northeast corner of Building 5825. The piping and pumps were all observed during the reconnaissance. According to the 1956 LAFB drawings titled "Hangar Shop Areas (east portion)", a paint handling area and a ketone tank with a ventilation hood was located in the northeast corner of the east hangar.

Active Soil Gas Sampling

Four ASG samples and one duplicate sample were collected from approved locations at Site 18. A sample collected on the north side of Building 5825, near the location of the clarifying tanks, detected 2.7 ppbv TCE. No other samples reported detectable levels of TCE.

Surface Soil Sampling

Three soil samples were collected at Site 18 and analyzed for metals and PCBs. Lead was detected (860 mg/kg) above the USEPA Region 9 PRG of 750 mg/kg in sample 00MLW001SS003S18. This sample was collected from a large ditch below the outfall. The ditch continues along the east side of the hangar toward Site 15. The individual USEPA Region 9 PRG for PCBs (Aroclor 1254 and 1260) was exceeded in sample 00MLW001SS01S18 located near a connection between a buried sump pump discharge pipe and a buried industrial/storm drain pipe north of the Paint Hangar.

Groundwater Sampling

Groundwater monitoring wells 00-BW07 and 00-BW04 were used to evaluate groundwater COPCs. The monitoring wells were initially sampled for the original suite of COPCs, which included VOCs and HDGs, as well as metals and TPH. Various subsets of the original suite of COPCs were sampled during subsequent sampling events. None of the COPCs listed above except arsenic and methylene chloride were detected in 00-BW04. Arsenic (5 µg/L) was measured in January 2001 and methylene chloride (0.18 µg/L) was detected in October 2002. TCE concentrations of 0.8 µg/L, 1.0 µg/L and non-detect (less than 0.5 µg/L) were detected in 00-BW07 during the September 2000, January

2001 and October 2002 sampling events, respectively. Manganese (48 µg/L) and zinc (20 µg/L) were also detected in this well during the September 2000 sampling event. However, all metals were reported as non-detect during the January 2001 sampling event. None of the other COPCs listed above were detected in the monitoring wells.

4.1.4.10 Site 19 – Liquid Oxygen Generating Plant (Building 5102)

Field Reconnaissance

The former Liquid Oxygen Generating Plant (LOX Plant) (Building 5102, Site 19) is located east of Site 17 with Tyndal Road to the north, Randolph Road to the east and Site 22 to the south. Reconnaissance of the site during the 2000 investigation included reviewing the LAFB construction drawings for the building and a field investigation covering 5.02 acres.

The LOX building consisted of a steel building with several large and small doors on the east and west sides. The north side of the building's interior consisted of a room with kitchen appliances, a bathroom, a storage room and an office room. The remainder of the building was open with six visible floor drains approximately six inches in diameter.

A concrete pad was located on the east side of the building and a loading ramp and dock were located on the southwest corner of the building. There were several overhead electrical cables on the east, south and north sides of the building. Galvanized electrical conduit ran from a power pole into the south side of the building. The conduit appeared new and could have been recently installed by property tenants. The exterior of the building was cluttered with debris including abandoned cars, equipment, trash and a pile of hay to the east.

A rectangular, buried, concrete tank was located south of the LOX building with its top flush to the ground surface. The tank was believed to be connected to the six floor drains inside the building and is labeled as a "2,500 gallon Industrial Waste Septic Tank" on the 1964 LAFB Master Plan Sanitary Sewage System drawing. Liquid from the tank flowed into two buried pipes that extended south and southeast approximately 200 and 270 feet, based on the drawing. Based on field observations, the pipes were six to eight inches in diameter and made of steel. The pipe drained to the southeast and discharged into a small square sump approximately 100 feet from the septic tank.

The sump, constructed with concrete blocks, had dimensions of approximately three feet long, five feet wide and eight feet deep. The sump was covered by a steel plate and contained sludge and liquid in the bottom. The liquid was sampled by Philips Environmental Service and found to contain 210,000 ppb TCE. The liquid was also analyzed from the larger septic tank and found to contain 260,000 ppb TCE. The tank and sump had an estimated capacity of 5,000 and 875 gallons respectively (Philips Services Corporation, communication to the USACE, dated October 26, 2000).

The pipe from the septic tank discharged into the sump approximately five feet below the ground surface. Located a few feet lower than the discharge point, a similar steel pipe continued southeast from the sump. GPR and EM were unsuccessful in locating the actual

ends of either the south or southeast pipes. However, according to the 1964 LAFB Master Plan Sanitary Sewage System drawing, the pipe running southeast continued approximately 70 feet.

A concrete pad extended east of the LOX building. The 1964 LAFB Liquid Fuel System Master Plan depicted a liquid oxygen tank and a nitrogen tank located on the pad. No tanks were found during reconnaissance. Square concrete covers with lifting lids were observed in the concrete pad running perpendicular to the LOX building and may cover a utility corridor; however, this has not been verified.

Stormwater from the perimeter of the plant and blowdown water (generated in the manufacturing process) containing TCE was reported to have been directed to a 40-foot diameter pit located adjacent to the east side of the plant.

Geophysical Surveys

An area was investigated with EM and GPR at Site 19 to determine the locations of disturbed soils due to previous excavations, possible leach fields and underground piping extending from the septic tank and sump. Many of the contour variations in the north and northwest portions of the EM survey area were due to electromagnetic interference caused by overhead utility lines and a utility trench, as well as interference from reinforced concrete. The southern portion of the site was devoid of contours indicating minimal subsurface variations. Throughout the rest of the site, the contours did not indicate a change in terrain conductivity values that could be interpreted as representing disturbed soils or a leach field.

An effort was made to locate the effluent pipes from two sumps (referred to as the west and southeast sumps) associated with the liquid in the 2,500 gallon septic tank south of the LOX building. The GPR data at the west sump did not show reflection patterns typical of a pipe to the south of the sump. The reflection patterns at the southeast sump showed possible indications of an outfall pipe on a GPR traverse approximately eight feet from the sump, but adjacent traverses were inconclusive.

Active Soil Gas Sampling

Five ASG samples were collected at Site 19 in August 2000 during the 2000 RI. Four of the samples reported TCE, two of which had relatively high concentrations compared to other sites, as presented in 4.6 and Appendix D3. A soil gas sample collected adjacent to the septic tank reported 7,200 ppbv TCE. Liquid from the septic tank flows into two underground pipes running south and southeast approximately 200 and 270 feet. A sample collected at the estimated end of the south pipe reported a concentration of 4.3 ppbv TCE. The other underground pipe drained southeast approximately 100 feet from the septic tank and discharges into a small square sump. A soil gas sample collected downgradient of the southeast sump reported a concentration of 2,000 ppbv TCE. A sample collected at the estimated end of an underground pipe leading out of the sump reported a concentration of 3.4 ppbv TCE. Additional ASG samples were collected in 2001 as part of an expedited investigation and during the 2002 RI, as described below.

Expedited Investigation

As a result of the high concentrations of TCE found in the above-mentioned septic tank/sump water and ASG samples, a work plan for additional investigations at the LOX Plant was developed. *The Work Plan for Expedited Investigation at the Liquid Oxygen Generating Plant* (Montgomery Watson, 2001c) described additional investigation activities to be conducted, which are listed below.

- Documentation of the tanks and piping during tank removal
- Soil sampling beneath and adjacent to the tanks and piping
- Soil gas sampling over the entire PSA
- Installation of groundwater monitoring wells

The septic tank, sump and associated piping were removed and the excavations were backfilled in January 2001 by the USACE (MCS, 2001). During the removal activities and soil sampling, it appeared that some leakage had occurred from the septic tank through the joint between the concrete floor and sidewall. Soil samples were collected on the west and east sides of the septic tank, as well as in the middle of the excavation at 20 feet bgs; approximately one to three feet below the floor of the tank. Samples were also collected below the piping connecting the septic tank and sump from below the pipe exiting the Site 19 building. Samples were collected between three and six feet beneath the piping. It was discovered that the pipe continuing from the sump ended 12 feet southeast of the sump. A soil sample was collected below the discharge point of this drainpipe. All soil samples were analyzed for VOCs, SVOCs, TPH, cPAHs and metals.

All eight soil samples reported concentrations of metals below benchmark levels, as shown on Table 4.5. Complete results can be found in Appendix D2. Four of the samples reported concentrations of Oilm-Dx below the MTCA-A Soil Cleanup Level of 2,000 mg/kg for TPH-Dx extended. The concentrations of OILM-Dx ranged from 140 mg/kg to 890 mg/kg with the highest concentration occurring beneath the sump. Two of the samples were collected beneath the septic tank on the east side and in the middle. The fourth sample was collected beneath the steel pipe exiting the LOX Plant. This same sample also reported a TCE concentration of 82 µg/kg and the sample beneath the septic tank on the east side reported a TCE concentration of 58.1 µg/kg. These detections did not exceed the EPA Region 9 PRG of 110 µg/kg for TCE. None of the samples exceeded the USEPA Region 9 PRGs for cPAHs or SVOCs.

After the tank and piping removal, a total of 61 ASG samples including duplicate samples were collected in February 2001 at 31 locations throughout the PSA. The locations were revised based on the tank removal activities. Samples were collected on a 50-foot grid spacing in an area measuring 200 by 200 feet. Samples were also collected on three sides of the former location of the septic tank and sump. At four of the locations, samples were collected at multiple depths. Detectable levels of TCE ranging from 1.1 to 120,000 ppbv were reported in 57 of the 61 samples. These samples were collected at depths ranging from 5 to 40 feet bgs. The highest concentrations of TCE were present at 20 feet bgs with decreased concentrations above and below this depth. The highest concentrations were located immediately surrounding and to the west of the former septic tank location. Soil gas concentrations were still elevated one month after source removal (the piping and

sumps) because the system did not have chance to cleanup via dissipation, degradation and introduction of ambient air. The results of the soil gas analyses in conjunction with groundwater flow directions and site history were used to optimize the location of a downgradient groundwater monitoring well (01-BW01). The soil gas TCE was not bounded (i.e., the area and extent of TCE in soil gas was not delineated by the grid used during the expedited investigation).

2002 Active Soil Gas Sampling

Additional ASG sampling was conducted in a two-phased process November and December 2002 during the 2002 RI. The objective of this task was to delineate the western lateral extent of TCE in soil gas detected during the 2001 Expedited Investigation at Site 19, evaluate the vertical distribution of TCE in soil gas, evaluate whether contaminants were released off the edge of the tarmac and evaluate risk to occupants of the Site 19 building. Consequently, ASG samples were collected from direct-push boreholes that were advanced in four types of locations:

- Co-located boreholes
- Tarmac locations
- Multiple-depth locations
- Building locations

A total of 62 ASG samples, including duplicate samples, were collected from 30 direct-push boreholes at the four types of locations listed above. Direct-push borehole locations were spaced 50 feet apart as presented in the related PFIDs. Nine of the boreholes were co-located with 2001 locations. Seven of these were sampled at various depths during phase one and two of the 2002 RI. Six tarmac locations, one of which was a multiple-depth location, were sampled at ten feet bgs during phase one and were located just outside the edge of the tarmac. Fourteen multiple-depth locations, one of which was also a tarmac location, were sampled at various depths during both phases one and two, in addition to the seven co-located boreholes that were also sampled at multiple depths. The building locations consisted of two boreholes located adjacent the Site 19 building with samples collected at four feet bgs.

All 62 ASG samples reported detectable levels of TCE ranging from 1.4 to 7,300 ppbv. These samples were collected at depths ranging from 4 to 40 feet bgs.

The lateral extent of TCE in soil gas has been delineated at Site 19. Concentrations of TCE in the perimeter boreholes for both 2001 and 2002 are all below the RBSL of 7,300 ppbv. In the samples collected in 2002, one sample was equal to the RBSL of 7,300 ppbv. It is not known if the increasing soil gas measurements with depth are due to preferential volatilization of TCE contamination near the ground surface, in the vadose zone between 40 feet and first groundwater (approximately 80 ft bgs), or at or within groundwater. Similarly, it is not known if TCE concentrations higher than those detected in the uppermost 40 ft may be present below this depth. For this reason there is uncertainty in the vertical characterization at Site 19. The 40-foot sample in SG007 located in the middle of the site near the northern former vault was reported at a value of 7,300 ppbv. All other results were less than 7,300 ppbv.

A comparison of the TCE concentrations was made between samples collected at the same depths in the 2001 and 2002 co-located boreholes. One sample was collected from each of the four 2002 boreholes at the same depth as samples collected from the co-located 2001 boreholes. The comparison indicated that concentrations of TCE in soil gas have decreased significantly since February 2001 subsequent to removal of the former septic tanks/sumps containing liquids with high concentrations of TCE. The results of the co-located samples are shown below.

2001	**2002**
SG001 (10') = 31,000	SG006 (10') = 1,100
SG002 (10') = 28,000	SG007 (10') = 2,000
SG027 (10') = 2,900	SG008 (10') = 11
SG031 (5') = 18,000	SG005 (5') = 300

An evaluation of the vertical distribution of TCE in 2002 soil gas samples was conducted using the results from twenty-one multiple-depth locations. In all of the locations except four concentrations increased with depth. With few exceptions, the highest concentrations occurred in the deepest (40-foot) samples. These data, and the results of 2001 sampling, suggest that higher concentrations of TCE may be present in the vadose zone beneath 40 feet bgs. It is also possible that residual contamination at depth could represent an ongoing source of contamination to groundwater. Although TCE concentrations increase with depth, there is no direct evidence that it has impacted groundwater, as no TCE has been detected in well 01-BW01 (see the following groundwater sampling section). An evaluation of the data at each of the depth intervals (e.g., ground surface 0 to 15 feet, 20 to 29 feet and 30 to 40 feet) indicates that there are trends in the distribution of TCE in soil gas (e.g., based on the distribution of 1,000 and 2,000 ppbv). Within the 0-to 15-foot interval there appears to be a northwest trend; within the 20-to 29-foot interval there appears to be a westerly trend; and within the 30-to 40-foot interval there appears to be a north-south trend. These trends suggest that there are variations in the gas permeability (vertical and horizontal) within the Hanford Formation.

Results from the tarmac locations were evaluated to determine whether liquids containing TCE were discharged to the tarmac surface and may have run off the tarmac into the subsurface. Three tarmac locations south, southeast and east of the Site 19 building reported relatively low TCE concentrations of 11.0, 1.4 and 2.3 ppbv, respectively. One tarmac location northwest of the Site 19 building reported a TCE concentration of 8.6 ppbv. The remaining five tarmac locations west, southwest and south of the Site 19 building reported TCE concentrations ranging from 170 to 2,200 ppbv. However, most of these concentrations are likely attributable to the former septic tanks/sumps that have been removed and/or to the Site 19 building.

The two samples collected adjacent to the Site 19 building were sampled to assist the evaluation of risk to humans within the Site 19 building. One sample was located southeast of the Site 19 building and reported a TCE concentration of 17 ppbv, and one sample was located southwest of the Site 19 building and reported a TCE concentration of 1,000 ppbv.

Groundwater Sampling

Groundwater monitoring well 00-BW05 was originally used to evaluate groundwater COPCs and was initially sampled for the original suite of COPCs, including VOCs, HDGs, metals and TPH. Various subsets of the original suite of COPCs were sampled during subsequent sampling events. The results were non-detect for all analytes during the September 2000 sampling event. Monitoring well 00-BW05 was later determined not to be downgradient of Site 19 because it was considered too far east. In February 2001, well 01-BW01 was installed downgradient of the Site 19 to evaluate potential impacts from this PSA. The well was sampled in May 2001 and analyzed for VOCs, HDGs, TPH and dissolved metals. The results of these analyses were non-detect for all analytes during the May 2001 sampling event. The well was also sampled for general water quality parameters, as summarized in Appendix D5. Monitoring well 01-BW01 was again sampled in October 2002 and analyzed for VOCs only, the results of which were non-detect.

4.1.4.11 Site 19b –LOX Disposal Site

Field Reconnaissance

The Alternative LOX Disposal (ALOX) Site (Site 19b) was located approximately 2,500 feet northeast of the Site 19, northeast of the intersection of Randolph Road and Tyndall Road. Reconnaissance of the site included touring the site and reviewing historical aerial photographs.

Site 19b consists of a shallow depression that is bermed with soil. The area of the depression is approximately 50 by 75 feet and less than three feet deep. A barbed-wire fence with an area of approximately 85 by 170 feet surrounds the depression. A sign attached to the barbed-wire fence was found that indicated this site was a LOX Disposal Site. A drainage ditch that ends approximately 100 feet west of the depression was observed. Although the ditch did not connect with the depression, it trended east-west towards Site 19b. The ditch was discovered to be the same ditch that was identified as part of Site 17 discussed in Section 4.1.4.8. Other disturbed areas of piled and pushed soil was observed in the vicinity of the Site 19b. Based on the review of historical aerial photographs, it appears that Site 19b has been present since 1955.

Active Soil Gas Sampling

Twenty ASG samples, plus quality assurance samples, were collected at Site 19b. Samples were collected on a 50-foot grid spacing in a 150-by-200 foot area covering the depression. All samples were collected at approximately ten feet bgs. TCE was detected in only one sample at a concentration of 0.084 ppbv. No other samples reported detectable levels of TCE. The lack of elevated levels of TCE reported in soil gas indicate that the Site 19b is not an existing primary source of TCE contamination.

Surface Soil Sampling

Surface soil samples were not collected at this site.

Groundwater Sampling

No site-specific groundwater monitoring wells are located at Site 19b. Monitoring wells 00-BW01, 00-BW05, 00-BW14 and 01-BW01 are potentially downgradient of Site 19b. All of these monitoring wells have reported non-detects for TCE during every sampling event since their installation.

4.1.4.12 Site 23 – Engine Buildup Facility (Building 2113)

Field Reconnaissance

The former Engine Buildup Facility (Building 2113, Site 23) was located directly south of Port Tarmac Area A. Reconnaissance of Site 23 included a review of the construction drawings to determine the location and function of the drainage system within the building and a field investigation of the buildings remains.

The Site 23 building was demolished with only the foundation and concrete floor remaining. A floor drain in the southeast corner of the former building floor connected to a leaching well located outside of the building. The leaching well consisted of a 55-gallon drum perforated with holes. A two-inch diameter galvanized pipe extended approximately ten feet high from a concrete pad located along the west side of the former building. A metal, six-inch diameter pipe standing approximately 2.5 feet above the ground was located near the northwest corner of the former building. This pipe appeared to have been associated with the building's fire suppression system. The pipe was 6.5 feet deep with rusty sediment on the bottom. Aerial photographs from 1955 showed aircraft parked between Building 2106 and Site 23 with some black staining visible on the concrete.

Active Soil Gas Sampling

Two ASG samples were collected at Site 23. A sample located near a leaching well and floor drain along the south side of the building detected 1.1 ppbv TCE. The other sample did not report a detectable concentration of TCE.

Surface Soil Sampling

Surface soil samples were not collected at this site.

Groundwater Sampling

Groundwater monitoring wells 91-AW14 and 99-BW16 were used to evaluate groundwater COPCs. Based on average groundwater flow directions, these wells may not capture contamination resulting from this PSA. Monitoring well 99-BW16 does not appear to be directly downgradient of Site 23. The monitoring wells were initially sampled for the original suite of COPCs, which included VOCs and HDGs, as well as glycol ethers. Various subsets of the original suite of COPCs were sampled during subsequent sampling events. Low concentrations of TCE were consistently detected in 91-AW14 from 3.8 to 5.6 µg/L. TCE was also detected in 99-BW16. Manganese was

detected (22 µg/L) in 99-BW16 during the one sampling event in which metals were sampled. In addition, several other VOCs including 1,2-dibromo-3-chloropropane, 2-hexanone, 4-methyl-2-pentanone, naphthalene, and chloroform were detected in 99-BW16 during the October 2002 sampling event. All other COPCs were reported below detection limits in these wells. Monitoring well 99-BW16 was resampled on February 27, 2003, to confirm the VOC detection by method SW8260B for VOCs and by method SW8011 for low-level 1,2-dibromo-3-chloropropane. All VOCs detected in October 2002 were non-detect during the resampling except TCE and chloroform which were detected at 2.9 µg/L and 0.23 µg/L, respectively. The chloroform result was flagged with a "J" to indicate that is was estimated.

4.1.4.13 Site 25 – Building 408

Field Reconnaissance

Building 408 (Site 25) is located on the south side of the parking/refueling apron of Site 4a, west of the Grant County International Airport terminal building. No floor plans or drawings were available for Building 408, but drains located within and around the structure were mapped.

Building 408 was an aircraft hangar building with large sliding doors at the north end. Additional rooms were built onto the south, east and west sides of the main hangar area. A majority of the main hangar room is currently used for storage. The remainder of Building 408 was remodeled into offices and work areas.

Six, approximately three-inch diameter floor drains were observed throughout the building additions. A wood-grate floor drain was located inside of Building 408 spanning the length of the north hangar doors.

Building 408 was surrounded by gravel parking areas to the south and west, tarmac to the north and paved road/parking to the east. A catch basin southwest of Building 408 was believed to be a french drain based on review of the 1956 Master Storm Drainage drawing and appeared to have a gravel bottom for infiltration. A new catch basin was located near the northeast corner of Building 408 in the vicinity of an old french drain according to the 1956 drawing.

Active Soil Gas Sampling

Three ASG samples were collected near Building 408. A sample located just south of Building 408 detected 3.2 ppbv TCE. The other two samples reported non-detect for TCE.

Surface Soil Sampling

Surface soil samples were not collected at this site.

Groundwater Sampling

Groundwater monitoring wells 91-AW14 and 99-BW16 were used to evaluate groundwater COPCs. The monitoring wells were initially sampled for the original suite of COPCs, which included VOCs and HDGs as well as glycol ethers. Various subsets of the original suite of COPCs were sampled during subsequent sampling events. Low concentrations of TCE were consistently detected in 91-AW14 from 0.38 to 0.6 µg/L. TCE was detected ranging from 3.8 to 5.6 µg/L in 99-BW16. Manganese was also detected in 99-BW16 during the one sampling event in which metals were sampled. In addition, several other VOCs including 1,2-dibromo-3-chloropropane, 2-hexanone, 4-methyl-2-pentanone, naphthalene and chloroform were detected in 99-BW16 during the October 2002 sampling event. All other COPCs were reported below detection limits in the wells. Monitoring well 99-BW16 was resampled on February 27, 2003, to confirm the VOC detection by method SW8260B for VOCs and by method SW8011 for low-level 1,2-dibromo-3-chloropropane. All VOCs detected in October 2002 were non-detect except TCE and chloroform which were detected at 2.9 µg/L and 0.23 µg/L, respectively. The chloroform result was flagged with a "J" to indicate that is was estimated.

4.1.4.14 Site 33 – Dump at the End of Runway 32

Field Reconnaissance

The approximate location of the Dump at End of Runway 32 (Site 33), was identified based on 1955 aerial photographs. Reconnaissance of the site covered 8.34 acres. The site was characterized by limited surface soil disturbance. A majority of the area now consists of the Alert Center pads. Close interpretation of aerial photographs indicated that Site 33 might have been a surface discharge area rather than a landfill. This site was characterized as a surface discharge area as a result of FCR MLW00/014. There is the potential that this site was both a surface discharge area and a small landfill.

Geophysical Surveys

An EM survey was performed near the Alert Center pads in an area that was covered with soil, asphalt and concrete. There was a large degree of electromagnetic variation throughout the site, which was believed to be attributed to numerous underground utilities based on the observations of utility manways in the vicinity and the nature of the contours. One zone of buried debris was identified in the area trending north-south across the alert pad taxiway. This anomaly was identified as buried debris because it did not line up with any observed man-ways or utility valves. Other features were identified as disturbed soil. These contour features were believed to be associated with construction of the alert pad taxiways.

Active Soil Gas Sampling

Two ASG samples were collected from approved locations at Site 33. A sample collected at the approximate location of the stained soil area observed in the 1961 aerial photo, detected 2.8 ppbv TCE.

Surface Soil Sampling

Previous investigations at this site included an environmental assessment performed by the landowners. This report, *Preliminary Environmental Assessment and Limited Subsurface Soil Characterization*, Alert Center Parcel (Dames & Moore, 1996), reported the results of surface and subsurface soil sampling at Site 33. These results were used to characterize this site and perform the risk assessment discussed in Section 6.0. Two test pits sampled at multiple depths and three surface soil samples were collected. All samples were analyzed for TPH. One sample, a test pit sample taken at a depth of five feet, was also analyzed for metals, VOCs, SVOCs, PCBs and pesticides. Lead, chromium, barium and PCPs were detected in this sample but at concentrations below the benchmark level. The test-pit sample reported no detections for VOCs and pesticides. All of the samples reported concentrations of TPH-Dx below the MTCA-A Soil Cleanup Level. The TPH concentrations at this site decreased with depth.

Groundwater Sampling

Groundwater monitoring well, 00-BW12, was used to evaluate groundwater COPCs. The monitoring well was initially sampled for the original suite of COPCs, which included VOCs and HDGs, as well as SVOCs, chlorinated pesticides, metals and TPH. Various subsets of the original suite of COPCs were sampled during subsequent sampling events. TCE was detected in 00-BW12 from 18 to 28 µg/L. Manganese and zinc were also detected in 00-BW12. All other COPCs were reported below detection limits in this well.

4.1.4.15 Site 35 – Stained Soil Area

Field Reconnaissance

The Stained Soil Area (Site 35) is located on the south side of the Port of Moses Lake property adjacent to two large above ground storage tanks (AST). The west AST (AST-W) was located within Site 35 boundaries. The east AST (AST-E) was located within the boundaries for Site 28. The AST-W appeared for the first time in the 1961 photograph. The AST-E appeared for the first time in the 1955 photograph.

A dark area believed to be stained soil was visible west and southwest of the AST-W area in the photographs dated 1949, 1955, 1961, 1969, 1973 and 1996. The dark area appeared the largest in the 1949 and 1955 photographs. The dark area appeared to have reduced in size in the 1961 photograph. The dark area in the 1969, 1973 and 1996 photographs appeared similar to the 1961 photograph. Dark gravel was observed at the site during the field reconnaissance. Dark material, that appeared coal-like, was also observed south of the AST-W. The exact composition of the dark material was unknown.

A chain link fence surrounded the AST-W. A propane tank storage area was also located inside the fence at the southwest corner of the AST-W area. A debris area was located at the southeast corner of the AST-W area and east of the propane tank storage area. The debris appeared to be of construction material consisting mainly of concrete and some metal and wood debris.

Five concrete structures were observed along the railroad tracks west of the AST-W area. These concrete structures were labeled "JP-4 Jet Fuel"; no piping was observed at these structures. Similar structures were observed east of AST-W and west of AST-E along the railroad tracks. During the reconnaissance, a drum, cut in half, was observed at surface-level in the northwest corner of the AST-W area. The top of this drum was open and was filled with an oily liquid. An approximate four feet in diameter area of stained soil was observed around the drum. Other small areas of stained soil were observed along the north side of the AST-W area. These appeared to be from recent illegal dumping of used oil. The Port of Moses Lake authority removed the oil and stained soil shortly after the reconnaissance.

Active Soil Gas Sampling

ASG samples were not collected at this site.

FPXRF Testing

Site 35 was the only site within this PSA category to utilize the FPXRF screening as part of its characterization program. A total of 16 in-situ FPXRF surface soil locations were analyzed for lead within the study area of the Stained Soil Area. At five of the in-situ locations, samples were collected and prepared prior to ex-situ analysis. Of the 21 readings, 18 of the analyses (86 percent) were reported below the detection limit. The detection limits for all of the FPXRF locations ranged from 45 ppm to 150 ppm. The FPXRF readings ranged from 62 ppm to 354 ppm with an average precision error of 54 ppm and a mean of 221 ppm. Two of the analyses that reported FPXRF readings above the detection limit were an in-situ/prepared sample pair. The FPXRF readings for the five surface soil samples selected for ex-situ analysis were 62 ppm and 354 ppm.

Surface Soil Sampling

Six soil samples were collected at Site 35. Three of the samples were analyzed for TPH and three of the samples were analyzed for metals. Sample locations for laboratory metal analyses were selected at three locations based on the FPXRF results. Only two locations reported a FPXRF reading above the detection limit within the Stained Soil Area. The third sample location reported an FPXRF reading below the detection limit, but was selected for laboratory analysis due to the high FPXRF detection limit. Two of the three samples reported concentrations exceeding the EPA Region 9 PRG for arsenic (00MLW001SS004S35 and 00MLW001SS005S35). No other benchmark level were exceeded for metals.

Two samples analyzed for TPH reported concentrations of gasoline or diesel above the MTCA-A Soil Cleanup Levels. Sample 00MLW001SS001S35, collected adjacent to five concrete structures in the northwest corner of the site, reported 110 ppm extended range gasoline. The concrete structures are labeled "JP-4 Jet Fuel." Sample 00MLW001SS003S35, collected from a stained area, where half of a 55-gallon drum full of liquid was removed, reported 16,000 ppm diesel and 32,000 ppm oil. This sample also reported several low concentrations of cPAHs, all below the USEPA Region 9 PRGs. Sample 00MLW001SS002S35, collected from within a dark soil area in the south-central

vicinity of the site, reported 170 ppm extended range diesel. However, this concentration was not greater than the MTCA-A Soil Cleanup Level of 2000 mg/kg

Groundwater Sampling

Site-specific groundwater monitoring wells were not sampled at this site.

4.1.4.16 Site 36 – Former Skyline Auto Wrecking Yard

Site 36, outside the boundary of the former Larson Air force base, is not thought to have been associated with base operations and is under the jurisdiction of the Washington DOE. As such, the results of the investigation conducted by the USACE have been forwarded to the DOE.

Field Reconnaissance

Site 36 is located in the 4300 block area of Airway Drive. The site is still present, but is no longer used as a wrecking yard. The site is located on the southwest side of Airway Drive, just south of Circle Place and the intersection of Airway Drive and Terminal Street. Reconnaissance of the site included touring the site, photographing and mapping pertinent site features, interviewing current site occupant, and reviewing historical aerial photographs and a Washington Department of Ecology (DOE) report.

The DOE report dated October 15, 2002 was reviewed prior to the site visit. The current site occupant (b) (6) showed MWH certain "points of interest" during a tour of the site. The points of interest included stained soil areas, stressed vegetation areas, the location of a former auto-service island with a service pit, a former UST location and the former locations of drums, some of which were labeled as containing TCE. According to (b) (6), the site had been a wrecking yard since the 1940's. Currently the site is owned by a cellular company and a cell tower is located on the site. (b) (6) indicated that some of the buildings and scraps were demolished and bulldozed over the western hillside. Scrap metal, car bodies (e.g., Model Ts), some empty drums, wood, broken glass and miscellaneous trash are located on the western hillside and across the site. (b) (6) indicated that the Cellular Company has been cleaning up the site by removing scrap metal, drums and other trash.

Active Soil Gas Sampling

Eight ASG samples, plus associated quality assurance samples, were collected from Site 36. The sample near the western hillside was collected at 30 feet bgs; all other samples were collected at ten feet bgs. All eight samples reported non-detect for TCE. Various other VOCs were detected at relatively low concentrations in numerous samples.

Surface Soil Sampling

Eight surface soil samples were collected at Site 36 and analyzed for VOCs. No TCE was detected above the practical quantitation limit (PQL) in any of the samples, although some of the PQLs were as high as 7,600 µg/kg. There were other VOCs detected in numerous

samples, as shown in Table 4.5. The lack of elevated levels of TCE reported in surface soil or soil gas indicates that the site is not an existing source of TCE contamination.

Groundwater Sampling

No site-specific groundwater monitoring wells are located at this site.

4.1.5 Ground-truth Areas

Ground-truthing of sixteen environmental anomalies was conducted during the 2002 investigation, based on the results of aerial photograph analysis described in the report *Photo-Interpretation for Moses Lake Wellfield Superfund Site* (Walker, 2002). The ground-truthing objective was to evaluate whether the GT areas are PSAs and to confirm the boundaries of the areas. The GT investigation included the review of historical aerial photographs and field reconnaissance and mapping.

The results of the investigations conducted at each GT area were initially documented in the PFIDs, as discussed in Section 2.0. Copies of all the PFIDs are included in Appendix C, *Field Reports.* Figure 1-3 shows the location of the GT areas investigated. GT investigation results for individual areas are described in further detail in the following subsections.

4.1.5.1 GT019

Ground-truth area GT019 is located east of State Route 17, in the southeast quarter of Section 30, Township 20N, Range 28E. This area is a pit located west-northwest of a vacant gun range. An inquiry made of one of the personnel from airport security about the gun range revealed that it is no longer being used or leased as a gun range. The pit appears to have been a borrow-pit for gravel or other fill material. Approximately eight rubber tires and four pieces of metal scrap were observed in the pit. Some fill material, mostly gravel and rocks, have been dumped into the pit. No other debris was observed in the pit. There was no evidence of hazardous waste disposal in this area. This area is recommended for NFC.

4.1.5.2 GT051

Ground-truth area GT051 is located west of the runways in the southeast quarter of Section 20, Township 20N, Range 28E. The area is within an area previously investigated during the 2000 RI, the results of which are summarized in Section 4.1.3.3. This area is recommended for NFC.

4.1.5.3 GT062

Ground-truth area GT062 is located in the far northwest portion of the study area in the northwest quarter of Section 17, Township 20N, Range 28E, just off of Road 10 NE. This disturbance is road gravel and asphalt that looks like it was discarded there during the paving of Road 10 NE. This area may have been a stockpile and preparation area for the

paving work. Otherwise, the area is an undeveloped field of grass. This area is recommended for NFC.

4.1.5.4 GT072

Ground-truth area GT072 is located in the northwest corner of the Grant County Airport in the southwest quarter of Section 17, Township 20N, Range 28E. This area is a large pit with a road that runs through it splitting it into two portions (north and south). The total pit is approximately 800 feet long and 450 feet wide, at its widest. It may have historically been a gravel pit and is now partially filled with construction debris primarily consisting of concrete, scrap metal and scrap wood. There was no evidence of hazardous waste disposal. This area is recommended for NFC as discussed in Section 4.1.1.

4.1.5.5 GT085

Ground-truth area GT085 was shown to be located southwest of the Skyline neighborhood along Shorecrest Drive (Walker 2002). After going to that location and not finding the features shown in the aerial photograph, a closer review of the aerial photographs provided to MWH digitally was conducted. It was determined that this area was actually north-northwest of Site 2 outside of the Site 2 study area. The actual location of the GT085 area is at the southwest end of Runway 3/12 (i.e., the NE/SW directional runway) in the southwest quarter of Section 29, Township 20N, Range 28E.

Based on the reconnaissance, the area was determined to be a surface disposal area (i.e., no pit) that consists of piles of construction debris (e.g., concrete, scrap metal and scrap wood). The area is approximately 1,500 feet by 850 feet. On the south side is a debris-lined ditch that was investigated in 2000 as part of Site 2. There was no evidence of hazardous waste disposal in this area. This area is recommended for NFC.

4.1.5.6 GT138

Ground-truth area GT138 is located northwest of the runways' intersection at the Grant County Airport in the southeast quarter of Section 20, Township 20N, Range 28E. This area consists of a large pit approximately 400 feet long by 170 feet wide. There are some piles of concrete and one drum at the bottom. Otherwise, concrete lines the bottom and sides, except at the north end. At the north end, there appear to be several concrete vaults. To the north of the pit, the ground surface is graded flat and covered with concrete. This area is unusual in that there was a clear effort to grade the ground flat with concrete. The nature of the concrete (heavily reinforced with rebar) and the presence of some chunks that had asphalt attached to it suggests that it was runway material or other demolition debris.

A review of historical aerial photographs between 1949 and 1977 revealed that the pit and concrete were present as far back as June 1955. The July 1949 aerial photograph showed the pit without any debris in it.

There was no evidence of any hazardous waste disposal. This area is recommended for NFC.

4.1.5.7 GT212

Ground-truth area GT212 is located southeast of the runways' intersection at the Grant County Airport in the center of Section 28, Township 20N, Range 28E. The area consists of piles of construction debris primarily consisting of concrete, gravel, asphalt and some empty, metal 5-gallon cans. There was no evidence of hazardous materials release. This area is recommended for NFC.

4.1.5.8 GT220

Ground-truth area GT220 is located near the intersection of Forbes Street and the former 19th Avenue, in the southwest quarter of Section 33, Township 20N, Range 28E. The area of concern based on the photo-interpretation report (Walker, 2002) was described as a controlled disposal area where materials are being buried in trenches. Jim Martinez, Assistant Work Programs Officer for the Job Corps, was interviewed. Jim stated that the site is owned by the Department of Interior, Bureau of Reclamation and that the Department of Labor funds the Job Corps program that is allowed to operate on the site. The site is used for instructional purposes relating to concrete, painting, welding and carpentry work. Mr. Martinez believed that the two buildings on the west side of the Walker and Associate aerial photographs were present during the military base operation and were maintenance and painting buildings.

Mr. Martinez indicated that the trench in the photograph and on the property was used to burn leaves, branches, wood and other construction debris. Recently, USEPA instructed them not to burn any construction debris. He indicated that they would be continuing to burn the landscape material, but not construction debris.

Mr. Martinez also stated that they have a small generator license and that they use Safety Kleen to dispose of their hazardous waste. He said they have been inspected by USEPA in the past. He said that some shops have floor drains that go to ditches or drains. He thought that some of the drains used to be connected to a septic drain field that is located in the northeast corner of the site. He said that the septic system is no longer used and that they have been connected to the city sewer. Mr. Martinez and other employees said that no military drums are or were present on the site as long as they can remember. They indicated that they had some drums on site that they store sand for use on sidewalks in winter.

Landscaping material and wood were observed in the trench. Some gravel fill material with rocks was piled in the southeast corner of the site. Concrete casts and structures along with fencing materials were located south of the Concrete Shop. Some drums were observed south of the concrete shop along the eastern fence. Most of the drums were empty, a few of them were labeled waste oil and contained liquids. The drums that were labeled as waste oil were on secondary containment. Metal desks, scaffolding and other items were stored south and east of the welding shop. A paint storage building that had a secondary containment device for open containers was located on the site. There was no evidence of hazardous waste disposal. This area is recommended for NFC.

4.1.5.9 GT222

Ground-truth area GT222 is located south of the Grant County Airport, approximately 2000 feet north of Site 20 along the railroad tracks in the northeast quarter of Section 4, Township 19N, Range 28E. The area consists of old piles of soil, gravel and boulders that are now overgrown with grass. There was no evidence of hazardous waste disposal. This area is recommended for NFC.

4.1.5.10 GT236

Ground-truth area GT236 is located south-southeast of the airport runways in the southeast quarter of Section 33, Township 20N, Range 28E and the northeast corner of Section 4, Township 19N, Range 28E. Area GT236 is within an area that was previously investigated during the 2000 investigation, the results of which are summarized in Section 4.1.2.2. This area is recommended for NFC.

4.1.5.11 GT276

Ground-truth area GT276 is located northeast of the runways' intersection and is in the southwest quarter of Section 22, Township 20N, Range 28E. This area is within an area that was previously investigated during the 2000 RI. The results of the investigation are summarized in Section 4.1.4.8. Area GT276 is recommended for NFC.

4.1.5.12 GT296

Ground-truth area GT296 is located south of the Grant County Airport, southeast of Site 20 in the southwest quarter of Section 3, Township 19N, Range 28E. The area was an old pit (approximately 120 by 60 feet) that now contains some contemporary trash (couple of cars and other miscellaneous trash). There was no evidence of hazardous waste disposal. This area is recommended for NFC.

4.1.5.13 GT316

Ground-truth area GT316 is located north-northeast of the Grant County Airport, in the northwest quarter of Section 15, Township 20N, Range 28E. The area of interest based on the photo-interpretation report (Walker, 2002) is an area of disturbed ground that has a trench dug around it. The owner indicated that the area depicted in the Walker and Associates aerial photograph is their manure lagoons for their farm. The farm has approximately 1,000 head of cattle and the manure is pumped from the farm to the lagoons. The owner indicated that the lagoons were built within the last ten years. There was no evidence of hazardous waste disposal. This area is recommended for NFC.

4.1.5.14 GT339

Ground-truth area GT339 is located east of Randolph Road in the northeast quarter of Section 27, Township 20N, Range 28E. The anomaly of interest based on the photo-interpretation report (Walker, 2002) was described as a controlled disposal area with several drums lined up. The site is owned by the City of Moses Lake. The site is a

shooting range that appears to be used for police training. Two buildings, a pile of rubber tires and a wooden-wall structure were located on the site. Not all of the drums observed in the aerial photographs (Walker, 2002) were observed in the field. Only two drums were observed being used as trash containers. There was no evidence of hazardous waste disposal. This area is recommended for NFC.

4.1.5.15 GT352

Ground-truth area GT352 is located northeast of the intersection of Tyndall Road and Stratford Road in the southwest quarter of Section 26, Township 20N, Range 28E. The feature is a large circular depression in the ground surface approximately 250 to 300 feet in diameter. Part of the depression was planted with corn; the remaining areas that were not planted with corn contained grass, discarded boulders and hay bales. A review of historical aerial photographs indicated that this depression might have been part of an irrigation system. An irrigation ditch that was located northeast of the site appeared to have overflown into this depression. There did not appear to be any features or disposed materials of concern, or evidence of hazardous waste disposal. This area is recommended for NFC.

4.1.5.16 GT353

Ground-truth area GT353 is located north-northeast of the intersection of Tyndall Road and Stratford Road, in the northwest quarter of Section 26, Township 20N, Range 28E. The anomaly of interest based on the photo-interpretation report (Walker 2002) was described as a long uncontrolled disposal area between irrigation ditch and fields which contains an abundance of materials that are interpreted to be pipe and containers. Although the owner did not grant access to the site, a review of aerial photographs indicates excavated material from the irrigation ditch piled along side the ditch. There also appears to be irrigation pipes and other farm-related metal scrap piled in places along the irrigation ditch. There did not appear to be any evidence of hazardous waste disposal. This area is recommended for NFC.

4.1.6 Summary of Potential Source Area Investigations

Landfill PSA investigations included field reconnaissance and mapping, geophysical surveys, FPXRF screening, surface soil sampling and groundwater sampling. Additional investigations during 2002 included trenching, soil sampling and ASG sampling at the five landfills (Sites 6a, 6b, 8, 20 and 31). High FPXRF readings for lead (greater than 750 mg/kg) were reported in most of the landfills. Similarly, soil samples from high FPXRF readings at Sites 6a, 6b, 20 and 31 reported concentrations exceeding the USEPA Region 9 PRGs for various metals including arsenic. A detailed discussion of background concentrations of arsenic in regional soils is presented in Section 6.2.2.4.

None of the site-specific monitoring wells used to evaluate COPCs at Site 6a, 6b and 20 reported TCE concentrations during any sampling event. A low concentration of TCE (0.6 µg/L) was detected in one monitoring well at Site 31 during one of two sampling events. Site 8 has had three site-specific monitoring wells consistently reporting TCE concentrations ranging from 2.0 to 30 µg/L and three monitoring wells further

downgradient have reported concentrations ranging from non-detect to 61 µg/L during five sampling events.

Landfill excavations did not reveal liquids of any kind or any evidence of releases of TCE. Excavated material generally consisted of miscellaneous construction debris (wood, metal, concrete, pipes, etc.) and glass bottles. Some rusted and empty fire extinguishers, ordinance-related scrap and crushed, rusted and empty metal drums were observed in various landfill trenches. Landfill ASG samples ranged from non-detect to low concentrations of TCE (less than 57 ppbv).

The open pits, ditches and drains PSA investigations included field reconnaissance and mapping, geophysical surveys, FPXRF screening, surface soil sampling, ASG sampling and groundwater sampling. Site 11 reported two soil samples with oil concentrations exceeding the MTCA-A Soil Cleanup Level of 2,000 mg/kg. A stained soil area at Site 12 reported one soil sample exceeding the diesel and oil MTCA-A Soil Cleanup Level of 2,000 mg/kg. Site 15 reported four soil samples with concentrations of arsenic above the USEPA Region 9 PRG of 1.6. Site 22 reported soil samples exceeding the benchmark level for arsenic, lead and gasoline of 1.6, 750, and 30.0 mg/kg, respectively. The soil sample reporting the gasoline exceedance also reported a concentration of Aroclor 1254 (PCB) that also exceeded the benchmark level of 740 µg/kg.

Site-specific monitoring wells were not installed for Site 3b, 11 or 12. However, ASG samples reported relatively low TCE concentrations (less than 39 ppbv) at these sites along with Sites 3c, 9, 15 and 22. None of the site-specific monitoring wells used to evaluate COPCs at Site 3c, 15 and 22 reported TCE concentrations during any sampling event. Low concentrations of TCE (less than 1.4 µg/L) were detected in one monitoring well 99-AW10 at Site 9 during six sampling events.

Surface discharge PSA investigations included field reconnaissance and mapping, geophysical surveys, FPXRF screening, surface soil sampling, ASG sampling and/or groundwater sampling. Site 17 reported three soil samples above the USEPA Region 9 PRG for arsenic of 1.6 mg/kg and above the USEPA Region 9 PRG for benzo(a)pyrene of 0.21 mg/kg and benzo(b)fluoranthene at 2.1 mg/kg. Site 18 reported one soil sample above the individual USEPA Region 9 PRG of 740 µg/kg for Aroclor 1254 and 1260 (PCBs) and one sample above the USEPA Region 9 PRG of for lead of 750 mg/kg.

Site 35 reported two soil samples exceeding the EPR Region 9 PRG for arsenic of 1.6. Two soil samples at Site 35 also reported TPH concentrations above MTCA-A Soil Cleanup Levels for TPH. No soil samples collected from Sites 14, 33, and 36 exceeded MTCA-A Soil Cleanup Levels and/or USEPA Region 9 PRGs.

Low concentrations of TCE (less than 42 ppbv) in soil gas were reported at Sites 2, 3a, 4a, 5, 14, 16, 17, 18, 19b, 23, 25, 33 and 36. The highest soil gas TCE concentrations reported in the study area (120,000 ppbv) was at Site 19 near the former industrial septic tanks.

Site-specific monitoring wells were not installed or sampled for Sites 5, 19b, 35 and 36. None of the site-specific monitoring wells used to evaluate COPCs at Sites 2, 3a,17 and

19 reported TCE concentrations during any sampling event. Low concentrations of TCE (less than 1 µg/L) were detected in monitoring well 00-BW07 at Sites 14 and 18 during two sampling events and at one of two monitoring wells, 99-AW15, at Site 16. Site 16 monitoring wells have also reported other VOC detections during the five sampling events. Monitoring wells at Sites 4a, 23 and 25 have reported TCE ranging from 0.5 to 5.6 µg/L during 5 sampling events, except 00-BW11. Monitoring well 00-BW12 at Site 33 reported concentrations of TCE ranging from 18 to 28 µg/L during three sampling events.

4.2 THE VADOSE ZONE

ASG samples were collected during the 2000 RI, the Expedited Investigation of the 8-Place Hangar, the Expedited Investigation of the LOX Plant and the 2002 RI. An evaluation of all the soil gas samples indicated low concentrations of TCE in the vadose zone on a site-wide basis with the exception of Site 19. The range of TCE concentrations excluding Site 19 is from non-detect to 57 ppbv. Figures 4-2 through 4-9 and the PFIDs in Appendix C provide a detailed presentation of soil gas sampling results on a site-by-site basis. Complete analytical results are included in Appendix D and summary results are included in Tables.

Low concentrations of TCE were common in ASG samples collected in the central part of the study area on or near the tarmac area of Site 4b and south of Site 4a. One soil gas TCE detection was reported at several sites (Sites 2, 3a, 5, 12, 23, 25 and 33) and two TCE detections were reported at Site 16. The highest concentration detected at these sites was 39 ppbv at Site 3b.

Soil gas samples were collected during the 2002 RI at three landfills (Sites 8, 20 and 31) in the southern section of the study area. All eight samples at Site 8 detected low concentrations of TCE ranging from 1.0 to 17 ppbv. Of the 15 samples collected at Site 20, four detected low concentrations of TCE (less than 10 ppbv) and two samples in anomaly 20GA02 detected TCE concentrations of 52 and 57 ppbv. Of the 20 samples at Site 31, seventeen detected low concentrations of TCE (less than 20 ppbv) and two samples in anomaly 31GA04 detected TCE concentrations of 24 and 76 ppbv.

The eastern section of the study area reported a higher frequency of detections of TCE in ASG samples. Most of the detections were relatively low with the exception of Site 19. There were 17 detections reported at Site 14, three soil gas detections at Site 15, two soil gas detections at Site 6a, four soil gas detections at Site 6b and one soil gas detection each at Sites 17, 18 and 19b. The highest of these TCE detections (28 ppbv) was from a sample collected near the southwest end of the ditch at Site 15.

The LOX Plant reported a high frequency of samples with elevated soil gas concentrations. The Expedited Investigation of the site resulted in 57, including duplicate samples, with detections of TCE to a maximum of 120,000 ppbv. The 2002 investigation at Site 19 resulted in 62 samples, including duplicate samples, with detections of TCE to a maximum of 7,300 ppbv. The 2002 soil gas results suggest that TCE concentrations have decreased significantly since February 2001. The 2002 results suggests that there may be

some stratification of TCE in the vadose zone (e.g., higher concentrations at depth) that could be a result of changes in hydraulic conductivities (i.e., pore size).

Sampling in the northwestern portion of the study area at Site 9, Gravel Pit and Site 11, Fire Training Burn Pit B, produced five detections of TCE in soil gas. The highest detection was 31 ppbv in a sample taken near a burn area at Site 11.

4.3 GROUNDWATER QUALITY – MONITORING WELLS

This section provides a summary of the results of groundwater sampling and chemical analyses. Groundwater samples from new and existing monitoring wells were collected during six monitoring events between November 1999 and January 2003, as follows.

- November 1999
- March 2000
- June 2000
- September 2000
- February 2001
- October 2002

Monitoring well 01-BW01 was sampled in May 2001 and is considered part of the February 2001 event in order to simplify the discussion. Monitoring wells (02-BW01, 02-BW02, 00-BW14 and 91-AW15) were sampled in January 2003 and are considered part of the October 2002 event.

These samples were analyzed for both inorganic and organic parameters to characterize the groundwater chemistry and the distribution of contaminants within the alluvium and bedrock groundwater systems. Additional details about groundwater quality and analytical results can be found in the *2000 Site Characterization Technical Memorandum.*

4.3.1 Inorganic Chemistry

Sixty-three groundwater monitoring wells were sampled for inorganic parameters during the September 2000 and February 2001 sampling events, which included 22 wells installed during the 2000 investigation. Existing (pre-2000) groundwater monitoring wells were sampled during the November 1999, March 2000 and June 2000 sampling events. Two new wells installed in 2002 were sampled for inorganic parameters in January 2003 (October 2002 sampling event). Groundwater samples were analyzed for some or all of the following inorganic parameters.

- Field parameters: alkalinity, carbon dioxide, conductivity, dissolved oxygen, ferrous iron, hardness, pH, redox, temperature and turbidity

- Major cations and anions: alkalinity, calcium, chloride, hardness, magnesium, nitrate, nitrite, nitrate/nitrite, potassium, sodium, sulfate, total iron and total organic carbon

- Dissolved metals: antimony, arsenic, beryllium, cadmium, copper, lead, manganese, mercury, nickel, selenium, silver, thallium, total chromium and zinc

- Perchlorate

A summary of the results of inorganic analyses is included in Table 4.7, *Summary of Inorganic Groundwater and Surface Water Analytical Results.* Complete chemical analytical results for all inorganic parameters, which includes the list of wells sampled, are presented in Appendix D.

4.3.1.1 General Water quality Parameters

In general, the basalt and alluvium groundwater are of circum-neutral pH. The basalt groundwater pH ranged between 6.8 and 8.1 s.u. and had a mean value of 7.7. Specific conductance (conductivity) is similar within the two units and ranged between 0.1 and 1.3 mS/cm. The mean conductivity values for the alluvium groundwater and basalt groundwater were at 0.4 mS/cm.

Trilinear diagrams were prepared to assess the major ion chemistry of the shallow Hanford Formation and basalt groundwater and are shown in Appendix B. These diagrams support previous water quality characterization and indicate that, in general, the major cation is calcium (with a few wells showing a predominance of sodium or potassium) and the major anion is bicarbonate. The diagrams provide a visual representation of water type and samples from Hanford Formation, Ringold Formation and basalt wells plot in similar locations. These data suggest that Hanford Formation, Ringold Formation and basalt groundwater have similar geochemical characteristics, which supports the concept that a hydraulic connection exists between these units and that they form a single hydrostratigraphic unit. Additionally, no difference can be discerned between groundwater types in the Priest Rapids and upper Roza 1.

4.3.1.2 Metals Evaluation

A summary of metals detections in groundwater is provided in Table 4.7. As indicated in Table 4.7, the only analytes for which metals concentrations were above detection limits were arsenic, manganese, mercury and zinc. Arsenic was detected in six alluvium wells and five basalt wells and ranged from 5.0 to 10.0 µg/L. Manganese was detected in nine basalt wells and three alluvium wells with the higher concentrations reported from basalt wells. The range of manganese concentrations within the basalt wells was 4.0 to 600.0 µg/L, while the range of concentrations within the alluvium wells was 6.0 to 76.4 µg/L. Mercury was detected in one basalt well (99-BW04) during the November 1999 sampling event. The mercury result was flagged with a “J” to report it was estimated. However, this well was not sampled during subsequent sampling. It should be noted that well 99-BW04 is located upgradient of all PSAs and metals concentrations in samples collected from 99-BW04 likely represent surface water impacts from Crab Creek (refer to Sections 3.5.4.1 and 3.5.5.1). Zinc was detected in six basalt wells and ranged from 10.0 to 420.0 µg/L. Zinc was not detected in any alluvium wells.

Arsenic concentrations in both alluvium and basalt wells were below drinking water MCLs. Manganese in basalt groundwater is believed to be due to natural conditions, but five monitoring wells exceeded the National Secondary Drinking Water Standard of 50.0 µg/L. Secondary standards are based on non-health issues such as aesthetics or taste. Mercury and zinc concentrations were also less than drinking water MCLs. The only mercury concentration reported above the detection limit was reported at an estimated value of 0.42 µg/L in November of 1999 in 99-BW04. As indicated above, it is unlikely that this detection is site-related.

Three wells on the Inflation Systems, Inc. property, located just north of the Grant County Airport runways, were sampled and analyzed for perchlorate in January 2001. These wells are numbered ISI01, ISI02 and ISI03 as shown in Appendix D. One sample each was collected from each of these wells plus a duplicate sample from well ISI02. Perchlorate was non-detect (less than the PQL at 0.004 mg/L) from all four samples

4.3.2 Organic Chemistry

Between 40 and 65 monitoring wells were sampled for organic constituents during each of the six sampling events. The results of these analyses are summarized in the following sections. Summaries of the analytical results are included in Table 4.8, *Summary of Groundwater TCE Detections* and Table 4.9, *Summary of Other Groundwater Detections*. Complete analytical results are included in Appendix D. Concentrations of TCE in alluvium groundwater wells are illustrated in Figure 4-11, *TCE Concentrations - Alluvial Groundwater*. Concentrations of TCE in basalt groundwater wells (Priest Rapids and upper Roza 1) are illustrated in Figure 4-12, *TCE Concentrations - Priest Rapids and Roza Groundwater*. Figure 4-12 shows the distribution of wells containing TCE above 5.0 µg/L (represented by shading) for results from the October 2002 sampling event. Historical results since November 1999 are also shown next to each well. No TCE detections were above 5.0 µg/L for the alluvium wells in October 2002.

4.3.2.1 Groundwater TCE Concentrations

Pre-1999 monitoring wells that previously reported detectable concentrations of TCE and reported measurable concentrations during all sampling events included 92-BW01, 92-BW02 and 91-BW03. In addition, wells 91-AW09, 91-AW14 and 91-AW15 reported low (less than 1.0 µg/L) concentrations of TCE.

The range of TCE concentrations reported in all samples from November 1999 to October 2002 was 0.25 to 61.3 µg/L with the highest concentrations reported in basalt wells. The highest concentrations detected during the October 2002 sampling event were 40 µg/L in 99-BW01 and 42 µg/L in 91-BW03. The mean of detected concentrations for all sampling events was 17.5 µg/L in the basalt wells compared with 1.5 µg/L in the alluvium wells. The means for TCE detections during the October 2002 sampling event were 1.4 and 13.2 µg/L for the alluvium and basalt wells, respectively.

Eight alluvium wells (91-AW09, 91-AW14, 91-AW15, 99-AW01, 99-AW03, 99-AW09, 99-AW10 and 00-AW11) reported TCE detections from November 1999 to October 2002,

as shown in Figure 4-11. The TCE concentrations in these wells ranged from 0.35 to 5.10 µg/L. Concentrations of TCE in the October 2002 sampling event were 0.35 to 3.9. These detections were spatially distributed throughout the study area including the northwest portion (99-AW10) and the southern portion of the study area (99-AW03). However, a majority of the alluvium wells with TCE detections were located in the central portion of the study area (i.e., in or near Section 33, near the 19th Avenue and Randolph Road Base Dumps). All alluvium wells with detectable TCE concentrations were paired with basalt wells that also reported TCE detections with the exception of 99-AW10, which is not paired with a basalt well.

Detections were generally less than 5.0 µg/L in the alluvium wells with some alluvium wells reporting low (less than 1.2 µg/L), but sporadic TCE detections. Five wells (91-AW09, 91-AW14, 91-AW15, 99-AW01 and 99-AW03) have reported concentrations of TCE less than 1.0 µg/L during some monitoring events and less than detection limits in others.

Only one alluvium well contained greater than 5.0 µg/L in any of the six sampling events. Monitoring well 00-AW11 contained 5.1 µg/L TCE in January 2001, which decreased to 3.9 µg/L in October 2002. It is located in an area in which TCE has consistently been detected in basalt wells (i.e., in or near Section 33 and near the 19th Avenue and Randolph Road Base Dumps).

Seventeen basalt wells reported TCE concentrations ranging from 0.8 to 61.3 µg/L from November 1999 to October 2002. Concentrations of TCE in wells sampled during the October 2002 sampling event were from 0.25 to 42 µg/L. The highest concentrations were detected in the central portion of the study area near 91-BW03 and 99-BW01, which contained TCE levels of 42 and 40 µg/L, respectively in October 2002. In the southern portion of the study area (i.e., in and near Section 9), wells 99-BW10, 99-BW18 and 02-BW01 reported TCE concentrations greater than the drinking water standard. In addition, 99-BW16 has reported TCE concentrations in excess of 5.0 µg/L, but reported at 3.8 µg/L in October 2002. Four additional basalt wells (99-BW01, 99-BW15, 99-BW18, and 00-BW12) consistently reported TCE concentrations in excess of 5.0 µg/L. Additional discussion of the distribution of TCE in groundwater is included in Section 4.3.3.

The concentration of TCE was evaluated from the three sets of co-located wells. As shown in Table 4.10, *Comparison of TCE Concentrations in Co-Located Wells*, the wells are:

- 99-AW08, 99-BW15 and 02-BW02
- 99-AW01, 91-BW03 and 99-BW01
- 99-AW03, 99-BW10 and 02-BW01

As can be seen on this table, the concentrations of TCE in the alluvium wells (non-detect to 1.2 µg/L) are significantly less than in the basalt wells.

The basalt wells are screened in both the Priest Rapids and Roza Members. Monitoring wells 99-BW15 and 02-BW02 are screened in the Priest Rapids/Roza 1 (top of Roza 1)

and the base of the upper portion of Roza 1, respectively. These two wells are located in the eastern portion of the study area at a point where the Ringold Formation is eight to ten feet thick. The concentration of TCE in 99-BW15 was reported at 9.4 µg/L, whereas it was reported at 0.58 µg/L in 02-BW02 in October 2002. The cause of this difference is unknown, but may be because 99-BW15 is mostly screened in the Priest Rapids (only one foot of Roza). These data suggest that at this location there may be a difference in TCE concentrations between the Priest Rapids and upper Roza 1. It is also possible that there is a concentration difference between the top and bottom of the Roza 1, as it is approximately 20 feet thick at this location.

Monitoring wells 91-BW03 and 99-BW01 are screened at the top and bottom of the upper Roza 1, respectively. These wells are located in the south-central portion of the study area, south of the runways. TCE concentrations were reported at 40 and 42 µg/L in October 2002. These data indicate that at this location there is no difference in TCE concentrations between the top and bottom of the upper Roza 1, consistent with previous results.

Monitoring wells 99-BW10 and 02-BW01 are screened in the Priest Rapids and base of the upper Roza 1, respectively. These wells are located in the southern portion of the study area in the Skyline area. TCE concentrations were reported at 16 and 19 µg/L in October 2002. These data indicate that at this location there is no difference in TCE concentrations between the Priest Rapids and the bottom of the upper Roza 1.

4.3.2.2 Other Organic Concentrations

Only ten monitoring wells contained detectable concentrations of organic constituents other then TCE between November 1999 and October 2002 sampling events. These wells included 91-AW09, 91-AW15, 92-BW01, 92-BW02, 99-BW11, 99-BW15, 00-AW13, 00-BW11, 02-BW01 and 02-BW02.

Based on information provided in the *Management Plan Addendum* (Montgomery Watson, 2000c), selected wells were analyzed for the following organic parameters.

- VOCs and HDGs
- glycol ethers
- hydrocarbon screen
- pesticides
- semi-volatile organic compounds (SVOCs)

Pesticides and SVOCs were not detected in any samples analyzed for those parameters. As shown in Table 4.9 and Appendix D, the following organic compounds were detected in wells between November 1999 and January 2001.

- n-butylbenzene
- trichlorofluoromethane
- sec-butylbenzene
- toluene

- cis-1,2-dichloroethene
- isopropylbenzene
- 1,2,4-trimethylbenzene
- 1,3,5-trimethylbenzene

The following additional organic compounds were detected in October 2002.

- acetone
- bromodichloromethane
- tert-butylbenzene
- benzene
- carbon disulfide
- chloroethane
- chloromethane
- dibromochloromethane
- 1,2-dibromo-3-chloropropane
- 2-hexanone
- 2-butanone
- 4-methyl-2-pentanone
- methylene chloride
- naphthalene
- chloroform

All of these parameters were detected at less than their benchmark levels during the October 2002 sampling event, except acetone, dibromochloromethane, bromodichloromethane, benzene, and 1,2-dibromo-3-chloropropane. Acetone was detected at 19,000 µg/L in both a primary sample and a duplicate sample collected from 02-BW02. These were the only detections of acetone during any of the sampling events between November 1999 and October 2002. While acetone is a common laboratory contaminant, it is unusual for it to be detected at such a high level and in only one well. Additionally, these data were validated and not qualified in any way (see Appendix F). Monitoring well 02-BW02 was resampled in February 2003 to confirm the acetone detection. Acetone was detected at 17,000 µg/L and 19,000 µg/L in the primary and duplicate samples, respectively.

Other organic compounds that were detected above their benchmark levels during the October 2002 sampling event were as follows:

- Dibromochloromethane was detected at 0.37 µg/L in 91-AW14

- Bromodichloromethane was detected at 0.61 µg/L in 91-AW14

- 1,2-dibromo-3-chloropropane was detected at 0.86 µg/L in 99-BW16 however, a resample result in February 2003 was non-detect (less than 0.1 µg/L) by method SW8011

- Benzene was detected at 0.43 µg/L in 00-BW11 and 0.28 µg/L in 91-AW15

Monitoring well 91-AW15 is downgradient of Site 27 which reported free-phase and dissolved-phase petroleum hydrocarbons in 91-AW06 during the 1992 investigation. This well has detected compounds that are related to hydrocarbons including benzene, n-butylbenzene, sec-butylbenzene, 1,2,4-trimethylbenzene and 1,3,5-trimethylbenzene. These parameters may be associated with historical groundwater contamination by petroleum hydrocarbons upgradient of the well. This well is also downgradient of Site 16 which could potentially be a source of hydrocarbon contamination.

Monitoring well 99-BW15 has reported concentrations of cis-1,2-dichloroethene during every sampling event, which may be associated with degradation of TCE within the aquifer. This monitoring well has reported concentrations of TCE ranging from 9.4 to 14 µg/L. This well is downgradient of the Larson WWTP injection wells, which may provide a carbon source to the aquifer.

4.3.3 TCE Distribution in Groundwater Monitoring Wells

The following subsections describe the distribution of TCE in terms of the locations of wells detecting TCE above 5.0 µg/L and the locations of wells reporting low or non-detect levels of TCE. Wells reporting low or non-detect levels are described in terms of their locations north, east, west and south of the areas with known concentrations of TCE above 5.0 µg/L. Centrally located wells reporting low or non-detect levels of TCE are also discussed.

4.3.3.1 Distribution of TCE Above 5 µg/L

In order to facilitate the discussion of the distribution of TCE concentrations in groundwater, Figure 4-12 shows the areas where TCE is known to occur above 5.0 µg/L during the October 2002 sampling event of basalt groundwater. Note that while alluvium groundwater wells did not contain above 5.0 µg/L during the October 2002 sampling event, some have historically, as shown on Figure 4-11. These areas are not meant to imply actual groundwater plumes, but simply display known areas of TCE greater than 5.0 µg/L. Concentrations of TCE in groundwater tend to be fairly consistent temporally (i.e., concentrations tend to be stable within a well between sampling events). However, there is a considerable amount of spatial variation when comparing concentrations between wells.

As can be seen in Figure 4-12, there are three areas where TCE contamination consistently exceed 5.0 µg/L. The first area is located near 00-BW12, the second area is between 99-BW15 and 91-BW03 and the third area is to the south between 99-BW18 and 99-BW10. Concentrations of TCE in these wells were discussed in Section 4.3.2.1. Outside of these areas, TCE concentrations in the basalt wells were below 5.0 µg/L during the October 2002 sampling event. The only other wells that have contained TCE above 5.0 µg/L since November 1999 are 00-AW11, which contained 5.1 µg/L in January 2001 and 99-BW16, which has consistently contained between 3.8 and 5.6 µg/L TCE between November 1999 and October 2002. Well 99-BW16 contained 3.8 µg/L TCE in October 2002 and 2.9 µg/L TCE in February 2003.

As introduced in Section 3.0, there is some evidence that concentrations in the Priest Rapids and the upper Roza 1 may be different as a result of:

- Spatial distribution relative to PSAs
- Slightly different hydraulic properties
- The presence of the Quincy interbed

The evidence for this hypothesis is inconclusive using the available data. In order to further evaluate this hypothesis separate maps showing concentrations of TCE in Priest Rapids and the upper Roza 1 are presented. The concentrations of TCE in Priest Rapids groundwater are shown in Figure 4-13, *TCE Concentrations - Priest Rapids Groundwater* and the concentrations of TCE in the upper Roza 1 groundwater are shown in Figure 4-14, *TCE Concentrations - Roza Groundwater*.

As can be seen in Figure 4-13, there are three areas within Priest Rapids groundwater in which TCE concentrations are greater than 5.0 µg/L. The first area is around 00-BW12 in which TCE has been at 18 µg/L or higher over the last three sampling rounds. The second area is around 99-BW15 in which TCE has been consistently between 9.4 and 14 µg/L since November 1999. Well 99-BW15 is screened across both Priest Rapids and the upper Roza 1, although it only includes the top one-foot of the Roza Member, therefore these concentrations could primarily be a reflection of the Priest Rapids. The third area is located in the southern portion of the study area at 99-BW18 and 99-BW10. Concentrations of TCE in these two wells have consistently been between 16 and 37 µg/L since November 1999.

As shown in Figure 4-14, there are two areas within Roza groundwater in which TCE concentrations are greater than 5.0 µg/L. One area is in the central portion of the study area between 99-BW15 and 91-BW03. The area around 91-BW03 also includes wells 99-BW01 and 92-BW01. These three wells contain the highest concentrations of TCE ever detected at the site. TCE concentrations in these Roza wells have consistently been between 22 and 61.3 µg/L since November 1999. The second area is around 02-BW01 in which TCE was detected at 19 µg/L.

4.3.3.2 Northern Wells

Wells in the far northern portion of the study area (91-BW01, 91-AW01, 91-AW02 and 91-AW03) are those around the Liquid Disposal Site (Site 1) and 99-AW10 near Site 9, and Site 11. Monitoring well 99-AW10 is downgradient from Site 1. Wells near Site 1 have never detected TCE, whereas, 99-AW10 has contained TCE between 1.0 to 1.4 µg/L since November 1999.

Other wells located north of the areas with high concentrations of TCE shown in Figure 4-12 include the cluster of wells around Sites 27 and 3a (southwest quarter of Section 28) and the wells in the eastern half of Section 28. Most of the wells in this area are basalt wells due to the lack of Ringold Formation in this area. Every one of these wells have been non-detect for TCE from November 1999 to October 2002, except 00-BW07, which twice contained up to 1.0 µg/L, but was non-detect in October 2002.

It is important to note that all of the basalt wells in the eastern half of Section 28 are screened in the Priest Rapids Member. This is also the area where Site 19 is located, a known source of TCE contamination although not necessarily a known source of impacts to groundwater. The lack of TCE in wells in this area, especially 01-BW01, which was drilled downgradient of Site 19, suggest that releases of TCE from Site 19 may have not impacted groundwater. However, it is also possible that groundwater contamination resulting from Site 19 is heterogeneous, located in the Upper Roza 1 or that contaminated groundwater has migrated downgradient and is no longer present near Site 19.

4.3.3.3 Eastern Wells

Wells located east of the areas with high concentrations of TCE shown in Figure 4-12 include the basalt wells 00-BW14, 00-BW01, 99-BW06 and 00-BW15 and alluvium wells 00-AW12 and to some extent 99-AW08. There are also the Larson WWTP wells to the northeast (MW-1, MW-2, MW-3A and MW-4). These wells all reported non-detect or very low (less than 1ppb) concentrations of TCE. The only well in the group in which TCE was detected was 00-BW15 (1.0 to 1.4 µg/L).

4.3.3.4 Western Wells

Wells to the west of the areas with high concentrations of TCE include the basalt wells 99-BW16, 99-BW12, 00-BW06, 00-BW11 and the alluvium wells 91-AW13, 91-AW14, 91-AW15, 91-AW17 and 91-AW18. All of these wells have consistently reported non-detect to low (less than 1.0 µg/L) levels of TCE, with the exception of 99-BW16 and 99-BW12. Monitoring well 99-BW12 has consistently detected TCE between 0.8 and 2.1 µg/L. This well is downgradient of the central area containing high concentrations of TCE. Monitoring well 99-BW16 is the only well in the western area that has reported TCE above 5.0 µg/L between November 1999 and October 2002, as shown in Figure 4-12 and Table 4.8.

4.3.3.5 Central Wells

Monitoring wells located between the two general areas with high concentrations of TCE (i.e., between the Randolph Road Base Dump and 99-BW18, shown in Figure 4-12), include all of the wells in Section 4 (not including 99-BW12/9-AW05) plus 00-BW16/00-AW13. These wells all reported non-detect to low (less than 1.0 µg/L) levels of TCE.

4.3.3.6 Southern Wells

The following well pairs are the farthest wells to the south:

- 99-AW04 and 99-BW11
- 00-AW10 and 00-BW10
- 99-AW02 and 99-BW09

All six of these wells were consistently non-detect for TCE between November 1999 and October 2002. These wells bound the southern extent of impacted groundwater as observed in monitoring wells. However, as is discussed in Section 4.3.4, there are

domestic wells very close to 99-BW11/99-AW04 that contain TCE below 1.0 µg/L. There are also domestic wells southwest of the line between 99-BW11/99-AW04 and 00-BW10/00-AW10 that contain TCE below 1.0 µg/L. Therefore, the data indicate that TCE extends farther south-southwest of the last line of monitoring wells, although at levels of less than 1.0 µg/L.

4.3.4 TCE Distribution in Domestic Groundwater Wells

A total of 46 domestic wells were sampled in 1999, 33 in 2000/2001 and 29 in 2002/2003. A summary of the results of these analyses is shown in Table 4.8 and Figure 4-15, *TCE Concentrations – Domestic Wells*. Complete analytical results are included in Appendix D. The domestic well field reports, as well as a copy of the domestic well database are included in Appendix E, *Domestic Well Surveys.* Of the 30 wells sampled in 2000, seven had been sampled in 1999 and were sampled again in 2000 to confirm results from 1999. Of the 29 wells sampled in 2002/2003, 16 were also sampled in 1999 and/or 2000.

As shown in Table 4.8, samples from 21 wells contained detectable levels of TCE ranging from 0.2 to 28 µg/L. Of these 21 wells, only three contained TCE above 5.0 µg/L; one south of the Larson WWTP (WP-14) and the two Skyline wells (WP-15E and WP-15W). These wells with TCE greater than 5 µg/L were not sampled in 2002. Of the 29 wells sampled in 2002/2003, 12 contained detectable levels of TCE ranging from 0.2 to 2.9 µg/L.

Figure 4-15 also includes the results from historical sampling conducted in the City of Moses Lake wells (ML). These wells were sampled prior to 1999 and prior to changes in their screened intervals that were conducted to seal of the contaminated zones. However, it is assumed for Figure 4-15 that groundwater within the Priest Rapids and/or Roza (likely Roza 1) Members are still contaminated where shown at these locations.

Well WP-15W has also been sampled under the supervision of the Washington Department of Health. TCE was detected eight times in this well in 2001 and 2002 between 3.5 and 5.8 µg/L. Well WP-15E was also sampled in 2003 and revealed 12.4 µg/L.

The areas of known impacted groundwater contamination, based on the wells in these areas that have reported detectable levels of TCE, are shown in Figure 4-15. These areas are as follows:

- South of the Larson WWTP
- In the vicinity of or downgradient of the Skyline wells
- Northern end of Cascade Valley

It is important to note that the shaded areas show on Figure 4-15 represent all detections of TCE and not just those above 5.0 µg/L.

TCE detected in domestic wells south of the Larson WWTP is in the same general area as TCE detected in 99-BW15. TCE detected in domestic wells in the Skyline area is in

approximately the same location as TCE detected in basalt monitoring wells in this area, although it extends at lower concentrations (less than 1.0 µg/L) farther to the southwest TCE-impacted groundwater observed in domestic wells located in northern Cascade Valley has not been detected in monitoring wells, as there are no monitoring wells in this area or immediately upgradient of this area.

During installation of the Skyline Replacement well, two sets of groundwater samples were collected. One sample was collected from the well in October 2001 with the open interval (either perforated casing or open hole) between 278 and 595 feet bgs (undeepened well). Therefore, the groundwater sampled from this well could have come from the Roza Member (the base of Roza 1 through Roza 3) or the Frenchman Springs Member (basalt of Sand Hollow or the upper flow of the basalt of Ginko). The second sample collected from the Skyline Replacement well was collected in September 2002 between 611 and 743 feet bgs (deepened well). Both samples were analyzed for VOCs. All analytical results were non-detect, except for TCE. TCE was detected at 5.5 µg/L in October 2001 (undeepened well) and then was non-detect (less than 0.5 µg/L) in 2002 (deepened well).

4.3.5 Monitored Natural Attenuation

Following is a summary of a monitored natural attenuation (MNA) assessment that was based on data collected at the site between November 1999 and January 2003. The assessment was performed to ascertain whether this process is actively reducing (TCE) in groundwater at the site. The MNA assessment includes a review of site data. Based on this initial evaluation, conditions do not appear favorable for rapid TCE degradation via the most common mechanism of reductive dechlorination.

Natural attenuation involves two main components: (1) physical attenuation processes, consisting primarily of aquifer dilution, dispersion and diffusion; and (2) intrinsic biodegradation. Both attenuation mechanisms play important roles in limiting contaminant migration and reducing the mass loading of contaminants in the system. However, the focus of this report is to summarize the available chemical and microbiological data to document whether intrinsic biodegradation is actively occurring at the site.

4.3.5.1 Monitored Natural Attenuation Data Collection

Several parameters were analyzed in groundwater samples from the site. Following is a list of parameters that are useful for evaluating whether MNA is actively occurring.

- TCE
- cis-1,2 dichloroethene (cis-1,2 DCE)
- trans-1,2 dichloroethene (trans-1,2 DCE)
- Vinyl chloride (VC)
- Chloride (Cl)
- Dissolved ethane and ethene
- Dissolved, reduced iron (Fe2+)
- Nitrate (as N)
- Nitrite (as N)

- Sulfate
- Dissolved methane
- Dissolved oxygen
- Reduction-oxidation potential (ORP)
- Total organic carbon (TOC)
- pH and specific conductivity

A summary of these data are presented in Appendix D and an evaluation of these data as they pertain to MNA are included in the following sections.

4.3.5.2 Technical Protocol for Evaluating Natural Attenuation

Natural attenuation refers to naturally-occurring processes in the environment that act to reduce the mass, toxicity, mobility, volume and/or concentration of contaminants in soil and groundwater. These in-situ processes include physical, chemical and biochemical mechanisms. Physical attenuation processes include advection, dispersion and dilution, and act to reduce the contaminant concentrations and thereby the level of toxicity in groundwater. Chemical adsorption, precipitation and/or volatilization reduce both the concentration and mass of contaminants in waters and soils. Intrinsic biodegradation is the process by which contaminants are transformed from toxic to nontoxic byproducts through biologically-mediated reactions that occur naturally in both groundwater and soils. Thus, only biological and some chemical attenuation mechanisms will act to destroy contaminant mass in the system, indicated by contaminant plume reduction.

It may generally be assumed that in most any groundwater systems, the physical attenuation mechanisms of advection, dispersion and dilution are working to reduce the concentration of contaminants. Investigating the effectiveness of intrinsic biodegradation at a site, however, typically requires site-specific information regarding aquifer geology and hydrogeology, nature and extent of contamination, and specific chemical and physical attributes of the aquifer soils and groundwater. Several investigators have developed lines of evidence, which they believe can adequately demonstrate that intrinsic bioremediation is occurring at a site (Rifai et al., 1995; Weidemeier et al., 1996; Wilson et al., 1996; Nyer and Duffin, 1997). Consistent with these studies, the *Office of Solid Waste and Emergency Response Directive 9200.4-17* (USEPA, 1998) identifies three lines of evidence that can be used to estimate natural attenuation of chlorinated aliphatic hydrocarbons, including:

1. "Historical groundwater data that demonstrate a clear and meaningful trend of decreasing contaminant mass and/or concentration over time at appropriate monitoring or sampling points. In the case of a groundwater plume, decreasing concentrations should not be solely the result of plume migration"

2. "Hydrogeologic and geochemical data that can be used to demonstrate indirectly the type(s) of natural attenuation processes active at the site, and the rate at which such processes will reduce contaminant concentrations to required levels"

3. "Data from field or microcosm studies (conducted in or with actual contaminated site media), which directly demonstrate the occurrence of a particular natural

attenuation process at the site and its ability to degrade the contaminants of concern".

The directive further states that evidence from microcosm studies (number 3, above) may only be necessary when evidence from the first two lines (numbers 1 and 2, above) are inadequate or inconclusive.

MNA data from the site have been reviewed to evaluate whether intrinsic biodegradation has been and is currently occurring to reduce the concentration and mass of chlorinated hydrocarbons. Lines of evidence that have been evaluated include the following:

- Groundwater TCE concentration trends and presence of TCE breakdown products (evaluation of TCE, dichloroethene (DCE), vinyl chloride (VC), chloride, ethane and ethene data);

- Indicators of anaerobic conditions and the general geochemical environment of the groundwater system (evaluation of dissolved oxygen (DO), oxidation-reduction potential (ORP), pH and total organic carbon (TOC) data); and

- Occurrence of electron donors/acceptors as evidence of the biodegradation process (evaluation of iron (Fe), manganese (Mn), nitrate (NO_3^-), sulfate (SO_4^{2-}) and methane (CH_4) data).

These lines of evidence are consistent with those suggested by other investigators and outlined in USEPA, 1998. These evaluations may be used as an initial screening to evaluate whether intrinsic bioremediation may be occurring.

4.3.5.3 Evaluation of Site Data for Natural Attenuation

TCE Concentration Trend Analysis

The first line of evidence to indicate that TCE is being attenuated at the site, possibly by biodegradation, is shown by significant decreasing temporal trends in TCE groundwater concentrations at individual well points. Reduction in TCE concentrations at a single point is likely a function of physical advection/dispersion and dilution mechanisms as well as chemical- and/or bio- degradation. Recent groundwater data (November 1999 to January 2003) of TCE and its breakdown products are presented in Table 4.9 and Appendix D6. A total of 25 wells reported detection of TCE in groundwater samples. Data from these wells were evaluated for historic trends and no decreasing trends in TCE concentrations were identified in any of these wells.

TCE Breakdown Products

The primary contaminant of concern at the site is TCE. Following the initial release and migration from a PSA, TCE may be biologically transformed in the subsurface to various byproducts. TCE is transformed via reductive dechlorination to cis-1,2-DCE, trans-1,2-DCE, 1,1-DCE, DCA, VC and finally ethene and ethane. These degradation steps also result in the release of chloride ions into groundwater. Therefore, the presence of these

breakdown products and chloride in groundwater are evidence that biodegradation of TCE has been occurring. Furthermore, Bouwer (1994) reported that during biodegradation, TCE degrades to cis-1,2-DCE as its most common intermediate product. If the amount of cis-1,2-DCE is greater than 80 percent of total DCE then it is likely a breakdown product of TCE (as opposed to having been directly released as a contaminant); (Weidemeier et al, 1996).

Recent groundwater TCE, DCE, DCA, VC ethane, ethene and chloride data are presented in Appendix D. Of the 25 monitoring wells with detectable concentrations of TCE, only one well, 99-BW15, also contained detectable levels of cis-1,2 DCE and slightly elevated levels of chloride (compared to background, uncontaminated wells). The occurrence of cis-1,2 DCE provides indirect evidence of TCE degradation in well 99-BW15. There were no detections of trans-1,2 DCE, DCA, VC, ethene or ethane in any groundwater samples.

General Geochemical Environment

Degradation of TCE predominantly occurs under anaerobic conditions via reductive dechlorination. Anaerobic conditions in an aquifer are indicated by several factors, including low dissolved oxygen (DO) concentrations and low oxidation/reduction potentials (ORP). Specifically, DO concentrations less than 0.5 mg/L (Wilson et al, 1996) to 1.0 mg/L (Weidemeier et al, 1996) represent anaerobic conditions in the aquifer and indicate an environment that is amenable to reductive dechlorination of chlorinated hydrocarbons. According to Weidemeier et al (1996), reductive dechlorination occurs ideally under redox conditions indicated by ORP values less than 50 mV (measured against Ag/AgCl potential). In addition, the ambient pH, temperature and specific conductance of the water (i.e., the general geochemical environment) may potentially affect the biodegradation process.

Groundwater field parameter data are presented in Appendix D4. In wells with TCE detections, DO measurements were generally high, varying between approximately 6.5 to 10 mg/L. Similarly, ORP measurements indicate generally oxidizing conditions and were generally above 250 mV across the site. Only one well, 91-AW15 had slightly lower DO content (1 to 2 mg/L) and reported one ORP measurement below 50 mV. Also, several of the November 1999 ORP measurements were extremely low; however, these measurements corresponded to high DO measurements and were not reproducible, indicating meter malfunction or calculation error. Therefore, these measurements were not used for this evaluation.

Field measurements of groundwater pH, temperature and specific conductance indicate general geochemical conditions that are amenable to biodegradation activity. pH values at the site are consistently near-neutral (ranging from 6.3 to 7.4 standard units) indicating good buffering capacity in the aquifer. Temperature and specific conductance of the groundwater are also within a tolerable range for biodegradation to occur. However, more importantly, DO and redox conditions are not generally favorable for biodegradation of chlorinated hydrocarbons via reductive dechlorination. So it is concluded that conditions are not favorable for biodegration to occur via reductive dechlorination.

Electron Donors and Acceptors for Biodegradation

Reductive dechlorination of TCE requires that a supply of carbon (i.e., an electron donor) be available to provide energy to the microbial population. This carbon source may include anthropogenic hydrocarbon sources and/or naturally-occurring organic carbon in the aquifer. Following the utilization of DO in an aquifer, a succession of other electron acceptors is utilized by microbes to anaerobically biodegrade organic carbon for energy. This succession of electron acceptors is as follows: nitrate (to nitrite), manganese (IV) (to manganese(II)), iron(III) (to iron(II)), sulfate (to hydrogen sulfide), and carbon dioxide (to methane). The presence or absence of these electron donors/acceptors gives evidence to the progression of these reactions. Reductive dechlorination is optimal under sulfate and carbon dioxide reduction (methanogenesis), although this process may also occur under nitrate, manganese and iron reducing conditions.

Groundwater data for these parameters are summarized in Appendix D. TOC concentrations at the site are approximately 2 to 16 mg/L in selected wells, which is sufficient to support TCE biodegradation at the levels detected at the site. However, there are several wells where TOC concentrations are below detection (less than 1.5 mg/L). Nitrate, sulfate and carbon dioxide concentrations are not significantly reduced below upgradient or "background" groundwater concentrations. Dissolved iron, nitrite and methane are generally not detected at the site, and therefore suggest anaerobic biodegradation is not occurring at the site.

4.3.5.4 Monitored Natural Attenuation Conclusions

Several lines of evidence were evaluated to investigate whether MNA is occurring at the site to reduce TCE contamination in groundwater. Temporal trends of TCE in individual wells indicated no decreasing trends. The general absence of TCE degradation products in any of the wells provides evidence that TCE is not degrading. The one exception is 99-BW15, which contained cis-1,2-DCE up to 3.7 µg/L during every sampling round since November 1999. In general, field data of DO and ORP indicate aerobic and oxidizing conditions which are generally not conducive to TCE degradation. Electron acceptor data (nitrate, sulfate and carbon dioxide) did not indicate decreased concentrations compared to background; and the absence of reduced compounds in groundwater (reduced iron, nitrite, and methane) suggests that anaerobic biodegradation is not occurring. Based on this initial evaluation, conditions do not appear favorable for rapid TCE degradation via reductive dechlorination.

4.4 DATA VALIDATION RESULTS

Analytical laboratory data for RI samples collected between 1999 and 2001 were verified and validated in compliance with the requirements of the *Management Plan* (Montgomery Watson, 1999b), as discussed in Section 2.15.5. Analytical data collected in 2002 and 2003 were validated in compliance with the *Supplemental Management Plan* (MWH, 2003). At a minimum, data package verification included evaluation of sampling documentation and representativeness, technical holding time, instrument calibration and tuning, field and lab blank sample analyses, method quality control sample results, field duplicates, the presence of any elevated detection limits, and a summary of qualified data.

All data were flagged in Appendix D with appropriate qualifiers prior to use in preparing the final report. As indicated in Appendix D, some data were rejected. Rejected data did not significantly effect the results of the analyses or the DQOs. Bubbles were noted by the receiving laboratory in a portion of the groundwater samples collected prior to 2002 in the VOC, HDG, and dissolved oxygen groundwater sample containers. An evaluation of the concentration bias that would be introduced by small bubbles was calculated and determined to be insignificant. None of the VOC, HDG, or dissolved oxygen data with bubbles was qualified or rejected. The bias calculation is presented in Appendix F2.

The narrative sections of the 1999, 2000, and 2001 RI validation reports were used to create the QCSRs. The 2002 validation reports and electronic summaries for qualified data were used to prepare 2002 RI QCSRs. Copies of the QCSRs are included in Appendix F, *Quality Control Summary Reports.*

4.5 SENSITIVITY ANALYSIS

A sensitivity analysis was conducted on the analytical data collected between November 1999 and February 2003. As stated in Section 2.14.6, soil detection limits were compared against Washington State MTCA-A Soil Cleanup Levels and USEPA Region 9 PRGs. The detection limits for water data were compared to Washington State MTCA-A Soil Cleanup Levels water clean up standards, Washington State and Federal MCLs, and USEPA Region 9 tap water PRGs. Method detection limits (MDLs) for non-detect data with a regulatory criterion were reviewed to ensure adequate sensitivity was achieved for the 2002 RI data. This information is summarized in Tables F.6 and F.7 in Appendix F. PQLs for non-detect 1999 and 2000 RI data were compared to regulatory criteria. This data is summarized in Tables 4.11 through 4.20. The dibromochloropropane, ethylene dibromide, and 1,2,3-trichloropropane soil MDLs and PQLs were greater than PRGs. The soil PQLs for five of the SVOC target compounds were greater than the PRGs and several of the water PQLs were greater than the SVOC regulatory criteria. The beryllium and iron water PQLs, as well as a small number of water PQLs for silver, cadmium, chromium, copper, manganese, nickel, and nitrate data were above the Federal MCL, Secondary MCL or tap water PRG. These compounds, with the exception of manganese, have not been identified as COPCs or COPECs for the site; therefore, the inability to compare the data against all regulatory criteria does not significantly impact DQOs. Since the number of water data points with manganese PQLs above the Federal Secondary MCL was small, this also does not significantly impact the project DQOs.

4.6 DATA USABILITY

An assessment of the usability of the soil, ASG and groundwater analytical data collected between November 1999 and February 2003 was conducted. This assessment was conducted by tabulating the rejected COPC data for each site to ensure sufficient data were available to make an assessment. All of the data (rejected and non-rejected) are shown in Appendix D and the COPCs for each site are presented in Section 6.0. The results of this assessment are presented below.

4.6.1 Ringold/Hanford Formation Groundwater Samples

The following parameters were rejected in groundwater sampled collected from Ringold and Hanford Formation monitoring wells:

- Four mercury results in November 1999
- One result each of 2-butanone, acetone, bromoform, and dibromochloropropane, and three aldrin results September 2000
- Six acetone results and three dibromochloropropane results in January 2001
- Twelve acetone results (including duplicates) in November 2002

Since sufficient data for these parameters were available from other monitoring wells during those sampling events and/or since these parameters have not been identified as COPCs for Ringold and Hanford Formation groundwater, these rejected data do not impact DQOs.

4.6.2 Basalt Groundwater Samples

The following parameters were rejected in groundwater samples collected from Priest Rapids Member and Roza Member monitoring wells:

- Three mercury results in November 1999
- One aldrin result in June 2000
- One result each of 2-butanone, acetone, bromoform, and dibromochloropropane and five aldrin results in September and October 2000
- Six acetone results and two dibromochloropropane results in January 2001
- One acetone result in November 2002

Since sufficient data for these parameters were available from other monitoring wells during those sampling events and/or since these parameters have not been identified as COPCs for basalt groundwater, these rejected data do not impact DQOs.

4.6.3 Domestic Groundwater Samples

Six acetone results were rejected in samples collected from domestic wells collected during the November 2002 sampling event. Since sufficient data for acetone were available from other domestic wells during the November 2002 sampling event and since acetone has not been identified as a COPC for domestic groundwater, these rejected data do not impact DQOs.

4.6.4 Soil Samples

The following parameters were rejected in soil samples collected during the 2000 and 2002 RIs:

- One vinyl acetate result from Site 31 during the 2002 RI
- Eight vinyl acetate results from Site 36 during the 2002 RI
- One result each of PCB1016, PCB1233, PCB1242 and PCB1248 at Site 17 during the 2002 RI
- One antimony result at Site 8 during the 2000 RI
- Four antimony results at Site 12 during the 2000 RI
- Four antimony results at Site 18 during the 2000 RI
- Two antimony results at Site 19 during the 2000 RI
- Five antimony results at Site 20 during the 2000 RI

Since sufficient data for these parameters were available from other samples locations and/or since these parameters have not been identified as COPCs for soil at the above-listed sites, these rejected data do not impact DQOs.

4.6.5 Active Soil Gas Samples

The following parameters were rejected in ASG samples collected during the 2002 RI:

- Two chloroethane results and one ethanol result at Site 6a
- Five chloroethane results at Site 6b
- Seven bromomethane results, 31 ethanol results and one propylene result at Site 19
- One bromomethane result at Site 19b

Since sufficient data for these parameters were available from other ASG samples at these sites collected during the 2002 RI and/or since these parameters have not been identified as COPCs for ASG, these rejected data do not impact DQOs.

5.0 CONTAMINANT FATE AND TRANSPORT

This section discusses the fate and transport of TCE at the site based on numeric groundwater and contaminant transport modeling. The results discussed here are a summary of modeling completed in 2000 (Montgomery Watson, 2001d). This section provides a description of input data and model parameters including information on the numeric configuration, boundary conditions, hydraulic parameters and initial contaminant concentrations used within the model.

5.1 MODELING STUDIES

Four technical memorandums have been prepared that discuss the results of the previous modeling studies, as listed below.

- *Technical Memorandum Number 1, Results from Steady-State Model Simulations* (Montgomery Watson, 1998)
- *Technical Memorandum Number 2, Preliminary Results from Contaminant Transport Simulations* (Montgomery Watson, 1999c)
- The *Groundwater Model Update, Results of Simulations Using 1999 Data* (Montgomery Watson, 2000d)
- *2001 Technical Memorandum, Results from Steady-State Groundwater Model and Contaminant Transport Simulations* (Montgomery Watson, 2001d)

Technical Memorandum Number 1 (Montgomery Watson, 1998) presented steady-state water levels and information on the hydrostratigraphy, numeric configuration, boundary conditions and hydraulic parameters used in the original model, which was constructed as a screening tool prior to data collection.

Technical Memorandum Number 2 (Montgomery Watson, 1999c) provided details on the additional features added to the model since completion of Technical Memorandum Number 1 including the addition of pumping wells, revision of the boundary condition along Crab Creek and results from preliminary contaminant transport simulations. The revised groundwater flow simulations were compared to observed water levels and the results were used to make a number of recommendations concerning the collection of additional hydraulic data in the field. The results of the contaminant transport simulations were also used to make a number of recommendations concerning additional field studies.

The *Groundwater Model Update* (Montgomery Watson, 2000d) provided details on additional features added to the model based on 1999 field data, as wells as the results of improved model calibration and complexities encountered in attempting to further calibrate the model.

The *2001 Technical Memorandum, Results from Steady-State Groundwater Model and Contaminant Transport Simulations* (Montgomery Watson, 2001d) provided an update on

the numerical groundwater model, based on data collected during the 2000 RI, and provided final contaminant transport simulations.

5.2 NUMERICAL GROUNDWATER MODEL PARAMETERS

The most pertinent hydrogeologic features that affect the numerical groundwater model are highlighted in this section. The details of the geology and hydrogeology of the site were presented in Section 3.0 and Figures 3-3 through 3-14.

The geology and depositional setting of the site have resulted in a complex hydrostratigraphic environment with variable hydraulic properties that affect groundwater flow and contaminant transport. Some of the more complicated components of the conceptual model include:

- The effect of the fractured bedrock on groundwater flow and contaminant transport
- The relationship between the Hanford Formation and basalt units with Moses Lake, Parker Horn and Crab Creek

The numeric model was designed to account for some of the hydraulic variability at the site but was not able to describe all of the small-scale variations in stratigraphy and hydraulic parameters. However, it is believed that the stratigraphic and hydraulic data used within the model reflect the general hydrogeology of the site at a level sufficient to begin to conservatively address contaminant transport.

An assumption of an equivalent porous medium model was used for this model for which MODFLOW is well suited. An equivalent porous medium assumes that the fractured material can be treated as a continuum and that a representative elementary volume (model cell) of material that is characterized by effective hydraulic parameters can be defined (Anderson and Woessner, 1992). However, this does not mean that the bedrock is homogenous, as even in an equivalent porous medium, parameters can and do change from cell to cell or from area to area within the model domain.

Most fractured rock systems consist of rock blocks bounded by discrete discontinuities comprised of fractures, joints and shear zones, often occurring in sets with similar geometric configurations (USEPA, 1989c). Fractured rock systems simulate equivalent porous media when the fracture apertures are constant, the fracture orientations are randomly distributed and the fracture spacing is small relative to the scale of the system (USEPA, 1989c). Rates of contaminant migration into and out of the rock matrix will depend on the permeability of the matrix and the matrix diffusion coefficient of the contaminants.

Some primary observations of the fracture system at Moses Lake are listed below:

- The orientations and apertures of the fractures are highly variable
- The density of the fractures is highly variable

- The presence of secondary mineralization and weathering products occurs randomly

Despite the fracture characteristics, the site in general appears to be amenable to modeling as an equivalent porous medium. The most recent model (Montgomery Watson, 2001d) was generally in good agreement with groundwater levels as observed in monitoring wells, but in some portions of the model domain (e.g., the west central area) there was not good agreement. However, there appeared to be zones of bedrock that are more heterogeneous and anisotropic. Evidence of the effect of this variability is in the heterogeneous distribution of contaminants at the site and the absence of contamination downgradient of likely sources of contamination.

Consequently, the models used for this site (MODFLOW and MT3DMS) were limited when it came to predicting contaminant fate and transport on a small scale compared to the site as a whole (e.g., contaminants associated with an individual PSA). The models tended to conservatively predict the presence of contamination given certain initial conditions. In other words, a model based on the equivalent porous medium approach tends to predict a more expansive distribution of contamination laterally and not to display a discontinuous distribution of contamination, such as has been observed in monitoring wells at the site.

5.3 COMPUTER MODELS

The computer software package used in these studies was the Groundwater Modeling System (GMS) 3.1 produced by the Engineering Computer Graphic Laboratory at Brigham Young University with support from the United States Department of Defense. The GMS software consists of a graphical user interface (the GMS program) that is used as a pre- and post-processor to a number of numeric codes, including the groundwater model MODFLOW and the contaminant transport model MT3DMS, which are also part of GMS.

MODFLOW is a three-dimensional, cell-centered, finite-difference model developed by the USGS (McDonald and Harbaugh, 1988). MODFLOW can be used to perform steady-state and transient simulations to represent a variety of hydrogeologic boundary conditions. MODFLOW is designed to simulate aquifer systems with the following assumptions:

- Saturated-flow conditions
- Groundwater flow described by Darcy's Law
- Constant density of groundwater
- Constant principal directions of horizontal K or transmissivity

Steady-state and transient flow can be simulated in unconfined aquifers, confined aquifers and confining units. MODFLOW simulates groundwater flow in aquifer systems using the finite-difference method.

MODFLOW produces output by solving the equations describing groundwater flow given the set of initial and boundary conditions used in the model. The solution consists of head

(groundwater level) at every cell in the aquifer system, except for cells where head was specified (i.e., constant head boundaries do not change). These water levels are used to construct contour maps for comparison with similar maps drawn from field data. The process of adjusting the model input values to improve the agreement between calculated and observed values is referred to as model calibration.

MT3DMS was used to conduct the contaminant-transport simulations. MT3DMS is a modular three-dimensional transport model for the simulation of advection, dispersion and chemical reactions of dissolved constituents in groundwater systems (Zheng, 1990). MT3DMS uses a modular structure similar to the structure utilized by MODFLOW. MT3DMS is used in conjunction with MODFLOW in a two-step flow and transport simulation. Heads and cell-by-cell flux terms are computed by MODFLOW during the flow simulation and are written to a specially formatted file. This file is then read by MT3DMS and utilized as the flow field for the transport portion of the simulation.

5.4 MODFLOW MODEL PARAMETERS AND RESULTS

5.4.1 Model Parameters

This section describes the model parameters used in the simulation of water levels. The parameters are listed below.

- Numeric grid geometry
- Hanford Formation boundary conditions
- Upper basalt boundary conditions
- Groundwater Recharge and discharge

5.4.1.1 Numeric Grid Geometry

The grid spacing was set to approximately 250 feet by 250 feet. The horizontal limits of the model domain were set to include the high priority PSAs and minimize the extent of the unsaturated Hanford Formation within the model domain. The grid was set as a three-layer model corresponding to the Hanford Formation (layer 1), the Ringold Formation (layer 2) and the upper basalt (layer 3).

The geometry of the grid was built using the stratigraphic information obtained from boreholes drilled between 1993 and 2000. The contacts between the three layers were linearly interpolated from the borehole data. Two issues were encountered during development of the model geometry: (1) the unsaturated state of the Hanford Formation and (2) incorrectly extrapolated contacts between the outer boreholes and the edges of the model domain (particularly on the eastern and southern boundaries). As discussed in Section 3.5, portions of the Hanford Formation are unsaturated. MODFLOW can calculate unsaturated cells but will not allow unsaturated cells as a starting condition. Therefore, it was necessary to lower the contact between the Hanford Formation and the Ringold Formation in the northwestern corner of the study area to allow for all cells to be saturated as an initial condition.

Using the existing borehole data to extrapolate the contacts out to the edges of the model grid resulted in some portions of the contacts crossing over each other or in abnormally thin zones of a particular unit. For example, the top of basalt was in some cases higher in elevation than the top of the Ringold Formation, or there were areas along the western model boundary where the Hanford Formation was only five feet thick. In order to avoid this, pseudo-boreholes (i.e., boreholes representing extrapolated conditions) were input into the model along the model boundary. The thickness of each unit and elevations of the contacts used in the pseudo-boreholes were estimated from the average dip and thickness of the nearest existing boreholes.

5.4.1.2 Hanford Formation Boundary Conditions

All boundaries for the Hanford Formation were set as specified heads. Specified heads were initially chosen based on observed water levels projected out to the model boundaries. The specified heads were then adjusted slightly during the course of the model calibration (i.e., adjusted so that calculated and observed water levels matched where there are monitoring wells screened in the applicable hydrostratigraphic unit).

Moses Lake and Parker Horn were assumed constant head boundaries for the southern and southwestern portions of the study area. Specified heads were inferred along all other boundaries within the Hanford Formation based on a linear interpolation of observed heads.

One of the biggest challenges in developing the model was understanding the relationship between the base of the Hanford Formation and the observed water levels in the monitoring wells. In the north and northwestern portions of the model domain, the contact between the Hanford and Ringold Formations crosses the water table such that the Hanford Formation is unsaturated in that portion of the model domain. Additionally, the Hanford Formation is in contact with Moses Lake in the southern portion of the model area and should therefore have a constant head value equal to the elevation of the lake. In the northern portion of the model domain (i.e., north of Cascade Valley), the Hanford Formation is not in direct contact with the lake. Therefore, in this area the western boundary along the lake is not actually a constant head boundary for the Hanford Formation.

The northern specified head boundary was selected based on the location of the PSAs and the location at which the Hanford Formation becomes unsaturated. As discussed in Section 3.5, the Hanford Formation becomes unsaturated in the northern portions of the study area, and many wells screened across the water table at those locations are screened within the Ringold Formation and not the Hanford Formation. The most northern PSAs that were believed to be potentially significant are Sites 22 and 19. However, the Hanford Formation is not saturated that far to the north at those locations. Consequently, in order to allow MODFLOW to operate, the contact between the Hanford and Ringold Formations was lowered in this area. It is also important to note that, as discussed in Section 4.0, the results of sampling from the monitoring well installed at Site 19 (01-BW01) suggest that groundwater is not impacted at this site.

The eastern boundary was originally along Crab Creek because it was thought that the upper permeable basalt and possibly the Hanford Formation, were in contact with and being recharged by Crab Creek. The results of drilling during the 1999 field investigation revealed that Crab Creek occurs on massive, impermeable basalt, except in the very southern portion of the model area (e.g., at 99-BW08). It was therefore interpreted that Crab Creek does not recharge the Hanford Formation and upper Roza, except maybe in the southern portion of the study area. Additionally, since the Hanford and Ringold Formation contact projects up to the northeast, the Hanford Formation becomes unsaturated toward Crab Creek. Consequently, the eastern model boundary was moved to the west away from Crab Creek, but still encompassed the high priority PSAs and all monitoring and domestic wells with historical TCE detections.

5.4.1.3 Basalt Boundary Conditions

All boundaries for the upper basalt, which is the Roza Member at the model edges, were set as specified head. The top of the basalt dips beneath Moses Lake and is not in direct contact with the lake. Therefore, the starting head values are not directly controlled by the lake level, and all starting heads were based on a linear interpolation of observed values. However, in the southeastern corner of the model domain, the basalt appears to be in contact with Crab Creek and Parker Horn and, therefore, the heads were set equal to the surface water levels along that segment of the boundary. As discussed in Section 3.5, the upper Roza 1 is not present at the surface along Crab Creek north of Section 11.

5.4.1.4 Groundwater Recharge

Recharge was input into the model representing the Larson WWTP, irrigation and precipitation. The value used for the Larson WWTP (450 ac-ft/yr) was based on information obtained from the plant operators, as discussed in Section 3.5.4.4.

Based on a study that was done at the Hanford site (Gee, et al, 1992), natural recharge rates can be as high as 35 percent of the annual precipitation for coarse soils, or up to four inches. A value of 0.0014 ft/dy was used in the model, which equates to six inches per year. This rate was used to try to simulate short-period rainfall events and account for the particularly coarse Hanford Formation within the model. However, an analysis of the sensitivity of the model to varying recharge rates within a reasonable range showed that recharge does not have a discernible impact on Hanford Formation water levels.

A value for recharge by irrigation of 0.005 ft/dy was input into the model for the irrigated areas in Sections 34 and 3, south of the Larson WWTP, based on the maximum water use value for high-use crops. The area of irrigated land was multiplied by an annual crop water usage value of 2.8 ac-ft/ac/yr (assuming high-water-use crops, such as alfalfa, corn and hay; USGS, 1990). Irrigated land within the model domain occurs primarily just to the south of the Larson WWTP (northeast area) and within the Cascade Valley (southwest area). The northeast area consists of approximately 1,300 acres of irrigated land and the southwest area consists of approximately 300 acres. Using the value of 2.8 ac-ft/ac/yr of water usage, approximately 3,640 ac-ft/ac/yr were used in the northeast area and 840 ac-ft/ac/yr were used in the southwest area. The value of 0.005 ft/dy is then 60 percent of the irrigation water that is applied during the growing season. Even with this high value, the

recharge had no discernible effect on water levels within the Hanford Formation. However, this lack of response may also be due to the high transmissivity of the Hanford Formation.

5.4.1.5 Discharge

As discussed in Section 3.5.3.4, there are 300 or more drinking water wells and 100 or more irrigation wells present within the study area. Most of these wells are in the southern portion of the site (south of Sections 2 through 5), which encompasses part of the model domain. In order to simplify the set-up of the model and reduce mathematical instability, a smaller number of well points were input into the model, and then these were given values that represented all of the wells within the model domain. Consequently, 26 wells were input into the Hanford Formation and 28 were input into the upper basalt. These data were used as starting conditions in the model prior to calibration. The final values were adjusted from their initial values during the calibration process.

The final flow budget for the calibrated model revealed the approximate total discharge rates for pumping wells per unit, as listed below.

- Hanford Formation - 241,000 ft^3/dy
- Basalt - 338,000 ft^3/dy

It is important to note that since the model was run as a steady-state model, seasonal affects of pumping could not be modeled. Seasonal shifts in flow direction due to pumping would tend to spread the plume out laterally.

5.4.2 Results from Steady-State Simulation

The output from the MODFLOW simulation was used to develop potentiometric surface maps for the site. The results from the modeling are shown in Figure 5-1, *Hanford Formation Calculated Water Levels*, and Figure 5-2, *Priest Rapids and Upper Roza 1 Calculated Water Levels*. These results show that groundwater generally flows southwest, with the exceptions listed below.

- Within the Hanford Formation, groundwater flows south to southeast in the area east of Site 20 within Sections 3 and 10

- Within the basalt, groundwater flows in all directions within the areas of influence around the larger pumping wells

The MODFLOW data (water level contours) were compared to the June 2000 water levels observed in monitoring wells. Each monitoring well with an observed water level serves as a calibration point and includes an error bar that shows the difference between the calculated water level and the observed water level. The error bar shows the target interval (black line with cross-hatching) and an error bar (colored bar) indicating the difference between the observed and calculated water levels. The target interval was set at ±4.0 feet based on the advice of Dr. Jim Warner of Colorado State University (personal communication). Dr. Warner stated that a reasonable confidence interval is ten percent of

the total head change across the model domain, which at this site is about 40 to 50 feet in both the Hanford Formation and basalt. As shown in Figures 5-1 and 5-2, all error bars are coded green, indicating that the calculated water levels are all within four feet of the June 2000 observed water levels.

The parameters shown in Table 3.3 were used as starting conditions. Model parameters were subsequently revised concurrently numerous times until a balance between them was reached that resulted in a calibrated model. Final hydraulic conductivities and pumping rates are listed below.

- Horizontal hydraulic conductivities:
  - Hanford Formation: 1,000 to 3,200 ft/dy
  - Ringold Formation: 1.0 to 1.7 ft/dy
  - Basalt: 15 to 120 ft/dy

- Vertical hydraulic conductivities:
  - Hanford Formation: 80 to 300 ft/dy
  - Ringold Formation: 0.01 to 0.003 ft/dy
  - Basalt: 1.5 to 12 ft/dy

- Irrigation well pumping rates: 750 to 270,000 gpd

- Drinking water pumping rates: 670 to 224,000 gpd

5.4.3 Sensitivity Analysis

Several model parameters were varied to evaluate the impact that each parameter had on the model results. The tested values of these parameters are listed below.

- Pumping wells (600 to 500,000 gpd)

- Recharge from precipitation and irrigation (one to six inches per year)

- Horizontal and vertical hydraulic conductivity of all three layers:
  - Hanford Formation: 1,000 to 28,000 ft/dy and 100 to 2,800 ft/dy
  - Ringold Formation: 0.01 to 28 ft/dy and 0.001 to 2.8 ft/dy
  - Basalt: 15 to 2,800 ft/dy and 1.5 to 280 ft/dy

- Starting heads for variable head cells (from a few feet bgs to a few feet above the contact between the Hanford Formation and the Ringold Formation)

- Starting heads along the specified head boundaries (varied 10 to 30 feet at each node)

The model was most sensitive to varying the starting heads along the specified head boundaries of all layers, pumping wells within the basalt and horizontal hydraulic conductivities within the basalt. Varying the specified heads by more than five feet or so

from the current values resulted in an uncalibrated model and/or unnatural deflections (by 90 degrees or more) of the contours within one or two cells of the model boundary. The introduction of the pumping wells within the range of reported/estimated pumping values showed almost no impact on water levels within the Hanford Formation. The introduction of the pumping wells did however show drawdown of 20 feet or more around the larger pumping wells within the basalt, given the current hydraulic conductivities.

As discussed in Section 5.4.1.4, varying recharge within reasonable limits had no discernible effect on water levels.

The specified heads within the Hanford Formation impacted the water levels of the basalt, which was most noticeable in areas of the site not impacted by pumping where the potentiometric surface between the two units are near-equal in elevation. If the specified heads along the boundary of the Hanford Formation were more than a foot or so higher or lower than the basalt, the basalt contours would try to match the equal water levels within the interior of the model domain and then rapidly deflect to the specified head near the boundary. Consequently, it was necessary to calibrate both the layers simultaneously.

The modeled hydraulic conductivities for the Ringold Formation were at the upper end of measured values presented on Table 3.3 and those for the basalt were at the lower end of the measured values. The measured values may not be accurate for the following reasons: (1) hydraulic conductivities for the Ringold Formation were based on very limited slug test data; and (2) hydraulic conductivities for the basalt were based on limited packer test data. Due to the limited amount of data, it was not unexpected that some of the modeled hydraulic conductivities were outside of the observed values. However, the difference between the model and measured values may also be an indication that the model was inaccurate and did not represent the actual hydrogeologic conditions in all areas of the model domain.

5.5 RESULTS FROM CONTAMINANT TRANSPORT SIMULATION

5.5.1 Fate and Transport Modeling Methods

The modeling approach utilizing MT3DMS during fate and transport simulations is presented in the following sections. Several contaminant sources at various initial concentrations were input as starting conditions in order to estimate solute transport in the Hanford Formation and basalt. As discussed in Section 5.2, an MT3DMS simulation is unable to accurately portray the fate and transport of TCE at the site. The model is able to illustrate the general direction of plume movement using the calibrated MODFLOW simulations. However, it is unable to simulate preferential flow pathways that result in a discontinuous contaminant distribution at a scale smaller than the grid spacing (i.e., 250 by 250 feet).

5.5.1.1 Simulation Input Data

The advection and source/sink packages were utilized during all simulations. The dispersion package was not utilized in order to enhance the computational efficiency of the model; however numeric dispersion was included in the model. Point source

concentrations were input at six PSAs upgradient of monitoring wells with known TCE concentrations. The following PSAs were selected for the simulations.

South-central portion of Site 4a, Aircraft Tarmac Area A - This area was selected due to the TCE contamination reported in the downgradient groundwater monitoring wells 99-BW16 and 91-AW14 and as a result of the historical practice of dumping materials off the edges of runways and tarmacs.

Site 16, Engine Rebuilding Facility - This area was selected due to the presence of TCE in soil gas around the perimeter of the building and due to the TCE contamination reported in the downgradient well 91-AW15.

South-central portion of Site 31, 19th Avenue Base Dump - This area was selected due to the discovery of linear landfill trenches during the 2000 field investigation. These trenches historically could have contained leaking containers of TCE. This area is upgradient of the highest reported TCE concentrations (e.g., wells 91-BW03 and 99-BW01).

Site 19, LOX Plant - This area was selected due to the discovery, sampling and removal of two concrete vaults and associated piping. The TCE concentrations of the liquids in the vault were 260,000 and 210,000 µg/L.

Site 21, Larson Waste Water Treatment Plant - A point source was located at the WWTP in order to represent possible sources in this general area and to illustrate TCE contamination in well 99-BW15, which is downgradient of the WWTP.

Northeast corner of Site 20, South Base Dump - This area was selected in order to simulate TCE contamination on the southern wells including 99-BW18 and 99-BW10. It was located in the area of landfill trenches discovered during the 2000 investigation. These trenches historically could have contained leaking containers of TCE.

A TCE concentration of 110 mg/L, which is ten percent of the solubility limit (1,100 mg/L), was input as the point source concentration at all areas except for the LOX Plant. The initial point source concentration at the LOX Plant was 260 mg/L.

MT3DMS provides five options for solving the advection-dispersion equation. A third-order Total Variation Diminishing method was utilized during these simulations, which is generally the preferred method for MT3DMS.

A number of assumptions were made during the contaminant transport simulations. These assumptions are summarized in Table 5.1, *Contaminant Transport Model Simulations.*

Due to the number of PSAs, pumping wells and the complex stratigraphy, the time step chosen by the program was extremely small and resulted in execution times of several days. MT3DMS calculates the maximum allowable time step automatically, based on four stability constraints (advection, dispersion, source/sinks and reaction components) at each grid point. Two simulations are evaluated in this document, as described below.

- A constant pulse at each PSA for a 50-year simulation
- A 50-day pulse at each PSA for a 10-year simulation

A constant pulse was used to simulate a source that may have been introduced while the former LAFB was active and that remained active up to the present (e.g., a slowly leaking drum). The 50-day pulse was used to simulate the introduction of a source that resulted from, for example, a drum containing TCE that did not decompose enough until 1990 to start leaking. The results of the simulations suggest that a constant (i.e., on-going) source (primary or secondary) could explain the near steady-state concentrations observed in the field. Neither of the model simulations included just a single source (i.e., the LOX Plant), but instead simulated multiple sources. The results of the RIs indicated that the LOX Plant was the only existing source present through 2001; no other existing sources were found during the RIs. However, as stated above, it is important to note that the results of the sampling at 01-BW01 located adjacent to the LOX plant have been non-detect. The lack of detections from 01-BW01 suggests that the LOX Plant was not a significant source of contamination to groundwater.

5.5.2 Results from Constant Pulse Transport Simulations

Simulations of contaminant transport were conducted for a 50-year period; a constant concentration was input to the model at each PSA during the entire 50-year simulation. This simulation was designed to approximate the effect of a source (e.g., pool of dense non-agueous phase liquid [DNAPL]) within the Hanford Formation and was input into the model as a constant source. Figure 5-3, *Hanford Formation Plume at 5 Years for a Constant Pulse*, illustrates the configuration of the plume near the beginning of the simulation. These results reflect the influence of relatively high rates of advective transport and the groundwater flow direction. The results indicate that the principle direction of contaminant transport is to the southwest with more southerly flow in the southern portion of the site. This southwest transport direction is also reflected in the basalt, as shown in Figure 5-4, *Priest Rapids and Upper Roza 1 Plume at 5 Years for a Constant Pulse*. However, the plume in the basalt has not spread as far as the Hanford Formation during the five years and the concentrations are lower. These results indicate smaller hydraulic conductivity rates in the basalt and the intervening, semi-confining Ringold Formation.

A comparison of Figure 5-3 and Figure 5-5, *Hanford Formation Plume at 50 Years for a Constant Pulse*, indicates that the plume concentrations and configuration have reached steady-state conditions within five years. However, Figure 5-6, *Priest Rapids & Upper Roza 1 Plume at 50 Years for a Constant Pulse,* illustrates a larger plume with higher concentrations at 50 years than at five years, as shown in Figure 5-4. The plume has not reached steady-state conditions in the a-basalt during the 50-year simulation. A downward gradient generally exists throughout the site that enables TCE contamination to migrate down through the Hanford Formation, Ringold Formation and into the basalt. However, the time required for this process to result in a steady-state distribution might be longer than 50 years based on advection alone. It is likely that the relatively constant TCE concentrations observed in monitoring wells could be influenced by the presence of DNAPL or other preferential flow processes not included in the model. Concentrations in the basalt are approximately ten times less than concentrations reported in the Hanford

Formation, which are the results of numerical dispersion, aquifer mixing and/or the impact of the Ringold Formation.

The plumes from the six PSAs spread to the southwest before reaching Moses Lake. Field data suggest that Moses Lake might be in partial hydraulic connection with the basalt in the northwest portion of the study area. Based on the conceptual model and the modeled dip of the units, the top of the basalt occurs near the base of the lake along the eastern shoreline. Using these projections, the basalt is possibly in hydraulic connection with Moses Lake somewhere within Section 5. In the southern portion of the study area, there appears to be a lack of direct hydraulic connection between the basalt and Moses Lake due to the geometric relationship between these two features. This suggests that any contamination in the basalt could travel west of Moses Lake in this area.

Spreading of the plume results from advection, dispersion, pumping wells and mixing. These transport processes reduce the concentration of the plume prior to reaching Moses Lake. The final configuration of the plume is a result of the original strength and location of the PSAs, advective transport by the groundwater flow field and mixing. The concentrations reported during this simulation are much greater than results from groundwater monitoring samples collected at the site. Concentrations from the simulation ranged from approximately 5 mg/L to 200 mg/L, whereas at the site they range from less than 1 µg/L to 60 µg/L. This may indicate the source term was weaker than simulated or that other processes not included in the model were significant (e.g., dilution, historic degradation attenuation within the vadose zone).

In both the Hanford Formation and basalt units, the plumes migrated toward areas of known TCE contamination such as the eastern, western, central and southern regions as well as the Skyline area and Cascade Valley in the southwest. The field data have indicated discontinuous regions of contamination. However, it is possible that a connection exists (as the simulation suggests) due to contaminant transport pathways that have not been intersected by existing monitoring wells. One possible mechanism for this is preferential flow features (e.g., fractures, structural features like a fault, or the topography of the tops of the stratigraphic units).

Some areas indicate TCE contamination in the simulations but report non-detect for TCE contamination in the field. This is the case in the area south of Site 4a near 91-AW17 and 91-AW18, as well as at 00-BW02, south of the landfill trenches at the 19th Avenue Base Dump. This scenario might provide evidence for preferential flowpaths, which are suggested by the discontinuous nature of the monitoring data. Based on the interpreted potentiometric surface maps in the *2000 Site Characterization Technical Memorandum* (Montgomery Watson, 2001a), the flow direction near the 19th Avenue Base Dump is primarily westward or west-southwest. However, due to the calibrated flow directions, 00-BW02 is located on the eastern edge of the contaminant plume originating at the LOX Plant and the 19th Avenue Base Dump. At the end of the 50-year simulation, both the Hanford Formation and basalt show a region of no contamination in the south-central portion of the study area. The monitoring wells within this area have historically reported non-detect for TCE; however, 91-BW04 reported a low TCE concentration (0.5 µg/L) during the September 2000 sampling event. This area of no contamination appears to be the result of a plume separation between the Sites 21 and 20 in the simulation. These

plumes might converge due to mechanical dispersion or if the model was able to illustrate southerly flow directions in the northeast area. The field data suggest southerly flow in this area; however the model reports southwest flow due to lack of data in this area.

The highest concentrations at the end of the 50-year simulations are located in the area of Site 31. This area has historically reported the highest concentrations at the site. However, the higher concentrations in this area are the result of the migration of the advective front from the LOX Plant, which had a higher initial concentration of 260 mg/L. This scenario suggests that the location of the PSAs as well as the initial concentration might account for the variability of TCE distribution and concentration.

5.5.3 Results from 50-Day Pulse Transport Simulations

Contaminant transport simulations were conducted for a ten-year period using the model parameters described in Section 5.1. A constant concentration was input to the model at each PSA during the first 50 days of the simulation. This simulation was designed to approximate the effect of a limited source within the Hanford Formation and was input into the model as a constant source for 50 days. Figure 5-7, *Hanford Formation Plume at 50 Days for a 50-Day Pulse*, illustrates the configuration of the plume at the end of the pulse. These results reflect the influence of relatively high rates of advective transport and the groundwater flow direction. The results indicate that the principle direction of contaminant transport is to the southwest. The concentrations of the plume are similar to the concentrations reported in constant pulse simulations described in Section 5.5.2. However, at 50 days, the TCE plume has just started to migrate vertically downward into the basalt as shown in Figure 5-8, *Priest Rapids and Upper Roza 1 Plume at 50 Days for a 50-Day Pulse.* A small area of higher TCE concentrations is located near the LOX Plant. This is the result of direct hydraulic connections between the Hanford Formation and basalt in this area. This northeastern area is characterized by a lack of the Ringold Formation. Small concentrations of TCE in the basalt are also found at the Tarmac Area A, the Engine Rebuilding Facility and the South Base Dump. However, concentrations of TCE were not found at the 19th Avenue Base Dump. This might be the result of the thickness of the Ringold Formation at these locations and/or different downward gradients.

At 50 days, the configuration of the plume is the largest in the Hanford Formation. After the pulse of contaminants is discontinued, the concentrations of the plume decrease as the plume migrates in the direction of groundwater flow to the southwest. Figure 5-9, *Hanford Formation Plume at 128 Days for a 50-Day Pulse*, illustrates the migration of the plume toward Moses Lake. The plume extends to the original PSAs, but at concentrations below the contour interval for this figure. The basalt plume, as shown in Figure 5-10, *Priest Rapids and Upper Roza 1 Plume at 128 Days for a 50-Day Pulse*, has also migrated in a southwest direction. The concentrations in the basalt are on the order of 20 µg/L, which is much less than the concentrations reported in the Hanford Formation.

At 512 days, the contamination in the Hanford Formation in the northern portion of the study area has migrated to the west of the eastern shoreline of Moses Lake, as shown in Figure 5-11, *Hanford Formation Plume at 512 Days for a 50-Day Pulse*. Two small areas in the south-central and southwest portion of the site report small concentrations of TCE.

These areas are migrating toward the southwest corner of the study area toward Moses Lake. In this same time period, the contamination in the basalt is beginning to reach Moses Lake in the northern portion of the site, as shown in Figure 5-12, *Priest Rapids and Upper Roza 1 Plume at 512 Days for a 50-Day Pulse*. The plume extending from Site 20 indicates a more southerly component of groundwater flow in the basalt. As stated in Section 5.5.2, Moses Lake may be in hydraulic connection with the basalt in the northwest portion of the study area. In the southern portion of the study area, there appears to be a lack of connection between the basalt and Moses Lake due to the geometric relationship between these two features. This suggests that any contamination in the basalt could travel west of Moses Lake in this area.

At the end of the ten-year simulation, the plume concentrations in the Hanford Formation are below 0.1 mg/L as shown in Figure 5-13, *Hanford Formation Plume at 10 Years for a 50-Day Pulse.* In the basalt, the plume has migrated from Site 19 toward Site 31 and has migrated further south from Site 20, as shown in Figure 5-14, *Priest Rapids and Upper Roza 1 Plume at 10 Years for a 50-Day Pulse*. Concentrations in the basalt appear to increase until 512 days but have slightly decreased between 512 days and ten years as a result of numerical dispersion and mixing.

The plume from the PSAs spread to the southwest and to the south before reaching Moses Lake. The spreading results from advection, dispersion, pumping wells and mixing. These transport processes reduce the concentration of the plume prior to its reaching Moses Lake. The final configuration of the plume is a result of the original strength and location of the PSAs, advective transport by the groundwater flow field and mixing. The concentrations reported during this simulation are much less than the concentrations reported during the constant pulse simulations. The minimum concentrations in the basalt are similar to concentrations reported in groundwater monitoring wells (approximately 20 µg/L).

In both the Hanford Formation and basalt units, the plume migrated toward areas of known TCE contamination such as the eastern, western, central and southern regions as well as the Skyline area and Cascade Valley in the southwest. The field data have indicated discontinuous regions of contamination. It appears that a non-constant pulse at several different PSAs can create discrete, discontinuous areas of contamination as seen in these simulations.

Lower hydraulic conductivities within the Ringold Formation and a-basalt restrict the migration of the plumes during the ten-year simulations. This allows for relatively constant TCE concentrations near and downgradient of the PSAs, which supports the field data. The magnitude of TCE concentrations for a 50-day pulse for a ten-year simulation averaged 20 µg/L in several areas. These concentrations are comparable to concentrations reported at the site that range from less than 1 to 60 µg/L. At the end of the ten-year simulation, the concentrations in the Hanford Formation is non-detect to less than 0.1 mg/L. These concentrations are much closer to the actual concentrations than the previous modeling scenario.

As discussed in Section 5.5.2, some areas indicate TCE contamination in the simulations but report non-detect for TCE contamination in the field. This is the case in the area south

of Site 4a near 91-AW17 and 91-AW18 and 00-BW02 and south of the landfill trenches at the 19th Avenue Base Dump. This scenario might provide evidence for preferential flowpaths, which are indicated by the discontinuous nature of the monitoring data. At the end of the 50-year simulation, both the Hanford Formation and basalt show a region of non-detects in the south-central portion of the study area. The monitoring wells within this area have historically reported non-detect for TCE. However, 91-BW04 reported a low TCE concentration (0.5 µg/L) during the September 2000 sampling event. This area of non-contamination appears to be the result of a plume separation between Site 21 and Site 20 in the simulation. These plumes might converge if mechanical dispersion was present or if the model was able to illustrate southerly flow directions in the northeast area. The field data suggest southerly flow in this area; however the model reports southwest flow due to lack of data in this area.

5.5.4 Uncertainty Analysis

The numeric modeling presented in Section 5.4 was based on fundamental physical assumptions concerning the mechanism controlling flow and solute transport in the Hanford Formation and basalt. However, the model only replicates the actual physical system if it is based on an accurate conceptual model that realistically describes the site stratigraphy, hydraulic properties, boundary conditions and initial conditions with a sufficient level of detail to fulfill the objectives of the study. Because the subsurface environment displays a high degree of spatial heterogeneity, the conceptual and numeric models need to make simplifying assumptions so that the physical characteristics of the system can be quantified and incorporated into the numeric model. Because of these simplifying assumptions and/or a lack of understanding of the details of the conceptual model, the numeric model was not able to precisely represent observed conditions, as follows:

- The shape of the potentiometric surface in the alluvium and to some degree the basalt in the west central portion of the site, where groundwater flow directions were more westerly than predicted.
- In the southern portion of the study area, the model predicted cones of depression from the wells discharging from the layer, but this was not observed in the field. This may be because no monitoring wells were located within the cones of depression.

The lack of correlation between observed and modeled conditions may be a result of uncertainties in the following:

- Hydraulic differences between and within the Priest Rapids and Roza Members
- Hydraulic relationship of alluvium and basalt groundwater with Moses Lake
- Inability of MODFLOW to model the unsaturated conditions in the Hanford Formation

- Unknown variations in horizontal and vertical hydraulic conductivities within each unit
- Relationship between subsurface geologic features and groundwater flow
- The locations, stratigraphic intervals and discharge rates of all the water supply wells
- MODFLOW's inability to model all of the more than 400 water supply wells individually

One of the most basic assumptions for a subsurface fate and transport model is the subsurface stratigraphy and hydraulic properties. Results of borehole drilling have indicated that the basalt layer is extremely fractured and weathered in places and may create preferential flow pathways. In the simulations, PSAs were located in order to simulate areas with known contamination, as well as being based on historical knowledge of the site. A number of assumptions were used in the model that limit the ability to model field conditions, including the following.

- Location of PSAs
- Strength and duration of source term
- Continuous flow and transport on the scale of a grid cell
- Continuous flow and transport between grid cells

All of these factors were characterized in the model using the best available knowledge, but exhibit spatial variation and changes in the field based on localized conditions. Contaminant transport modeling in fractured media is subject to a high degree of uncertainty as indicated by the results of these simulations.

5.5.5 Summary of Numeric Groundwater and Contaminant Transport Modeling

The predicted water-level contours indicate that groundwater flow is generally to the southwest, except in the southeast corner of the model domain and near pumping wells. In general, water levels at the site are primarily controlled by the components listed below.

- Hydrologic boundary conditions imposed by Moses Lake, Parker Horn and the eastern boundary at the model
- Horizontal and vertical hydraulic conductivity of the Ringold Formation and basalt
- Unsaturated portions of the Hanford Formation
- The effects of groundwater withdrawal from pumping

The model results are in general agreement with June 2000 observed water levels. However, the model does not match well with observed conditions in some areas of the

site. These areas are likely the results of uncertainties in the conceptual model as discussed in Section 5.5.4.

The concentrations reported during the 50-year constant pulse simulation are much greater than those found in groundwater monitoring samples collected at the site. This might indicate that there was a constant pulse at lower concentrations than used in the model or that other processes not used in the model are occurring (such as diffusion from residual phase saturation and fracture flow). The field data do not indicate breakdown of TCE, which supports the theory of a weaker source. The simulated TCE plumes migrated by advective processes in the primary direction of groundwater flow. Some areas in the model indicated TCE contamination in the simulation, but results from field monitoring reported non-detect for TCE contamination. Again, these inconsistencies are likely a result of uncertainties in the numeric model, such as variation in hydraulic properties within a grid cell, as well as the location, strength and duration of contaminant sources.

The concentrations reported during the 50-day constant pulse for a ten-year simulation are much less than the concentrations reported during the 50-year constant pulse simulation. The plume in the Hanford Formation is almost non-existent at the end of the ten-year simulation. This is primarily due to rapid movement of groundwater through the coarse sediments. This supports the general trend of non-detect to very low concentrations in the Hanford Formation wells. However, some monitoring wells, such as 91-AW14 and 99-AW09, have consistently reported low concentrations of TCE. Lower hydraulic conductivities within the Ringold Formation and basalt restrict the migration of the plumes during the ten-year simulation. This allows for relatively constant TCE concentrations near and downgradient of the PSAs.

The most basic assumptions for a subsurface fate and transport model, such as the one presented here, are those regarding the subsurface stratigraphy and continuity of flow processes on the scale of the model grid and hydraulic properties. Results of borehole drilling have indicated that the upper basalt (Priest Rapids and upper Roza 1) is highly fractured and weathered in places and might create preferential flow pathways at the site. Heterogeneities in groundwater flow directions could also be a result of irregularities in the shape of the stratigraphic contacts and/or structural features (e.g., faults or folds). This limits the ability of a model, such as MODFLOW, to simulate groundwater flow and contaminant transport at the site.

Areas of uncertainty that affect the results of contaminant transport modeling include a lack of known initial concentrations, starting times, duration of the contaminant pulse(s) and actual PSA locations. In addition, the presence of retardation or sorption would affect model results. The partition coefficient (Kd) was set to zero for all model simulations reported in this report. The travel times of the contaminant plumes would increase if sorption were introduced to the model.

5.6 DISCUSSION OF CONTAMINANT TRANSPORT

This section discusses two possible scenarios with respect to the source of the contaminants (i.e., one source vs. multiple sources) and contaminant transport pathways. The two scenarios presented in this section are: (1) that groundwater contamination is the result of

one source, Site 19 (LOX Plant); and (2) that groundwater contamination is the result of multiple sources of TCE. These scenarios were tested in the numerical model by introducing sources at the location of the LOX Plant and other locations, as presented in Section 5.5. However, neither of the model simulations included just a single source (i.e., the LOX Plant), but instead simulated multiple sources. It is important to note that while the only proven PSA is the LOX Plant (Site 19), other sources (e.g., the landfills) could have existed historically. However, due to the age of those historical sources and the action of multiple mechanisms for attenuation, any direct evidence of those sources would have long since disappeared.

The first scenario suggests that groundwater contamination is the result of one source, Site 19, as shown in Figures 3-12 through 3-14. Alluvium groundwater generally flows southwest from Site 19, with some evidence for southerly flow, as shown in Figure 3-11. Basalt groundwater also generally flows to the southwest from Site 19. Additionally, there are seasonal variations in groundwater flow and additional evidence for southerly flow illustrated in the *2000 Site Characterization Technical Memorandum* (Montgomery Watson, 2001b). Therefore, it is possible that particles of contamination from Site 19 could travel southwest toward the area where the highest concentrations of TCE have been detected at the site (i.e., 91-BW03). It is also possible that these particles of contamination could travel in a more southerly direction toward Site 20 and the Skyline area.

These same particles released at Site 19 would migrate downgradient and vertically to the base of the Priest Rapids probably within a couple thousand feet. If in fact the contact between the Priest Rapids and Roza Members at least partially impedes groundwater flow, these particles could continue to travel laterally within the Priest Rapids. Then the particles would eventually reach the area where the Priest Rapids is thinner (i.e., Section 33) shown in Figure 3-7. In this area, the particles could diverge, with some migrating across the Quincy interbed and into the Roza and others staying within the Priest Rapids. This divergence of the particles could account for contamination in both the Priest Rapids and Roza if the groundwater flow is impeded at the contact between the two members. If the Priest Rapids and Roza act as one hydrologic unit, it is still possible to account for contamination in each of the two areas where TCE is above 5.0 µg/L. This may be possible due to divergent lateral groundwater flow (i.e., southwest versus south).

Under this first scenario, it is still difficult to explain why contamination is so discontinuously distributed (e.g., contamination in the area of Section 33 and contamination in the Skyline area). It is also difficult to account for contamination detected directly west-southwest of Site 19, such as in 91-AW14, 91-AW15 and 99-BW16. Therefore, although it might be possible for most of the contamination to be from Site 19, it appears that at least some of it has to be from other sources.

As discussed in Section 4.0, there are multiple PSAs at this site, and many of them have some evidence of having been historical sources of contamination (e.g., empty 55-gallon drums buried in the landfills). Therefore, it seems just as likely a scenario that there were multiple sources of TCE that contributed to groundwater contamination. For example, contamination in the southern part of the study area (e.g., the Skyline area) is more easily explained by assuming the source was at Site 20. Unfortunately, these two scenarios will

always be a source of uncertainty simply because any direct evidence of any one of the PSAs having been historical sources of contamination, except the LOX Plant, are apparently long gone.

6.0 HUMAN HEALTH RISK ASSESSMENT

This section presents the methods and results of the Human Health Risk Assessment (HHRA) conducted for the Moses Lake Wellfield Superfund Site. This HHRA was conducted in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Remedial Response process, as amended by the Superfund Amendment and Reauthorization Act (SARA). The results of this HHRA, in conjunction with the results of the assessment of potential threats to ecological habitats and receptors presented in Section 7.0, will be used in the Feasibility Study for remedial alternatives to evaluate whether current concentrations of chemicals present in site media are protective of human health and the environment, or whether further evaluation or remedial measures are warranted.

6.1 INTRODUCTION

The HHRA presented in this RI report was conducted in accordance with the methods and procedures described in the USEPA's *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A)* (USEPA, 1989d), *USEPA Region 10 Supplemental Risk Assessment Guidance for Superfund* (USEPA, 1991a) and *Interim Final Guidance: Developing Risk-Based Cleanup Levels at Resource Conservation and Recovery Act Sites in Region 10* (USEPA, 1998a). More recent changes in USEPA procedures and policies were included based on discussions between the USEPA, USACE, and its contractor, MWH. These methods are described in the *Management Plan* (Montgomery Watson, 2000c), *Draft Technical Memorandum Exposure Assessment Methods for Moses Lake Wellfield Superfund Site* (MWH, 2001a) and *Draft Technical Memorandum Toxicity Assessment Methods for Moses Lake Wellfield Superfund Site* (MWH, 2001b).

The HHRA presented in this section is a baseline risk assessment. The baseline HHRA is a quantitative and qualitative evaluation of risks to human health based on protective assumptions relative to land use, in the absence of remediation or any attempt to mitigate or prevent chemical exposures (USEPA, 1989d). Consistent with the USEPA guidance document, *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions* (USEPA, 1991c), the results of the baseline HHRA are evaluated based on an acceptable cancer risk range of 10^{-6} to 10^{-4} and a noncancer hazard of 1.0. Source areas and media for which the cumulative cancer risk is between 10^{-6} and 10^{-4}, and the noncancer hazard is less than 1.0, may be considered appropriate for NFC, depending upon site-specific considerations including current and potential future land uses. Source areas and media that are associated with cumulative cancer risk or noncancer hazard estimates greater than these criteria are generally considered appropriate for further investigation or evaluation of remedial alternatives (USEPA, 1991c).

6.1.1 Purpose and Objectives

The purpose of the baseline HHRA presented in this report is to evaluate potential human health risks associated with exposures to chemicals present in soil and groundwater associated with the Moses Lake Wellfield Superfund Site. The specific objectives of this baseline HHRA are to evaluate potential cancer risks and noncancer hazards for human

receptors that might be exposed to impacted PSAs and media. The individual steps included in this HHRA are consistent with USEPA's *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A)* (USEPA, 1989d), as follows:

1. Identification of contaminant PSAs, media, and chemicals of concern

2. Identification of potentially complete exposure pathways between sources of contaminants and human receptors

3. Quantification of potential human exposures (i.e., intakes)

4. Characterization of potential cancer risks and noncancer hazards for human receptors

5. Evaluation of the uncertainties in the baseline HHRA

Each of these steps is described in Sections 6.2 through 6.6.

6.1.2 Scope

The overall study area for the HHRA presented herein includes PSAs located within and adjacent to the boundaries of the former LAFB, and areas hydraulically downgradient of the former LAFB that are either known to be impacted or are potentially impacted by chemicals derived from suspected PSAs. Potential downgradient areas evaluated in this HHRA include portions of Grant County located south of LAFB in which TCE has been detected in groundwater, and nearby surface water bodies including Crab Creek and Moses Lake. This HHRA presents quantitative risk estimates for the primary media of concern: soil associated with known or suspected PSAs, and groundwater beneath and downgradient of the Moses Lake Wellfield Superfund Site. The individual PSAs included in the RI and evaluated in this baseline HHRA were identified in Section 1.3. Potential impacts of site-related contaminants on off-site surface water and sediment are qualitatively evaluated, as described in Sections 6.2 and 6.3.

The methods used in the performance and interpretation of this HHRA were derived from the following guidance documents:

- Washington State Department of Ecology *Model Toxics Control Act Cleanup Regulations* amended February 12, 2001 (WAC 173-340)

- *Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites* (USEPA, 2002a)

- *Ecological Soil Screening Level for Guidance* (USEPA, 2000b)

- *Interim Final Guidance: Developing Risk-Based Cleanup Levels at Resource Conservation and Recovery Act Sites in Region 10* (USEPA, 1998a)

- *Risk Assessment Guidance for Superfund Supplemental Guidance - Dermal Risk Assessment, Interim Guidance* (USEPA, 1998b).
- *Exposure Factors Handbook, Volume I: General Factors* (USEPA, 1997c)
- *Exposure Factors Handbook, Volume III: Activity Factors* (USEPA, 1997d)
- *Risk Assessment Handbook Volume I: Human Health Evaluation* (USACE, 1995a)
- *Final Exposure Assessment Guidelines* (USEPA, 1992a)
- *Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors* (USEPA, 1991b)
- *USEPA Region 10 Supplemental Risk Assessment Guidance for Superfund* (USEPA, 1991a)
- *Risk Assessment Guidance for Superfund - Volume I: Human Health Evaluation Manual (Part A)* (Baseline Risk Assessment) (USEPA, 1989d)

6.1.3 Organization

The information presented in this HHRA is organized as follows:

Section 6.1 – Introduction: Presents a brief overview of the risk assessment process and describes the purpose and scope of the HHRA for the Moses Lake Wellfield Superfund Site.

Section 6.2 – Identification of Chemicals of Potential Concern: Identifies the chemical contaminants to be evaluated in the baseline HHRA.

Section 6.3 – Exposure Assessment: Describes the methods used in the evaluation of exposures for human receptors. This section includes descriptions of current and future land uses, potentially exposed populations, potentially complete and incomplete exposure pathways, and methods for the quantification of human exposures.

Section 6.4 – Toxicity Assessment: Describes methods for the development of toxicity information for use in characterizing risks to each receptor.

Section 6.5 – Risk Characterization: Presents the risk characterization methods and results of the baseline HHRA for the Moses Lake Wellfield Superfund Site.

Section 6.6 – Uncertainty Analysis: Presents the uncertainties and limitations associated with the baseline HHRA.

6.2 IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN

The COPCs to be evaluated in the HHRA for the Moses Lake Wellfield Superfund Site are identified in this section. The COPCs for each site and media were identified based on the methods and procedures described in *USEPA Region 10 Supplemental Risk Assessment Guidance for Superfund* (USEPA, 1991a) and *Interim Final Guidance: Developing Risk-Based Cleanup Levels at Resource Conservation and Recovery Act Sites in Region 10* (USEPA, 1998a). These guidance documents specify data quality requirements and screening procedures to be used in the selection of COPCs for quantitative evaluation in risk assessment. The data analysis phase is described in Section 6.2.1. The screening procedures used in the selection of COPCs are presented in Section 6.2.2, and the results of COPC screening for each site and medium are presented in Section 6.2.3.

6.2.1 Data Analysis

As specified in USEPA's *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A)* (USEPA, 1989d) and *Final Guidance for Data Usability in Risk Assessment (Part A)* (USEPA, 1992d), data intended for quantitative use in risk assessment should be evaluated based on the following data usability criteria:

- Data sources
- Documentation
- Analytical methods, detection limits, and quantitation limits
- Data quality indicators
- Data review
- Reports from sampling and analysis

Each of these criteria, as they relate to the data considered for use in the identification of COPCs for the Moses Lake Wellfield Superfund Site, are described below.

6.2.1.1 Data Sources

The data sources selected for quantitative use must be comparable and of sufficient quality to meet DQOs (USEPA, 1998a). The data sources selected for use in screening COPCs for the Moses Lake Wellfield Superfund Site included fixed-laboratory results for soil and soil gas samples collected between March 2000 and November 2002 and groundwater monitoring data collected between November 1999 and January 2003. The results of field screening methods (e.g., PID measurements and field analyzed soil gas results) were not used in quantitative screening for COPCs. However, such data were used to augment and assist in the interpretation of fixed-laboratory analyses, as appropriate.

6.2.1.2 Documentation

Sample collection and analysis procedures must be fully and accurately documented to substantiate the reliability of the data derived from analysis (USEPA, 1998a). Such documentation includes the Quality Assurance Project Plan (QAPP), Sampling and Analysis Plan (SAP), and Standard Operating Procedures (SOPs), as appropriate. The

SAP for the 1999/2000 field investigation was included in Volume II of the *Management Plan* (Montgomery Watson, 1999b), and consisted of the Field Sampling Plan (FSP) and QAPP. The *Supplemental Management Plan* (MWH, 2003) described the 2002 supplemental RI activities, including field sampling activities, analytical methods, and QA/QC procedures.

6.2.1.3 Analytical Methods, Detection Limits, and Quantitation Limits

Analytical methods should be sufficiently sensitive to meet required detection limits for metals and quantitation limits for nonmetals (USEPA, 1998a). Comparison of practical quantitation limits (PQLs) and method detection limits (MDLs) to Applicable or Relevant and Appropriate Requirements (ARARs), to be considered (TBC) criteria, and other risk-based levels (RBLs) was conducted to ensure adequate method sensitivity (Montgomery Watson, 2001a). Soil PQLs and MDLs were compared to Washington State MTCA-A Soil Cleanup Levels (WAC 173-340-740) and USEPA Region 9 PRGs For Soil (USEPA, 2002c). Groundwater PQLs and method detection limits (MDLs) were compared to Washington State Maximum Contaminant Levels (MCLs) (WAC 246-290-310), national drinking water MCLs (40 CFR 141.61 and 40 CFR 141.62), MTCA-A Groundwater Cleanup Levels (WAC 173-340-720), and USEPA Region 9 Tap Water PRGs (USEPA, 2002c).

6.2.1.4 Data Quality Indicators

Data quality indicators (DQIs) are identified during the development of the DQOs to quantitatively measure the achievement of quality assurance objectives (USEPA, 1998a). The five DQIs described by the USEPA (1992d) include precision, accuracy, representativeness, completeness, and comparability. The DQIs for the 1999/2000 field investigation were presented in the QAPP, included in Volume II of the *Management Plan* (Montgomery Watson, 1999b). The DQIs for the 2002 supplemental RI investigation were included in the *Supplemental Management Plan* (MWH, 2003).

6.2.1.5 Data Review

DQOs dictate the amount and level of data review required (USEPA, 1998a). USEPA data review guidance for Contract Laboratory Program data includes *U.S. Environmental Protection Agency Contract Laboratory Program Guidance National Functional Guidelines for Organic Data Review* (USEPA, 1994b) and *U.S. Environmental Protection Agency Contract Laboratory Program Guidance National Functional Guidelines for Inorganic Data Review* (USEPA, 1994c). Soil and groundwater data used in the selection of COPCs for the Moses Lake Wellfield Superfund Site are considered “definitive” data, consistent with requirements of the National Functional Guidelines (USEPA, 1994b,c).

6.2.1.6 Reports from Sampling and Analysis

Preliminary reports help to identify sampling and analysis problems or deficiencies before sampling and analysis resources are exhausted (USEPA, 1998a). Results of the 1999-2000 field investigation were included in the 1999 and 2000 SCTMs (Montgomery Watson, 2000a and 2001b) and submitted to the USACE and USEPA for review on March

2000 and January 2001, respectively. Results of the 2002 RI are described in Section 4.0 of this report. During the 2002 supplemental RI, PFIDs were used to notify the USACE and USEPA of changes in field sampling procedures and interim field sampling results.

6.2.2 Screening Procedures

The screening procedures used in the identification of COPCs for the Moses Lake Wellfield Superfund Site are consistent with methods described in *USEPA Region 10 Supplemental Risk Assessment Guidance for Superfund* (USEPA, 1991a) and *Interim Final Guidance: Developing Risk-Based Cleanup Levels at Resource Conservation and Recovery Act Sites in Region 10* (USEPA, 1998a). The methods described in these guidance documents are generally based on the *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A)* (USEPA, 1989d). In accordance with these guidance documents, the criteria used in the identification of site-specific COPCs generally includes the following:

- Frequency of detection
- Essential nutrient status
- Comparison to laboratory and field blanks
- Comparison to background concentrations
- Comparison to ARARs
- TBCs or other appropriate risk-based criteria

Each of these criteria are described below, as they relate to the identification of soil, soil gas, and groundwater COPCs for the Moses Lake Wellfield Superfund Site.

6.2.2.1 Frequency of Detection

According to USEPA guidance (USEPA, 1989d), frequency of detection, in conjunction with other evaluation criteria, may be used in the selection of COPCs for site media. For example, if data from a minimum of 20 samples of a given medium are available, chemicals detected in less than five percent of the samples may potentially be eliminated from consideration as COPCs in that medium (USEPA, 1989d). Other criteria to be considered include whether or not a specific chemical presents a particular health concern (e.g., is a carcinogen), represents a significant fraction of its concentration benchmark, or might indicate a hot spot of contamination. Because fewer than 20 soil samples were collected from individual sites, this criterion was not applied to soil data. More than 20 sample results were available for most analytes detected in groundwater. The following COPCs had frequencies of detection in groundwater of less than 5 percent: 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, bromodichloromethane, dibromochloromethane, and trichlorofluoromethane in the Hanford and Ringold Formation; and acetone, benzene, and methyl tert butyl ether (MTBE) in the Priest Rapids/Roza members of the Wanapum Formation. The petroleum-related chemicals were detected in monitoring well 91-AW15, located hydogeologically downgradient of Site 16 (Engine Rebuilding Facility) and Site 3a (Aircraft Wash Rack). Thus, the presence of these chemicals in groundwater is reasonably anticipated to be site-related. Although acetone was detected in only one well and in one sampling event, the concentration was 19,000 µg/L. Resampling of this well in February 2003 confirmed the

presence of acetone. Therefore, acetone was retained as a groundwater COPC for the Roza Member of the Wanapum Formation. Frequency of detection was not used to exclude any COPCs in this HHRA, and all of the above chemicals were retained as COPCs for quantitative risk evaluation.

6.2.2.2 Essential Nutrient Status

Essential nutrients are not necessarily considered COPCs, even when media concentrations are a large fraction of what is necessary to induce a toxic response. This is because these concentrations can be beneficial, or even necessary. USEPA Region 10 considers calcium, magnesium, potassium, and sodium to be essential nutrients for purposes of human health screening. Consequently, these constituents were not analyzed in site media.

6.2.2.3 Comparison with Blank Concentrations

If a field sample has detectable concentrations of chemicals that are also detected in associated laboratory method blanks, trip blanks, or equipment rinsate blanks, field sample concentrations are compared to the associated blank concentrations. For chemicals commonly identified as artifacts resulting from laboratory or field procedures (e.g., methylene chloride, acetone, phthalates, etc.), the chemical detected in the field sample might not be considered to be site-related if the detected concentration is less than ten times the blank concentration. For all other chemicals, the selection criterion used is five times the associated blank concentration (USEPA, 1992d). The comparison of field sample concentrations to associated blank concentrations was performed as part of the analytical data validation task. Therefore, the chemical concentrations evaluated in this baseline HHRA were previously evaluated by this criterion.

6.2.2.4 Comparison with Background Concentrations

The USEPA's *Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites* (USEPA, 2002a) recommends that inorganic chemicals potentially representative of ambient conditions be included in the quantitative risk estimate, and qualified in the risk characterization. However, this guidance also describes an example (i.e., Hypothetical Case 2 in Appendix B) that typifies the situation at Moses Lake in regard to arsenic concentrations in soil and groundwater. Hypothetical Case 2 describes a situation where arsenic that has been demonstrated to represent ambient conditions may be excluded from the baseline risk assessment. However, this guidance also recommends that the potential contribution of ambient arsenic concentrations to risk should be described qualitatively in the risk characterization discussion. Furthermore, consistent with USEPA Region 10 guidance (USEPA, 1991b), comparison of concentrations of chemicals detected in site media with background concentrations might be appropriate for inorganic chemicals. Identification and sampling of background soil locations was not conducted as part of the RI for the Moses Lake Wellfield Superfund Site. However, monitoring wells that are believed to be unimpacted by chemicals released from the site were identified and sampled as part of the RI. During discussions between the USEPA, the USACE, and its contractor, it was identified that concentrations of arsenic measured in soil and groundwater might be representative of naturally occurring levels or regional

contamination associated with historic agricultural practices. Consequently, evaluation of ambient conditions for arsenic in soil and groundwater was performed as described in the following subsections.

Evaluation of Arsenic Concentrations in Soil

Arsenic concentrations in surface soil were measured at a total of 56 sampling locations within areas of known or suspected contaminant release. Summary statistics for site-wide arsenic concentrations in soil are provided in Table 6.1. Arsenic concentrations ranged from non-detect to a maximum value of 94 mg/kg measured at Site 6 (i.e., 6a – Base Closure Landfill and 6b – Dumpster Wash Area). The mean arsenic concentration measured in site-wide soils was 3.0 mg/kg with no values, other than the maximum concentration of 94 mg/kg, exceeding 5.6 mg/kg. Arsenic concentrations reported in soils of the Western United States range from less than 0.10 to 97 mg/kg, with a mean concentration of 5.5 mg/kg (Shaklette and Boerngen, 1984). The site-wide arsenic data set was statistically evaluated to determine whether it is potentially representative of ambient conditions, as described below.

Consistent with USEPA's *External Review Draft Guidance for Characterizing Background Chemicals in Soil at Superfund Sites* (USEPA, 2002a), the site-wide arsenic data set was first statistically evaluated to determine whether the maximum concentration of arsenic detected represents a statistical outlier. To evaluate the presence of outliers within the arsenic data set, the 95 percent background upper tolerance limit (BUTL) for 95 percent coverage (i.e., 95/95 BUTL) was calculated for the entire data set. The 95/95 BUTL represents a value below which 95 percent of the population are expected to fall with 95 percent confidence (USEPA, 2002a). The 95/95 BUTL for arsenic in site-wide soils was estimated as 8.1 mg/kg, suggesting that the maximum detected concentration of 94 mg/kg is not representative of the site-wide arsenic population. The site-wide arsenic data set was then censored to exclude the maximum value of 94 mg/kg, and summary statistics were recalculated for the censored data set, as shown in Table 6.1. A coefficient of variation (CV) equal to 0.69 suggests that the censored data set is normally distributed. The censored data set contains a maximum arsenic concentration of 5.6 mg/kg, with a mean of 1.6 mg/kg. These concentrations are well within the range reported for Western United States soils (Shaklette and Boerngen, 1984) and are believed representative of soils unimpacted by potential sources associated with the Moses Lake Wellfield Superfund Site. Assuming a normal distribution for the censored data set, a 95/95 BUTL was calculated as 5.4 mg/kg arsenic in soil, as shown in Table 6.1. This value was used to screen concentrations of arsenic in soil for potential inclusion of arsenic as a COPC for individual PSAs. Potential risks and uncertainties associated with arsenic detections in soil are qualitatively described in Sections 6.5.2.1 and 6.6.2, respectively.

Evaluation of Regional Arsenic Concentrations in Groundwater

A total of six monitoring wells believed to be unimpacted by chemicals released from the site were identified and sampled as part of the RI to evaluate ambient groundwater conditions. Monitoring wells identified for background sampling included three wells in the Hanford and Ringold Formation (91-AW01, 91-AW02, and 91-AW03) and three wells in the Roza Member of the Wanapum Formation (91-BW01, 99-BW05, and 99-B17).

Arsenic concentrations in the Hanford and Ringold Formation ranged from 6 to 10 µg/L, with a mean concentration of 8.4 µg/L, as shown in Table 6.2. Arsenic concentrations in the Wanapum Formation ranged from <5 to 6 µg/L, with a mean concentration of 5.3 µg/L, as shown in Table 6.2. No attempt was made to calculate a 95/95 BUTL for arsenic in groundwater because of the relatively small data sets for each groundwater zone, and because it is unknown whether arsenic concentrations represent true background levels or regional contamination resulting from potential historic application of arsenical pesticides on agricultural areas surrounding the site. Instead, arsenic concentrations in background and non-background monitoring wells were qualitatively compared to regional arsenic data collected by the USGS, as described below.

The USGS collected and analyzed arsenic in potable water from 18,850 wells in 595 counties across the United States over the past 20 years. These arsenic data are reported in *A Retrospective Analysis on the Occurrence of Arsenic in Ground-Water Resources of the United States and Limitations in Drinking Water Supply Characterizations* (USGS, 1999). Mean arsenic concentrations measured in public water supply wells and other wells within the Pacific Mountain System were reported as 6 and 9 µg/L, respectively. These concentrations are comparable to the mean values of 5.3 and 8.4 µg/L, respectively, that were measured in the Wanapum Formation and Hanford and Ringold Formation at the Moses Lake Wellfield Superfund Site, as shown in 6.2. Arsenic was only detected in a total of eleven non-background monitoring wells within the Moses Lake Wellfield Superfund Site. Arsenic was present in samples collected from these monitoring wells at concentrations of 10 µg/L or less.

It is worth noting that arsenic concentrations measured in background and non-background monitoring wells associated with the Moses Lake Wellfield Superfund Site are below the current maximum contaminant level (MCL) of 50 µg/L allowed for arsenic in drinking water, and are at or below the proposed new drinking water standard of 10 µg/L for arsenic. Based on the above, arsenic concentrations in groundwater associated with the site are within the range of regional arsenic levels and are in compliance with current and potential future drinking water standards. Consequently, potential risks associated with arsenic in groundwater were not quantified in the HHRA for the Moses Lake Wellfield Superfund Site. Potential uncertainties associated with arsenic detections in groundwater are qualitatively described in Sections 6.5.2.2 and 6.6.2, respectively

6.2.2.5 Comparison to ARARs, TBCs, or Other Risk-Based Criteria

USEPA Region 10 considers the appropriate criteria for screening COPCs at hazardous waste sites within the State of Washington to be USEPA Region 9 PRGs (USEPA, 2002c) and Washington State Department of Ecology amended MTCA-A Cleanup Levels (173-340-740 WAC, amended February 12, 2001). Consistent with the current and future designated land uses for PSAs included in this investigation, Region 9 PRGs and MTCA-A Cleanup Levels for industrial soils were used to screen COPCs for human receptors. Soils cleanup levels associated with unrestricted land use were not used in this risk assessment. Risks were evaluated based on site-specific land use considerations (i.e., MTCA-A Cleanup Levels for industrial soils were used to screen COPCs for human receptors). Maximum detected concentrations of carcinogenic chemicals were evaluated

based on a chemical-specific target risk level of 1.0 x 10^{-6}, and noncarcinogenic chemicals were evaluated using a target hazard quotient (HQ) of 0.1, consistent with USEPA Region 10 policy. Table 6.3 summarizes the COPC screening levels for detected analytes in soil samples. It should be noted that USEPA Region 9 PRGs for industrial soils were used as the first tier of screening criteria for soils. When a Region 9 PRG was unavailable for a chemical, the MTCA-A Cleanup Level for industrial soils was used in its place. Because Region 9 PRGs for carcinogenic chemicals are based on a chemical-specific cancer risk of 1.0 x 10^{-6}, the PRGs were used unmodified for carcinogens. However, Region 9 PRGs for noncarcinogenic chemicals are based on a target HQ of 1.0; therefore, one-tenth the PRG was selected as the COPC screening criterion for noncarcinogens, as shown in Table 6.3.

The potential criteria available for screening COPCs in soil gas are limited to USEPA Region 9 ambient air PRGs, as shown in Table 6.4. There are no MTCA-A Cleanup Levels currently available for soil gas or ambient air. Therefore, maximum concentrations of analytes detected in soil gas samples were compared to USEPA Region 9 Ambient Air PRGs for the protection of human health. An assumption used in this COPC screening assessment is that soil gas concentrations are equivalent to ambient air concentrations to which human receptors could be exposed. This is an extremely protective assumption, given that it does not take into account attenuation processes that would occur during vertical migration through soil and dispersion into ambient air

Criteria considered in the identification of COPCs for groundwater included USEPA Region 9 Tap Water PRGs and MTCA-A Groundwater Cleanup Levels, as shown in Table 6.5. For all detected chemicals in groundwater, Region 9 Tap Water PRGs were available, with the exception of methane. MTCA-A Groundwater Cleanup Level was also not available for methane. Consequently, methane detected in groundwater was not evaluated as a COPC due to the current unavailability of screening values and the low potential for chronic toxicity associated with this chemical. For all remaining analytes, Region 9 Tap Water PRGs were used exclusively in COPC screening for groundwater. Similar to the screening procedure used for soils, groundwater COPC screening was based on a comparison of maximum detected concentrations in groundwater to unmodified Region 9 PRGs for carcinogenic chemicals, or one-tenth the Region 9 PRGs for noncarcinogenic chemicals. The one exception to this decision rule was the screening process used for TCE. In concurrence with USEPA, the current federal primary drinking water standard and MTCA-A Groundwater Cleanup Level of 5 µg/L (0.005 mg/L) was selected as the screening level for TCE in groundwater. Groundwater COPC screening levels for the Moses Lake Wellfield Superfund Site are summarized in Table 6.5.

Potential impacts of TCE and other chemicals in surface water and groundwater on human or ecological receptors using Crab Creek and Moses Lake are believed to be limited. Surface water originating from the site does not drain to Crab Creek. In addition, there is little potential for communication between site groundwater and Crab Creek in the vicinity of PSAs, consistent with the hydrogeologic conceptual model presented in Section 3.0. Although there is evidence of possible communication between Crab Creek and groundwater in the northeastern portion of the study area, no identified PSAs are present in this portion of the site. Therefore, potential exposure pathways between PSAs and Crab Creek are currently incomplete. The hydrogeologic conceptual model also indicates that potential communication between groundwater and Moses Lake might exist

within the northwestern portion of the study area. However, the concentrations of chemicals in groundwater near areas of potential communication with Moses Lake are anticipated to be low because: (1) the distance between PSAs (e.g., Site 19) and Moses Lake allows time for attenuation of TCE in groundwater; (2) potential groundwater flow volumes into Moses Lake represent only a very small fraction of the total lake volume and contaminant concentrations would be greatly diluted in this surface water body; (3) TCE is subject to natural attenuation processes in surface water including volatilization, photochemical oxidation, and hydrolysis; and (4) TCE does not appreciably bioaccumulate in aquatic organisms. An attempt was made to validate these assumptions through the collection and analysis of seep samples in the vicinity of Moses Lake. Only a few surface seeps were found in the northwestern portion of the site, and samples collected from these seeps were non-detect for trichloroethene. It should be noted, however, that sampled seeps might not be located downgradient of the highest trichloroethene sources, such as Site 19. In addition, there are uncertainties regarding the hydraulic relationship between Moses Lake and groundwater in the northwest portion of the study area due to the lack of monitoring wells in this vicinity. Therefore, definitive conclusions regarding this potential pathway cannot be made at this time.

Based on the above, and in accordance with the results of an October 15, 2001 meeting between USEPA and the Corps, surface water exposure pathways (e.g., subsistence or recreational uses of Moses Lake) were qualitatively evaluated. The uncertainties associated with this potential exposure pathway are described further in Section 6.6.1.

6.2.3 Results

The results of COPC screening for soil, soil gas, and groundwater are presented in Sections 6.2.3.1, 6.2.3.2, and 6.2.3.3, respectively.

6.2.3.1 Soil COPCs

The results of soil COPC screening for individual sites are described in the following subsections.

Site 6 (6a – Base Closure Landfill and 6b – Dumpster Wash Area)

Sampling results for Sites 6a – Base Closure Landfill and 6b – Dumpster Wash Area were combined for purposes of COPC screening. Chemical-specific soil COPC screening levels for Site 6 were exceeded by arsenic, lead, and nickel, as shown in Table 6.6. Arsenic exceeded the chemical-specific screening criterion and, therefore, was retained as a COPC. Lead exceeded the chemical-specific soil screening level of 750 mg/kg and was also retained as a COPC. The maximum concentration of nickel was approximately four fold higher than the screening level. Therefore, nickel was also retained as a COPC for evaluation in the HHRA.

Site 8 (Randolph Road Base Dump)

Concentrations of all analytes detected in soil samples collected from this site were below chemical-specific COPC selection criteria, as shown in Table 6.7. Therefore, no soil COPCs were retained for evaluation in the HHRA.

Site 11 (Fire Training Area - Burn Pit A)

Only Oilm-Dx at a concentration of 14,000 mg/kg in soil exceeded its chemical-specific COPC selection criterion, as shown in Table 6.8. Therefore, Oilm-Dx was retained as a soil COPC for evaluation in the HHRA. A screening level was not available for benzo(g,h,i) perylene; consequently this analyte was also retained as a COPC.

Site 12 (Motor Pool Drain Areas)

Maximum detected concentrations of metals and PAHs, with the exception of benzo(a)pyrene, were all below chemical-specific COPC selection criteria, as shown in Table 6.9. Benzo(a)pyrene slightly exceeded its screening criterion and was retained as a soil COPC. Diesel-Dx and Oilm-Dx also exceeded soil screening criteria and were retained as soil COPCs for evaluation in the HHRA.

Site 14 (8-Place Hangar)

Concentrations of all analytes detected in soil samples collected from this site were below chemical-specific COPC selection criteria, as shown in Table 6.10. Therefore, no soil COPCs were retained for evaluation in the HHRA.

Site 15 (8-Place Hangar Ditch)

All analytes were below their respective chemical-specific screening criteria, as shown in Table 6.11. Therefore, no soil COPCs were retained for evaluation in the HHRA.

Site 17 (3-Place Hangar - Building 5801)

Arsenic, benzo(a)pyrene and benzo(b)fluoranthene exceeded their respective chemical-specific screening criteria and, therefore, were retained as soil COPCs, as shown in Table 6.12. A screening level was not available for benzo(g,h,i)perylene; therefore this analyte was also retained as a COPC.

Site 18 (Paint Hangar - Building 5825)

Maximum concentrations of all metals were below their chemical-specific COPC screening criteria, as shown in Table 6.13. The PCBs, Aroclor 1254 and Aroclor 1260, exceeded their chemical-specific screening criteria and were retained as soil COPCs for evaluation in the HHRA.

Site 19 (Liquid Oxygen Generating Plant - Building 5102)

No soil analytes exceeded their chemical-specific COPC screening criteria, as shown in Table 6.14. A screening level was not available for benzo(g,h,i) perylene; therefore this analyte was retained as a soil COPC.

Site 20 (South Base Dump)

Concentrations of all analytes detected in soil samples collected from this PSA were below COPC selection criteria with the exception of lead, as shown in Table 6.15. Lead was detected at a maximum concentration of 5,700 mg/kg and was retained as a soil COPC for evaluation in the HHRA.

Site 22 (Paint Hangar Leach Pit)

The PCB, Aroclor 1254, exceeded its soil screening criterion, as shown in Table 6.16. Lead at a maximum concentration of 1,200 mg/kg, bezo(a)pyrene at a maximum concentration of 0.29 mg/kg, and Gro-Gx at a maximum concentration of 150 mg/kg also exceeded chemical-specific screening criteria. A screening level was not available for benzo(g,h,i)perylene; therefore this analyte was retained as a COPC. Based on the above, Aroclor 1254, benzo(a)pyrene, benzo(g,h,i)perylene, lead, and Gro-Gx were retained as soil COPCs for evaluation in the HHRA.

Site 31 (19th Avenue Base Dump)

Concentrations of all analytes detected in soil samples collected from Site 31 were below chemical-specific COPC selection criteria, as shown in Table 6.17. Therefore, no soil COPCs were retained for evaluation in the HHRA.

Site 33 (Runway 32 Landfill)

Analytes detected in Site 33 soils were present at concentrations below their chemical-specific COPC screening criteria, as shown in Table 6.18. Therefore, no soil COPCs were identified for this site.

Site 35 (Stained Soil Area)

Maximum concentration of Gro-Gx, Diesel-Dx, and Oilm-Dx exceeded soil screening criteria and were retained as soil COPCs for evaluation in the HHRA, as shown in Table 6.19.

A summary of the soil COPCs identified for each site is presented in Table 6.20.

6.2.3.2 Soil Gas COPCs

Screening of soil gas concentrations against human health criteria was performed on 20 potential sites within the Moses Lake project area. These results are described below for each site.

Site 2 (Big Bend Community College Hangar)

Twelve analytes were screened at Site 2, as shown in Table 6.21. The maximum concentrations of 1,3-butadiene, 1,4-dioxane, acetone, benzene and trichloroethene exceeded their chemical-specific criteria and were retained as COPCs for evaluation in the HHRA.

Site 3a (Aircraft Wash Rack & Discharge Areas)

Twenty analytes were screened at Site 3a. Of these, 18 analytes exceeded their chemical-specific criteria. These analytes included 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, 1,3-butadiene, 2-butanone, 4-ethyltoluene, acetone, benzene, carbon disulfide, chloromethane, ethylbenzene, heptane, hexane, m,p-xylene, propene, toluene, and trichloroethene. These analytes were retained for evaluation in the HHRA, as shown in Table 6.22.

Site 3b (Aircraft Wash Rack & Discharge Areas)

Of the 17 analytes screened at this location, 13 exceeded their chemical-specific criteria. 1,2,4-Trimethylbenzene, 1,3-butadiene, 1,4-dioxane, acetone, benzene, chloroform, chloromethane, ethylbenzene, heptane, hexane, xylenes, toluene and trichloroethene were retained as COPCs for the HHRA, as shown in Table 6.23.

Site 3c (Aircraft Wash Rack & Discharge Areas)

Eight of 11 analytes screened at Site 3c exceeded their chemical-specific criteria, as shown in Table 6.24. These were 1,2,4-trimethylbenzene, 1,3-butadiene, 1,4-dioxane, acetone, benzene, carbon disulfide, chloromethane and m,p-xylene. All of these analytes were retained as COPCs for evaluation in the HHRA.

Site 4a (Tarmac Areas)

Maximum concentrations of ten analytes exceeded their chemical-specific soil gas criteria at this site. These included 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, 1,3-butadiene, 4-ethyltoluene, acetone, benzene, chloromethane, m,p-xylene, tetrachloroethene and trichloroethene, as shown in Table 6.25. These analytes were retained as COPCs for evaluation in the HHRA.

Site 4b (Tarmac Areas)

The only analytes at this site that exceeded their chemical-specific criteria were 1,2,4-Trimethylbenzene, acetone, and trichloroethene, as shown in Table 6.26. These were retained as COPCs for evaluation in the HHRA.

Site 5 (JAL Hangar Area & Tarmac)

Of the nine analytes detected at Site 5, six exceeded their chemical-specific criteria. These analytes included 1,2,4-trimethylbenzene, acetone, chloroform, propene,

tetrachloroethene, and trichloroethene, as shown in Table 6.27. The above analytes were retained as COPCs for evaluation in the HHRA.

Site 9 (Gravel Pit)

Six analytes at this site exceeded their chemical-specific soil gas criteria, as shown in Table 6.28. These analytes were 1,2,4-trimethylbenzene, 1,3-butadiene, acetone, benzene, chloromethane, and trichloroethene. These analytes were retained as COPCs for evaluation in the HHRA.

Site 11 (Fire Training Area Burn Pit B)

For Site 11, 8 of 12 detected analytes exceeded their chemical-specific criteria. These analytes included 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, 1,4-dioxane, acetone, benzene, chloroform, chloromethane, and trichloroethene, as shown in Table 6.29. The above analytes were retained as COPCs for evaluation in the HHRA.

Site 12 (Motor Pool Drain)

Seventeen analytes at Site 12 exceeded their chemical-specific criteria. These included 1,2,4 trimethylbenzene, 1,3,5-trimethylbenzene, 1,3-butadiene, 2-butanone, 2-hexanone, 4-ethyltoluene, acetone, benzene, carbon disulfide, chloromethane, ethylbenzene, hexane, m,p-xylene, o-xylene, propene, toluene and trichloroethene, as shown in Table 6.30. These analytes were retained as COPCs for evaluation in the HHRA.

Site 14 (8-Place Hangar)

For this site, 18 of 25 analytes detected in soil gas exceeded their chemical-specific criteria, as shown in Table 6.31. These analytes were 1,2,4 trimethylbenzene, 1,2-dichloroethane, 1,3-butadiene, 1,4-dichlorobenzene, 1,4-dioxane, acetone, benzene, bromomethane, carbon disulfide, carbon tetrachloride, chloroform, chloromethane, cis-1,2-dichloroethene, ethylbenzene, heptane, m,p-xylene, methylene chloride, and trichloroethene. These analytes were retained as COPCs for evaluation in the HHRA.

Site 15 (8-Place Hangar Ditch)

Five out of nine analytes detected at Site 15 exceeded their chemical-specific criteria, as shown in Table 6.32. These analytes included acetone, chloromethane, cis-1,2-dichloroethene, methylene chloride, and trichloroethene, which were retained as COPCs for evaluation in the HHRA.

Site 16 (Engine Rebuilding Facility - Building 2203)

At Site 16, 1,3-butadiene, acetone, benzene, chloroform, propene, tetrachloroethene, and trichloroethene exceeded their chemical-specific criteria, as shown in Table 6.33. These analytes were retained as COPCs for evaluation in the HHRA.

Site 17 (3-Place Hangar - Building 5801)

Eight analytes at this site exceeded their chemical-specific criteria, as shown in Table 6.34. The analytes exceeding screening criteria were 1,2,4-trimethylbenzene, 1,4-dioxane, acetone, benzene, carbon disulfide, chloromethane, methylene chloride and trichloroethene. These analytes were retained as COPCs for evaluation in the HHRA.

Site 18 (Paint Hangar - Building 5825)

Analytes that exceeded their chemical-specific criteria at Site 18 included 1,2,4-trimethylbenzene, 1,3-butadiene, acetone, benzene, chloromethane, ethylbenzene, m,p-xylene, o-xylene, propene and trichloroethene, as shown in Table 6.35. These analytes were retained as COPCs for evaluation in the HHRA.

Site 19 (Liquid Oxygen Generating Plant - Building 5102)

Thirty-one analytes were detected at Site 19, as shown in Table 6.36. Of the detected analytes, 20 exceeded chemical-specific screening criteria for soil gas including 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, 1,3-butadiene, 2-propanol, 4-ethyltoluene, acetone, benzene, bromomethane, carbon tetrachloride, chloroform, cis-1,2-dichloroethene, cis-1,3-dichloropropene, ethylbenzene, heptane, hexane, m,p-xylene, propylene, tetrachloroethene, trans-1,3-dichloropropene, and trichloroethene. The above analytes were retained as COPCs for evaluation in the HHRA.

Site 19b (Liquid Oxygen Generating Plant)

Thirty-four analytes were detected at Site 19b, as shown in Table 6.37. Of the detected analytes, 22 exceeded chemical-specific screening criteria for soil gas including 1,1,2-trichloro-1,2,2-trifluoroethane, 1,1,2-trichloroethane, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, 1,3-butadiene, 1,4-dichlorobenzene, 2-propanol, 4-ethyltoluene, 4-methyl-2-pentanone, acetone, benzene, carbon tetrachloride, chloroform, chloromethane, ethylbenzene, heptane, hexane, m,p-xylene, propylene, toluene, trichloroethene and vinyl chloride. The above analytes were retained as COPCs for evaluation in the HHRA.

Site 22 (Paint Hangar Leach Pit)

Five analytes were detected at Site 22, and three exceeded their chemical-specific screening criteria, as shown in Table 6.38. These analytes included acetone, benzene and chloromethane. The above analytes were retained as COPCs for soil gas and were evaluated in the HHRA.

Site 23 (Engine Buildup Facility - Building 2113)

For Site 23, seven analytes exceeded their chemical-specific screening criteria, as shown in Table 6.39. Analytes exceeding screening criteria were 1,2,4-trimethylbenzene, acetone, benzene, bromodichloromethane, chloroform, propene, and trichloroethene. These analytes were retained as COPCs for evaluation in the HHRA.

Site 25 (Building 408)

Fourteen analytes were detected at Site 25, with ten analytes exceeding chemical-specific screening criteria, as shown in Table 6.40. These analytes included 1,2,4-trimethylbenzene, acetone, benzene, carbon disulfide, heptane, hexane, m,p-xylene, o-xylene, toluene and trichloroethene. The above analytes were retained as soil gas COPCs for evaluation in the HHRA.

Site 33 (Landfill at the end of Runway 32)

Five out of seven analytes detected at Site 33 exceeded their chemical-specific screening criteria , as shown in Table 6.41. Acetone, benzene, carbon disulfide, chloromethane, and trichloroethene were retained as COPCs for further evaluation in the HHRA.

A summary of soil gas COPCs identified for each site is presented in Table 6.42.

6.2.3.3 Groundwater COPCs

Screening for groundwater COPCs was conducted separately for monitoring data collected from the Hanford and Ringold Formation, Priest Rapids and Roza members of the Wanapum Formation, and drinking water supply wells. Results of COPC screening for these groundwater regimes are presented in the following subsections.

Hanford and Ringold Formation

Maximum concentrations of 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, bromodichloromethane, dibromochloromethane and trichloroethene detected in Hanford and Ringold Formation wells exceeded chemical-specific groundwater COPC screening criteria, as shown in Table 6.43. These chemicals were retained as groundwater COPCs for evaluation in the HHRA.

Priest Rapids and Roza Members of the Wanapum Formation

Consistent with the revised hydrologic model, it is possible that the Priest Rapids and Roza members of the Wanapum Formation represent different groundwater flow units. However, insufficient information currently exists to conclude a functional difference between the two, and it is possible that they are not hydrologically distinct. Therefore, groundwater COPC screening for the Wanapum Formation was conducted assuming (1) the Priest Rapids and Roza members as separate flow units and (2) the Priest Rapids and Roza members combined as one groundwater flow unit.

Based on an assumption of two separate flow units, maximum concentrations of manganese, benzene, MTBE and trichloroethene detected in wells screened in the Priest Rapids Member exceeded chemical-specific groundwater COPC screening criteria, as shown in Table 6.44. Therefore, these chemicals were retained as groundwater COPCs for evaluation in the baseline HHRA. Maximum concentrations of acetone, MTBE and trichloroethene detected in wells screened in the Roza Member exceeded chemical-specific groundwater COPC screening criteria, as shown in Table 6.45.

Based on an assumption of one combined flow unit, maximum concentrations of manganese, acetone, benzene, MTBE and trichloroethene detected in wells screened in the Priest Rapids/Roza members exceeded chemical-specific groundwater COPC screening criteria, as shown in Table 6.46.

Uncertainties associated with the above groundwater flow assumptions, as they pertain to the baseline HHRA, are described in Section 6.6. In addition, uncertainty is associated with detections of MTBE in groundwater. Detections of MTBE in groundwater are unlikely to be associated with historic activities at the Former LAFB. As agreed under IAG, however, potential source areas unrelated to the Former LAFB are included in the RI for the Moses Lake Wellfield Superfund Site.

Drinking Water Supply Wells

Bromodichloromethane, dibromochloromethane and trichloroethene were the only analytes detected in drinking water supply wells for which maximum detected concentrations exceeded groundwater screening criteria. Therefore, these chemicals were retained as COPCs for drinking water supply wells, as shown in Table 6.47.

A summary of groundwater COPCs identified for the Moses Lake Wellfield Superfund Site is presented in Table 6.48.

6.3 EXPOSURE ASSESSMENT

The exposure assessment describes the qualitative and quantitative relationships between contaminant sources and chemical intakes for potentially exposed receptors. The potential routes of exposure, exposure duration and frequency, and magnitude of potential exposures are described in terms of potentially exposed populations. The exposure assessment includes the following steps (USEPA, 1989d):

1. Identification of contaminated media and COPCs

2. Identification of land uses and potentially exposed populations

3. Evaluation of potentially complete exposure pathways between contaminated media and receptors

4. Quantification of exposure doses (i.e., intakes) for potential receptors

The contaminated media and COPCs for the Moses Lake Wellfield Superfund Site were identified in the previous section (refer to Section 6.2). The remaining steps in the exposure assessment process are described in the following subsections.

6.3.1 Current and Future Land Uses

Current and future land use plans for the former LAFB and vicinity are summarized in the following subsections. The reader is referred to the *Management Plan* (Montgomery

Watson, 1999b) for a detailed description of current and future land use plans for the Moses Lake area. Future land uses are also depicted in Figure 6-1.

6.3.1.1 Current Land Uses

Since deactivation of the former LAFB, a variety of private, federal, state, county and other city entities have acquired portions of the land. Currently, the Port of Moses Lake District No. 10 owns the majority of the site, a large portion of which is operated by the Grant County Municipal Airport. Other principal landowners of the former LAFB property include Boeing, CMC Heartlands, Inc., the Washington State Board for Community College Education and the Housing Authority of Grant County.

In general, the areas north and east of the subject site consist of unimproved open lands used for rural residences, agriculture and range lands. Unimproved lands are also located east of the industrial properties on the east side of the port. Properties zoned for irrigated agriculture are located southeast of the Port district. Land use in the southern portion and south of the site consists of residential subdivisions, apartments, mobile home parks and commercial areas. Moses Lake is used for irrigation and recreational purposes.

Based on the above, current land uses in the vicinity of the site include the following:

- Commercial/Industrial
- Public
- Residential
- Agriculture

6.3.1.2 Future Land Uses

Grant County, the Port of Moses Lake and the City of Moses Lake have undertaken land use planning in the area of the site. According to the *Grant County Airport Master Plan* (1994), the first priority for land use is air operations within Port of Moses Lake property. The second priority is for activities directly related to aviation such as rescue and fire fighting, fueling, aircraft maintenance and storage and terminal activities. The third priority is assigned to businesses that have some dependence upon air transport. The following categories designate the proposed land uses for airport property according to the *Grant County Airport Master Plan* (1994):

- Air Operations
- Aviation Support
- Aviation-Related Industrial
- Aviation-Compatible Industrial
- Commercial
- Industrial
- Open/Agricultural

Aviation-related industry includes fabrication, assembly and activities that rely on aviation for the movement of products or people, while aviation-compatible industry includes

industrial activities that do not interfere with aircraft operations. Commercial use includes facilities that relate to general office space and retail trade. The area on the northeast corner of State Route 17 and Chanute Street is proposed for commercial use. Examples of commercial activities include retail, food service, professional service and general office space. One institutional property, the Washington Army National Guard Armory located south of the proposed commercial zone on State Route 17 and Chanute Street, is on Port property.

Future land use designations in Grant County near Moses Lake are separated into the following categories.

- Residential
- Commercial/Industrial
- Public
- Irrigated
- Commercial Freeway Service
- Rural Remote
- UGB

The Port district area has 1,400 acres available for industry inside the UGA. The City of Moses Lake estimates that adequate land appears to be available near the airport and to the south and east and has designated these properties as Industrial Light and Industrial Heavy.

There are no portions of former the LAFB that are scheduled for residential development. However, Rural Residential land will be located to the east of the Port district and west of the west end of Runway 3/12. Rural Residential land is characterized by small-scale farms, dispersed single-family homes, and open spaces. The maximum density is one dwelling per five acres.

Rural Remote land will be located west of the northwest corner of the Port district boundaries. Rural Remote lands are not suitable for intensive farming and are generally not attractive for residential development. The maximum density is one dwelling per ten acres.

Moses Lake is used for irrigation and recreational purposes. Although it suffers from eutrophication, Moses Lake supports recreational fishing and boating and might potentially sustain swimming.

6.3.2 Identification of Potentially Exposed Populations

The potentially exposed populations to be evaluated in the HHRA are based on the current and future land uses for the Moses Lake Wellfield Superfund Site that were previously described (refer to Section 6.3.1). Within the study area, the *Grant County Airport Master Plan* generally divides land uses into Commercial/Industrial and other including potential residential growth areas, as shown in Figure 6-1. For areas identified as Commercial/Industrial, the potential current and future receptors are as follows:

- Commercial/Industrial workers
- Construction workers
- Trespassers

The maintenance worker scenario was not specifically evaluated in this risk assessment. A maintenance worker scenario could include someone responsible for mowing the grass at various sites. The maintenance worker scenario was not evaluated due to the evaluation of commercial/industrial workers and construction workers for sites location within the industrial land use area, with the exception of landfills which have restricted access and for which development is precluded under Washington State law. The commercial/industrial worker and construction worker scenarios are protective of the potentially infrequent exposure that may occur for maintenance workers. Because landfills are not mowed, the current and potential future human receptors are limited to trespassers. Due to the conservative exposure parameters associated with the trespasser scenario, this receptor is also believed to be protective of potentially infrequent exposures that may be associated with a maintenance worker during maintenance activities (refer to Section 6.3.4.).

The majority of the former LAFB is designated for future commercial/industrial land use. As such, the primary human receptors are commercial/industrial workers employed by the airport or light commercial manufacturing or retail businesses. Future development of the area might also occur. Construction workers might potentially have direct contact with suspected PSAs with the exception of landfills (refer to Section 6.3.3.1.).

Portions of the study area not designated as commercial/industrial in the *Grant County Airport Master Plan* comprise land use categories including UGAs, commercial/ industrial, rural, resource lands and open space. For these areas, current and future receptors are as follows:

- Adult residents
- Child residents
- Commercial/Industrial workers
- Construction workers
- Recreational users of Moses Lake

These receptors represent a range of potentially exposed individuals. Additional population subgroups might be exposed to site-related COPCs; however, their exposures are anticipated to be limited or exposure information is not readily available.

6.3.3 Identification of Potential Exposure Pathways

The relationships between contaminant PSAs, receptors, and potentially complete and incomplete exposure pathways are generally described in the conceptual site model (CSM) presented in the *Management Plan* (Montgomery Watson, 1999b). The CSM is summarized in the following subsection.

6.3.3.1 Conceptual Site Model

The CSM describes the receptors that are present or potentially present at a site and the exposure pathways by which the receptors could be exposed to contaminants that have been released into the environment. An exposure pathway involves a source, a point of release, a transport pathway to the point of exposure, and a route of exposure (e.g., ingestion, dermal contact or inhalation). The human health CSM for the Moses Lake Wellfield Superfund Site is summarized in Figure 6-2. Media-specific descriptions of the exposure relationships for PSAs (i.e., soil) and groundwater are presented below.

Sites

The term exposure source as used in this HHRA refers to exposure pathways from (1) use of groundwater and (2) surface soil, subsurface soil, and soil gas COPCs. The term PSA refers to locations where releases to environmental media could be occurring or could have occurred. The PSAs that have been identified to date are landfills; open pits, ditches and drains; and surface discharge areas. These are associated with former military activities at the former LAFB. The relevant exposure pathways for current and future receptors for each of these potential source categories are described below.

Landfills

The landfills source category includes six PSAs (i.e., Sites 6a and 6b, 8, 20, 31, and 33) for which COPCs were identified during the RI (Montgomery Watson, 2001). All of these PSAs are located within the future commercial/industrial land use designation according to the *Grant County Airport Master Plan* (Figure 6-1). However, all of the landfills except the Randolph Road Base Dump (Site 8) have restricted access. Construction on landfills is not a permissible land use. State of Washington rules preclude future development of landfills and, thus, exposures to future construction workers or commercial/industrial workers. Consequently, receptors with direct exposures to COPCs in landfills are limited to trespassers. Potential direct exposure pathways for current and future trespassers include incidental ingestion of soil and dermal contact with soil. Indirect exposure pathways include inhalation of particulates or vapor phase VOCs derived from soil.

Indirect exposure pathways including inhalation of VOCs or wind-borne particulates are also potentially complete for receptors other than trespassers. However, such exposures are anticipated to be insignificant due to the remote locations of the landfills. Consequently, such exposures will not be quantitatively evaluated in the HHRA for the Moses Lake Wellfield Superfund Site.

Open Pits, Ditches and Drains

The open pits, ditches and drains source category includes eight PSAs (Sites 3a, 3b, 3c, 9, 11, 12, 15, and 22) for which COPCs were identified during the RI. All of these PSAs are located within the future 'commercial/industrial' land use designation according to the *Grant County Airport Master Plan* (Figure 6-1). Therefore, exposure pathways between current and future commercial/industrial workers and these PSAs are potentially complete.

However, with the exception of Sites 11 (Fire Training Area – Burn Pit B), 12 (Motor Pool Drain Areas), and 22 (Paint Hangar Leach Pit), these sites are either paved or covered by concrete. In addition, access is restricted for Sites 11 and 12; although bare surface soils are present in these areas. Potentially complete exposure pathways for Sites 3a, 3b, 3c, 9, and 15 are limited to inhalation of VOCs derived from subsurface soils. For Sites 11 and 12, potentially complete exposure pathways for current and future commercial/industrial workers include inhalation of VOCs and windborne particulates. Site 22 is neither covered nor is access-restricted, and potentially complete pathways include both direct and indirect exposure pathways. Direct exposure pathways include incidental ingestion and dermal contact with soil. Indirect exposure pathways include inhalation of particulates or VOCs derived from soil.

Although unlikely, it is possible that construction activities could occur at Sites 11, 12, 15, and 22 in the future. Therefore, future construction workers might potentially receive direct exposures to COPCs in soil through incidental ingestion and dermal contact and indirect exposures via inhalation of particulates or VOCs derived from soil.

Surface Discharge Areas

The surface discharge areas source category includes 12 PSAs (Sites 2, 4a, 4b, 5, 14, 16, 17, 18, 19, 23, 25, and 35) for which COPCs were identified during the RI. All of these PSAs are located within the future commercial/industrial land use designation according to the *Grant County Airport Master Plan* (Figure 6-1). Therefore, exposure pathways between current and future commercial/industrial workers and these PSAs are potentially complete. With the exception of Sites 18 (Paint Hangar) and 35 (Stained Soil Area), however, these sites are either paved or covered by concrete. Consequently, potentially complete exposure pathways for current and future commercial/industrial workers are limited to inhalation of VOCs for all locations within this PSA category except for Sites 18 and 35. Potentially complete exposure pathways for Sites 18 and 35 include both direct and indirect exposure pathways. Direct exposure pathways include incidental ingestion and dermal contact with soil. Indirect exposure pathways include inhalation of particulates or VOCs derived from soil.

Although unlikely, it is possible that future construction activities could occur at Sites 18 and 35. Therefore, future construction workers may potentially receive direct exposures to COPCs in soil through incidental ingestion and dermal contact and indirect exposures via inhalation of particulates or VOCs derived from soil.

For all PSA categories, soil depths to be considered in the evaluation of direct exposure pathways will be 15 feet bgs, in accordance with Washington State Model Toxics Control Act (MTCA) guidance (WAC 173-340).

Groundwater

Chemicals including trichloroethene have been historically released to groundwater, possibly from multiple locations at the former LAFB, because several areas of groundwater contamination are present. The screening procedure presented in Section 6.2.3.3 identified COPCs for groundwater including trichloroethene, 1,2,4-

trimethylbenzene, 1,3,5-trimethylbenzene, bromodichloromethane, dibromochloromethane, MTBE, acetone, benzene and manganese. The petroleum-related COPCs (i.e., 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, and benzene) were limited to monitoring wells 91-AW15 and 00-BW11, which are located within the future industrial/commercial land use area immediately downgradient of Site 16 (the Engine Rebuilding Facility). MTBE was detected in one well screened in the Hanford and Ringold Formation (99-AW-09) and two wells screened in the Roza Member (92-BW02 and 99-BW18). Manganese was present at concentrations above COPC screening criteria in three Priest Rapids wells (00-BW02, 00-BW12 and 00-BW13) and one Roza well (99-BW04,) that is located upgradient of all suspected PSAs. Arsenic was detected in nine monitoring wells at concentrations ranging from non-detect to 10 µg/L. As described previously (Section 6.2.2.4.2), arsenic concentrations in groundwater associated with the site are within the range of regional arsenic levels and are in compliance with current and potential future drinking water standards. Consequently, potential risks associated with arsenic in groundwater were not quantified in this HHRA.

Trichloroethene is believed to be the primary contaminant in groundwater associated with the Moses Lake Wellfield Superfund Site and is the subject of the remaining CSM for groundwater. As described in Section 2.0, trichloroethene has migrated to both the Hanford and Ringold Formation and the Wanapum Formation. In these aquifers, trichloroethene has reached both supply and private wells. With the completion of the new Skyline community well by the Corps of Engineers, all known supply and private wells are either not contaminated above the primary drinking water standard (i.e., the MCL) for trichloroethene, or have been provided point-of-use treatment systems for the reduction of trichloroethene to concentrations below the MCL. Therefore, direct exposures associated with potable uses of groundwater (i.e., drinking and showering) are believed to be either incomplete or at levels that are in compliance with federal and State drinking water standards, as described in Section 6.2.2.4.2.

In the absence of groundwater use restrictions, there is nothing to preclude the development of future wells for either commercial/industrial or residential water uses. Future commercial/industrial exposures to trichloroethene in groundwater could result from either industrial or potable uses of groundwater. Future commercial/industrial workers could consume contaminated water at work. At workplaces where showering occurs, workers could also be exposed through ingestion and inhalation. However, these exposures are expected to occur with lower frequency, duration and contact rates than for a future residential receptor. For future residents, exposures could potentially occur during ingestion of drinking water, or dermal and inhalation contact while bathing or showering. Inhalation exposures may result following the volatilization of trichloroethene from shower or bath water. These potential exposure pathways were quantitatively evaluated in this HHRA. Other exposure pathways (e.g., inhalation of trichloroethene vapors while watering lawns, or consumption of home grown produce irrigated with contaminated groundwater) may be potentially complete but are considered to result in insignificant exposures relative to the ingestion or indoor inhalation pathways. These potential exposure pathways are qualitatively addressed in this HHRA.

Consistent with MTCA (WAC 173-340-708) and USEPA Region 10 policy, all groundwater in the State of Washington is considered a potential drinking water resource,

with a few limited exceptions. Therefore, a hypothetical unrestricted drinking water scenario was evaluated for all portions of the study area, based on an assumed residential use. The hypothetical unrestricted drinking water scenario was used to evaluate human health risks associated with potential use of groundwater beneath the industrial land use area in the absence of institutional controls.

As described previously in Section 6.2.2.5, potential impacts of groundwater on surface water bodies including Crab Creek and Moses Lake are believed to be either incomplete or insignificant. Although there is evidence of possible communication between Crab Creek and groundwater in the northeastern portion of the study area, no identified PSAs are present in this portion of the site. Therefore, potential exposure pathways between PSAs and Crab Creek are currently incomplete. The hydrogeologic conceptual model (Montgomery Watson, 2001b) indicates that potential communication between groundwater and Moses Lake may exist within the northwestern portion of the study area. However, chemicals including trichloroethene present in groundwater are not believed to pose a significant risk to potential human or ecological receptors using Moses Lake, as described in Section 6.2.2.5. Accordingly, potential surface water exposure pathways (e.g., subsistence or recreational uses of Moses Lake) are believed to result in insignificant exposures. It should be noted, however, that there are uncertainties regarding the hydraulic relationship between Moses Lake and groundwater in the northwest portion of the study area due to the lack of monitoring wells in this vicinity. Therefore, definitive conclusions regarding this potential pathway cannot be made at this time. Surface water exposure pathways (e.g., subsistence or recreational uses of Moses Lake) were qualitatively evaluated in this HHRA, in accordance with the results of an October 15, 2001 meeting between USEPA and the Corps. The uncertainties associated with this potential exposure pathway are described further in Section 6.6.1.

6.3.4 Quantification of Exposure

This section describes the quantification of potential exposure to COPCs in soil and groundwater associated with the exposure pathways identified in Section 6.3.3. Specifically, the methods used in the derivation of media exposure concentrations are described in Section 6.3.4.1, and calculations for quantifying exposure doses for current and future human receptors are presented in Section 6.3.4.2.

6.3.4.1 Derivation of Exposure Point Concentrations

The exposure point concentration (EPC) describes the level of chemical in media (e.g., air, soil or water) to which a receptor is exposed (USEPA, 1989d, 1992e). As such, the EPC serves as the basis for the quantification of pathway-specific exposure doses. The general methods that were used in the calculation of EPCs for use in quantifying human exposures to site media are described in Section 6.3.4.1.1. The derivation of EPCs for PSAs (i.e., soil) and groundwater are presented in Sections 6.3.4.1.2 and 6.3.4.1.3, respectively.

General Methods

Calculation of exposure point concentrations for soil and groundwater was based on measured concentrations and non-detect results. If a data set contained non-detect results,

one-half the sample quantitation limit was assumed for that sample. The EPC was estimated as either the maximum or the 95 percent upper confidence limit (UCL) on the arithmetic mean concentration detected in site media. If the calculated 95 percent UCL on the mean concentration was greater than the maximum value, then the maximum value was assumed as the EPC; otherwise the 95 percent UCL was used.

The 95 percent UCL on the arithmetic mean concentration was calculated based on a normal or lognormal distribution, according to the methods described in Gilbert (1987). First, the soil sampling results for individual COPCs detected within a PSA was evaluated in order to identify whether the data population is representative of an underlying normal or lognormal distribution. The Shapiro-Wilks W test for normality (Gilbert, 1987) and the coefficient of variation (CV) statistic (Gilbert, 1987), as necessary, was used to test the underlying data distribution. For data sets that were best represented by a normal distribution, the 95 percent UCL on the arithmetic mean was calculated based on the student-t statistic. The equation for calculating the 95 percent UCL on the arithmetic mean for a normal distribution (USEPA, 1992e) is given by:

$$UCL = x(bar) + t\ (s/vn)$$

where:

UCL = upper confidence limit
x(bar) = mean of the transformed data
s = standard deviation of the untransformed data
t = student-t statistic (from table published in Gilbert, 1987)
n = number of samples

For data sets that are best represented by a lognormal distribution, the 95 percent UCL on the arithmetic mean was calculated based on the H-statistic. Four-point Lagrangian interpolation and an H table from Gilbert (1987) was used to determine H values for use in the UCL calculation. The equation for calculating the UCL of the arithmetic mean for a lognormal distribution (Gilbert, 1987) is given by:

$$UCL = e^{x(bar)+0.5\ s2+sH/v(n-1)}$$

where

UCL = upper confidence limit
e = constant (base of the natural log, equal to 2.718)
x(bar) = mean of the transformed data
s = standard deviation of the transformed data
H = H-statistic (Gilbert, 1987)
N = number of samples

Site Exposure Point Concentrations

For PSAs, EPCs were derived based on the concentrations of COPCs measured in site soils. The maximum or 95 percent UCL on the arithmetic mean concentration for COPCs, whichever was lower, was used as the EPC for soil. As described in Section 6.3.3.1.1, data used in the derivation of EPCs for commercial/industrial workers included soil sampling results to a maximum depth of 15-ft bgs in accordance with MTCA guidance

(WAC 173-340). This soil depth range was also used in the calculation of soil EPCs for trespassers and future construction workers.

For all PSAs other than Sites 6, 19 and Site 20, insufficient data were available to calculate 95 percent UCL on the mean concentrations; therefore, maximum concentrations of each COPC were assumed as the EPC. The derivation of EPCs for soil COPCs associated with Site 6, 19 and 20 are presented in Table 6.49.

Groundwater Exposure Point Concentrations

As shown in Figure 6-1, trichloroethene has been detected in multiple locations within the study area. However, there are also many portions of the study area where groundwater monitoring results for trichloroethene are non-detect or below the federal and State drinking water standard for TCE of 5 µg/L. Areas of significant trichloroethene contamination appear to occur in several discrete locations, or "plumes." As used in this HHRA, the term "plume" refers to a discreet area of groundwater contamination with trichloroethene concentrations above the federal MCL of 5 µg/L. Although attempts were made to identify potential vadose and groundwater-based PSAs for trichloroethene contamination, only one documented source of trichloroethene (Site 19 – Liquid Oxygenating Plant) was identified. Based on the spatial patterns of groundwater contamination and current knowledge of groundwater flow conditions, however, it is possible that more than one source of trichloroethene contamination existed. Well clusters were assigned to co-located or adjacent wells to represent a common historic source of trichloroethene contamination or a common transport process. These well clusters serve as the basis for the derivation of groundwater EPCs for use in evaluating groundwater exposures for commercial/industrial and residential receptors.

Well clusters used in the calculation of groundwater EPCs for trichloroethene were identified, as summarized in Table 6.50. Wells were grouped into clusters based upon their proximity to one another, trichloroethene concentrations, and the stratigraphic unit they were screened in. Proximal wells having trichloroethene concentrations at or above the federal and State drinking water standard of 5 µg/L were included in a given well cluster. Groundwater data from well clusters were used to derive EPCs for evaluating exposures to trichloroethene in groundwater for commercial/industrial and residential receptors, as shown in Table 6.50.

Other COPCs identified for groundwater include 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, bromodichloromethane, dibromochloromethane and manganese in the Hanford and Ringold Formation; and acetone, benzene, MTBE, and manganese in the Wanapum Formation (i.e., Priest Rapids and/or Roza Members). Groundwater EPCs for these COPCs were based on maximum detected concentrations.

6.3.5 Calculation of Exposure Doses

This section describes the methods that were used in quantifying exposure doses for human receptors in the HHRA. The specific dose equations presented below are consistent with USEPA guidance for conducting exposure assessments (USEPA, 1997c; 1992a; and 1989d).

The equations used in the quantification of exposures to COPCs in soil are as follows.

$$\text{Ingestion Intake for VOCs (mg/kg-day)} = \frac{CS \times IR \times CF \times EF \times ED}{BW \times AT}$$

where:

CS	=	Concentration In Soil (mg/kg)
IR	=	Ingestion Rate (mg soil/day)
CF	=	Conversion Factor (10^{-6}kg/mg)
EF	=	Exposure Frequency (days/year)
ED	=	Exposure Duration (years)
BW	=	Body Weight (kg)
AT	=	Averaging Time (period over which exposure is averaged - days)

$$\text{Dermal Intake (mg/kg-day)} = \frac{CS \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT}$$

where:

CS	=	Concentration In Soil (mg/kg)
CF	=	Conversion Factor (10^{-6} kg/mg)
SA	=	Skin Surface Area Exposed (cm^2)
AF	=	Adherence Factor Of Soil (mg/cm^2-day)
ABS	=	Skin Absorption Factor (unitless)
EF	=	Exposure Frequency (days/year)
ED	=	Exposure Duration (years)
BW	=	Body Weight (kg)
AT	=	Averaging Time (period over which exposure is averaged - days)

$$\text{Inhalation Intake for VOCs (mg/kg-day)} = \frac{(CS/VF)xIRxEFxED}{BWxAT}$$

where:

CS	=	Concentration In Soil (mg/kg)
VF	=	Volatility Factor (m^3/kg)
IR	=	Inhalation Rate (m^3/day)
EF	=	Exposure Frequency (days/year)
ED	=	Exposure Duration (years)
BW	=	Body Weight (kg)
AT	=	Averaging Time (period over which exposure is averaged - days)

$$\text{Inhalation Intake for Particulates (mg/kg-day)} = \frac{(CS/PEF)xIRxEFxED}{BWxAT}$$

where:

CS	=	Concentration In Soil (mg/kg)

PEF	=	Particulate Emission Factor (m^3/kg)
IR	=	Inhalation Rate (m^3/day)
EF	=	Exposure Frequency (days/year)
ED	=	Exposure Duration (years)
BW	=	Body Weight (kg)
AT	=	Averaging Time (period over which exposure is averaged - days)

The equations used in the quantification of exposures to COPCs in groundwater are as follows.

$$\text{Ingestion Intake (mg/kg-day)} = \frac{CW \times IR \times EF \times ED}{BW \times AT}$$

where:

CW	=	Concentration in Groundwater (mg/L)
IR	=	Ingestion Rate (groundwater/day)
EF	=	Exposure Frequency (days/year)
ED	=	Exposure Duration (years)
BW	=	Body Weight (kg)
AT	=	Averaging Time (period over which exposure is averaged - days)

$$\text{Dermal Intake (mg/kg-day)} = \frac{CW \times CF \times SA \times PC \times ET \times EF \times ED}{BW \times AT}$$

where:

CW	=	Concentration in Groundwater (mg/L)
CF	=	Conversion Factor (L/cm^3)
SA	=	Skin Surface Area Exposed (cm^2)
PC	=	Dermal Permeability Constant (cm/hour)
ET	=	Exposure Time (hours/day)
EF	=	Exposure Frequency (days/year)
ED	=	Exposure Duration (years)
BW	=	Body Weight (kg)
AT	=	Averaging Time (period over which exposure is averaged - days)

$$\text{Inhalation Intake for groundwater (mg/kg-day)} = \frac{CA \times VFw \times CF \times InhR \times ET \times EF \times ED}{BW \times AT}$$

where:

CA	=	Concentration in Groundwater (mg/L)
VFw	=	Volatility Factor for Water (unitless)
CF	=	Conversion Factor (10^3 L/m^3)
InhR	=	Inhalation Rate (m^3/hr)
ET	=	Exposure Time (hours/day)
EF	=	Exposure Frequency (days/year)
ED	=	Exposure Duration (years)

BW = Body Weight (kg)
AT = Averaging Time (period over which exposure is averaged - days).

The specific assumptions used in quantifying exposures for human receptors are summarized in Table 6.51. Where available and applicable, default USEPA exposure parameters were generally used. Peer-reviewed literature has been used for parameters where no USEPA default value exists. Also, default parameters have in some cases been supplanted by more recent USEPA guidance/peer-reviewed literature.

For evaluating inhalation exposures associated with use of groundwater for showering or bathing, it was necessary to model VOC concentrations in indoor air. Concentrations of VOCs in indoor air while showering were modeled based on methods described by Andelman (1990). Indoor air concentrations were modeled from groundwater concentrations using a chemical-specific volatility factor for water (VFw). Based on the observation that up to 90 percent of trichloroethene in water volatilizes while showering (Andelman, 1990), a VFw of 4.5×10^{-3} was calculated for trichloroethene. A VFw of 2.7×10^{-3} was derived for 1,2,4-trimethylbenzene, 3.8×10^{-3} for 1,3,5-trimethylbenzene, 6.8×10^{-3} for 2-hexanone, 1.9×10^{-5} for acetone, 2.7×10^{-3} for benzene, 7.9×10^{-4} for bromodichloromethane, 4.2×10^{-4} for dibromochloromethane 7.1×10^{-5} for dibromochloropropane, 9.2×10^{-3} for sec-butylbenzene and 2.9×10^{-4} for MTBE, based on their Henry's law constants relative to trichloroethene.

6.3.5.1 Vapor Intrusion Modeling Methods and Assumptions

Human exposures and risks associated with the potential migration of VOCs in the subsurface to indoor air were evaluated using the Johnson & Ettinger Model (USEPA, 2000). Results of the 2000 and 2002 soil gas sampling surveys were used to quantify the indoor air pathway, in preference to soil or groundwater sampling results, because the were deemed to be more representative of vadose zone soil vapor concentrations than modeled concentrations derived from either soil or groundwater measurements. In general, exposure point concentrations were based on the maximum concentration of each soil gas COPC identified for a suspected PSA that was measured at less than or equal to 15 feet below ground surface (bgs). Soil gas samples were generally collected at one or two depths for each PSA. The exception to the above rule was Site 19, the Liquid Oxygen Generating Plant, where samples were collected at multiple depths and a maximum concentration of 31,000 parts per billion volume (ppbv) trichloroethene was measured at 5 feet bgs [152.4 centimeters (cm)] in 2000. In subsequent sampling conducted at Site 19 in 2002, the maximum concentration of trichloroethene measured in soil gas at 4 feet bgs depth was 1,000 ppbv. Thus, a TCE soil gas concentration of 1,000 ppbv and a source depth of 121.9 cm were used as inputs to the Johnson & Ettinger Model for Site 19 because these values resulted in the highest modeled indoor air concentration and risk estimates of all trichloroethene concentrations measured between 0 and 15 feet bgs at this site.

All suspected PSAs occur within the future industrial land use area (refer to Section 6.3.3.1). Of the three exposure scenarios identified for the future industrial land use area (i.e., commercial/industrial workers, construction workers and trespassers), only commercial/industrial workers are anticipated to have prolonged exposures to indoor air.

Therefore, evaluation of human health risks for commercial/industrial workers was assumed to be protective of all potential exposure scenarios occurring within the industrial land use zone. Soil gas sampling results collected at each PSA were used as exposure point concentrations in the Johnson & Ettinger Model, as described above. Because data in the form of soil gas sampling results were used to model indoor air concentrations and risks, soil gas exposure point concentrations in units of micrograms per cubic meter ($\mu g/m^3$) were input directly to the source vapor concentration cell appearing on the inter-calculations sheet of the Johnson & Ettinger Soil-ADV Model.

The input parameters used to estimate indoor air VOC concentrations and risks in the Johnson & Ettinger Model are presented in Table 6.52. Two sets of input assumptions were used to estimate exposures and risks as follows: (1) highly protective assumptions that result in an upper bound estimate of risk and (2) more typical assumptions that result in a central tendency estimate of risk. Input assumptions were derived from site-specific information (i.e., soil type and depth) or ranges of soil parameter values presented in *Johnson & Ettinger (1991) Model for Vapor Intrusion to Indoor Air, 2000 Update* (USEPA. 2000d) and *Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils* (USEPA, 2002b).

Upper Bound Risk Estimate Assumptions

Input assumptions used in the derivation of upper bound risk estimates are presented in Table 6.52. With the exception of the following site-specific assumptions, input values were default assumptions recommended by USEPA (2000, 2002b). The 'soil gas sampling depth below grade' was assumed to be 121.9 cm (or 4 feet) because 4 feet bgs was the shallowest depth of ASG sample collection. The 'thickness' of the 'upper soil layer' was assumed to be 40 cm (or 16 inches) based on the presence of loamy sand in borings collected from the Washrack area extending 1 to 1.5 feet bgs. The 'soil type' for the upper soil layer was assumed to be loamy sand based on the nature of surficial soil in these boring logs. The 'soil total porosity' value of 0.39 cm^3/cm^3 for the upper soil layer represents the default value cited in USEPA (2000, 2002b). The 'soil dry bulk density' for this layer was calculated as 1.62 grams per cubic cm (g/cm^3), from the 'soil total porosity' value of 0.39 and a 'typical' soil particle density of 2.65 g/cm^3 cited in USEPA (2000). A 'soil water-filled porosity' of 0.049 was assumed, based on the low end of the range of soil water-filled porosity values for loamy sand cited in USEPA (2000, 2002b).

The thickness of the 'lower soil layer' was assumed as 81.9 cm, based on the difference between the upper soil layer (40 cm) and the shallowest depth of ASG sample collection (121.9 cm). The 'soil type' for the lower soil layer was assumed to be sand based on the presence of sand and gravel in borings collected from the site. The 'soil total porosity' value of 0.375 cm^3/cm^3 for the lower sand layer represents the low end of the range of soil total porosity values cited in USEPA (2000, 2002b). A 'soil dry bulk density' was calculated as 1.66 g/cm^3 from the 'soil total porosity' value of 0.375 and a 'typical' soil particle density of 2.65 g/cm^3 cited in USEPA (2000). A 'soil water-filled porosity' of 0.053 was assumed, based on the low end of the range of soil water-filled porosity values for sand cited in USEPA (2000, 2002b).

Central Tendency Risk Estimate Assumptions

Input assumptions used in the derivation of central tendency risk estimates are also presented in Table 6.52. 'Central tendency' risk estimates are based on a combination of mean, mid-point, and extreme values as presented in Table 6.52 and described below. With the exception of the following site-specific assumptions, input values were default assumptions recommended by USEPA (2000, 2002b). The 'soil gas sampling depth below grade' was again assumed as 121.9 cm (or 4 feet) because 4 feet bgs was the shallowest depth of ASG sample collection. An 'average soil temperature' of 13.6 ^{o}C was calculated from groundwater temperatures measured in groundwater beneath the site. The 'thickness' of the 'upper soil layer' was assumed to be 40 cm, as described above. The 'soil type' for the upper soil layer was assumed to be loamy sand based on the nature of surficial soil in soil borings collected from the Washrack area. A 'soil total porosity' value of 0.43 cm^3/cm^3 for the upper soil layer represents the average for 'all soil types' cited in USEPA (2002b). The 'soil dry bulk density' for this layer was calculated as 1.5 g/cm^3, from the 'soil total porosity' value of 0.43 and a 'typical' soil particle density of 2.65 g/cm^3 cited in USEPA (2000). A 'soil water-filled porosity' of 0.10 was assumed, based on the upper end of the range of soil water-filled porosity values for loamy sand cited in USEPA (2000, 2002b).

The thickness of the 'lower soil layer' was calculated as 81.9 cm, as described above. The 'soil type' for the lower soil layer was assumed to be sand based on the presence of sand and gravel in borings collected from the site. A 'soil total porosity' value of 0.3 cm^3/cm^3 for the lower sand layer was assumed, as agreed during the December 20, 2002 teleconference between USEPA and the Corps. This value is below the range of soil total porosity values for all soil types cited in USEPA (2002b). However, it represents a "reasonable" total porosity value for well-graded/poorly sorted sand, gravel and silt mixtures (API, 2002). A 'soil dry bulk density' was calculated as 1.86 g/cm^3 from the 'soil total porosity' value of 0.3 and a 'typical' soil particle density of 2.65 g/cm^3 cited in USEPA (2000). A 'soil water-filled porosity' of 0.055 cm^3/cm^3 was assumed, based on the upper end of the range of soil water-filled porosity values for sand cited in USEPA (2000, 2002b). Finally, an indoor air exchange rate of 0.6 hr^{-1} was selected based on the mid-point of the range 0.2 to 1 hr^{-1}, cited in API (2002).

In comments on the Draft Final RI Report, USEPA Region 10 identified uncertainties in the assumptions and methods that were used to estimate risks associated with vapor intrusion to indoor air. The USEPA also provided alternative risk calculations. Alternate USEPA assumptions and risk estimates for the vapor intrusion pathway are discussed in the Uncertainty Analysis section (refer to Section 6.6.3).

6.4 HUMAN HEALTH TOXICITY ASSESSMENT

This section describes the toxicity assessment methodology that was used in the evaluation of public health risks for the Moses Lake Wellfield Superfund Site. The toxicity assessment involves a critical review and interpretation of toxicology data from epidemiological, clinical, animal and *in vitro* studies. The review of toxicology data ideally determines both the nature of the health effects associated with a particular chemical and the probability that a given dose of a chemical could result in an adverse

health effect. Toxicology information considered important for quantitative risk assessment includes:

- The potential for carcinogenic health effects
- The potential for chronic noncarcinogenic, adverse health effects
- The ability to cause short-term, acute effects
- The ability to affect reproduction

For carcinogens, it is assumed that no threshold dose exists and that any dose may induce cancer. The slope of the dose response curve describes an upper bound estimate of the probability of cancer development. The doses from various known or suspected carcinogens are assumed to be additive. For noncarcinogens, it is assumed that a dose exists below which no adverse health effects are seen (i.e., threshold dose). Compounds with short-term, acute effects are also generally considered to have a threshold dose. Compounds that affect reproduction are considered to have threshold doses unless the mechanism of action of the compound has been confirmed as one for which no threshold exists.

Consistent with guidance established by USEPA Region 10 (USEPA, 1991a) and Ecology (WAC 173-340-708), the hierarchy of toxicity information sources to be used in this assessment is as follows:

1. IRIS Database (USEPA, 2003)

2. National Center for Environmental Assessment (USEPA, 2001c) peer reviewed toxicity values developed by the Superfund Health Risk Technical Support Center (SFTSC)

3. Other sources (Cal-EPA, ATSDR's MRLs, HEAST (1995a))

Staats et al. (1997) and Total Petroleum Hydrocarbon Work Group (TPHCWG, 1997) will be used for noncancer reference dose information for Sec-butylbenzene, Gro-Gx, Diesel-Dx, and Oilm-Dx. These sources are considered part of the Tier 3 hierarchy.

For purposes of conducting quantitative HHRAs, toxic effects of chemicals are generally categorized as carcinogenic or noncarcinogenic. The carcinogenic potential of a chemical is used in a quantitative estimate of potential cancer risk. The potential for a chemical to produce noncarcinogenic adverse health effects is used in a quantitative estimate of noncarcinogenic hazard.

6.4.1 Carcinogenic Effects of COPCS

The cancer slope factor (CSF) is the toxicity value used to quantitatively express the carcinogenic potential of cancer-causing constituents. The slope factor is expressed in units of milligrams per kilogram per day (mg/kg-day)-1 and represents the cancer risk per unit daily intake of carcinogenic chemical. The CSF represents the upper 95 percent confidence interval of the slope of the dose response curve. The 95 percent upper confidence interval value ensures a safety factor to protect the most sensitive receptors.

6.4.1.1 Unit Risk Conversions

In cases where available carcinogenic toxicity values were presented as inhalation unit risks (expressed as the inverse of micrograms per cubic meter $(\mu g/m^3)^{-1}$) or drinking water unit risks (expressed as the inverse of micrograms per liter $(\mu g/L)^{-1}$), the following conversion method was used (WAC 173-340-708):

$$\text{Inhalation Slope Factor (mg/kg-day)}^{-1} = \frac{\text{Air Unit Risk } (\mu g/m^3)^{-1} \times 70 \text{ kg} \times 10^3\ \mu g/mg}{20\ m^3/\text{day}}$$

$$\text{Oral Slope Factor (mg/kg-day)}^{-1} = \frac{\text{Water Unit Risk } (\mu g/L)^{-1} \times 70 \text{ kg} \times 10^3\ \mu g/mg}{2L/\text{day}}$$

The following default assumptions are incorporated as parameters for these equations:

- Body weight of 70 kilograms
- Inhalation rate of 20 cubic meters per day (m^3/day)
- Water ingestion rate of 2 liters per day (L/day)

Where an absorption fraction of less than 1.0 was applied in deriving the unit risk, an additional conversion factor was necessary so that the slope factor was based on an administered dose. The standardized duration assumption for slope factors is continuous lifetime exposure.

6.4.2 Noncarcinogenic Effects of COPCS

The reference dose (RfD) is the toxicity value used to quantitatively express the potential for a chemical to produce chronic noncarcinogenic effects. The RfD is expressed in units of mg/kg-day and represents a daily intake of contaminant per kilogram of body weight that is not sufficient to cause the threshold effect of concern for the contaminant. Exposure doses that are above the RfD, or the threshold dose for noncarcinogens, could potentially cause adverse health effects.

The RfD is usually based on a no-observable-adverse effect-level (NOAEL) derived from animal studies. An uncertainty factor (UF) is typically incorporated into the RfD, resulting in a reduction in the numerical value (i.e., resulting in a more conservative toxicity value). The uncertainty factor is intended to account for uncertainties associated with (1) the extrapolation of dose-response data from animal studies to humans (2) the existence of sensitive subpopulations within the human population and (3) the quality of the laboratory study and database from which the dose response information is derived.

Uncertainty factors are typically applied to NOAELs and LOAELs as follows (USEPA, 1989d):

- A UF of up to ten may be used to account for variations in the general population in order to protect sensitive subgroups (i.e., the elderly and children).

- A UF of ten may be used when extrapolating from animals to humans to account for interspecies variability.

- A UF of ten may be used when a NOAEL is derived from a subchronic, rather than a chronic, study.

- A UF of ten may be used when the critical value is a LOAEL to account for the uncertainty associated with extrapolation to a NOAEL value.

In addition to the UFs listed above, a modifying factor (MF) is often used in calculating the RfD. An MF ranging from 0 to 10 can be included to reflect a qualitative professional assessment of additional uncertainties in the critical study as well as the available database. The default value is 1.

The equation to calculate the RfD is as follows:

$$RfD = \frac{NOAEL\ OR\ LOAEL}{UF_1 \times UF_2 \ldots \times MF}$$

Where:

RfD	=	Reference dose (mg/kg-day).
NOAEL	=	No-observable-adverse-effect-level (mg/kg-day).
LOAEL	=	Lowest observed adverse effect level (mg/kg-day).
UF_n	=	Uncertainty factor.
MF	=	Modifying factor.

Confidence in the RfD is judgmental, based on USEPA review groups and the supporting quality of the database. Chemical-specific RfDs do not account for the potential effects of chemical mixtures.

6.4.3 Chemical-Specific Assumptions

Modeled exposure doses were compared to toxicity values established for cancer and noncancer endpoints in order to evaluate risks to each receptor. The toxicity values used in the baseline risk assessment are presented in Table 6.53. Oral and inhalation toxicity values were generally available for most chemicals identified. Dermal toxicity values, however, have not been established by the USEPA. For evaluating estimated exposure doses for the dermal pathway, oral toxicity values were used without modification.

Following are chemical-specific assumptions that were used in the toxicity assessment for the Moses Lake Wellfield Superfund Site.

6.4.3.1 Lead Assessment

Currently there are no toxicity values (i.e., CSFs or RfDs) available for the quantitative evaluation of potential human health impacts associated with exposures to lead in soils. Potential human health effects resulting from lead exposure are evaluated by comparing modeled blood-lead concentrations to a generally accepted blood-lead criterion of ten micrograms per deciliter (µg/dl). In support of such an evaluation, the USEPA has

developed several risk models including the *Integrated Exposure Uptake Biokinetic (IEUBK) Model* for the evaluation of residential exposures to lead and the *Technical Review Workgroup (TRW) for Lead Approach for Non-Residential Exposures to Lead* (USEPA, 1996c) for non-residential exposures. As described in the Section 6.3.1.1, all PSAs containing lead as a COPC are included within the future land use zone designated commercial/industrial by the *Grant County Airport Master Plan* (Grant County, 1994). Therefore, potential human exposures to lead associated with PSAs containing lead as a COPC are non-residential in nature. Consistent with the non-residential nature of potential lead exposures at the Moses Lake Wellfield Superfund Site, the USEPA's *Technical Review Workgroup (TRW) for Lead Approach for Non-Residential Exposures to Lead* (USEPA, 1996c) was used to evaluate potential human health effects associated with lead.

Consistent with USEPA's TRW approach, soil-lead concentrations were used to calculate a blood-lead concentration estimate for an adult receptor (i.e., commercial/industrial worker or trespasser) in units of micrograms of lead per deciliter of blood (µg/dl). Blood-lead estimates were calculated according to the following equation (USEPA, 1996c).

$$PbBadult = PbB0 + (PbS \times BKSF \times IRs \times AFs \times EF)/AT$$

Where:

PbBadult	=	Estimate of blood lead concentration in exposed adults (µg/dl)
PbB0	=	Typical blood lead concentration in workers in the absence of site exposure (1.7 µg/dl)
PbS	=	Lead concentration in soil (µg/g)
BKSF	=	Biokinetic slope factor (0.4 µg-lead/dl-blood per µg-lead/day)
AFs	=	Absolute gastrointestinal absorption fraction for ingested lead from soil (0.12, unitless)
		EF = Exposure frequency (days/year)
		AT = Averaging time (days/year)

The input parameters to the model were as defined above, with the exception of the exposure frequency (EF) and averaging time (AT), which are identified in Table 6.51 for individual exposure scenarios. The results of the blood-lead estimate (in units of µg/dl) were compared to an acceptable blood-lead screening criterion of ten µg/dl (USEPA, 1996c).

6.4.3.2 Trichloroethene Assessment

As described in Section 6.3.3.1, current residential receptors and commercial/industrial workers could be exposed to trichloroethene in soil, above ground ambient air, and groundwater. Exposures were quantitatively evaluated for commercial/industrial workers present in portions of the study area designated for commercial/industrial land use, and for residential receptors in areas that are designated for other than commercial/industrial land use. The USEPA is currently in the process of finalizing a health effects reassessment for

trichloroethene. The draft document, *Trichloroethene Health Risk Assessment: Synthesis and Characterization (External Review Draft)* was published in the NCEA Database September 19, 2001. The USEPA's draft reassessment concludes that trichloroethene exposure is associated with several adverse health effects including neurotoxicity, immunotoxicity, developmental toxicity, liver toxicity, kidney toxicity, endocrine effects, and several forms of cancer. In addition, the draft reassessment characterizes trichloroethene as "highly likely to produce cancer in humans."

Because the USEPA's draft reassessment for trichloroethene is in the draft external review stage and the corresponding toxicity values included therein are likely to undergo revision, the Department of Defense (DoD) recommends against use of draft reassessment values at this time. The Seattle District has decided to use the old NCEA toxicity values for TCE in the risk assessment. Therefore, the previous cancer and noncancer toxicity values withdrawn from IRIS were used to evaluate risks associated with this chemical. Pending finalization of USEPA's toxicity reassessment for trichloroethene, risks associated with trichloroethene may be reevaluated during future RI/FS activities for the Moses Lake Wellfield Superfund Site, as appropriate.

6.4.3.3 TPH Assessment

Petroleum mixtures measured as TPH were analyzed using the Ecology Northwest Total Petroleum Hydrocarbon – Hydrocarbon Identification (NWTPH-HCID) method (Ecology, 1997a). Currently, there is no universally accepted method available for evaluating the potential health effects associated with exposures to TPH. Available methods include (1) the evaluation of specific toxic indicator compounds of petroleum mixtures such as benzene, ethylbenzene, toluene, and xylenes (BTEX) and polynuclear aromatic hydrocarbons (PAHs); (2) toxicity information developed for petroleum products including gasoline, jet fuel, or diesel; (3) toxicity values developed for petroleum components that are chemically and toxicologically representative of other components; and (4) toxicity values developed for a surrogate mixture that is toxicologically similar to the petroleum hydrocarbon mixture to which human or ecological receptors are potentially exposed. Toxicity values have been developed for neat petroleum products and for surrogate petroleum fractions. The USEPA's Superfund Health Risk Technical Support Center (USEPA, 1992c) developed RfDs for several petroleum mixtures including gasoline, JP-4, JP-5, and diesel. Staats, et al. (1997) conducted a comprehensive review of the open literature, including studies used by the Total Petroleum Hydrocarbon Work Group (TPHCWG, 1997) and the Massachusetts Department of Environmental Protection (MDEP, 1994) to refine the RfDs for these mixtures by including more recent data that was not available to the USEPA and developed RfDs for additional mixtures. Because they are based on more complete information, the RfDs developed by Staats et al. (1997) for gasoline, marine diesel, and mineral oil were used in the evaluation of potential health hazards associated with human exposures to gasoline-Gx, diesel-Dx, and Oilm-Dx, respectively.

One potential concern with evaluating the health hazards associated with TPH as described above is that petroleum indicator compounds including PAHs were also analyzed for PSAs. Consequently, there is the potential for overestimation of risk due to quantifying exposures for certain petroleum constituents twice. In order to avoid this

potential problem, the risks associated with indicator compounds (e.g., BTEX and PAHs) were included in cumulative risk and hazard estimates for each PSA, while the health hazards associated with TPH were evaluated and reported separately.

6.4.3.4 PCB Assessment

Polychlorinated biphenyls (PCBs; commonly known as Aroclors) were evaluated for their potential to elicit potential carcinogenic and noncarcinogenic effects. Carcinogenic effects were evaluated using the most recent slope factor for PCBs, as reported in the USEPA's IRIS Database (USEPA, 2003). Recent guidance from USEPA (1996b) recommends different slope factors depending upon the exposure route and chlorine content of the PCB mixture. For this assessment, the most conservative oral CSF reported in IRIS, 2 $(mg/kg\text{-}day)^{-1}$, was used to assess potential cancer risks for both Aroclor 1254 and Aroclor 1260. Also for this assessment, the most conservative inhalation CSF reported in IRIS, 0.4 $(mg/kg\text{-}day)^{-1}$, was used to assess potential cancer risks for both Aroclor 1254 and Aroclor 1260. Noncarcinogenic effects were evaluated using the current RfD for Aroclor 1254, as cited in IRIS (USEPA, 2003). The USEPA's IRIS Database does not currently contain oral or inhalation RfDs for Aroclor 1260. Therefore, oral and inhalation RfDs for Aroclor 1254 were used as surrogate values for Aroclor 1260.

6.4.3.5 PAH Assessment

The carcinogenic potential of polynuclear aromatic hydrocarbons (PAHs) was evaluated using the toxicity equivalency factor (TEF) approach described in USEPA's *Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons* (USEPA, 1993a). The TEF approach assigns toxicity values to carcinogenic PAHs based on their estimated carcinogenic potency relative to benzo(a)pyrene. Benzo(a)pyrene is assigned a TEF of 1.0 because it is assumed to be the most potent of the carcinogenic PAHs. Other carcinogenic PAHs are assigned a TEF ranging from 1.0 to 0.001, depending upon their carcinogenic potency relative to benzo(a)pyrene. The CSFs for carcinogenic PAHs based on the TEF approach are presented in Table 6.53. It should be noted that benzo(g,h,i)perylene is not considered by the USEPA to be carcinogenic, nor are noncarcinogenic toxicity values (i.e., oral RfDs or inhalation RfCs) available for this chemical. Consequently, the potential noncarcinogenic hazard associated with this COPC was evaluated using another noncarcinogenic PAH compound, naphthalene, as a surrogate. Available oral and inhalation noncarcinogenic toxicity values for naphthalene were used to evaluate benzo(g,h,i)perylene, as indicated in Table 6.53.

6.4.4 Toxicity Information Sources

The primary sources of toxicity values used in the baseline HHRA for the Moses Lake Wellfield Superfund Site were as follows:

- IRIS Database (USEPA, 2003)
- National Center for Environmental Assessment (USEPA, 2001c) peer reviewed toxicity values developed by the Superfund Health Risk Technical Support Center (SFTSC)

- Other sources (Cal-EPA, ATSDR's MRLs, HEAST (1995a))

6.5 RISK CHARACTERIZATION

This section presents the methods and results of the risk characterization performed for the Moses Lake Wellfield Superfund Site. Risk characterization involves the integration of exposure estimates developed as part of the exposure assessment with dose-response information (toxicity values) developed as part of the toxicity assessment. The result is a quantitative estimate of the likelihood of chronic health effects, in the form of carcinogenic risks or noncarcinogenic hazards. The carcinogenic risk estimate is based on the premise that carcinogenicity is a non-threshold effect (i.e., that even at the lowest dose there is some potential to develop carcinogenic effects). In contrast, the noncarcinogenic hazard estimate is based on the premise that for noncarcinogens there is a threshold dose below which adverse health effects will not occur.

6.5.1 Methods

Following are the methods that were used in the evaluation of carcinogenic risks and noncarcinogenic hazards for PSAs and groundwater associated with the Moses Lake Wellfield Superfund Site.

6.5.1.1 Carcinogenic Risks

Baseline human health risks were evaluated separately for carcinogenic effects and noncarcinogenic effects. The incremental lifetime cancer risk (ILCR) is an estimate of the increased risk of cancer due to lifetime exposure, at apportioned average daily doses, to constituents detected in each medium at the site. Carcinogenic risk estimates were calculated as the product of the exposure dose and the carcinogenic toxicity value, the CSF (USEPA, 1989d).

The equation for calculating carcinogenic risks is as follows:

$$\text{ILCR (unitless)} = \text{CSF} \times \text{Dose}$$

where:

CSF = Cancer slope factor (mg/kg-day)-1
Dose = Exposure dose (mg/kg-day)

Cancer risks from multiple COPCs were assumed to be additive, and were summed to estimate a total cumulative ILCR for all carcinogenic site contaminants. The resulting risk estimates are an indication of the increased risk, above that applying to the general population, which may result from the exposures assumed for each scenario. The risk estimate is an upper bound estimate of risk, because of the protective assumptions used in the development of toxicity values and exposure estimates. Therefore, it is probable that the actual risks associated with potential exposures to site contaminants are lower than estimated risks.

6.5.1.2 Noncarcinogenic Hazards

To evaluate noncarcinogenic health effects due to potential exposures to site COPCs, a HQ was calculated for each COPC. The HQ was calculated as the ratio of the exposure dose to the RfD (USEPA, 1989d).

The equation for calculating noncarcinogenic hazards is as follows:

$$HQ\ (unitless) = \frac{Dose}{RfD}$$

where:

Dose = exposure dose (mg/kg-day)
RfD = reference dose (mg/kg-day)

A HQ greater than 1.0 indicates that the estimated exposure dose for that COPC may exceed acceptable health-protective levels for noncarcinogenic effects. Although an HQ of less than 1.0 suggests that noncarcinogenic health effects should not occur, an HQ of slightly greater than 1.0 is not necessarily an indication that adverse effects will occur.

Individual HQs for site COPCs having similar endpoints or target organs are typically summed to produce a total cumulative HI. If the total HI estimate is less than 1.0, then no noncarcinogenic chronic health effects are expected to occur. If the total HI estimate is greater than 1.0, then adverse health risks are considered possible. In the event of a total HI estimate greater than 1.0, however, noncarcinogenic COPCs will be grouped according to target organ response, and target organ-specific HI estimates will be recalculated.

Sites with an estimated cumulative cancer risk between 10^{-6} and 10^{-4} and a noncancer HI less than 1.0 are within USEPA's generally acceptable risk range and may be considered for No Further Characterization (USEPA, 1991c). Sites that are associated with a cumulative cancer risk or noncancer HI greater than these criteria are generally considered for further action including potential evaluation of remedial alternatives (USEPA, 1991c).

6.5.1 Results

Results of the risk characterization performed for the Moses Lake Wellfield Superfund Site are described in this section. Risk characterization results for PSAs are described in Section 6.5.2.1, and results for groundwater are presented in Section 6.5.2.2.

6.5.2.1 Potential Source Areas

The risk characterization for PSAs included an evaluation of soil sampling results and soil gas sampling results. In order to avoid the potential for overestimation of risks due to double counting of COPC concentrations in soil and soil gas, risk estimates for each medium were calculated separately, as described in the following subsections. The highest risks associated with soil and soil gas sampling results are summarized in Table 8.2, in Section 8.

With the exception of Site 6a, arsenic concentrations detected in PSA soils were determined to represent ambient conditions (refer to Section 6.2.2.4). Soil arsenic levels in the range of ambient concentrations frequently result in estimated cancer risk estimates in excess of the MTCA cancer risk criterion of 1×10^{-5}. Uncertainties in the assumption that most arsenic detections in PSA soils represent ambient conditions are discussed in Section 6.6.2.

Risk Estimates Based on Soil Sampling Results

Carcinogenic risk and noncarcinogenic hazard estimates for soils associated with PSAs are summarized in Table 6.54 and are discussed below. Detailed calculations for individual PSAs and receptors are presented in Appendix G.

Site 6 (6a - Base Closure Landfill and 6b - Dumpster Wash Area)

Consistent with the CSM presented in Section 6.3.3.1, current and potential future receptors for Site 6 are limited to trespassers. The total cumulative cancer risk and noncancer hazard estimates for hypothetical trespassers exposed to Site 6 soils were 2.8×10^{-5} and 0.4, respectively, as shown in Table 6.54. The sole contributor to the cancer risk estimate was arsenic, present in a sample collected from Site 6a soils at a maximum detected concentration of 94 mg/kg. The maximum detected concentration of arsenic exceeded the estimated 95/95 BUTL for arsenic in site-wide soils of 5.4 mg/kg (refer to Section 6.2.2.4.1). Although the cancer risk and noncancer HI estimate for Site 6a soils are within USEPA's generally acceptable cancer risk range of 10^{-6} to 10^{-4}, and HI less than 1.0, the cancer estimate exceeds the acceptable MTCA carcinogenic risk of 10^{-5}. Blood-lead concentrations for a hypothetical trespasser estimated using USEPA's TRW approach were below 10 µg/dl, based on a maximum detected lead concentration of 1,900 mg/kg.

Site 8 (Randolph Road Base Dump)

Concentrations of all analytes detected in Site 8 soils were below chemical-specific COPC screening criteria, as shown in Table 6.7; consequently, risk and hazard estimates were not calculated for this site.

Site 11 (Fire Training Area - Burn Pit A)

No carcinogenic COPCs were identified for Site 11 soils, and cumulative HI estimates for commercial/industrial workers and future construction workers were well below the acceptable HI criterion of 1.0. Concentrations of Diesel-Dx up to 1,600 mg/kg and Oilm-Dx up to 14,000 mg/kg exceeded the MTCA-A Cleanup Level for Soil – Protection of Drinking Water criteria for Diesel-Dx of 2,000 mg/kg and Oilm-Dx of 2,000 mg/kg.

Site 12 (Motor Pool Drain Areas)

Current and potential future receptors for Site 12 include commercial/industrial workers and future construction workers. The only carcinogenic COPC identified for Site 12 soils was benzo(a)pyrene which resulted in an incremental lifetime cancer risk of 9.5×10^{-7} and

1.0 x 10^{-7} for commercial/industrial workers and construction workers, respectively. Both risk estimates are below the acceptable ILCR criterion. Cumulative HI estimates for commercial/industrial workers and future construction workers were well below the acceptable HI criterion of 1.0.

Site 14 (8-Place Hangar)

Concentrations of all analytes detected in Site 14 soils were below chemical-specific COPC selection criteria, as shown in Table 6.10, consequently, risk and hazard estimates were not calculated for this site.

Site 15 (8-Place Hangar Ditch)

Concentrations of all analytes detected in Site 15 soils were below chemical-specific COPC selection criteria, as shown in Table 6.11; consequently, risk and hazard estimates were not calculated for this site.

Site 17 (3-Place Hangar - Building 5801)

Consistent with the CSM presented in Section 6.3.3.1, Site 17 is paved or covered in concrete. Therefore, direct exposure pathways for this site are only complete for future construction workers. The total cumulative cancer risk and noncancer hazard estimates for future construction workers exposed to Site 17 soils were 1.5 x 10^{-6} and 0.06, respectively, as shown in Table 6.54. These cancer risk and noncancer HI estimates are within USEPA's generally acceptable cancer risk range of 10^{-6} to 10^{-4} and HI of 1.0. In addition, these estimates are below the acceptable MTCA carcinogenic risk and noncarcinogenic HI criteria of 1.0 x 10^{-5} and 1.0, respectively.

Site 18 (Paint Hangar - Building 5825)

Current and potential future receptors for Site 18 include commercial/industrial workers and future construction workers. The total cumulative cancer risk and noncancer hazard estimates for commercial/industrial workers exposed to Site 18 soils were 3.1 x 10^{-6} and 0.2, respectively, as shown in Table 6.54. Total cumulative cancer risk and noncancer hazard estimates for potential future construction workers were 3.3 x 10^{-7} and 0.6, respectively. The sole contributor to the cancer risk estimates for commercial/industrial workers and future construction workers was Aroclor 1260, present in soils at a maximum detected concentration of 2.1 mg/kg. However, these cancer risk and noncancer HI estimates are below USEPA's generally acceptable cancer risk range of 10^{-6} to 10^{-4} and HI of less than 1.0. In addition, these estimates are below the acceptable MTCA carcinogenic risk and noncarcinogenic HI criteria of 10^{-5} and 1.0, respectively. Lead was detected in Site 18 soils at a maximum concentration of 860 mg/kg. However, blood-lead concentrations for commercial/ industrial workers and future construction workers estimated using USEPA's TRW approach were below ten µg/dl.

Site 19 (Liquid Oxygen Generating Plant - Building 5102)

Consistent with the CSM presented in Section 6.3.3.1, direct exposure pathways for Site 19 are only complete for future construction workers. No carcinogenic COPCs were identified for this site. The total noncancer hazard estimate for future construction workers was 0.000002, as shown in Table 6.54. This noncancer HI estimates below USEPA's generally acceptable noncancer HI of less than 1.0. In addition, this estimate is below the acceptable MTCA noncarcinogenic HI criterion of 1.0.

Site 20 (South Base Dump)

Concentrations of all analytes detected in soil samples collected from this site were below COPC selection criteria with the exception of lead, as shown in Table 6.14. Lead was detected at a maximum concentration of 5,700 mg/kg. Consistent with the CSM presented in Section 6.3.3.1, the only potential receptor identified for this site is a potential trespasser. The estimated blood-lead concentration for a hypothetical trespasser using USEPA's TRW approach was below ten µg/dl.

Site 22 (Paint Hangar Leach Pit)

Current and potential future receptors for Site 22 include commercial/industrial workers and future construction workers. The total cumulative cancer risk and noncancer hazard estimates for commercial/industrial workers exposed to Site 22 soils were 9.5×10^{-6} and 0.6, respectively, as shown in Table 6.54. Total cumulative cancer risk and noncancer hazard estimates for potential future construction workers were 1.0×10^{-6} and 2, respectively. The primary contributor to the carcinogenic risk and noncarcinogenic HI estimates was Aroclor 1254, detected at a maximum concentration of 8.1 mg/kg. Gro-Gx was detected at a maximum concentration of 150 mg/kg in soils, and was associated with a noncarcinogenic HI of 0.0003 for commercial/industrial workers and 0.0009 for future construction workers. All cancer risk estimates are within USEPA's generally acceptable cancer risk range of 10^{-6} to 10^{-4}. In addition, the cancer risk estimates are below the acceptable MTCA carcinogenic risk criterion of 1.0×10^{-5}. However, the noncarcinogenic HI estimate for construction workers slightly exceeds the USEPA and MTCA acceptable HI criterion of 1.0. In addition, lead detected at a maximum concentration of 1,200 mg/kg was associated with an estimated blood-lead concentration of 12 µg/dl for construction workers. This blood-lead estimate exceeds USEPA's blood-lead criterion of ten µg/dl.

Site 31 (19th Avenue Base Dump)

Concentrations of all analytes detected in Site 31 soils were below chemical-specific COPC screening criteria, as shown in Table 6.17; consequently, risk and hazard estimates were not calculated for this site.

Site 33 (Runway 32 Landfill)

Concentrations of all analytes detected in Site 33 soils were below chemical-specific COPC screening criteria, as shown in Table 6.18; consequently, risk and hazard estimates were not calculated for this site.

Site 35 (Stained Soil Area)

No carcinogenic COPCs were identified for Site 35 soils; therefore carcinogenic risk estimates were not calculated for this site. Petroleum hydrocarbons including Gro-Gx, Diesel-Dx, and Oilm-Dx were retained as COPCs for soil. Noncarcinogenic HI estimates for commercial/industrial workers and future construction workers potentially exposed to these petroleum hydrocarbons were 0.2 and 0.4, respectively. These noncarcinogenic HI estimates are below the USEPA and MTCA acceptable HI criterion of 1.0. Concentrations of GRO-Gx up to 110 mg/kg, Diesel-Dx up to 16,000 mg/kg and Oilm-Dx up to 31,500 mg/kg exceeded the MTCA-A Cleanup Level for Soil – Protection of Drinking Water criteria for GRO-Gx of 100 mg/kg, Diesel-Dx of 2,000 mg/kg and Oilm-Dx of 2,000 mg/kg. In addition, visible petroleum hydrocarbon staining of soils is present at this site.

Risk characterization results for soils for all sites are summarized in Table 6.54.

Risk Estimates Based on Soil Gas Sampling Results

As described in Section 6.3.5.1, potential human health risks based on soil gas sampling results were evaluated using the Johnson & Ettinger Model (USEPA, 2000a). Potential human health risks for all PSAs based on soil gas sampling results were evaluated for a commercial/industrial worker scenario. The Johnson & Ettinger Model evaluates risks associated with indoor air exposures to volatile chemicals derived from the subsurface. Of the three exposure scenarios identified for the future industrial land use area, only commercial/industrial workers are anticipated to have prolonged exposures to indoor air. Therefore, evaluation of human health risks for commercial/industrial workers is protective of all potential exposure scenarios within the industrial land use zone.

Carcinogenic risk and noncarcinogenic hazard estimates for PSAs based on soil gas sampling results are summarized in Table 6.55, and discussed below.

For all potential sites with the exception of Site 19, carcinogenic risk and noncarcinogenic hazard estimates for commercial/industrial workers exposed to COPCs in indoor air derived from soil gas were below 10^{-6} and 1.0, respectively. For Site 19, upper bound carcinogenic risk and noncarcinogenic hazard estimates were 1.1×10^{-6} and 0.0003, respectively. The primary contributor to the carcinogenic risk estimate for Site 19 was trichloroethene, detected at a maximum concentration of 1,000 ppbv in soil gas collected at a depth of 5 ft bgs. The carcinogenic risk and noncarcinogenic hazard estimates for Site 19 are within USEPA's generally acceptable cancer risk range of 10^{-6} to 10^{-4} and HI of less than 1.0, as shown in Table 6.55. In addition, these estimates are below the acceptable MTCA carcinogenic risk and noncarcinogenic HI criteria of 10^{-5} and 1.0, respectively.

6.5.2.2 Groundwater

As described in Section 6.3.4.1, groundwater-related risks were evaluated based upon groundwater hydrostratigraphic flow units for single wells or well clusters. The major groundwater flow units are comprised of the Hanford and Ringold Formation and the

Wanapum Formation. Furthermore, COPC screening and risk estimates performed for the Wanapum Formation were conducted assuming (1) the Priest Rapids and Roza members are separate flow units or (2) the Priest Rapids and Roza members are combined as one groundwater flow unit. Risk estimates for each of these conceptual hydrologic models are presented in Table 6.56 and 6.57.

For all monitoring wells or well clusters evaluated in the baseline HHRA, with the exception of Roza Cluster #1b and Priest Rapids/Roza Combined Cluster #1b, carcinogenic risk and noncarcinogenic hazard estimates were within USEPA's acceptable risk range of 10^{-6} to 10^{-4} and HI equal to 1.0. In addition, these risk and hazard estimates were below the MTCA risk and hazard criteria of 10^{-5} and 1.0, respectively. The estimated excess noncancer HI (18) for Roza Cluster #1 and Priest Rapids/Roza Combined Cluster #1 was attributable to acetone detections in well 02-BW02, as shown in Tables 6.56 and 6.57. Acetone is a common laboratory contaminant, however confirmation samples confirmed that the maximum detected concentration of 19 mg/L is an accurate measurement of acetone in well 02-BW02. The potential source of acetone in 02-BW02 is not currently known, but this chemical has not previously been identified as a significant contaminant in groundwater associated with the Moses Lake Wellfield Superfund Site. It is possible that this chemical was introduced as a contaminant during construction of Well 02-BW02, or from a non-site-related source. Although a source of acetone to groundwater collected from well 02-BW02 has not been identified, it was included in the baseline risk assessment.

Arsenic was detected in groundwater samples collected from all hydrostratigraphic units, but was excluded as a COPC for groundwater based upon ambient considerations (Section 6.2.2.4). Arsenic levels in the range of ambient concentrations frequently result in estimated cancer risk estimates in excess of the MTCA cancer risk criterion of 10^{-5}. Uncertainties in the assumption that arsenic detections in site groundwater represent ambient conditions are discussed in Section 6.6.2.

Based upon the risk estimates presented in this HHRA, concentrations of TCE in groundwater associated with the site are not anticipated to pose a significant risk to human health. It should be noted, however, that concentrations of TCE in numerous wells associated with the site exceed the federal and State drinking water standard of 5.0 µg/l, which is a recognized ARAR. Evaluation of the compliance of TCE and other chemicals with ARARs will be conducted during the FS. Chemicals and media that are demonstrated not to be in compliance with ARARs as a result of this evaluation will be considered further in the FS as part of the remedial measures study. Appropriate remedial decisions concerning such chemicals and media will be made based upon the results of this study.

6.6 UNCERTAINTY ANALYSIS

The presence of uncertainty is inherent in the risk assessment process. Generally, uncertainties in risk assessment typically result from limitations in the available methods, information, and data used in the following:

- Characterization of contaminant sources

- Identification of site COPCs
- Evaluation of potential exposure scenarios and pathways
- Toxicity assessment
- Risk characterization

The uncertainties associated with each of these steps as they relate to the baseline HHRA for the Moses Lake Wellfield Superfund Site are described in the following subsections.

6.6.1 Characterization of Contaminant Sources

There is a degree of uncertainty in the characterization of contaminant sources, since it is not possible to sample an entire site. The site investigations for the Moses Lake Wellfield Superfund Site were based on site histories, known or suspected releases, and physical characteristics (e.g., the presence of waste materials or topographic anomalies). The nature of these site investigations focused on known or suspected sources of contamination. A supplemental RI was conducted in 2002 to address uncertainties in the site characterizations that included additional soil sampling and soil gas collection at landfills and other PSAs, and installation of additional monitoring wells downgradient of suspected PSAs of contamination to groundwater. Based on the 2002 supplemental RI, no additional sources of trichloroethene contamination were identified. While it is believed that sufficient groundwater monitoring was conducted to characterize the general nature and extent of contamination in groundwater associated with the site, it was not feasible to sample all groundwater locations. Therefore, it is possible that areas not sampled may also contain trichloroethene or other chemical contaminants. One area of potential uncertainty identified in the HHRA involves possible levels of trichloroethene in groundwater in the area of potential communication between the groundwater and Moses Lake. This data gap potentially affects the accuracy of the qualitative assessment of risks for human receptors using Moses Lake. As described in Section 6.2.2.5, however, potential surface water exposure pathways (e.g., subsistence or recreational uses) for Moses Lake are believed to be incomplete or will result in insignificant exposures.

In regard to the sampling investigations conducted for each PSA, it is possible that areas not sampled may have also contained contaminants. In addition, the PSA investigations were targeted with respect to contaminant types, and not all chemicals were analyzed at each PSA. Therefore, it is possible that chemicals could have been present in PSA soils that were not analyzed. However, sample locations and analytical suites were generally chosen such that they represented the greatest potential to detect contaminants.

The only site demonstrated to be a potential source of TCE contamination to groundwater was the LOX Plant (Site 19). The septic tank, sump, associated piping and impacted soils were removed in January 2001. Immediately following the source removal action, a total of 61 ASG samples (including duplicate samples) were collected at 31 locations throughout the site. At four of the locations, samples were collected at multiple depths. Detectable levels of TCE ranging from 1.1 to 120,000 ppbv were reported in 57 of the 61 samples. The highest concentrations of TCE were present at 20 feet bgs, with decreasing concentrations above and below this depth. The highest concentrations were located immediately surrounding and to the west of the former septic tank location. Additional investigations were conducted in 2002 with a total of 62 ASG samples (including

duplicates) collected from six tarmac locations, two Site 19 Building locations, nine co-located locations and fourteen multiple-depth locations. Samples were collected at depths ranging from 4 to 40 feet bgs, and TCE was detected at concentrations ranging from 1.4 to 7,300 ppbv. The highest TCE concentration was measured in the middle of the site, near the northern former vault, with decreasing levels occurring distal to this location. Although the lateral extent of contamination at Site 19 is well delineated, there is uncertainty regarding the vertical extent of contamination. Concentrations of TCE generally increased with depth and the maximum concentration of 7,300 ppbv was detected at 40 feet bgs. This maximum concentration was equivalent to a RBSL of 7,300 ppbv derived from the MTCA Method B Protection of Groundwater Level for Soil. As described in Section 4.1, a soil vapor SSL of 7,300 ppbv TCE was developed to determine whether TCE contamination was delineated at a site. Derivation of the soil vapor SSL for TCE was based on the assumption that soil concentrations of a volatile compound are in equilibrium with soil vapor. Uncertainties in this assumption include the soil parameters that were used to model a vapor concentration equivalent to the MTCA-B Soil Concentration for Protection of Groundwater of 0.026 mg/kg, and the use of the Johnson-Ettinger Model to perform this calculation. The more protective of the two MTCA Method B Soil Levels (i.e., the Concentration for Protection of Groundwater equal to 0.026 mg/kg) was assumed. The Johnson-Ettinger Model was then used to estimate the soil vapor concentration in equilibrium with a soil concentration of 0.026 mg/kg, using the 'Upper Bound Risk Estimate Assumptions' soil parameters described in Section 6.3.5.1. Highly protective input assumptions for soil parameters were obtained from site-specific information or values obtained from *Johnson & Ettinger (1991) Model for Vapor Intrusion to Indoor air, 2000 Update* (USEPA, 2002b) and *Draft guidance for Evaluating the Vapor Intrusion to Indoor air Pathway from Groundwater and Soils* (USEPA, 2002b). An uncertainty in the use of the SSL for TCE includes PSAs for which the vertical extent of TCE contamination in soil vapor was not adequately characterized. For Site 19, the potential for TCE concentrations greater than 7,300 ppbv below 40 ft bgs indicate the possibility that TCE in the vadose zone may be impacting groundwater at this PSA. The soil vapor concentration in equilibrium with the MTCA-B Soil Concentration for Protection of Groundwater for TCE was estimated to be 7,300 ppbv. This concentration was assumed as a soil vapor SSL for TCE for use in describing soil gas sampling results for PSAs. (Note: This soil vapor SSL was not used for contaminant screening, or for any other purposes, in the risk assessments included in Sections 6.0 and 7.0 of this report.) It is not known if the observed increasing trend in soil gas concentrations with depth is due to preferential volatilization of TCE contamination near the ground surface, in the vadose zone between 40 feet and first groundwater (approximately 80 ft bgs), or at or within groundwater. Similarly, it is possible that TCE concentrations higher than those detected in the uppermost 40 ft may be present below this depth. For this reason there is uncertainty in the vertical characterization of TCE contamination at Site 19, and in the characterization of risks for this PSA. It is possible that risk estimates and potential impacts to groundwater have been underestimated for this PSA.

6.6.2 Identification of Site COPCs

The process used in the selection of site COPCs may also introduce a degree of uncertainty in the baseline HHRA. However, protective assumptions were used in the selection of site COPCs. Chemicals selected for quantitative evaluation in the HHRA

included all organic chemicals, and inorganic chemicals (other than essential nutrients), detected at concentrations above protective COPC screening criteria. The one exception to the above was arsenic, which was compared to a 95/95 BUTL for soil screening and regional groundwater concentrations developed by the USGS for groundwater screening (refer to Section 6.2.2.4). Statistical evaluation of arsenic concentrations detected in soil and groundwater resulted in a 95/95 BUTL of 5.4 mg/kg arsenic in soil, and a mean range of ambient concentrations in groundwater equal to 6 – 9 µg/L (Section 6.2.2.4). As a result of this evaluation, arsenic was only identified as a COPC in soils at Site 6a and was excluded as a COPC for groundwater. This assumption could potentially have resulted in the underestimation of risks for soil and groundwater at the Moses Lake Wellfield Superfund Site.

As described in Section 6.2.2.5, protective COPC screening criteria for soil and groundwater were used. Furthermore, maximum detected concentrations of carcinogenic chemicals were evaluated based on a chemical-specific target risk level of 1.0×10^{-6}, and noncarcinogenic chemicals were evaluated using a target HQ of 0.1, consistent with USEPA Region 10 policy. To be maximally protective, chemicals without available COPC screening criteria, such as benzo(g,h,i)perylene, were carried into the quantitative baseline risk assessment. All COPCs identified during Tier I screening and carried into the quantitative baseline risk assessment were evaluated in the same manner, consistent with methods described in Section 6.5.1.

6.6.3 Exposure Assessment

Because the exposure assessment is based on the estimation of potential rather than actual exposures, there is a degree of uncertainty in the dose estimate. The evaluation of residential receptors, commercial/industrial workers, and trespassers under hypothetical future land use conditions was included in this HHRA to provide a basis for assessing future exposures and land uses. Potential exposure of all receptors to COPCs in soils to a maximum depth of 15 ft bgs was considered, in accordance with USEPA Region 10 policy. However, it is unlikely that actual exposures to soils approaching this depth would occur. Protective exposure assumptions obtained from established USEPA guidance documents were used to evaluate RME conditions for groundwater and all PSAs. Finally, maximum or 95 percent UCL concentrations were used in estimating exposure doses for all current and hypothetical future receptors. Based on the above considerations, the exposure doses presented in this baseline HHRA are protective.

In comments on the Draft Final RI Report, USEPA Region 10 identified uncertainties in the assumptions and methods that were used to estimate risks associated with vapor intrusion to indoor air. Alternative central tendency assumptions were noted for soil dry bulk density, soil total porosity, soil water-filled porosity, and the indoor air exchange rate. Alternative upper bound assumptions were identified for average soil temperature and indoor air exchange rate. In addition to alternative Johnson & Ettinger modeling assumptions, USEPA Region 10 provided risk estimates based on an assumption that the upper loamy sand layer would be removed during construction of an above-ground structure, and using USEPA's draft revised toxicity values for TCE. Based on these assumptions, USEPA calculated central tendency and upper bound cancer risk estimates for TCE at Site 19 of 2×10^{-4} and 4×10^{-4}, respectively. The Corps does not agree with

the alternate assumptions proposed by USEPA Region 10, or with the use of USEPA's draft revised toxicity values for TCE (as described in Section 6.6.4, below). It is worthwhile to note that when USEPA's draft revised toxicity factors for TCE are replaced by the Corps' assumed toxicity values for TCE, the range of risks based on USEPA's alternate assumptions is 1×10^{-6} to 8×10^{-6}. These cancer risk estimates are clearly below the MTCA cancer risk criterion of 10^{-5}, and are within EPA's 10^{-6} to 10^{-4} cancer risk range. As a result, the Corps does not believe that differences of technical opinion between the Corps and USEPA concerning the vapor intrusion modeling assumptions used in this HHRA will significantly impact risk management decisions for PSAs at the Moses Lake Wellfield Superfund Site.

6.6.4 Toxicity Assessment

There are also sources of uncertainty in the derivation of toxicity values (i.e., CSFs and RfDs) used to quantify risks. Generally, the toxicity values that were used represent upper bound estimates and incorporate uncertainty factors for extrapolation from animal data to humans, differences in individual sensitivity within populations, and the overall confidence in the data set. Furthermore, the use of oral slope factors or oral RfDs for dermal toxicity values do not correct for differences in absorption and metabolism between the oral and dermal routes. Because the toxicity values established by USEPA are based on NOAEL concentrations and incorporate uncertainty factors, they are generally considered to be protective. The use of conservative toxicity values in the risk estimate tends to overestimate actual risks.

As described in Section 6.4.3.2, the USEPA is currently in the process of finalizing a health effects reassessment for trichloroethene. The draft document, *Trichloroethene Health Risk Assessment: Synthesis and Characterization (External Review Draft)* was published in the National Center for Environmental Assessment (NCEA) Database September 19, 2001. The USEPA's draft reassessment concludes that trichloroethene exposure is associated with several adverse health effects including neurotoxicity, immunotoxicity, developmental toxicity, liver toxicity, kidney toxicity, endocrine effects, and several forms of cancer. In addition, the draft reassessment characterizes trichloroethene as "highly likely to produce cancer in humans."

The USEPA's draft reassessment proposes an oral RfD of 3×10^{-4} mg/kg-d and an inhalation RfC of 4×10^{-2} mg/m^3 for the evaluation of noncarcinogenic health effects. A range of CSF values are proposed for evaluating carcinogenic risk, with most ranging between 2×10^{-2} and 4×10^{-1} (mg/kg-d)$^{-1}$. Because the proposed CSF values are higher than those that were used in this HHRA, it is possible that risk estimates for trichloroethene could increase in the event that these values are approved in the final guidance. Pending finalization of USEPA's toxicity reassessment for trichloroethene, risks associated with trichloroethene may be re-evaluated during future RI/FS activities for the Moses Lake Wellfield Superfund Site, as appropriate.

6.6.5 Risk Characterization

The different sources of uncertainty previously described are incorporated in the risk estimate. Because the majority of these uncertainties err on the conservative side, the risk

estimate is considered to be protective. Furthermore, a 1.0 x 10^{-6} risk level does not equate to an actual cancer incidence of one-in-one-million for substances that may cause cancer. The risk assessment process uses animal data to predict the probability of humans developing cancer over a 70-year lifetime. The estimated risks presented in this HHRA represent upper bound estimates; the actual risks are anticipated to be less.

7.0 BASELINE ECOLOGICAL RISK ASSESSMENT

The methods and results of the ERA for the Moses Lake Wellfield Superfund Site are presented in this section. This ERA was conducted in accordance with the CERCLA Remedial Response process, as amended by the SARA. The purpose of the ERA is to evaluate the impacts of contaminants released from the site on potentially exposed ecological habitats and non-human receptors. The results of the ERA, in conjunction with the results of the assessment of public health threats that was presented in Section 6.0, will be used to evaluate whether current concentrations of chemicals present in site media pose an acceptable risk to human health or the environment, or whether further evaluation, including potential remedial action, is warranted.

7.1 INTRODUCTION

The ERA presented in this RI report was conducted in accordance with the methods and procedures described in USEPA's *Guidelines for Ecological Risk Assessment - Final* (USEPA, 1998c), and *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments – Interim Final* (USEPA, 1997b). Refinement of these methods and procedures, as they relate to the Moses Lake Wellfield Superfund Site, was conducted based on discussions between the USEPA, USACE and its contractor, MWH. These methods and procedures are described in the *Management Plan Addendum Remedial Investigation/Feasibility Study Moses Lake Wellfield Superfund Site* (Montgomery Watson, 2000c), *Draft Technical Memorandum Exposure Assessment Methods Moses Lake Wellfield Superfund Site* (MWH, 2001a), and *Draft Technical Memorandum Toxicity Assessment Methods Moses Lake Wellfield Superfund Site* (MWH, 2001b). These discussions and technical memoranda were intended to provide a site-specific analysis of potential impacts to ecological receptors exposed to contaminants released from the site.

The ERA presented in this section includes a description of the "problem formulation" phase, in which biological resources are evaluated and assessment and measurement endpoints are selected; the 'analysis' phase, in which exposures are quantified for representative ecological receptors; the 'effects assessment' phase in which methods for the evaluation of effects of contaminants on representative ecological receptors are selected; and the 'risk characterization' phase, in which ecological hazards are evaluated. The results of the predictive ERA includes a qualitative and a quantitative description of the potential impacts of site-related contaminants on potentially exposed ecological habitats and receptors. The quantitative description of effects is typically presented as an estimate of ecological hazard. According to the USEPA (1998c), a total cumulative hazard less than or equal to 1.0 for representative ecological receptors indicates that adverse ecological effects are unlikely to occur. An ecological hazard estimate greater than 1.0 does not necessarily indicate that effects will occur, but suggests that ecological effects are possible (USEPA, 1998c).

7.1.1 Purpose and Objectives

The purpose of the ERA presented in this RI report is to evaluate the potential hazards associated with exposures of ecological habitats and receptors to chemicals present in soil

and groundwater associated with the Moses Lake Wellfield Superfund Site. The specific objectives of this predictive ERA are to qualitatively and quantitatively evaluate potential hazards for ecological receptors that may be exposed to impacted PSAs and media. The quantitative portion of this evaluation will include estimates of ecological hazard for representative indicator species. The individual steps included in this ERA are consistent with USEPA's *Guidelines for Ecological Risk Assessment - Final* (USEPA, 1998c), as follows:

- Identification of contaminant PSAs, media, and chemicals of ecological concern
- Identification of potentially exposed biological resources and assessment endpoints
- Evaluation of potentially complete exposure pathways between ecological receptors and sources of contaminants
- Identification of appropriate measurement endpoints and potential ecological effects
- Characterization of the potential ecological hazards for representative ecological receptors
- Evaluation of the uncertainties in the predictive ERA

These steps are described in Sections 7.2 through 7.6, below.

7.1.2 Scope

The overall study area for the ERA presented herein includes PSAs located within and adjacent to the boundaries of the former LAFB as well as areas hydraulically downgradient of LAFB that are either known to be impacted or are potentially impacted by chemicals derived from suspected PSAs. Potential downgradient areas that are qualitatively evaluated in this ERA include portions of Grant County located south of LAFB AFB in which trichloroethene and other contaminants have been detected in groundwater and nearby surface water bodies including Crab Creek and Moses Lake. This ERA presents quantitative hazard estimates for the primary medium of concern, soils associated with known or suspected contaminant PSAs, and qualitative evaluations of potential threats to ecological receptors inhabiting surface water bodies located adjacent to, or downgradient of, the Moses Lake Wellfield Superfund Site. The individual PSAs included in the RI and evaluated in this baseline ERA were identified in Section 1.2.

The methods used in the performance and interpretation of this ERA were derived from the following guidance documents:

- Development of Terrestrial Exposure and Bioaccumulation Information for the Army Risk Assessment Modeling System (CH2M Hill, 2001)

- Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites (USEPA, 2002a)
- Region 9 PRGs Table, 2002 Update (USEPA, 2002c)
- Ecological Soil Screening Level Guidance Draft (USEPA, 2000b)
- Surface Impoundment Study – Technical Plan for Human Health and Ecological Risk Assessment (USEPA, 2000c)
- Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Facilities (USEPA, 1999b)
- Bioconcentration of Organics in Beef, Milk, and Vegetation (Travis and Arms, 1998)
- Interim Final Guidance: Developing Risk-Based Cleanup Levels at Resource Conservation and Recovery Act Sites in Region 10 (USEPA, 1998a)
- Guidelines for Ecological Risk Assessment – Final (USEPA, 1998c)
- Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments – Interim Final (USEPA, 1997b)
- Region 10 Supplemental Ecological Risk Assessment Guidance for Superfund, Draft (USEPA, 1997e)
- Risk Assessment Handbook Volume II: Environmental Evaluation (USACE, 1995b)
- Wildlife Exposure Factor Handbook (USEPA, 1993b)
- Region 10 Supplemental Risk Assessment Guidance for Superfund (USEPA, 1991a)

7.1.3 Organization

Section 7.1 – Introduction: Presents a brief overview of the ERA process and describes the purpose and scope of the ERA for the Moses Lake Wellfield Superfund Site.

Section 7.2 – Habitat Assessment and Potential Biological Resources: Identifies the local and regional biological resources in the vicinity of the site. Any special status plant or animal species occurring within the vicinity of the Moses Lake Wellfield Superfund Site are identified, and simplified food webs are presented for terrestrial and riparian receptors.

Section 7.3 – Selection of Chemicals of Potential Ecological Concern: Describes the data analysis process and identifies the chemical contaminants to be evaluated in the predictive ERA.

Section 7.4 – Ecological Problem Formulation: Describes the 'problem formulation' phase of the ERA in terms of the contaminated media, chemical contaminants, contaminant fate and transport, and potentially exposed ecological habitats and receptors. This section presents the ecological conceptual site model and includes the assessment and measurement endpoints that were evaluated for the Moses Lake study area. Also included are methods for the quantification of exposures of ecological receptors to contaminated media.

Section 7.5 – Ecological Effects Assessment: Contains methods describing the process used in the development of toxicity information for use in characterizing risks for each receptor.

Section 7.6 – Ecological Risk Characterization: This section presents the risk characterization methods, and results of the predictive ERA for the Moses Lake Wellfield Superfund Site.

Section 7.7 – Uncertainty Analysis: Describes the uncertainties and limitations associated with the predictive ERA for the Moses Lake Wellfield Superfund Site.

7.2 HABITAT ASSESSMENT AND POTENTIAL BIOLOGICAL RESOURCES

The biological resources (i.e., plants and animals) present or potentially occurring within the vicinity of the Moses Lake Wellfield Superfund Site are described in the following subsections.

7.2.1 Regional Ecology

The Moses Lake Wellfield Superfund Site lies within Washington Department of Fish and Wildlife (WDFW) Region 2 (Figure 7-1). This region is dominated by upland habitat. Subsystems of upland habitat that exist within this region are shrub-steppe ecosystem (Figure 7-2), which characteristically contains shrubs in association with grasses, and Central Arid Steppe, according to the Washington Gap Analysis (WAGAP, 1998). Other habitat types within this region include agricultural, woodland, and lacustrine open water systems (Figure 7-2).

7.2.2 Local Ecology

The Moses Lake Wellfield Superfund Site lies within an area of WDFW Region 2 that is dominated by shrub-steppe habitat, agricultural lands, and aquatic biomes (i.e., lacustrine open water and palustrine wetlands). Lacustrine and palustrine are both wetland systems defined by Washington State Department of Natural Resources. The three primary native habitats that are located within Grant County are upland habitat, lacustrine open water, and palustrine wetlands (Montgomery Watson, September 1999b). Ecosystems occurring within Grant County are documented at:

- Washington State Department of Natural Resources Natural Heritage Program (WNHP), 1999 http://www.wa.gov/dnr/htdocs/fr/nhp/refdesk/fguide/htm/fgmain.htm.

- Washington Natural Heritage Information System, Known High-Quality Plant Communities and Wetland Ecosystems of Washington, State of Washington, Department of Natural Resources http://www.wa.gov/dnr/htdocs/fr/nhp/refdesk/lists/communitiesxco/grant.html. September 2000. (WNHP, 2000)

- Washington Department of Fish and Wildlife (WDFW), 2000a. Species of Concern in Washington State http://www.wa.gov/wdfw/wlm/diversty/soc/soc.htm.

The plant and animal communities present in Grant County are believed to be generally representative of those native habitats occurring within, or potentially impacted by, the former LAFB. However, much of the former LAFB site is comprised of abandoned agricultural lands, rangeland, highly disturbed areas (i.e., landfills and disposal pits), and developed areas. The natural ecosystems present or potentially occurring include the following:

1. **Terrestrial Biomes -** Grant County is composed of plant communities of dwarf-shrub, herbaceous vegetation, shrubland, and some woodland (WNHP, 2000). The plant species associated with these communities are outlined in Table 7.1. In addition, some of the site consists of abandoned agricultural lands. These areas would be characterized as presently in the early successional stage.

    - **Upland Areas** - All non-wetland ecosystems fall under the generalization of upland habitat.

2. **Aquatic Biomes -** The site is bordered on the east by Crab Creek, on the south by Parker Horn and Lewis Horn, and on the southeast by Moses Lake. There is no communication between site groundwater and Crab Creek (Montgomery Watson, 2000c); however, there is the potential for limited communication between site groundwater and Moses Lake. The possibility exists for receptors living in Crab Creek and Moses Lake to utilize the site while foraging, migrating, or fulfilling another life stage. Therefore, wildlife associated with Crab Creek and Moses Lake are included in the following discussion. Within the vicinity of the site lies lacustrine and palustrine wetland systems.

    - Lacustrine Open Water – Lacustrine systems are distinguished by their association with open water bodies such as lakes, reservoirs, and impounded rivers. The lacustrine subsystem found at the site is defined as limnetic. This consists of all deepwater habitats at depths greater than two meters below the average low water level (DNR, 1979).

    - Palustrine Wetlands – This system includes most traditional wetland types in transitional areas such as marshes, bogs, swamps, bottomland forests and small

ponds. This system "includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5percent. It also includes wetlands lacking such vegetation, but with all of the following four characteristics: (1) area less than 8 ha (20 acres); (2) active wave-formed or bedrock shoreline features lacking; (3) water depth in the deepest part of the basin less than 2m at low water; and (4) salinity due to ocean-derived salts less than 0.5 percent" (Cowardin et al., 1979). The palustrine system does not have any subsystems; however many classes of palustrine habitat do exist. Those classes found within the vicinity of the Moses Lake Wellfield Superfund Site are aquatic bed, emergent, forested, open water, scrub-shrub, and unconsolidated shore (USFWS, 2001).

A classification of wetlands and deepwater habitats of the United States is provided in Appendix A.

7.2.2.1 Vegetation

Of the various habitat types in the vicinity of the site, many contain or potentially contain species of concern. Table 7.2 identifies plant species known to occur in Grant County. The table also highlights rare species.

7.2.2.2 Wildlife

- **Mammals -** Coyotes are the most abundant predatory mammal. Jackrabbits, marmots, ground squirrels, muskrats, and a wide variety of mice and shrews also occur (WAGAP, 1998; WDFW, 1999). Table 7.3 outlines mammals known to occur or potentially occur at the site. Also highlighted in the table are state and federally recognized species for protection.

- **Birds -** The area around Crab Creek provides habitat consisting of thousands of small lakes, potholes, and seeps. The water sources around Crab Creek are home to a variety of avian species. The site is also used by many bird species for breeding and foraging grounds. Table 7.4 identifies bird species known to occur or potentially occur at the Moses Lake Wellfield Superfund Site. Some species potentially occurring at the site are listed under state and/or federal protection. Table 7.4 identifies these species.
- **Reptiles and Amphibians -** Many lizards, snakes, and frogs reside in or near the site (WAGAP, 1998; WDFW, 1999). Table 7.5 lists all reptiles and amphibians known to occur or potentially occur at Moses Lake Wellfield Superfund Site.

- **Aquatic Biota -** Bass, perch, sunfish, and crappie exist in the Crab Creek ecosystem, along with stocked rainbow trout. These resources offer fishing opportunities for the community and visitors to the area (WDFW, 1999). The fish present in Moses Lake include species of walleye, rainbow trout, largemouth bass, smallmouth bass, lake whitefish, crappie, bluegill, perch and some panfish (WDFW, 2000b).

Threatened and Endangered Species

Within the site, there potentially exist species listed as state and/or federally endangered, threatened, candidate, sensitive, species of concern, proposed threatened, proposed endangered, and priority for conservation and management. Each species identified to potentially occur at or near the site is identified in Tables 7.2 through 7.5.

Known High-Quality Plant Communities

Washington Natural Heritage Information System has identified known high-quality plant communities and wetland ecosystems of Grant County. These communities and ecosystems are identified in Table 7.1. Figures 7-3 and 7-4 depict the various wetland systems within the vicinity of the site.

7.2.2.3 Simplified Food Webs

Simplified food webs were developed to help identify specific receptors that might be directly or indirectly exposed to contaminants of potential concern and to perform the exposure assessment. These food webs show the major trophic levels present at the site and the webs of interconnecting patterns of consumption. The food webs depict how energy or contaminants may be transferred within an ecosystem (Figures 7-5 and 7-6). A food web was constructed for each of the two ecosystem types present at the site: riparian/freshwater food web and shrub-steppe, upland, food web.

7.3 SELECTION OF CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN

The Chemicals of Potential Ecological Concern (COPECs) that were evaluated in the ERA for the Moses Lake Wellfield Superfund Site are identified in this section. The COPECs for each PSA and media were selected based on the methods and procedures described in *USEPA Region 10 Supplemental Ecological Risk Assessment Guidance for Superfund* (USEPA, 1997e) and *Interim Final Guidance: Developing Risk-Based Cleanup Levels at Resource Conservation and Recovery Act Sites in Region 10* (USEPA, 1998a). These guidance documents specify data quality requirements and screening procedures to be used in the selection of COPCs and COPECs for quantitative evaluation in risk assessment. The data analysis phase in support of the ERA for the Moses Lake Wellfield Superfund Site was conducted identically to that for the HHRA. For a discussion of the methods and requirements applied in the analysis of data for potential inclusion as COPECs, see referred to Section 6.2.1. The screening procedures used in the selection of COPECs are presented in Section 7.3.1, and the results of COPEC screening for each PSA and medium are presented in Section 7.3.2.

7.3.1 Screening Procedures

The screening procedures used in the identification of COPECs for evaluation in the ERA are generally consistent with the methods that were used in the selection of COPCs for the HHRA (refer to Section 6.2.2). The 95/95 BUTL for arsenic that was derived for screening soils during the selection of COPCs for evaluation in the HHRA was also used in the ERA for screening COPECs at individual PSAs. The primary difference between

the COPC and COPEC screening procedures is that soils to a maximum depth of 15 ft bgs were evaluated in the HHRA, while the ERA considered soils to a maximum depth of five ft bgs. This is because burrowing animals do not generally burrow deeper than five feet.

7.3.1.1 Comparison to ARARs, TBCs, or Other Risk-Based Criteria

USEPA Region 10 considers the appropriate criteria for screening COPECs at hazardous waste sites within the State of Washington to be Ecology amended MTCA-A Cleanup Levels (173-340-740 WAC, amended February 12, 2001). MTCA-A Soil Cleanup Levels for Plants, Soil, Biota, and Wildlife (173-340-740 WAC) were used in the identification of COPECs for soil at individual PSAs. The lowest of the three available criteria was selected, and maximum detected analyte concentrations in soil were compared to one-tenth the lowest criterion to account for potential cumulative toxicity. The screening levels used in the selection of soil COPECs for evaluation in the ERA are summarized in Table 7.6.

Soil gas results were not screened for COPECs or quantitatively used in the ERA for the Moses Lake Wellfield Superfund Site. The inhalation pathway is generally not considered in ecological risk assessments, because methods for the evaluation of inhalation exposures for ecological receptors are not currently available (USEPA, 1998c). The potential uncertainties associated with exclusion of this pathway from the quantitative ERA are discussed in the Uncertainty Analysis (Section 7.7).

Potential impacts of trichloroethene and other chemicals in surface water and groundwater on ecological receptors using Crab Creek and Moses Lake are believed to be limited. Surface water originating from the site does not drain to Crab Creek. In addition, there is little potential for communication between site groundwater and Crab Creek in the vicinity of PSAs, consistent with the hydrogeologic conceptual model presented in the *Technical Memorandum Results from Steady-State Numeric Groundwater Model and Transport Simulations* (Montgomery Watson, 2001d). Although there is evidence of possible communication between Crab Creek and groundwater in the northeastern portion of the study area, no identified PSAs are present in this portion of the site. Therefore, potential exposure pathways between PSAs and Crab Creek are currently incomplete. The hydrogeologic conceptual model also indicates that potential communication between groundwater and Moses Lake may exist within the northwestern portion of the study area (Montgomery Watson, 2001d). However, the concentrations of chemicals in groundwater near areas of potential communication with Moses Lake are anticipated to be low, as described in Section 6.2.2.5. It should be noted that there are uncertainties regarding the hydraulic relationship between Moses Lake and groundwater in the northwest portion of the study area. Therefore, conclusions regarding this potential exposure pathway and potential impacts to surface water receptors cannot be made at this time.

Based on the above, COPECs were not identified for quantitative evaluation of potential surface water exposure pathways in the ERA. Uncertainties related to potential impacts of chemicals in groundwater on ecological receptors are further described in Section 7.7.

7.3.2 Results

The results of COPEC screening for soil at individual PSAs are described in the following subsections.

7.3.2.1 Site 6 (6a - Base Closure Landfill and 6b - Dumpster Wash Area)

A number of inorganic analytes detected in soils exceeded chemical-specific ecological screening criteria for this site, including antimony, arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, thallium, and zinc, as shown in Table 7.7. These chemicals were retained as COPECs for evaluation in the ERA.

7.3.2.2 Site 8 (Randolph Road Base Dump)

Soil analytes exceeding chemical-specific ecological screening criteria included cadmium, chromium, copper, lead, mercury, nickel, thallium, and zinc, as shown in Table 7.8. These inorganic chemicals were retained as COPECs for evaluation in the ERA.

7.3.2.3 Site 11 (Fire Training Area - Burn Pit A)

Concentrations of all analytes detected in soil samples collected from this site were below chemical-specific COPEC screening criteria, as shown in Table 7.9. Therefore, no COPECs were retained and a quantitative ERA was not performed for this site. It should be noted, however, that Oilm-Dx at a concentration of 14,000 mg/kg was detected; therefore, this site was qualitatively evaluated in the ERA.

7.3.2.4 Site 15 (8-Place Hangar Ditch)

Inorganic analytes exceeding chemical-specific ecological screening criteria included cadmium, chromium, copper, lead, mercury, nickel, and zinc, as shown in Table 7.10. These chemicals were retained as COPECs for evaluation in the ERA.

7.3.2.5 Site 17 (3-Place Hangar - Building 5801)

A number of inorganic analytes, PAHs, and PCBs exceeded their respective chemical-specific ecological screening criteria, as shown in Table 7.11. Based on ecological screening, all inorganic analytes (with the exception of beryllium), PAHs, and PCBs were retained as COPECs for evaluation in the ERA. It should be noted that Diesel-Dx at a concentration of 260 mg/kg, and Oilm-Dx at a concentration of 440 mg/kg were also detected.

7.3.2.6 Site 19 (Liquid Oxygen Generating Plant - Building 5102)

Cadmium, chromium, copper, lead, manganese, nickel, zinc, trichloroethene, bis-(2-ethylhexyl)phthalate, and 2,4-dimethylphenol exceeded chemical-specific ecological screening criteria, as shown in Table 7.12. The above analytes were retained as COPECs for evaluation in the ERA. Screening criteria were not available for Diesel-Dx and Oilm-Dx; therefore, these constituents were also retained as COPECs.

7.3.2.7 Site 20 (South Base Dump)

Analytes exceeding chemical-specific ecological screening criteria included cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc, as shown in Table 7.13. Therefore, these chemicals were retained as COPECs for evaluation in the ERA.

7.3.2.8 Site 22 (Paint Hangar Leach Pit)

Analytes in soil exceeding chemical-specific ecological screening criteria included cadmium, chromium, copper, lead, mercury, nickel, zinc, and the PCB, Aroclor 1254, as shown in Table 7.14. The above chemicals were retained as COPECs for evaluation in the ERA. Screening criteria were not available for Gro-Gx, Diesel-Dx and Oilm-Dx; therefore, these constituents were also retained as COPECs.

7.3.2.9 Site 31 (19th Avenue Base Dump)

Ecological screening criteria were exceeded by cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc, as shown in Table 7.15. Therefore, these chemicals were retained as COPECs for evaluation in the ERA.

7.3.2.10 Site 33 (Runway 32 Landfill)

Barium, lead and pentachlorophenol concentrations in soil exceeded chemical-specific ecological screening criteria, as shown in Table 7.16. These chemicals were retained as COPECs for evaluation in the ERA. A screening criterion was not available for TPH-Dx; therefore, this constituent was also retained as a COPEC.

7.3.2.11 Site 35 (Stained Soil Area)

Analytes exceeding chemical-specific ecological screening criteria included cadmium, chromium, copper, lead, nickel, and zinc, as shown in Table 7.17. These chemicals were retained as COPECs for evaluation in the ERA. Screening criteria were not available for Gro-Gx, diesel-Dx and Oilm-Dx; therefore, these constituents were also retained as COPECs.

7.4 ECOLOGICAL PROBLEM FORMULATION

This section includes a description of the ‘problem formulation’ phase of the ERA in which the ecological conceptual site model is presented and the assessment and measurement endpoints are identified. Potential ecological concerns for the study area are discussed in terms of contaminated media, specific chemical contaminants, fate and transport pathways, and potentially exposed ecological habitats and receptors. Also included in this section is a description of the ‘analysis phase’ in which exposures are quantified for representative ecological receptors.

These methods were developed in accordance with the USEPA (1998a and 1997e).

7.4.1 Ecological Conceptual Site Model

All of the sites for which soil sampling was conducted were included in COPEC screening (Sections 7.3.1 and 7.3.2). However, much of former LAFB is comprised of abandoned agricultural lands, range lands, highly disturbed areas (i.e., landfills and disposal pits), and developed areas. Most of these areas provide only poor to moderate habitat for ecological receptors. In addition, ecological receptors such as birds are considered a nuisance in the vicinity of the Grant County Airport, due to safety considerations associated with current flight operations. Nevertheless, most of the sites for which COPEC screening was conducted (in particular, the landfills) contain some form of habitat that may potentially be used by ecological receptors and result in potential exposures. The following sites, however, contain little to no potential ecological habitat:

- Site 12 – Motor Pool Drain Areas
- Site 14 – 8-Place Hangar
- Site 18 – Paint Hangar

The above sites are covered by asphalt or concrete and offer no useable habitat for ecological receptors. Consequently, these sites were not further evaluated in the ERA.

For the remaining sites, COPECs identified for soil include metals (e.g., arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc), TCE, several SVOCs e.g., bis-(2-ethylhexyl)phthalate and pentachlorophenol, PAHs, PCBs (e.g., Aroclors 1254 and 1260), and petroleum hydrocarbons. These COPECs have the potential for uptake in the food chain and for resultant impacts on growth, survival or reproduction of terrestrial, avian or mammalian receptors. Consequently, assessment endpoints were developed for terrestrial, avian and mammalian receptors exposed to site COPECs (refer to Section 7.4.2.1). Dietary uptake through food chain transfer of chemicals in soil was identified as a complete exposure route for terrestrial receptors (Figure 7-5). Direct exposures of terrestrial species to contaminants in soil through incidental ingestion and dermal contact are also potentially complete exposure pathways. Methods for evaluating incidental ingestion of contaminants in soil, as well as soil ingestion rates, are available for terrestrial receptors. Therefore, this pathway was quantitatively addressed in the predictive ERA. Methods for the evaluation of dermal exposures for ecological receptors, however, are not well developed. Therefore, the dermal pathway was *qualitatively* addressed in this ERA. It is worth noting, however, that the ingestion pathway is generally the primary exposure pathway for terrestrial species (Suter, 1993).

Volatile chemicals including TCE were detected in soil and soil gas samples collected from the study area. The pathways for inhalation of vapors or non-volatile COPECs (e.g., metals, PAHs) adsorbed to soil particulates may be potentially complete but were judged unlikely to result in significant exposures. Furthermore, methods for the quantitative evaluation of inhalation pathways for ecological receptors are not currently available. Therefore, potential inhalation exposures for ecological receptors were only qualitatively addressed in this ERA.

Water-soluble COPECs such as metals and TCE have the potential to migrate in storm water runoff or leach into groundwater. However, surface water pathways are judged to

be incomplete (e.g., surface water runoff to Crab Creek) or are believed to represent minor exposure potential (e.g., Moses Lake). Surface water originating from the site does not drain to Crab Creek, and there is little potential for communication between site groundwater and Crab Creek in the vicinity of contaminant PSAs, consistent with the hydrogeologic conceptual model. The only contaminant detected in potentially significant concentrations in groundwater was TCE. As described in Section 6.2.2.5, potentially complete exposure pathways exist between TCE in groundwater and aquatic/riparian receptors inhabiting Moses Lake, or terrestrial receptors using Moses Lake as a source of drinking water. However, concentrations of chemicals in groundwater near areas of potential communication with Moses Lake are anticipated to be low because: (1) the relatively low hydraulic gradient between PSAs (e.g., Site 19) and Moses Lake allows considerable time for attenuation of TCE in groundwater; (2) potential groundwater flow volumes into Moses Lake represent only a very small fraction of the total lake volume, and contaminant concentrations would be greatly diluted in this surface water body; (3) ecological exposure would be low because TCE is subject to natural attenuation processes in surface water including volatilization, photochemical oxidation, and hydrolysis; and (4) TCE does not appreciably bioaccumulate in aquatic organisms. An attempt was made to validate these assumptions through the collection and analysis of seep samples in the vicinity of Moses Lake. Only a few surface seeps were found in the northwestern portion of the site, and samples collected from these seeps were non-detect for TCE. Consequently, potential surface water exposure pathways were not quantified for ecological receptors. It should be noted, however, that there are uncertainties regarding the hydraulic relationship between Moses Lake and groundwater in the northwest portion of the study area. Therefore, definitive conclusions regarding this potential exposure pathway and potential impacts to surface water receptors cannot be made at this time. Uncertainties related to potential impacts of chemicals in groundwater on ecological receptors are further described in Section 7.7.

7.4.2 Assessment and Measurement Endpoints

As defined in *Guidelines for Ecological Risk Assessment* (USEPA, 1998c), an assessment endpoint is an explicit expression of the environmental value that is to be protected (for example, a decline in a specific species population). Assessment endpoints focus the ERA on the guild or community that might be affected adversely by exposure to a COPEC. A measurement endpoint is defined as a quantitative expression of an observed or measured effect of the hazard; that is, a measurable response to a stressor that is related to the ecological characteristic chosen as the assessment endpoint (USEPA, 1998c). The assessment and measurement endpoints that were selected for evaluation of potential impacts to terrestrial and aquatic/riparian receptors are described in the following subsections.

7.4.2.1 Assessment and Measurement Endpoints for Terrestrial Habitats

Terrestrial receptors inhabiting or foraging at suspected PSAs may be exposed to site-derived COPECs. Herbivorous mammals (e.g., Washington ground squirrel) and omnivorous mammals and birds (e.g., Great Basin pocket mouse and sage sparrow, respectively) are likely to inhabit vegetated areas including the landfills. These may serve as prey for higher trophic level carnivorous receptors, such as the coyote or ferruginous

hawk, that use the PSAs for foraging. Consequently, potential exposure of receptors from multiple trophic levels to site-related chemicals through food chain transfer is possible. The assessment endpoints selected for terrestrial receptors reflect these possible exposures and potential for impacts, and are as follows:

- Protection of populations of herbivorous mammals from adverse effects of site-related COPECs on growth, survival, and reproduction
- Protection of populations of omnivorous mammals from adverse effects of site-related COPECs on growth, survival, and reproduction
- Protection of populations of omnivorous birds from adverse effects of site-related COPECs on growth, survival, and reproduction
- Protection of populations of carnivorous mammals from adverse effects of site-related COPECs on growth, survival, and reproduction
- Protection of populations of carnivorous birds from adverse effects of site-related COPECs on growth, survival, and reproduction

The measurement endpoints selected for evaluation of terrestrial assessment endpoints are receptor-specific hazard indices (HIs) for indicator receptors. HIs are the sum of the HQs. HQs are calculated by estimating the exposure dose received by the receptor and dividing it by a reference dose that is either anticipated not to cause adverse effects or represents the lowest adverse effect level. The HI approach is applied in estimating the risk to the indicator receptor.

7.4.2.2 Assessment and Measurement Endpoints for Aquatic/Riparian Habitats

Potential aquatic/riparian habitats in the vicinity of the Moses Lake Wellfield Superfund Site include Crab Creek and Moses Lake (Section 7.4.1). As described in Section 7.4.1, there is believed to be limited to insignificant potential for exposures of aquatic/riparian receptors to contaminants in groundwater originating from the site. Based on the rationale presented in Section 7.4.1, assessment and measurement endpoints for aquatic/riparian receptors were not identified.

7.4.3 Indicator Receptors for Site Evaluations

It is not possible to evaluate potential impacts to all receptors inhabiting an ecosystem. Therefore, it is necessary to identify one or more representative indicator species for evaluation in the quantitative ERA. Using the habitat-specific food webs, indicator receptors were selected to focus the risk analysis and characterization. The following factors were evaluated when choosing an indicator receptor species:

- **Ecological Relevance -** Highly relevant receptors provide an important functional or structural aspect in the ecosystem. Attributes of highly relevant receptors typically fall under the categories of food, habitat, production, seed dispersal, pollination, and decomposition. For example, the northern pocket gopher and the

Washington ground squirrel were chosen because they are known to be important dietary components for raptors. Critical attributes include those that affect or determine the function or survival of a population.

- **Exposure Potential** - Receptors with high exposure potentials are those that, due to their metabolism, feeding habits and range, location, or reproductive strategy, tend to have higher potentials for exposure than other receptors.

- **Sensitivity** - Highly susceptible receptors include those with low tolerances to a COPC as well as receptors with enhanced COPC susceptibility due to other contaminant stressors that may not be related to a COPC, such as reduced habitat availability. For example, a species that forages entirely within the contaminated site will be more exposed to the COPC and will be more sensitive.

- **Availability of Natural History Information** - Natural history information is essential to quantitatively evaluate risk to measurement receptors. If information such as body weight, food, water, soil, and sediment ingestion rates was unavailable for a receptor, then another species was chosen, or estimates were made from taxonomically related species.

- **Status** - Species designated as 'threatened and endangered' or 'priority for conservation and management' were given preference in selection as indicator receptors to ensure that potential risk to the most sensitive species in a guild is evaluated.

7.4.3.1 Bird and Mammal Measurement Receptors

Measurement receptors were selected using the criteria outlined in the previous section. Detailed below are the natural histories of the indicator receptors analyzed and the rationale for selecting the species for analysis.

- **Washington Ground Squirrel** - The Washington ground squirrel (*Spermophilus washingtoni*) is a herbivorous mammal. It is a medium-sized gray squirrel with only three populations found in the arid desert grasslands and sagebrush of northeastern Oregon and southeastern Washington. Due to the harsh desert environment, these animals spend about seven months of the year dormant (ODFW, 2000). It feeds on seeds and green vegetation and serves as prey for large carnivorous birds/raptors and carnivorous mammals (Burke Museum, 2000). The species is a candidate for both state and federal listing under the Endangered Species Act. The Washington Department of Fish and Wildlife also notes it as a species of priority for conservation and management (WDFW, 2000c). Because of the species' very limited distribution range, it is very susceptible to habitat destruction and disruption. Grazing, agriculture and irrigation activities have contributed to population declines in the recent past. Natural history information for this species is not readily available due to the limited range of this species.

- **Great Basin Pocket Mouse** - The Great Basin pocket mouse (*Perognathus parvus*) is an omnivorous mammal of the shrub-steppe ecosystem. Nearly 100

percent of the mouse's diet consists of seeds during the winter months; and vegetation and insects become important diet elements in spring and summer months (UM, 2000). This species is nocturnal with the greatest activity occurring about an hour after sunset. No aboveground activity occurs from November to March or April, presumably a period of torpor. When food is scarce in summer, they often enter a state of torpor that lasts a few hours to conserve energy. Predators of this species are carnivorous mammals, snakes and owls (UM, 2000). The Great Basin pocket mouse is not listed in Washington State, or federally, as an endangered or threatened species. Natural history information is abundant for this species.

- **Sage Sparrow** - The sage sparrow (*Amphispiza belli*) is a small bird that habitats the successional-scrub ecosystem. This omnivorous bird's diet consists mostly of insects, spiders, and seeds while breeding in the spring and summer months, and mostly of seeds and some green foliage in winter (Zeiner et al., 1990a). It is found in the successional-scrub habitat of southeastern Washington through California. Some populations stay in the Northwest year-round but most migrate to southern deserts to winter. Fragmentation of the shrub-steppe ecosystem is causing a decline in this species through reduced nesting success and increased parasitism by brown-headed cowbirds. It is currently a candidate for state listing and is listed as a priority for conservation and management (WDFW, 2000c).

- **Ferruginous Hawk** - The ferruginous hawk (*Oceanodroma furcta*) is a raptor present in the shrub-steppe ecosystem. It primarily hunts small-to-medium-sized mammals but will also take birds, reptiles, and some insects. Mammals generally comprise 80 to 90 percent of the prey items or biomass in the diet, with birds being the next most common component (BLM, 2001). The hawk's diet can vary, depending on the distribution and abundance of certain prey species. Common prey species include gophers, voles, mice, rabbits, prairie dog, and ground squirrels. Hunting may occur at any time of the day depending upon the activity patterns of the major prey species. Fall migration to warmer southern climates is seen from late September through early April (Zeiner et al., 1990a). This species' exposure potential varies due to variability in home range. As an upper trophic level receptor, it is susceptible to bioaccumulating compounds from the ecosystem. The ferruginous hawk is state-listed as threatened and a priority for conservation and management (WDFW, 2000c). It is also listed federally as a species of concern. Natural history information is available for this species.

- **Coyote** - The coyote (*Canis latrans*) is a carnivorous mammal in the upper trophic level of the ecosystem. Nearly 90 percent of their diet is mammalian, in addition to occasionally eating birds and snakes (UM, 2000). During the fall and winter months they consume more fruits and vegetables and the leaves of some plants. The coyote is non-migratory and is active yearlong so its exposure potential is high (Zeiner et al., 1990b). The exposure potential is also affected by its position in the upper trophic level and its carnivorous diet. The coyote is not listed under state or federal endangered or threatened lists. As a common species of open habitats in North America, natural history information is abundant for this species.

7.4.4 Exposure Point Concentrations

Calculation of the exposure point concentration from soil sampling results was based on both measured concentrations and non-detect results. If a data set contained non-detect results, one-half the sample quantitation limit was assumed for that sample. The exposure point concentration was estimated as either the maximum or the 95 percent upper confidence limit (UCL) on the arithmetic mean concentration detected in site media. If the calculated 95 percent UCL on the mean concentration was greater than the maximum value, then the maximum value was assumed as the exposure point concentration; otherwise the 95 percent UCL was used.

The 95 percent UCL on the arithmetic mean concentration was calculated based on a normal or lognormal distribution, according to the methods described in Gilbert (1987). First, the soil sampling results for individual COPECs detected within a site were evaluated in order to identify whether the data population was representative of an underlying normal or lognormal distribution. The Shapiro-Wilks W test for normality (Gilbert, 1987) and the coefficient of variation (CV) statistic (Gilbert, 1987), as necessary, was used to test the underlying data distribution. For data sets that are best represented by a normal distribution, the 95 percent UCL on the arithmetic mean was calculated based on the Student t-statistic. The equation for calculating the 95 percent UCL on the arithmetic mean for a normal distribution (USEPA, 1992e) is given by:

$$UCL = x(bar) + t\ (s/vn)$$

where:

UCL	=	upper confidence limit
x(bar)	=	mean of the transformed data
s	=	standard deviation of the untransformed data
t	=	Student-t statistic (from table published in Gilbert,1987)
n	=	number of samples

For data sets that are best represented by a lognormal distribution, the 95 percent UCL on the arithmetic mean was calculated based on the H-statistic. Four-point Lagrangian interpolation and an H table from Gilbert (1987) was used to determine H values for use in the UCL calculation. The equation for calculating the UCL of the arithmetic mean for a lognormal distribution (Gilbert, 1987) is given by:

$$UCL = e^{x(bar)+0.5\ s2+sH/v(n-1)}$$

where:

UCL	=	upper confidence limit
e	=	constant (base of the natural log, equal to 2.718)
x(bar)	=	mean of the transformed data
s	=	standard deviation of the transformed data
H	=	H-statistic (Gilbert, 1987)
n	=	number of samples

The 95 percent UCL on the arithmetic mean concentration of COPECs in soil was used as an EPC in the quantification of exposures for terrestrial receptors at four sites. The sites

for which 95 percent UCL on the mean concentrations were calculated include Sites 6, 8, 20, and 31, as shown in Table 7.18. For the remaining sites evaluated in the ERA, the quantity of data available for each COPEC was insufficient to calculate a meaningful 95 percent UCL on the mean concentration. Therefore, maximum concentrations of each COPEC were used in the calculation of exposure doses.

7.4.5 Exposure Dose Calculation

The final phase of the exposure assessment consolidates the exposure pathways and exposure routes, exposure point concentrations, and exposure parameters into an equation that provides an exposure dose estimate in units of milligrams of COPEC per kilogram of body weight per day.

Ingestion dose estimates were calculated using the following general equations derived from USEPA (1993b):

$$\text{Dose}_{\text{Ingestion}} = \frac{[(IR_{Biotic} \times C_{Biotic}) + (IR_{Abiotic} \times EPC_{Abiotic})] \times ED \times SUF \times UC}{BW}$$

where:

$\text{Dose}_{\text{Ingestion}}$	=	Estimated exposure dose from ingestion of food and ingestion of abiotic media (mg/kg-day)
IR_{Biotic}	=	Food ingestion rate (mg/day)
C_{Biotic}	=	Average concentration of COPEC in food items (mg/kg)
$IR_{Abiotic}$	=	Abiotic media ingestion rate (mg/day)
$EPC_{Abiotic}$	=	Concentration of COPEC in abiotic media (mg/kg) (referred to as C_{SOIL} below)
ED	=	Exposure Duration (unitless)
SUF	=	Site Utilization Factor (unitless)
UC	=	Unit Conversion, (10^{-6} kg/mg)
BW	=	Body Weight (kg)

7.4.6 Tissue Concentration in Terrestrial Plants

Estimation of exposure point concentrations in biotic media (i.e., plant and animal tissues) is based on guidance in USEPA (1999b).

For purposes of the ERA, the COPEC concentrations in terrestrial plants (C_{PLANTS}) was assumed to equal plant concentrations due to root uptake (P_r). The equation used to compute COPEC concentrations in terrestrial plants due to root uptake is as follows:

$$C_{PLANTS} = 0.12 * P_r$$

where:

C_{PLANTS}	=	Total COPEC concentration in the plant (mg COPEC/kg wet tissue).
P_r	=	Concentration of COPEC in the plant due to root uptake (mg/kg dry tissue)
0.12	=	Converts from dry tissue concentration to wet tissue concentration.

The concentration taken up by the roots was calculated using the following equation:

$$P_r = C_{SOIL} * BCF_{S-P}$$

where:

P_r	=	COPEC concentration in the plant due to root uptake (mg/kg tissue).
C_{SOIL}	=	COPEC concentration in the soil (mg/kg dry soil)
BCF_{S-P}	=	Soil-to-terrestrial plant bioconcentration factor (kg dry soil/kg wet or dry tissue)

BCFs for metals were obtained from USEPA (1999b). BCFs for organic compounds were estimated using the following equation from Travis and Arms (1988):

$$\log BCF_{S-P} = 1.588-0.578 * \log K_{ow}$$

where:

BCF_{S-P}	=	Soil-to-terrestrial plant bioconcentration factor (mg COPEC/kg wet tissue) / (mg COPEC/kg dry soil or sediment)
K_{ow}	=	Octanol-water partition coefficient (unitless)

Many of these compounds were also sighted in USEPA (1999b) as having come from the Travis and Arms equation above. Chemical-specific data, including K_{ow} values for COPECs, are presented in Table 7.19.
Estimated tissue concentrations in terrestrial plants are presented in hazard calculation spreadsheets for each site and receptor in Appendix H.

7.4.7 Tissue Concentration in Soil Invertebrates

COPEC concentrations in soil invertebrates were estimated from an appropriate BCF and the COPEC concentration in soil using the following equation:

$$C_{TI} = C_{SOIL} * BCF_{S-TI}$$

where:

C_{TI}	=	COPEC concentration in soil invertebrates (mg/kg wet tissue)
C_{SOIL}	=	COPEC concentration in soil, dry weight (mg/kg dry soil)
BCF_{S-TI}	=	Soil-to-soil invertebrate COPEC bioconcentration factor (kg dry soil / kg wet tissue)

Literature, derived BCFs for inorganic COPECs and some organic COPECs were obtained from USEPA (1999b). Where literature values were not available in USEPA (1999b), BCFs for organic COPECs were estimated from the water-to-aquatic invertebrate BCF using the equilibrium partitioning method.

7.4.7.1 Equilibrium Partitioning (EqP) Method

The equilibrium partitioning method assumes that the bioavailable portion of COPECs in soil or sediment exists in the interstitial water; therefore, the COPEC concentrations in soil invertebrates can be estimated from the concentrations of COPECs in the interstitial water as follows:

$$C_{TI} = C_{IW} * BCF_{IW-I}$$

where:

C_{TI}	=	COPEC concentration in soil invertebrates (mg/kg wet tissue)
C_{IW}	=	Dissolved COPEC concentration in interstitial water (mg/L water)
BCF_{IW-I}	=	Interstitial water-to-invertebrate bioconcentration factor (L water/kg wet tissue)

Organic carbon in soil and sediment is a sorption phase that controls the concentration of non-polar organic compounds in the interstitial water. The organic carbon partitioning coefficient (K_{oc}) relates the chemical concentration in the interstitial water to the organic-carbon-normalized COPEC concentration in soil or sediment. The equilibrium partitioning method assumes that the interstitial water and solid phase organic carbon are in equilibrium. Therefore, the COPEC concentration in soil or sediment is related to the concentration in the interstitial water as follows:

$$C_{IW} = \frac{C_{SOIL}}{f_{oc} * K_{oc}}$$

where:

C_{IW}	=	COPEC concentration in soil interstitial water (mg/L water)
C_{SOIL}	=	COPEC concentration in soil (mg/kg dry soil or dry sediment)
f_{oc}	=	Fraction or organic carbon in soil, assuming a value of 1 percent (USEPA, 1995b) (kg org. carb./kg dry media)
K_{oc}	=	Organic carbon partitioning coefficient (L water/kg org. carb.)

Using the above equalities, the soil-to-invertebrate BCF can be estimated from the water-to-invertebrate BCF as follows:

$$BCF_{S-TI} = \frac{BCF_{IW-I}}{f_{oc} * K_{oc}}$$

where

BCF_{S-TI}	=	Soil-to-soil-invertebrate bioconcentration factor (kg dry soil/kg wet tissue)
BCF_{IW-I}	=	Soil-interstitial water-to-invertebrate bioconcentration factor (L water/kg wet tissue)
f_{oc}	=	Fraction of organic carbon in soil, assuming a value of 1 percent (USEPA, 1995b) (kg org. carb./kg dry media)
K_{oc}	=	Organic carbon partitioning coefficient (L water/kg org. carb.).

The interstitial-water-to-invertebrate BCF can be predicted using the following equation (Southworth et al., 1978):

$$\log BCF_{IW-I} = 0.819 * \log K_{OW} - 1.146$$

where:

BCF_{IW-I}	=	Soil interstitial water-to-invertebrate bioconcentration factor (L water/kg wet tissue)
K_{ow}	=	Octanol/water partition coefficient (unitless)

Estimated tissue concentrations in invertebrate prey are presented in hazard calculation spreadsheets for each site and receptor in Appendix H.

7.4.8 Tissue Concentrations in Herbivorous Prey

The food chain model for indicator receptors considers one herbivorous prey species: the Washington ground squirrel. COPEC concentrations in herbivores depend on ingestion of abiotic media and plant matter. The equation for calculating COPEC concentrations in herbivores is as follows:

$$C_{HERB} = C_{PLANT} * BCF_{TL2/TL1} + C_{SOIL} * BCF_{S-H}$$

where:

C_{HERB} = COPEC concentration in the herbivore (mg/kg wet tissue)
C_{PLANT} = Total COPEC concentration in the plant (mg COPEC/kg wet tissue)
$BCF_{TL2/TL1}$ = Plant-to-herbivore bioconcentration factor (kg wet plant tissue/kg wet herbivore tissue)
C_{SOIL} = COPEC concentration in soil (mg/kg dry soil or dry sediment)
BCF_{S-H} = Bioconcentration factor for soil-to-herbivore (kg dry media/kg wet tissue)

For discussion of $BCF_{TL2/TL1}$ (plant-to-herbivore bioconcentration factor) and BCF_{S-H} (soil-to-herbivore bioconcentration factor), see section 7.4.11.1 below.

Estimated tissue concentrations in herbivorous prey are presented in hazard calculation spreadsheets for each site and receptor in Appendix H.

7.4.8.1 Bioconcentration Factors for Medium-to-Wildlife, Plant-to-Herbivore, and Plant–to-Omnivore

BCFs for estimating COPEC exposure by mammals and birds due to ingestion of abiotic media and COPEC exposure from the plant ingestion pathway ($BCF_{TL2/TL1}$, $BCF_{TL3/TL1}$) were computed from biotransfer factors for beef cattle. Biotransfer factors for organic COPECs were calculated according to Travis and Arms (1988), and biotransfer factors for inorganic COPECs were estimated values taken from Baes et al. (1984). Media-to-wildlife and plant-to-herbivore/omnivore BCFs were computed for each mammal or bird consumer according to the following equation:

$$BCF_{M-W} = Ba * IR$$

where:

BCF_{M-W} = Media-and-plant-to-wildlife bioconcentration factor (L water/kg wet tissue or kg media/kg wet tissue or kg wet plant tissue/kg wet tissue)
Ba = Biotransfer factor (day/kg wet tissue)
IR = Mammal or bird ingestion rate (kg food or media/day)

Biotransfer factors for metals were estimated from literature values by Baes et al. (1984) based on wet feed-to-cattle and can be used in the above equation directly. Biotransfer factors for organics were calculated as follows (USEPA, 1999b):

For mammals:

$$LogBa_{mammal} = -7.6 + \log K_{ow}$$

where:

Ba_{mammal} = Biotransfer factor for mammals (day/kg wet tissue)
K_{ow} = Octanol/water partition coefficient (unitless)

For birds:

$$Ba_{bird} = 0.8 * Ba_{mammal}$$

where:

Ba_{bird} = Biotransfer factor for birds (day/kg wet tissue)
Ba_{mammal} = Biotransfer factor for mammals (day/kg wet tissue)
0.8 = Bird and mammal fat content ratio

7.4.9 Tissue Concentrations in Omnivorous Prey

The food chain model considers two omnivorous prey species as indicator receptors: the Great Basin pocket mouse and the sage sparrow. These omnivorous species eat terrestrial plants (TL1) and terrestrial invertebrates (TL2). The COPEC concentration in omnivorous mammals and birds depends on the COPEC concentration in each food item and the COPEC concentration in abiotic media. The equation for calculating concentrations in omnivorous prey species is as follows:

$$C_{OMN} = \frac{BMF_{TL3/TL2} * ? C_{TL2,i} + BCF_{TL3/TL1} * ? C_{TL1,i}}{F} + BCF_{S-O} * C_{SOIL}$$

where:

C_{OMN} = COPEC concentration in the omnivore (mg/kg wet tissue)
$BMF_{TL3/TL2}$ = Invertebrate-to-omnivore biomagnification factor (kg wet plant tissue/kg wet tissue)
$C_{TL2,i}$ = COPEC concentration in the *i*th trophic level 2 food source–invertebrates (mg/kg wet tissue)
$BCF_{TL3/TL1}$ = Plant-flora-to-omnivore bioconcentration factor (kg wet plant tissue/kg wet tissue)
$C_{TL1,i}$ = COPEC concentration in the ith trophic level 1 food source–plants and flora (mg/kg wet tissue)
BCF_{S-O} = Soil-or-sediment-to-omnivore bioconcentration factor (kg media/kg wet tissue)
C_{SOIL} = COPEC concentration in soil (mg/kg dry media)
F = Number of food sources in diet

For discussion of $BCF_{TL3/TL1}$ (pant-to-omnivore bioconcentration factor), see section 7.4.11.1 above. For discussion of biomagnification factors, see section 7.4.12.1 below.

Estimated tissue concentrations in omnivorous prey are presented in hazard calculation spreadsheets for each site and receptor in Appendix H.

7.4.9.1 Use of Food Chain Multiplier (FCM) Ratio to Estimate Biomagnification from Ingestion of Animal Matter

Biomagnification involves the transfer of a chemical in food through successive trophic levels. The exposure assessment uses FCM ratios to estimate biomagnification factors for the ingestion of TL2 food sources by TL3 prey species and the ingestion of TL2 and TL3 prey by the coyote or ferruginous hawk, TL4 species. The BMF equals the quotient of the FCM of the measurement receptor divided by the FCM of the prey. For example:

$$BMF_{TL3/TL2} = FCM_{TL3} / FCM_{TL2}$$

FCMs were derived from literature values in USEPA (1999b) that were estimated for organics from the octanol-water partition coefficient. COPECs with a log *Kow* less than 2 were conservatively estimated to have an FCM of 1, consistent with USEPA (1999b). FCMs for metals were assumed to be 1 based on literature review and USEPA (1997b). Chemical-specific FCM and BMF values for COPECs are presented in Table 7.20.

The equations for estimating COPEC concentrations in ecological indicator receptors are summarized in Table 7.21.

7.4.10 Bioavailability

Chemical bioavailability was not considered in the above estimation methods for intermediate and upper trophic level exposures. However, a number of inorganic chemicals have bioavailability factors less than one, indicating that the absorbed dose is substantially lower than the administered dose. For example, bioactive arsenic occurs in only the organic form once it is in animal tissues. The potential use of bioavailability factors in the quantification of ecological exposures was considered in the calculation of exposure doses for lead and zinc, as follows.

The toxicity reference values (TRVs) used in the effects assessment for lead for birds and mammals are based on studies using lead acetate and lead sulfate. These studies represent a ‘worst-case’ analysis of lead toxicity, because lead acetate is one of the most soluble forms of lead (Freeman et al., 1996) and organolead compounds are more toxic than inorganic forms (USFWS, 1988). Absorption studies in rats have shown that lead bioavailability is highly dependent upon the form of lead in the diet (Freeman et al., 1996). Decreasing levels of lead absorption by rats following dietary administration were in the following order: lead acetate, lead sulfide, and lead-contaminated soil (Freeman et al., 1996). The estimated bioavailability of lead sulfide was approximately 10 percent that of lead acetate. The predominant forms of lead in lead-contaminated soil are iron-lead oxide, manganese lead oxide, lead phosphate, and iron-lead sulfate (ATSDR, 1997). There is no evidence that inorganic or organic forms of lead are biomagnified in terrestrial food chains. Lead concentrations are usually highest in benthic organisms and lowest in upper trophic level predators (e.g., carnivorous birds) (USFWS, 1988). This is probably due to the tendency of lead to distribute into the hard tissues (i.e., teeth and bones) of animals, which either are not consumed or are poorly digested. Approximately 73 to 94 percent of lead is accounted for in the bones of higher trophic level organisms (ATSDR, 1997). In the diets of omnivores and carnivores, the majority of lead is incorporated into

the skeleton or exoskeleton of forage or prey organisms, or bound up in incidentally ingested soil. In consideration of the above, a bioavailability factor of ten percent (i.e., 0.1) was used during calculation of the lead exposure dose for bird and mammal indicator receptors.

The TRVs for zinc were also based on studies in which zinc absorption was optimized through the use of highly soluble forms (i.e., zinc oxide or zinc chloride). Zinc oxide and zinc chloride are highly soluble in acidic environments including the digestive tract (Solomons and Cousins, 1984). Natural forms of zinc are frequently adsorbed to, or complexed with, minerals and organic components of soils (ATSDR, 1989). Readily mobile forms of zinc comprise only about 1 to 20 percent of total zinc in soil (Kabata-Pendias and Pendias, 1984). Approximately 20 to 30 percent of *soluble* zinc is absorbed in animals with normal zinc status (ATSDR, 1989). However, this percentage appears to decrease with higher zinc intake. In addition, the presence of fiber and phytate concentrations in the diets of herbivorous and omnivorous species may reduce zinc bioavailability by up to 50 percent (ATSDR, 1989; NRC, 1989). For carnivorous species, such as the ferruginous hawk or coyote, significant portions of the total zinc body burden in prey species may be tied up in non-bioavailable forms including bone, other hard tissues, or phosphate complexes (NRC, 1989; Greger, 1988; Callahan et al., 1979). For purposes of this analysis, the bioavailable portion was conservatively estimated as 50 percent. Assuming the upper range of zinc absorption in laboratory subjects exposed to *soluble* forms of zinc (i.e., 30 percent), and an estimate of the bioavailable forms of dietary zinc in typical diets for herbivores, omnivores, and carnivores equal to 50 percent, total zinc bioavailability may be estimated as 30 percent x 0.50, or 15 percent. Consistent with the above, a bioavailability factor of 15 percent (i.e., 0.15) was used during calculation of the zinc exposure dose for bird and mammal indicator receptors.

7.4.11 Exposure Parameters

Exposure parameters for each indicator receptor were required to estimate the exposure dose. Exposure parameters were obtained from the following sources:

- Bureau of Land Management, Birds of Prey (BLM, 2001)
- Orders of Mammals in Washington (Burke Museum, 2000)
- CRC Handbook of Avian Body Masses (Dunning, 1993)
- ENature: http://www.wnature.com/main.home.asp
- Wildlife Exposure Factors Handbook (USEPA, 1993b)
- United States Geological Survey, Bird Monitoring in North America (USGS, 2000a)
- Patuxent Bird Identification InfoCenter (USGS, 2000b)

- University of Michigan, Museum of Zoology (UM, 2000)
- National Audubon Society Field Guide to North American Birds (Whitaker, 1977)
- National Audubon Society Field Guide to North American Mammals (Whitaker,1996)
- California's Wildlife–Volume II –Birds (Zeiner et al., 1990a)
- California's Wildlife–Volume III –Mammals (Zeiner et al., 1990b)

The exposure parameters required for the quantitative dose estimate include the receptor's:

- Body weight
- Ingestion rate of biotic and abiotic media
- Site utilization factor (the area of contamination in relation to the receptor's home range)
- Exposure duration (time in a year that a receptor is exposed to site COPECs)

The assumptions used for each of these exposure parameters are presented in Table 7.22 and are described in more detail in the following subsection.

7.4.11.1 Body Weight

The average body weights (BWs) for both males and females were used for each indicator receptor.

7.4.11.2 Biotic Ingestion Rates

Food ingestion rates (FIR) for each indicator receptor were calculated using allometric equations provided in USEPA (1993b) that are based on established relationships between body size and metabolic requirements. Food ingestion rates expressed in grams of food per day were calculated based on the following equations: 3-3 (ferruginous hawk), 3-4 (sage sparrow), 3-8 (Great Basin pocket mouse), 3-7 (coyote), and 3-9 (Washington ground squirrel, in USEPA (1993b).

7.4.11.3 Abiotic Ingestion Rates

Soil ingestion rates were derived from USEPA (1993b). The abiotic ingestion rates for the species were based on the following: Washington ground squirrel, based on meadow vole soil ingestion rate; sage sparrow, based on observations of omnivorous birds derived by Beyer et al. (1994); ferruginous hawk, based on passerines' soil ingestion rate; coyote, based on red fox soil ingestion rate; and Great Basin pocket mouse, based on white-footed

mouse soil ingestion rate. Rates were calculated as percent soil ingestion rates derived from USEPA (1993b) multiplied by the food ingestion rate (g/d).

7.4.11.4 Site Utilization Factor

The site utilization factor (SUF) describes the area of contamination that a receptor potentially contacts relative to its home range. Home range is the area of habitat required by an ecological receptor to meet its dietary needs. Home range values were obtained from a variety of sources noted below. In instances where multiple home range areas were reported, the average of all reports was taken. The home range for the Washington ground squirrel was calculated by averaging the home ranges of similar species: Franklin's ground squirrel, the mexican ground squirrel and the thirteen-lined ground squirrel. The home range of the sage sparrow was calculated by averaging the home ranges of similar species: song sparrow, lark sparrow, white-crowned sparrow, rufous-crowned sparrow, savannah sparrow, and golden-crowned sparrow. Comparison of a receptor's home range to the area extent of contamination of a site is used to determine the relative amount of potentially contaminated diet the receptor is exposed to. The SUF is calculated as the ratio of the area of contamination to a receptor's home range. When the receptor's home range is greater than the area of contamination, the SUF is less than one. When a receptor's home range is less than or equal to the area of contamination, the SUF is equal to one.

7.4.11.5 Exposure Duration

The exposure duration (ED) refers to the fraction of the year that a receptor is likely to spend utilizing a site. This is frequently a function of migration and/or hibernation potential. Exposure durations for species were based on the following facts:

- Washington ground squirrel = 0.42 - spends 7 months of the year dormant
- Sage sparrow = 0.5 - migrates to southeastern deserts to winter
- Ferruginous hawk = 0.5 - migrates to California to winter
- Great Basin pocket mouse = 0.6 - no above ground activity from November to March or April
- Coyote = 1.0 - does not migrate and is active yearlong

7.5 ECOLOGICAL EFFECTS ASSESSMENT

The nature of the ecological effects assessment relates to the specific assessment and measurement endpoints that are selected for evaluation during the problem formulation phase of the ecological risk assessment. As defined in USEPA (1998c), an assessment endpoint is an explicit expression of the environmental value that is to be protected (for example, a decline in a specific species population). A measurement endpoint is defined as a quantitative expression of an observed or measured effect of the hazard; that is, a measurable response to a stressor that is related to the ecological characteristic chosen as the assessment endpoint (USEPA, 1998c). If a specific assessment endpoint selected for a

site is the protection of benthic infaunal diversity and abundance from adverse effects of bioaccumulating pesticides entering a watershed, an appropriate measurement endpoint could include sediment toxicity testing or the calculation of receptor-specific HIs for sediment invertebrates. The corresponding effects assessment could include an evaluation of sediment bioassay results or an evaluation of appropriate sediment benchmarks for use in calculating HIs for sediment invertebrates.

The assessment endpoints that were selected for the Moses Lake Wellfield Superfund Site include the protection of populations of terrestrial mammals and birds from adverse effects of site COPECs on growth, survival, and reproduction (MWH, 2001a). The measurement endpoints selected for evaluation of these assessment endpoints are the calculation of receptor-specific HIs for terrestrial indicator species. The corresponding effects assessment for terrestrial indicator receptors includes the evaluation and selection of TRVs for use in calculating receptor-specific HIs (MWH, 2001b).

The methods to be used in the effects assessment for terrestrial receptors are described in Section 7.5.1.

7.5.1 Effects Assessment for Terrestrial Receptors

The overall goal of the ERA for the Moses Lake Wellfield Superfund Site is to evaluate whether COPEC concentrations identified in soils within specific PSAs are sufficiently protective of ecological receptors or whether the concentrations are elevated and suggest potential risks to the ecosystem. To provide an indication of whether the ecosystem is protected, specific assessment endpoints were identified (refer to Section 7.4.1). Measurement endpoints were also selected as described in Section 7.4.2 for evaluating the assessment endpoints.

The measurement endpoints evaluated in the ERA include comparison of modeled exposure doses with TRVs for mammalian and avian indicator receptors (i.e., Washington ground squirrel, Great Basin pocket mouse, sage sparrow, ferruginous hawk, and coyote). The rationale for selection of indicator receptors was presented in Section 7.4.2.

The TRVs used in the evaluation of potential risks to indicator receptors are expressed in terms of milligrams of COPEC per kilograms of body weight per day (mg/kg-day). The TRVs that were selected for evaluation of ecological effects to terrestrial indicator receptors are based on the following hierarchy of information sources:

1. Ecological Soil Screening Level Guidance Draft (Eco SSLs) (USEPA, 2000b)

2. Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities (USEPA, 1999b)

3. Toxicological Benchmarks for Wildlife: 1996 Revision (ORNL, 1996b)

Toxicity benchmarks were based on experimentally derived no-observed-adverse-effects-levels (NOAELs) or lowest-observed-adverse-effects-levels (LOAELs). In cases where a NOAEL for a specific COPEC was not available, but an experimentally derived LOAEL

was available, the LOAEL was reduced by an uncertainty factor of up to ten to arrive at a NOAEL. In most cases, toxicity benchmarks were not available for the indicator receptors selected for evaluation in the ecological risk assessment. To account for differences in body weight, toxicity benchmarks provided for a test species were allometrically converted to a toxicity reference value for each indicator species using the following equation (ORNL, 1996b):

$$Dose_I = Dose_T \times (BW_T/BW_I)^{1/4}$$

where:

$Dose_I$	=	toxicity reference value for indicator receptor (mg/kg-d)
$Dose_T$	=	benchmark of NOAEL for test species (mg/kg-d)
BW_T	=	body weight of test species (kg)
BW_I	=	body weight of indicator species (kg)

The TRVs used in the evaluation of ecological hazards for terrestrial indicator receptors are presented in Tables 7.23 and 7.24.

7.6 ECOLOGICAL RISK CHARACTERIZATION

The methods and results of the ecological risk characterization performed for the Moses Lake Wellfield Superfund Site are presented in Sections 7.6.1 and 7.6.2, respectively.

7.6.1 Methods

The measurement endpoints identified for the ERA include comparison of modeled exposure doses to TRVs for mammalian and avian indicator receptors (i.e., Washington ground squirrel, Great Basin pocket mouse, sage sparrow, ferruginous hawk, and coyote). The rationale for selection of indicator receptors was presented in Section 7.4.2. The comparison of exposure doses with TRVs yields chemical-specific HQs, as follows:

$$HQ = \frac{Dose}{TRV}$$

where:

HQ	=	hazard quotient (unitless)
Dose	=	modeled exposure dose for indicator receptor (mg/kg-day)
TRV	=	toxicity reference value for indicator receptor (mg/kg-day)

To estimate the potential cumulative effects of COPECs, a HI was also calculated for each indicator receptor. This HI was determined by adding the HQs obtained from food chain modeling for all COPECs identified at the site for each indicator receptor. HQ or HI values that exceed 1 are generally considered to be indicative of potential biological or ecological effects on representative receptors. These values do not necessarily indicate that a biological or ecological effect will occur, but only that a lower threshold has been exceeded (Menzie et al., 1992). In general, the evaluation of the significance of the HQ and HI values was conducted in a manner consistent with Menzie, et al. (1992), as follows:

- HQ or HI less than 1: Adverse effects on representative receptors are not anticipated
- HQ or HI between 1 and 10: There is a limited potential for adverse effects on representative receptors
- HQ or HI between 10 and 100: There is potential for adverse effects on representative receptors
- HQ or HI exceeds 100: There is significant potential for adverse effects on representative receptors

Note that the above are only guidelines. Site-specific factors such as spatial distribution and frequency of detection of COPECs, uncertainty of assumptions used in exposure determination, and endpoint of study used to determine the toxicity benchmarks should be considered when reviewing specific HQs and HIs.

Sites with HI estimates greater than 1.0 are proposed for further consideration in the FS. If further evaluation is required, potential risk management options could include the collection of additional soil sampling data to refine the EPC estimate, an ecological validation study to collect plant tissue data in support of a refined exposure assessment, ecological monitoring, or evaluation of remedial alternatives.

7.6.2 Results

The results of the ecological risk characterization for the Moses Lake Wellfield Superfund Site are summarized in Table 7.25, and discussed below. Detailed ecological hazard calculations for each site and receptor are presented in Appendix H.

7.6.2.1 Site 6 (6a – Base Closure Landfill and 6b – Dumpster Wash Area)

Ecological HI estimates for the Washington ground squirrel, Great Basin pocket mouse, and sage sparrow were 1.1, 1.8, and 1.6, respectively, as shown in Table 7.25. These cumulative HI estimates slightly exceed USEPA's ecological screening criterion of 1.0. According to the guidelines established by Menzie et al. (1992), these results suggest that there is a limited potential for adverse effects on representative receptors using the site. The highest HI was estimated for the Great Basin pocket mouse, and the primary contributors to the HI were arsenic, cadmium, copper, nickel and zinc. Maximum detected concentrations of these inorganics were elevated above naturally occurring levels (Shacklette and Boerngen, 1984) and were derived from three samples collected at Sites 6a and 6b. The HI estimates for the ferruginous hawk and coyote were significantly below 1.0, as shown in Table 7.25, suggesting that ecological impacts to higher trophic level receptors are not anticipated.

7.6.2.2 Site 8 (Randolph Road Base Dump)

Ecological HI estimates for Site 8 were below USEPA's ecological screening criterion of 1.0 for all indicator receptors, as shown in Table 7.25. These results suggest that

ecological impacts to terrestrial receptors potentially inhabiting or using the site are not anticipated.

7.6.2.3 Site 11 (Fire Training Area – Burn Pit A)

Concentrations of all analytes detected in soil samples collected from this site were below chemical-specific COPEC screening criteria, as shown in Table 7.9. Therefore, ecological HIs were not calculated for Site 11. It should be noted, however, that Oilm-Dx was detected in soils at a maximum concentration of 14,000 mg/kg. The relatively high Oilm-Dx levels in soil at this site was consistent with its former use as a fire training area and most likely explains the presence of stressed vegetation at the site. This observation suggests that adverse impacts to plants have occurred, with a corresponding reduction in overall habitat quality.

7.6.2.4 Site 15 (8-Place Hangar Ditch)

Ecological HI estimates for all receptors were below USEPA's ecological screening criterion of 1.0 for this site, as shown in Table 7.25. These results suggest that ecological impacts to terrestrial receptors potentially inhabiting or using the site are not anticipated.

7.6.2.5 Site 17 (3-Place Hangar – Building 5801)

Ecological HI estimates for Site 17 were below USEPA's ecological screening criterion of 1.0 for all indicator receptors, as shown in Table 7.25. These results suggest that ecological impacts to terrestrial receptors potentially inhabiting or using the site are not anticipated.

7.6.2.6 Site 19 (Liquid Oxygen Generating Plant – Building 5102)

For Site 19, ecological HI estimates for all receptors were below USEPA's ecological screening criterion of 1.0, as shown in Table 7.25. These results suggest that ecological impacts to terrestrial receptors potentially inhabiting or using the site are not anticipated.

7.6.2.7 Site 20 (South Base Dump)

Ecological HI estimates for Site 20 were below USEPA's ecological screening criterion of 1.0 for all indicator receptors, as shown in Table 7.25. These results suggest that ecological impacts to terrestrial receptors potentially inhabiting or using the site are not anticipated.

7.6.2.8 Site 22 (Paint Hangar Leach Pit)

Ecological HI estimates for all receptors were below USEPA's ecological screening criterion of 1.0 for this site, as shown in Table 7.25. These results suggest that ecological impacts to terrestrial receptors potentially inhabiting or using the site are not anticipated.

7.6.2.9 Site 31 (19th Avenue Base Dump)

For Site 31, ecological HI estimates for all receptors were below USEPA's ecological screening criterion of 1.0, as shown in Table 7.25. These results suggest that ecological impacts to terrestrial receptors potentially inhabiting or using the site are not anticipated.

7.6.2.10 Site 33 (Runway 32 Landfill)

Ecological HI estimates for Site 33 were below USEPA's ecological screening criterion of 1.0 for all indicator receptors, as shown in Table 7.25. These results suggest that ecological impacts to terrestrial receptors potentially inhabiting or using the site are not anticipated.

7.6.2.11 Site 35 (Stained Soil Area)

For Site 35, ecological HI estimates for all receptors were below USEPA's ecological screening criterion of 1.0, as shown in Table 7.25. These results suggest that ecological impacts to terrestrial receptors potentially inhabiting or using the site are not anticipated. It should be noted that Diesel-Dx, Gro-Gx and Oilm-Dx were detected at concentrations of 16,000 mg/kg, 110 mg/kg, and 31,500 mg/kg, respectively. These maximum detected concentrations exceeded their respective MTCA-A Cleanup Level for Soil - Protection of Drinking Water criterion. In addition, significant petroleum hydrocarbon staining was observed at this site.

7.7 UNCERTAINTY ANALYSIS

The presence of uncertainty is inherent in the ERA process. Generally, uncertainties in the ERA result from limitations in the available methods, information, and data used in the following:

- Characterization of contaminant sources
- Identification of site COPECs
- Problem formulation including exposure pathway analysis
- Ecological effects assessment
- Ecological risk characterization

The uncertainties associated with each of these steps as they relate to the predictive ERA for the Moses Lake Wellfield Superfund Site are described below.

7.7.1 Characterization of Contaminant Sources

There is a degree of uncertainty in the characterization of contaminant sources, since it is not possible to sample an entire site. The site investigations for the Moses Lake Wellfield Superfund Site were based on site histories, known or suspected releases, and physical characteristics (e.g., the presence of waste materials or topographic anomalies). The nature of these site investigations focused on known or suspected sources of contamination. Because of the targeted nature of the sampling investigations conducted for each PSA, it is possible that areas not sampled may have also contained contaminants.

It is also possible that chemicals could have been present in PSA soils that were not analyzed. However, sample locations and analytical suites were generally chosen such that they represented the greatest potential to detect contaminants.

One area of potential uncertainty identified in the ERA (Section 7.3.1.1) involves possible levels of trichloroethene in groundwater in the area of potential communication between the groundwater and Moses Lake. This data gap potentially affects the accuracy of the qualitative assessment of risks for ecological receptors inhabiting or using Moses Lake. As described in Section 7.3.1.1, however, concentrations of trichloroethene or other groundwater contaminants potentially entering Moses Lake are believed to be at levels that will not result in significant exposures for ecological receptors. This assessment is based on the following:

- The relatively low hydraulic gradient between PSAs (e.g., Site 19) and Moses Lake allows considerable time for attenuation of TCE in groundwater.
- Potential groundwater flow volumes into Moses Lake represents only a very small fraction of the total lake volume and contaminant concentrations would be greatly diluted in this surface water body.
- Trichloroethene is subject to natural attenuation processes in surface water including volatilization, photochemical oxidation, and hydrolysis.
- None of the chemicals detected in groundwater (including trichloroethene) appreciably bioaccumulate in aquatic organisms.
- Concentrations of trichloroethene were non-detect in the few surface seeps found in the northwestern portion of the site. It should be noted, however, that sampled seeps may not be located downgradient of the highest TCE sources.

Based on the above, if site groundwater is in communication with Moses Lake, the concentrations of chemicals present in groundwater are not believed to pose a significant risk to ecological receptors inhabiting or using the lake. However, there are uncertainties regarding the hydraulic relationship between Moses Lake and groundwater in the northwest portion of the study area due to the lack of monitoring wells in this vicinity. Therefore, conclusions regarding this potential exposure pathway and potential impacts to surface water receptors cannot be made at this time.

7.7.2 Identification of Site COPECs

The process used in the selection of site COPECs may also introduce a degree of uncertainty in the ERA. However, protective assumptions were used in the selection of site COPECs. Chemicals selected for quantitative evaluation in the ERA included all organic chemicals identified in soils, and inorganic chemicals present at concentrations greater than background.

The inorganics, calcium, iron, magnesium, potassium, and sodium, were eliminated from consideration as COPECs for the Mohave ground squirrel and the golden eagle, based on

essential nutrient status. These inorganic chemicals have relatively low toxicities and are generally of low concern for potential impacts on non-plant terrestrial receptors. Zinc is also an essential nutrient that was eliminated as a potential COPC in the HHRA based on essential nutrient status. However, zinc is capable of producing adverse ecological impacts in some aquatic and terrestrial receptors at fairly low environmental concentrations. Therefore, zinc was not eliminated as a COPEC for the baseline ERA.
The process used in the selection of site COPCs may also introduce a degree of uncertainty in the baseline HHRA. However, protective assumptions were used in the selection of site COPCs. Chemicals selected for quantitative evaluation in the HHRA included all organic chemicals, and inorganic chemicals (other than essential nutrients), detected at concentrations above protective COPC screening criteria. The one exception to the above was arsenic, which was compared to a 95/95 BUTL for soil screening and regional groundwater concentrations developed by the USGS for groundwater screening (refer to Section 6.2.2.4).

As described in Section 7.3.1, protective COPEC screening criteria for soil were used. Furthermore, maximum detected concentrations of soil analytes were screened using a target HQ of 0.1, consistent with USEPA Region 10 policy. Chemicals without available COPEC screening criteria, such as Oilm-Dx, were carried into the predictive ERA and qualitatively evaluated.

7.7.3 Problem Formulation and Exposure Pathway Analysis

Uncertainties associated with the exposure assessment include (1) the selection of assessment and measurement endpoints; (2) the identification of indicator receptors; (3) the exposure assumptions and parameters used; and (4) the exposure dose estimates. The assessment and measurement endpoints that were selected for evaluation in the ERA (Section 7.4.1.1) are protective of a wide variety of terrestrial feeding guilds. It is very likely that some or all of these guilds are not applicable to specific PSAs because the areas are highly disturbed or are near centers of human activity (e.g., the industrial areas and the airport). Consequently, the ecological hazards associated with these areas may be overestimated.

Methods used in the selection of indicator receptors were intended to identify the most sensitive or highly exposed and relevant species, as indicated in Section 7.4.1.1. The Washington ground squirrel is believed to be a protective indicator receptor for small herbivorous species, and the Great Basin pocket mouse is believed protective of omnivorous mammals, because they (1) forage extensively on soil-associated biota (i.e., plants and/or soil invertebrates); (2) are burrowing animals; and (3) have small home ranges (i.e., foraging areas). Consequently, exposure and hazard estimates for these receptors are believed to be protective of other small herbivorous and omnivorous mammals. The sage sparrow also has a relatively small home range and is believed to be protective of omnivorous birds. The ferruginous hawk and coyote were selected as indicator receptors for higher trophic level species, based on the criteria described in Section 7.4.2. One of the factors contributing to the low hazard estimates for the ferruginous hawk and coyote was the large home range for these species. As a result of their large home ranges, the SUF values for these species were significantly less than one for several PSAs. Other terrestrial species with smaller home ranges (e.g., the striped

skunk) could have higher SUF values. However, it is doubtful that the metabolic requirements for such species could be met by any one PSA, since most of the PSAs are disturbed and of relatively low habitat quality.

Many exposure parameters (e.g., soil ingestion rates, dermal surface areas, and absorption fractions) are not available for the indicator receptors evaluated in this ERA; and best estimates based on similar species or allometric equations were used. This introduces a level of uncertainty into the exposure estimates. However, appropriate exposure values and estimation methods were taken from USEPA (1993b), when available.

Uncertainties in the EPCs also result in uncertainty in the exposure dose estimates. EPCs for indicator receptors potentially exposed to surface soils were based on the maximum concentration of COPECs in most cases, because the number of samples did not permit calculation of the 95 percent UCL concentration. Use of the maximum EPC results in a protective estimate of exposure, given that receptors tend to forage in different locations of a site and would not be exposed to the highest concentrations 100 percent of the time. For several PSAs (i.e., Sites 6, 8, 20, and 31-8), a protective estimate of the mean (i.e., the 95 percent UCL) concentration was used as the EPC. The use of protective exposure assumptions and EPCs based on maximum or 95 percent UCL concentrations in soil tends to result in protective HI estimates.

7.7.4 Ecological Effects Assessment

The toxicity values used in the quantitative evaluation of ecological hazards for indicator receptors were generally derived from the lowest NOAEL or LOAEL data obtained from the literature. Uncertainty factors were applied where appropriate in deriving the benchmarks, and the most protective values from the literature were used. The use of conservative toxicity values in the risk characterization tends to result in protective hazard estimates.

The species upon which the benchmark criteria are based were different from those present at the site. Because toxicity values are often not available for a species, toxicity benchmarks derived for a surrogate species are selected for quantitative risk evaluation. Toxicity benchmarks derived from toxicology studies in rats and mice were allometrically converted for each indicator receptor, based on established methods (ORNL, 1996b). It is not known whether the indicator receptors chosen may be more sensitive or less sensitive to the adverse effects of COPECs identified at the sites than the test species upon which the toxicity benchmarks are based. However, the benchmarks are thought to be protective because they are based on the lowest toxicity values obtained from the literature.

An additional source of uncertainty results from a lack of toxicity values for some COPECs. Mammalian toxicity benchmarks were not available for 2,4-dimethylphenol, as shown in Table 7.23. Toxicity benchmarks for birds were not available for 2,4-dimethylphenol and trichloroethene, as shown in Table 7.24. Therefore, the potential hazards associated with these COPECs were not included in the cumulative HIs for birds and mammals.

7.7.5 Ecological Risk Characterization

The sources of uncertainty previously described are incorporated in the ecological hazard estimates. Because the majority of these uncertainties err on the protective side, the hazard estimates are also considered to be protective. Nevertheless, there is a degree of uncertainty in the quantitative hazard estimates presented in this ERA, based on the uncertainties previously described.

8.0 CONCLUSIONS

This report presents a summary of the results and analysis of RI data collected between June 1999 and February 2003 and the results of a human health and ecological risk assessment. The objectives of the RIs were as listed in Table 8.1, *Objectives of Remedial Investigations and Feasibility Study*. This table lists the objectives stated in the following documents:

- *Interagency Agreement* (USEPA, 1999d)
- *USACE's Scope of Work* (USACE, 1999)
- *Management Plan* (Montgomery Watson, 1999b)
- *Management Plan Addendum* (Montgomery Watson, 2000c)
- *Supplemental Management Plan* (MWH, 2003)

As indicated in this table, all objectives have been met, except those that will be addressed as part of the FS. Objectives which have not been met include:

- Characterize the vertical and lateral extent of the existing TCE plume – the vertical extent of the plume (i.e., deeper than Roza 1) has not been fully characterized and will be addressed in the FS.

- Identify alternatives for addressing the plume – This is an FS issue and will be addressed in the FS.

- Determine how to prevent or minimize migration of the TCE plume – this is an FS issue and will be address in the FS

Additional vadose zone and groundwater investigations will be considered to resolve uncertainties regarding potential sources and fate and transport issues within and near the site.

The subsurface at the site is largely comprised of unconsolidated fluvial gravel and flood sediments of the Hanford Formation underlain by sand, silt and clay of the Ringold Formation. The Ringold Formation is underlain by the Priest Rapids and Roza Members of the Wanapum Basalt. For the purpose of the RIs, the upper flow of the Roza Member has been divided into an upper portion (vesiculated portion of the upper Roza flow, Roza 1) and a lower portion (entablature-colonnade portion of the Roza 1). Within the study area, the Roza Member includes two deeper flows (Roza 2 and Roza 3).

The water table generally occurs within the Hanford Formation in the southern and central portions of the study area and in the Ringold Formation in the northern portion of the study area. Groundwater flow directions in the alluvium (Hanford and Ringold Formations) are variable, ranging from south-southeast to southwest to westerly. Within the basalt, groundwater flow directions are generally similar between the Priest Rapids and upper Roza 1. Basalt groundwater typically flows to the southwest, but with some west-southwest and southerly flow in some parts of the site. Groundwater flow directions change by as much as 35 to 40 degrees from season to season.

The distribution of TCE in groundwater monitoring wells and domestic wells exhibits a considerable amount of spatial variation throughout the study area. However, the concentrations reported in each well have been consistent during each sampling event. These factors are controlled by the hydrostratigraphy and hydrogeologic characteristics of the site. The alluvium wells contained average and maximum TCE concentrations that were significantly less than in basalt wells throughout the site. TCE concentrations detected in each region of the site were as described below.

- Concentrations of TCE in the eastern region were generally low (less than the drinking water standard) with the exception of two monitoring wells and one domestic well. Two domestic wells sampled near 99-AW08, 99-BW15 and 02-BW02 reported TCE detections (up to 7.9 µg/L) between 1999 and 2002. The monitoring wells in this area contained TCE up to 9.4 µg/L in 2002.

- Monitoring well 99-BW16 was the only well in the northwestern area to report a TCE concentration above 5.0 µg/L. However, this well reported 3.8 µg/L TCE in 2002. Monitoring wells 91-AW14 and 91-AW15 reported trace (less than 1.0 µg/L) levels of TCE.

- Wells in the south-central portion of the study area have reported the highest concentrations of TCE at the site. Concentrations in wells 91-BW03, 99-BW01 and 92-BW01 have reported concentrations of TCE up to 61.3 µg/L since 1999. The highest concentration detected in 2002 was 42 µg/L.

- Within the southern portion of the site, measurable concentrations of TCE have been consistently detected at monitoring wells 99-BW10 and 99-BW18, as well as the new well 02-BW02. These values have consistently exceeded 5.0 µg/L for TCE (up to 37 µg/L). The Hanford Formation wells paired with these basalt wells have not exceeded 5.0 µg/L during any sampling event. Several domestic wells in this area have consistently reported TCE concentrations, as well (up to 28 µg/L).

- Also within the southern portion of the study area at the northern end of Cascade Valley, samples collected from a cluster of eight domestic wells have reported up to 4.2 µg/L. No monitoring wells exist in this area.

Forty-one PSAs were evaluated during the RIs as potential sources of TCE or other contaminants. Thirteen of those were categorized as NFC sites in 1999 and 2000, based on historical information and/or information collected during the RIs. Of the remaining 28 PSAs, only one was found to be a definite source of TCE (LOX Plant). It should be noted that the source of TCE contamination has been removed from the LOX Plant (Site 19) and TCE concentrations in ASG samples collected from this site declined substantially between 2001 and 2002. Furthermore, human health and ecological risks for Site 19 were below target risk levels and TCE concentrations in ASG samples collected from the site in 2002 were equivalent to, or below, the RBSL derived from the MTCA Method B Protection of Groundwater Level for Soil. However, due to uncertainties in the vertical characterization of TCE contamination in the vadose zone, and in groundwater, at Site 19, this PSA is proposed for further investigation. Four other PSAs (i.e., Sites 6a/6b, 11, 22 and 35) are proposed for further evaluation in the FS due to the presence of non-

TCE related contaminants, as described below. The other remaining 22 PSAs could have been historical sources of TCE, but direct evidence for this is no longer present. Therefore, all of the remaining 22 PSAs are recommended for NFC.

Groundwater contours predicted by the numeric model indicate that groundwater flow is generally to the southwest, except in the southeast corner of the model domain and near pumping wells. The model results are in general agreement with observed water levels. However, the model does not match well with observed conditions in some areas of the site, likely a result of uncertainties in the conceptual model. These uncertainties include:

- Unknown variations in horizontal and vertical hydraulic conductivities within each unit
- Hydraulic differences between the Priest Rapids and Roza Members
- The Hydraulic relationship of alluvium and basalt groundwater with Moses Lake
- The effect of unsaturated conditions in the Hanford Formation
- The locations, stratigraphic intervals and discharge rates of the more than 400 water supply wells within the southern portion of the study area

Concentrations of TCE predicted by the transport simulation were greater than those observed in groundwater for the 50-year constant pulse and less for the 50-day constant pulse for a ten-year period than what has been observed in monitoring wells at the site. At the end of the 50-year constant pulse simulation, the simulated TCE plumes migrated in the primary direction of groundwater flow downgradient of known TCE concentrations and to areas of known TCE contamination. However, some areas in the model indicated TCE contamination in the simulation, but results from field monitoring reported non-detect for TCE contamination. At the end of the ten-year simulation, the plume in the Hanford Formation is almost non-existent, which supports the general trend of non-detect to very low concentrations in the Hanford Formation wells. However, some monitoring wells, such as 91-AW14 and 99-AW09, have consistently reported low concentrations of TCE. These inconsistencies are likely a result of uncertainties in the conceptual model, as well as the location, strength and duration of contaminant sources.

The most basic assumptions for a subsurface fate and transport model, such as the one presented in this document, are those regarding the subsurface stratigraphy and continuity of flow processes on the scale of the model grid and hydraulic properties. Results of borehole drilling have indicated that the upper basalt (Priest Rapids and upper Roza 1) is highly fractured and weathered in places and may create preferential flow pathways at the site. Heterogeneities in groundwater flow directions could also be a result of irregularities in the shape of the stratigraphic contacts and/or structural features. This limits the ability of a model to simulate groundwater flow and contaminant transport at the site.

In the transport simulations, PSAs were located in order to simulate contamination in areas of potential contamination based on historical knowledge of waste disposal practices at the site. Contaminant plumes from these PSAs will flow in the primary direction of groundwater flow. Areas of uncertainty that affect the results of contaminant transport

modeling include a lack of known initial concentrations, retardation or sorption rates, starting times, duration of the contaminant pulse(s) and the locations of historical PSAs.

The baseline human health and ecological risk assessment was intended to evaluate potential risks to public health and the environment from chemicals present in, or released from, media associated with the site. Media and site characterization data evaluated in the human health and ERA included soil sampling results and soil gas sampling results collected from suspected PSAs. Groundwater monitoring data collected from the alluvium (Hanford and Ringold formations) and the Wanapum Basalt (Priest Rapids and Roza Members) were also evaluated. These data were screened, as described in Sections 6.2.2 and 7.3.1, to identify COPCs and COPECs for evaluation in the baseline HHRA and ERA, respectively.

Based upon human health screening, Sites 8 and 31 were found to have no parameter concentrations above soil or soil gas COPC screening levels and were not further evaluated in the baseline HHRA, as shown in Table 8.2, *Risk Assessment Summary for Sites*. For Sites 14, 15 and 33, soil sampling results were below COPC screening criteria, but soil gas sampling results exceeded COPC screening criteria. These three sites were further evaluated in the baseline HHRA, along with the remaining sites, for which chemical concentrations exceeded COPC screening criteria based on soil sampling results and/or soil gas sampling results. The following sites were evaluated in the baseline HHRA, but were associated with carcinogenic risk and non-carcinogenic hazard estimates below USEPA's acceptable risk range of 10^{-6} to 10^{-4} and HI equal to 1.0: Sites 2, 3a, 3b, 3c, 4a, 4b, 5, 9, 14, 16, 19b, 20, 23, 33, and 35. Sites 6a and 6b, 17, 18 and 19 were associated with carcinogenic risk and non-carcinogenic hazard estimates within USEPA's acceptable risk range of 10^{-6} to 10^{-4} and HI equal to 1.0. For Sites 6a and 6b, however, the estimated cancer risk of 2.7×10^{-5} exceeds the MTCA acceptable risk criterion of 1.0×10^{-5} due to the presence of arsenic in soils at a maximum concentration of 94 mg/kg in a single sample (00MLW001SS001S06) collected from Site 6a (Base Closure Landfill). Arsenic concentrations in all other soil samples collected from Sites 6a and 6b were below the BUTL for arsenic in Moses Lake soils. Consequently, Site 6a is proposed for further evaluation in the FS in regards to potential human health concerns. The maximum concentration of Oilm-Dx equal to 14,000 mg/kg at Site 11 exceeded the MTCA-A Cleanup Level for Soil – Protection of Groundwater criterion. Therefore, Site 11 is proposed for further evaluation in the FS. Site 22 was associated with a total HI in excess of the USEPA and MTCA acceptable hazard criterion of 1.0 due to the presence of Aroclor 1254 in soils at a maximum detected concentration of 8.4 mg/kg. In addition, the results of the baseline HHRA indicate that lead concentrations in Site 22 soils may pose a potential hazard to future construction workers potentially exposed to site soils. Consequently, Site 22 is also proposed for further evaluation in the FS. Finally, Site 35 contained maximum concentrations of Gro-Gx, Diesel-Dx and Oilm-Dx in excess of the respective MTCA-A Cleanup Level for Soil – Protection of Groundwater criteria, and significant petroleum hydrocarbon staining was present. Therefore, Site 35 is proposed for further evaluation in the FS.

The ERA for the site included an evaluation of suspected PSA impacts to ecological receptors potentially inhabiting or foraging at the PSAs. The following sites contain no usable habitat and were not further evaluated in the ERA: Sites 2, 3a, 3b, 3c, 4a, 4b, 5, 9,

12, 14, 16, 18, 19b, 23 and 25. For the remaining suspected sites, the ERA included a comparison of soil sampling results to protective COPEC screening criteria. For Sites 11 and 35, maximum concentrations of soil parameters were below available COPEC screening criteria. However, these sites were further evaluated in the ERA due to the presence of Oilm-Dx at concentrations up to 14,000 mg/kg and the presence of stressed vegetation at Site 11, and the presence of Diesel-Dx, Gro-Gx, and Oilm-Dx at concentrations up to 16,000 mg/kg, 110 mg/kg, and 31,500 mg/kg, respectively at Site 35. Ecological HI estimates for all remaining sites evaluated in the ERA, with the exception of Sites 6a and 6b, were below the USEPA and MTCA acceptable ecological hazard criterion of 1.0, as shown in Table 8.2. The ecological hazard criterion of 1.0 was slightly exceeded by total HI estimates for the Washington ground squirrel, Great Basin pocket mouse and sage sparrow. Chemicals in soil that contributed to excess HI estimates for these ecological indicator receptors were arsenic, cadmium, chromium, copper, nickel and zinc. Maximum detected soil concentrations for these inorganic COPECs were derived from three samples collected at Sites 6a or 6b and were elevated above typical soil concentrations observed in the western U.S. Consequently, Sites 6a and 6b are proposed for further evaluation in the FS, in regard to potential ecological concerns. Site 11 was also proposed for further evaluation in the FS in regard to potential ecological concerns due to the presence of Oilm-Dx at concentrations up to 14,000 mg/kg, and the observation of stressed vegetation.

The results of COPC screening for groundwater indicated that TCE concentrations measured in the Hanford and Ringold formations were below the COPC screening criterion of 5.0 µg/l. An exception to this is in monitoring well 00-AW11, as shown in Table 8.3, *Summary of Human Health Risk Assessment Results - Groundwater*. Monitoring well 00-AW11 is located in the south-central portion of the study area. Other chemicals exceeding COPC screening criteria in the Hanford and Ringold formations groundwater included two trihalomethanes (bromodichloromethane and dibromochloromethane) in monitoring well 91-AW14, and two petroleum-related compounds (1,2,4-trimethylbenzene and 1,3,5-trimethylbenzene) in monitoring well 91-AW15. Maximum concentrations of TCE exceeded the COPC screening criterion in four wells screened in the Priest Rapids Member (i.e., 99-BW10, 99-BW15, 99-BW18 and 00-BW12). Other chemicals exceeding COPC screening criteria in the Priest Rapids included benzene (00-BW11), manganese (00-BW02, 00-BW12 and 00-BW13) and MTBE (00-BW18). Maximum concentrations of TCE exceeded the COPC screening criterion in seven wells screened in the Roza Member (i.e., 91-BW03, 92-BW01, 99-BW01, 99-BW15, 99-BW16, 02-BW01 and 02-BW02). Maximum concentrations of MTBE (92-BW02) and DBCP (99-BW16) in wells screened in the Roza Member also exceeded their COPC screening criteria. Because it is not known if the Priest Rapids and Roza Members actually represent separate hydrologic units, data from wells screened in the Priest Rapids and Roza were also combined, as shown in Table 8.3. Since COPC screening was performed on a well-specific basis, however, screening results for this combined unit are the same as those described above for the Priest Rapids and Roza Member wells. Screening intervals for drinking water wells are not currently known. Therefore, drinking water wells were not assigned to a specific stratigraphic unit. Maximum concentrations of TCE exceeded the COPC screening criterion in drinking water wells WP-14, WP-15E and WP-15W. The two trihalomethanes, bromodichloromethane and dibromochloromethane,

were detected in drinking water well WP-13E at concentrations above their COPC screening criteria.

All groundwater stratigraphic units were further evaluated in the baseline HHRA, because they contained TCE and other COPCs. For all monitoring wells or well clusters evaluated in the baseline HHRA carcinogenic risk estimates were within USEPA's acceptable risk range of 10^{-6} to 10^{-4}. With the exception of Roza Cluster #1 and Priest Rapids/Roza Combined Cluster #1, all noncarcinogenic hazard estimates were below USEPA's acceptable HI equal to 1.0. In addition, these risk and hazard estimates were below the MTCA risk and hazard criteria of 1×10^{-5} and 1.0, respectively. The estimated noncancer HI (18) for Roza Cluster #1b and Priest Rapids/Roza Combined Cluster #1b was attributable to acetone detections in Well 02-BW02 of 19 mg/L, as shown in Table 8.3. Acetone is a common laboratory contaminant, but confirmation sampling on February 27, 2003 confirmed the detection of 19 mg/L acetone in well 02-BW02. The source of this contaminant is not currently known, but its presence in groundwater is believed to be unrelated to historical site activities.

Based upon the above results, concentrations of TCE in groundwater associated with the site are not anticipated to pose a significant risk to human health. It should be noted, however, that concentrations of TCE in numerous wells associated with the site exceed the federal and State drinking water standard of 5.0 µg/l, which is a recognized ARAR. Evaluation of the compliance of TCE and other chemicals with ARARs will be conducted during the FS. Chemicals and media that are demonstrated not to comply with ARARs because of this evaluation will be considered further in the FS as part of the remedial measures study. Appropriate remedial decisions concerning such chemicals and media will be made based upon the results of this study.

Potential impacts of TCE concentrations in groundwater on human and ecological receptors associated with Moses Lake were qualitatively evaluated. Although the baseline HHRA and ERA concluded that potential impacts of TCE in groundwater on human or ecological receptors using Moses Lake are unlikely, uncertainties exist regarding the hydraulic relationship between Moses Lake and groundwater at the site. Therefore, conclusions regarding this potential exposure pathway and potential impacts on surface water receptors cannot be made at this time.

The Environmental Protection Agency (Comments on Draft Final Remedial Investigation Report, April 2003) has indicated to the U.S. Army Corps of Engineers that in their judgement the objective of finding potential sources of contamination at the Moses Lake Wellfield Superfund Site has been completed. Based on the results of the Remedial Investigations, no current sources of TCE contamination to groundwater were found, that would explain the long-term, low concentration large-scale TCE plume observed at the site. The only possible exception to this is the Liquid Oxygen Generating Plant, discussed above. Furthermore, the Environmental Protection Agency believes that it is unlikely that additional investigations and/or remedial actions that may be conducted at the site will ever find or remove existing sources at the site.

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TABLES

TABLE 1.1 OBJECTIVES OF THE REMEDIAL INVESTIGATIONS AND FEASIBILITY STUDY
INTERAGENCY AGREEMENT (FEBRUARY 1999)
Identify the nature and extent of the plume.
Inventory and sample selected domestic wells.
Determine future movement of the plume and if other domestic water wells may be affected.
Identify safe domestic water alternatives for identified contaminated wells.
Identify alternatives for addressing the plume.
Identify surface exposures of contamination.
Locate potential source(s) of trichloroethene (TCE) contamination.
U.S. ARMY CORPS OF ENGINEERS SCOPE OF WORK (MARCH 1999)
Determine who is (and who will be) exposed to TCE in groundwater above acceptable risk.
Determine how to prevent current (and future) exposure to TCE above acceptable risk.
Determine how to prevent or minimize migration of the TCE plume.
Determine how to prevent or minimize the migration of TCE from dense non-aqueous phase liquid (DNAPL) sources.
Determine how to return groundwater to beneficial use if practicable.
Determine whether current (or potentially future) exposures to radionuclide contamination exist in site soil, groundwater or air.
Determine how to prevent current (and future) exposure to radionuclides above acceptable risk levels.
Determine whether current (or potentially future) exposures to tetraethyl lead (TEL) contamination exist in site soil, groundwater or air.
Determine how to prevent current (and future) exposure to TEL above acceptable risk levels.
Determine whether current (or potentially future) exposures to common United States Air Force (USAF) installation contaminants (e.g., heavy metals and chlorinated pesticides at landfills) exist in site soil, groundwater, or air.
Determine how to prevent current (and future) exposure to common USAF installation contaminants above acceptable risk levels.
MANAGEMENT PLAN (SEPTEMBER 1999)
Characterize the vertical and lateral extent of the existing TCE plume
Characterize geologic and hydrogeologic conditions within the study area to support development of the conceptual and numeric hydrogeologic models.
Identify potential contaminant pathways.
Measure the concentrations of TCE, if present, within domestic wells.
Determine current and future land use.
Determine the presence or absence of radiological anomalies at the Low Level Radioactive Waste Disposal Site.
Characterize concentrations of TCE in springs and seeps along Moses Lake.
MANAGEMENT PLAN (SEPTEMBER 1999)[1]
Fill in any remaining data gaps with respect to the TCE plume or hydrogeologic characterizations.
Determine the presence or absence of potential TCE sources.
Characterize potential sources associated with other (non-TCE) contaminants of concern.
Continue quarterly monitoring well sampling.
MANAGEMENT PLAN ADDENDUM (APRIL 2000)
Determine the presence or absence of potential TCE sources.
Characterize potential sources associated with non-TCE Chemical of Potential Concern (COPCs).
Address data gaps with respect to the TCE plume or hydrogeologic characterization.
Continue the quarterly well monitoring initiated in the fall of 1999.
Measure the concentrations of TCE, if present, within additional domestic and public water supply well samples for TCE.
SUPPLEMENTAL MANAGEMENT PLAN (JANUARY 2003)
Confirm specific conclusions made during execution of the 1999 and 2000 RIs.
Evaluate whether certain sites not previously investigated are current or historical sources of TCE.
Determine the exact nature of representative geophysical anomalies at the landfills.
Conduct well maintenance/conversion. Note: [1] These objectives are listed in the Management Plan, but are relative to the 2000 RI.

TABLE 1.2
REMEDIAL INVESTIGATION FINDINGS SUPPORTING NO FURTHER CHARACTERIZATION FOR NFC SITES

Source Area No.	Source Area Name	Description of Site	Remedial Investigation Findings	Conclusions[1]	Recommendations
Site 1	Liquid Disposal Site (D&M Site 1)	This site is a 45-foot by 25-foot area that is fenced with barbed wire and marked with two signs stating "Danger". There are two roughly circular excavations: one is approximately two feet deep; the other is approximately 10 feet deep. Based on aerial photographs, liquid wastes may have been disposed of directly into the two circular excavations as early as 1949.	Soil was analyzed from test pit samples for pesticides, PCBs, TPH, BNAs, VOCs and metals (D&M, 1993). Groundwater was analyzed for VOCs. There were no TCE detections in groundwater. All parameters were non-detect in soil, except for metals. Metals concentrations were all less than "background" concentrations as well as ARARs (D&M, 1993).	No exceedances of soil parameters and no TCE detected in GW. Re-sampling of wells 91-AW01, 91-AW02, 91-AW03 and 91-BW01 confirmed absence of TCE (MWH, 2003).	No further characterization (MW, 2000).
Site 7	Rock Landfill	This site was used for rock disposal only.	Since this site was only used for rock disposal it has a low potential as a contaminant source (MW, 2000). Therefore, no sampling activities were conducted at this site. This site was also investigated as part of the Randolph Road Base Dump (Site 8), which confirmed that that the site has a low potential as a contaminant source (MWH, 2003).	Low potential as a contaminant source because the site was used for rock disposal only. There are sufficient GW monitoring wells in the area to monitor potential GW impacts (MW, 2000).	No further characterization (MW, 2000).
Site 10	Fire Training Area Burn Pit A	This is a pit where solvents and other wastes were disposed. Aerial photographs from 1955 and 1961 show dark stained soil at the site. A fire training area was established near the pit in approximately 1974. The site was supplied with JP-4 and diesel fuel that was piped to the site. After burn events, residual fuel-water mixtures were allowed to evaporate and percolate into the underlying soil. The burn pit was used by Big Bend Community College and the Port of Moses Lake. In 1992, approximately 3,081 cubic yards of petroleum contaminated soil was removed to a depth of 47 feet by the Port of Moses Lake (Maddox and Associates, 1992).	One analytical test of soil obtained from a depth of six feet in the center of the training area identified TCE concentrations below 0.5 mg/kg (Maddox and Associates, 1992)	Because of the removal action and available GW monitoring data, preliminary RAOs have been met (MW, 2000). A well to the southwest of the site (91-AW13) exists, and an additional well pair will be (***was?***) installed to the south near the community college.	No further characterization (MW, 2000).
Site 13	Rock Drain	This site was used as a rock drain.	Field reconnaissance did not reveal any indication that this site could be a source of contaminants.	Low potential as a contaminant source area.	No further characterization (MW, 2000).

Source Area No.	Source Area Name	Description of Site	Remedial Investigation Findings	Conclusions[1]	Recommendations
Site 21	Larson Municipal WWTP	The Wastewater Treatment Plant consists of the sewage treatment plant, four lift stations, sewer mains and easements. The sewage plant consists of two aeration basins, two sedimentation ponds and three leaching ponds. The annual average daily flow rate into the sewage plant in 1986 was reported to be 307,000 gpd. Reportedly, the principal type of industrial waste discharged to the plant was electronic and high technology plant wastewater with an estimated flow of 30,000 gpd. According to a 1956 Washington Pollution Control Commission discharge permit, approximately 200 gallons of solvent waste per year was estimated to be discharged to the treatment plant. The 1956 permit was renewed in 1961 and 1967.	Wells 99-BW15 and 99-AW08 are adequate for monitoring potential GW impacts at this site (MW, 2000).	Existing wells can be used to monitor potential GW contamination (MW, 2000).	No further characterization (MW, 2000).
Site 24	Building 2802	At this site, air bag inflator assemblies were manufactured. When the company first occupied the site in 1972, company personnel noted minor soil staining around Buildings 5302 and 5309, and evidence of previous automobile repair work. TCE may have been used for working on automobiles.	No vadose sampling was conducted because the site has low potential as a TCE source. Numerous GW monitoring wells are located downgradient of the site (91-AW07, 91-AW08, 91-AW09, 91-BW03, 99-AW01, 99-BW01).	Low potential as a source area; existing monitoring wells can be used to monitor potential GW impacts (MW, 2000).	No further characterization (MW, 2000).
Site 26	Conventional Ammunition Storage Bunkers	Conventional ammunition was stored at the former LAFB in bunkers. Based on known practices, these facilities may have stored solvent materials. However, no interviews or written information indicates the storage or disposal of liquid wastes.	No vadose zone or GW sampling conducted because the site has a very low potential as a source area.	Low potential as a source area, due to historical use of the site (MW, 2000).	No further characterization (MW, 2000).
Site 27	TEL Disposal Site (D&M Site 2)	Tetraethyl lead (TEL) may have been disposed of at this site. Other than a warning sign attached to a fence surrounding Sites 2, there is no historical information indicating that TEL was disposed at this site. A chain link fence surrounded` the pumphouse and the associated underground storage tank area. On the southeast corner of the fence is a sign stating "Danger, Materials Containing Tetraethyl Lead Buried Here, Do Not Uncover." The location of the buried TEL that the sign is referring to is unknown and historical documents do not refer to the use of TEL during former LAFB operations. No visible signs of burial are present.	During the Phase 1 RI (D&M, 1993; 1995), four perimeter test pits were excavated near magnetic and geophysical anomalies. Lead concentrations measured in 15 subsurface soil samples collected from test pits were demonstrated not to be elevated (MW, 1999). Dissolved lead levels in GW monitoring wells located near the site were below the MTCA A level and Region 9 PRG (MW, 1999). Additionally, pesticides, PCBs and PNAs tested in soil samples were all non-detect; low levels of TPH and VOCs were detected; and metals were less than "background" levels and ARARs (D&M, 1993).	Elevated levels of lead in soil and GW were not found during the Phase 1 RI (D&M, 1993; 1995) or subsequent evaluation of this data (MW, 1999). It is unlikely that TEL will be found at the site because any TEL released over 30 years ago would have volatilized or degraded to metallic forms; metallic forms such as lead sulfate are immobile and are unlikely to reach GW (MW, 1999).	No further characterization (MW, 1999; 2000). "Future remedial action should include land use restrictions due to potential physical hazards associated with intrusion into the potential disposal area." (MW, 1999).

Source Area No.	Source Area Name	Description of Site	Remedial Investigation Findings	Conclusions[1]	Recommendations
Site 28	TEL Disposal Site (D&M Site 3)	Tetraethyl lead (TEL) may have been disposed of at this site. Currently the site is the location of a 1.1 million-gallon AST. The AST area is surrounded by containment berms and a chain link fence. On the chain link fence are two signs stating "Danger, Materials Containing Tetraethyl Lead Buried Here, Do Not Uncover." The location of the buried TEL that the signs refer to is unknown and historical documents do not refer to the use of TEL during former LAFB operations. Other than the warning signs, there is no historical information indicating that TEL was used or disposed of at this site. No visible signs of burial are present.	During the Phase 1 RI (D&M, 1993; 1995), four perimeter test pits were excavated near magnetic and geophysical anomalies. Lead concentrations measured in 15 subsurface soil samples collected from the test pits were demonstrated not to be elevated (MW, 1999). Dissolved lead concentrations in groundwater monitoring wells located near the site were below the Region 9 Tap Water PRG (MW, 1999). Additionally, pesticides, PCBs, PNAs and VOCs tested in soil samples were all non-detect and metals were less than two times "background" levels and MTCA cleanup levels (D&M, 1993).	Elevated levels of lead in soil and GW were not found during the Phase 1 RI (D&M, 1993; 1995) or subsequent evaluation of this data (MW, 1999). "It is unlikely that TEL will be found at the site because any TEL released over 30 years ago would have volatilized or degraded to metallic forms; metallic forms such as lead sulfate are immobile and are unlikely to reach GW" (MW, 1999).	No further characterization (MW, 1999; 2000). "Future remedial action should include land use restrictions due to potential physical hazards associated with intrusion into the potential disposal area." (MW, 1999).
Site 29	Low Level Radioactive Medical Waste Disposal Site (D&M Site 4)	The site consisted of a small circular feature, approximately 50 feet in diameter that was previously enclosed by a barbed wire fence. Based on interviews with former site personnel, the site was used for disposal of low-level radioactive medical waste. A sign was posted that radioactive materials were disposed in the area.	This site was evaluated in the Phase 1 RI (D&M, 1993). Pesticides, PCBs and PNAs tested in soil samples were all non-detect and metals were less than two times "background" levels and "regulatory levels" cleanup levels (D&M, 1993). The soil samples did contain low levels of VOCs, chlorinated pesticides, TPH and gross alpha and beta. Gross alpha and gross beta levels detected in downgradient wells were below Washington State Groundwater Quality Criteria (D&M, 1993). However, a more recent radiation survey was conducted during the 1999 RI and no radionuclides were detected (MWH, 2003).	This site was characterized, and radiation levels were demonstrated to be below levels of concern (D&M, 1993).	No further characterization (MW, 2000).
Site 30	Bunker Disposal Area	This site was identified as a potential source area based on an interview with (b) (6)	No investigation or sampling activities were conducted.	This site has low potential as a source area (MW, 2000).	No further characterization (MW, 2000).
Site 32	South Burn Pit	This site is located south of the airfield and straddles what is now Patton Boulevard near the City of Moses Lake water storage tank tower number 4. The site was a PSA since it appeared in the aerial photographs to be similar to a burn pit.	Field reconnaissance during the 2000 RI and further review of the aerial photographs indicated that the site was actually a shadow from the adjacent City of Moses Lake water tower.	Not a potential source area.	No further characterization (MW, 2000).

Source Area No.	Source Area Name	Description of Site	Remedial Investigation Findings	Conclusions[1]	Recommendations
Site 34	Patton Park Landfill	This area is located near the South Burn Pit (Site 32) area in a field bounded by 21st Street to the north, a gas station and Harris Road to the south, railroad tracks to the east and Patton Boulevard to the west. A nearby resident reported to the RI teams that solvents had historically been discharged and/or drums had been buried at this site. The resident showed the field team the approximate location of the landfill to focus the field investigation.	Neither field reconnaissance during the 1999 RI nor a geophysical survey revealed any indication of a landfill or disturbed area. Nor were there any historic evidence or records of a landfill or other disturbances in the area identified.	Low potential as a contaminant source.	No further characterization (MW, 2000).

Notes:

(1) See also table titled *Scoring Table for Potential TCE Release Areas*.

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TABLE 1.3 SUMMARY OF PREVIOUS INVESTIGATIONS			
Agency/Company	**Contractor**	**Scope and Site Work Duration**	**Documentation**
State of Washington Department of Health	None	Five well sampling periods from 20 municipal and private supply wells; Feb. to Dec.1988	Analytical reports
Washington State Department of Ecology	Science Applications International Corporation	Review of existing information and recommendations for further work	Preliminary Assessment Report, Grant County Municipal Airport; Sept. 1988
EPA	E & E	Records review, soil gas survey	Background Data Report for Old Larson Air Force Base; April, 1989
EPA	E & E	Records review, soil gas survey, groundwater sampling and analysis and a geophysical investigation	Site Inspection Report; Dec. 1990
City of Moses Lake	Golder Associates	Groundwater evaluation; summary of known information to 1991 with additional field work in June 1991	Hydrogeological Evaluation of Larson Area, Moses Lake, Washington; Oct.1991
EPA	E & E	Site assessment for National Priority List (NPL); Sept. 1991 and Mar. 1992	Technical Assistance Team Site Assessment Final Report for Moses Lake Well Field; Sept. 1992
Port of Moses Lake	George Maddox and Associates, Inc. (George Maddox)	Fire Fighting Training Facility cleanup; Feb. – Mar. 1992	Site Assessment – Fire Fighting Training Facility at the Port of Moses Lake; May 1992
USACE	Dames & Moore	Evaluation of soil and groundwater at 4 potential disposal sites and shallow groundwater downgradient of suspected TCE sources; Summary of historical USACE work. '88 to Mar. 1990; field work conducted during Aug. 1991 – Oct. 1992	Phase I Remedial Investigation Report; Mar.1993
City of Moses Lake	Golder Associates (Golder)	Water quality and hydraulic properties of Wanapum C & D zones; Oct. 1992-Jan. 1993	Temporary Modification and Long-Term Pump Testing of Well 21; April 1993
USACE	Dames & Moore	Additional groundwater investigation work; Oct. 1993 – Sept. 1994	Phase I Remedial Investigation Addendum Report; July 1995
Port of Moses Lake and Exxon Company	Secor International Inc.	Leaking underground storage tank investigation, feasibility study and cleanup at Pumphouse 1 area; Jan. 1993 – Nov. 1996	Site Assessment, Focused Feasibility Study and Fate and Transport Modeling Report: Pumphouse 1, Grant County Airport; Aug. 1997
The Boeing Company	Woodward-Clyde	Shallow alluvium field investigation at 3-Place Hangar area; Feb. – Mar. 1998	Investigation of Boeing Moses Lake Facility; April 1998
EPA	URS Greiner, Inc.	Identification and sampling of selected private wells and wells for Class A and Class B water systems; May 1998	Private Well Data Summary Report for the Moses Lake Wellfield; July 1998.
USACE	Montgomery Watson	Additional groundwater and potential source area investigation work and sampling of selected private wells and wells for Class A and Class B water systems; June - Sept. 1999.	Site Characterization Technical Memorandum, Remedial Investigation/Feas bility Study, Moses Lake Wellfield Superfund Site, Mar. 2000. Site Characterization Summary Report, Remedial Investigation/Feas bility Study, Moses Lake Wellfield Superfund Site, 2001.
USACE	Montgomery Watson	Additional groundwater and potential source area investigation work and sampling of selected private wells and wells for Class A and Class B water systems; June 2000 - May. 2001.	2000 Site Characterization Technical Memorandum, Remedial Investigation/Feas bility Study, Moses Lake Wellfield Superfund Site, Jan. 2000. Site Characterization Summary Report, Remedial Investigation/Feas bility Study, Moses Lake Wellfield Superfund Site, 2001.

TABLE 2.1 SUMMARY OF INVESTIGATIVE AND ANALYTICAL METHODS: TOOL BOX	
TOOL	**PURPOSE**
INVESTIGATIVE METHODS	
Review existing data	Compared what was known about specific locations to determine whether additional investigation was necessary; complemented data collected during field investigation in RI and FS preparation; provided hydrogeologic model input.
Sample monitoring wells	Provided hydrogeologic model input; evaluated groundwater chemistry
Install and sample new monitoring wells	Provided hydrogeologic model input; verified hydrogeologic model results; evaluated groundwater chemistry
Sample surface water and seeps	Determined volume of TCE entering Moses Lake
Inventory and sample domestic water supplies	Determined TCE concentration in household water and verified hydrogeologic model results.
Collect groundwater elevation data	Provided better understanding of groundwater flow gradient (including possible seasonal differences) and provided hydrogeologic model input.
Conduct aquifer testing and grain-size analysis	Provided hydrogeologic model input.
Perform field reconnaissance	Identified visual evidence of potential impacts to soil or groundwater.
Conduct standard non-intrusive electromagnetometry	Determined presence of disturbed soil to identify extents of landfills, drain fields, trenches; determine presence of subsurface pipes and other anomalies.
Conduct standard non-intrusive ground penetrating radar	Determined extents of landfills, drain fields, septic tanks, pipes and trenches.
Perform landfill excavations	Determined the nature of geophysical anomalies and evaluated whether existing sources exist.
Perform soil borings	Determined site stratigraphy and presence of Dense Non-Aqueous Phase Liquid and collected deep soil samples.
Install piezometers	Determined site stratigraphy, collection point for water level measurement data.
Conduct active soil gas surveys	Determined whether volatile contaminants were present in subsurface (may indicate TCE source) provided faster sample collection time than passive surveys.
Analyze active soil gas with fixed laboratory for VOCs	Provided more accurate data then a mobile laboratory
Perform radiation scan using Micro Rem meter	Determined whether surface radiation anomalies existed that indicated the presence of radionuclide contamination, to supplement radiation data collected during 1991 and 1993 remedial investigations.
Surface (0-2 ft. bgs) soil sampling	Determined whether contamination existed in surface soil.
Near-surface (2-10 ft. bgs) soil sampling	Determined whether contamination existed in near-surface soil.
Analyze water samples with fixed laboratory for volatile and semi-volatile organic compounds, metals and general water quality parameters (see Table 2.3)	Provided plume definition and water quality assessment.
Analyze water samples with fixed laboratory for hydrocarbon dissolved gases (target compounds were methane, ethene, and ethane) (see Table 2.3)	Provided indicators of TCE and daughter degradation in groundwater (e.g., natural attenuation parameters).
Analyze water samples with fixed laboratory for natural attenuation parameters (see Table 2.3)	Enabled assessment of natural attenuation.
Analyze water samples with a manufactured flow through cell for routine field parameters (e.g., redox potential, pH, temperature, specific conductance, dissolved oxygen) (see Table 2.3)	Assisted with determining when to sample during low-flow sampling events.
Analyze soil samples with fixed laboratory for volatile and semi-volatile organic compounds, metals and radionuclide species (see Table 2.2)	Determined whether contamination existed in soil. Only alternative for speciation of radionuclides.
Analyze soil samples with mobile laboratory (portable x-ray fluorescence meter) for lead (see Table 2.2)	Determined whether contamination existed in soil; in-field analysis directed whether and where additional soil samples were collected, and whether wells were to be installed and/or sampled; provided screening for landfill contamination indicator parameter to determine whether samples should be analyzed at a fixed laboratory for a larger suite of contaminants.
Conduct hydrogeologic modeling	Provided picture of plume to assist with assessing potential future TCE concentrations and TCE sources.
Conduct Expedited Investigation	Kept investigation focused on collecting only the data that were needed to meet project objectives; kept "value of data" decisions in the field; minimized time of investigation.

TABLE 2.2 SAMPLE ANALYTES AND METHODS FOR SOIL AND SOIL GAS		
Analytes	**Analytical Method**	**Matrix**
Volatile Organic Compounds	TO-14A	Gas
Volatile Organic Compounds	SW5035/SW8260B	Soil
13 Priority Pollutant metals (Ag, As, Be, Cd, Cr, Cu, Hg, Pb, Ni, Sb, Se, Th, Zn)	SW6010B/7471A/7000 Series	Soil
Polychlorinated biphenyls	SW8082	Soil
Hydrocarbon Screen (followed by TPH-Gx and TPH-Dex if necessary)	NWTPH-HCID + TPH-Gx & TPH-Dex (8015M)	Soil
Field pH	SW9045	Soil

TPH-Gx - Total Petroleum Hydrocarbons as gasoline.
TPH-Dex - Total Petroleum Hydrocarbons as diesel.
"x" indicates quantification of carbon fractions detected.
Extended indicates that the method is extended into the carbon range of heavy oil.

TABLE 2.3
SAMPLE ANALYTES AND METHODS FOR GROUNDWATER

Analytes	Analytical Method	Matrix	Filtered
General Parameters[1] (Fixed)			
Alkalinity	EPA Method 310.1	Water	No
Chloride	EPA Method 300.0	Water	No
Nitrate	EPA Method 300.0	Water	No
Sulfate	EPA Method 300.0	Water	No
Dissolved major cations (Na, K, Mg, Ca, Fe)	SW6010B	Water	Yes
Hardness	SM314A	Water	Yes
Total organic carbon	SW9060	Water	No
General Analytes[2] (Field)			
Carbon Dioxide	Hach Method 8205	Water	No
Ferrous Iron	Hach Method 8146	Water	No
Dissolved Oxygen	Hach Method 8166	Water	No
VOC Parameters			
Volatile Organic Compounds	SW8260B	Water	No
1,4-Dioxane	SW8270C	Water	No
Hydrocarbon dissolved gasses[3]	RSK 175	Water	No
Metals			
Dissolved metals (Sb, As, Be, Cd, Cr, Cu, Pb, Hg, Mn, Ni, Se, Ag, Tl, Zn)	SW6010B/7000	Water	Yes
Pesticides			
Organochlorine Pesticides	SW8081	Water	No
Petroleum Hydrocarbons			
Hydrocarbon Screen (followed by TPH-Gx and TPH-Dex, if necessary)	NWTPH-HCID + TPH Gx & TPH-Dex (8015M)	Water	No
SVOCs Parameters			
Semi-Volatile Organic Compounds	SW8270C	Water	No
Carcinogenic polycyclic aromatic hydrocrbons[4]	SW8270C SIM	Water	No
Other Analytes			
Perchlorate	EPA Method 314.0	Water	No
Glycol Ethers	SW8260B	Water	No

Notes:
TPH-Gx - Total Petroleum Hydrocarbons as gasoline ("x" indicates quantification of carbon fractions detected)
TPH-Dx extended -Total Petroleum Hydrocarbons as diesel ("x" indicates quantification of carbon fractions detected). Extended indicates that the method is extended into the carbon range of heavy oil.

1 Fixed general analytes include natural attenuation parameters and major ions
2 Field general analytes include natural attenuation parameters analyzed using a Hach titration kit
3 Hydrocarbon dissolved gasses are methane, ethane and ethene
4 Carcinogenic polycyclic aromatic hydrocarbons are benzo(a)pyrene, chrysene, indeno(1,2,3-cd)pyrene, benzo(k)flouranthene, benzo(b)flouranthene, benzo(a)anthracene, dibenzo(a,h)anthracene, fluoranthene, benzofluoranthene, benzo[ghi]perylene, and pyrene.

TABLE 3.1 PROPOSED ZONING				
Land Use Category	**Area (acres)[1]**			
	UGA outside current City limits[2]		**Cascade Valley**	
	Total	**Vacant**	**Total**	**Vacant**
Residential	2,024.3	721.3	1,768.5	1,030.2
Commercial	156.8	0	38.9	0
Industrial	5,681.9	2,973.9	0	0
Agricultural	4,896.4	355.9	0	0
Airport[3]	0	0	0	0
Public/Open Space	348.1	0	0	0
Total	13,107.5	4,051.1	1,807.4	1,030.2

Notes:

[1] Based on 1998 future zoning map.

[2] Includes the Port of Moses Lake as well as the Wheeler Corridor, which is located east of the City.

[3] Airport land use areas are air operation areas such as runways and associated areas

TABLE 3.2
SUMMARY OF GEOLOGIC DATA FROM BOREHOLES

Well ID	Screen Interval[1]	2003 Screen Lithology	Hanford Formation Thickness	Elevation Top of Ringold Fm.	Ringold Thickness	Elevation of Top of Basalt	Priest Rapids Thickness (measured)	Priest Rapids Thickness (inferred)[2]	Elevation of Top of Roza[3]	Northing	Easting	Monument Cap Elevation	Ground Surface Elevation	Elevation of Top of Steel Casing	Elevation of Top of PVC
Alluvium Wells - USACE															
00AW03	70-80	Hanford	80.5	Not Present	n/a	1076.83	n/a	n/a	Unknown	677689.70	2297837.80	1157.33	nm	1159.90	1159.03
00AW08	71-81	Hanford/Ringold	74.0	1091.23	Unknown	Unknown	n/a	n/a	Unknown	680151.80	2294583.30	1165.23	nm	1168.05	1167.70
00AW10	125.3-135.3	Hanford/Ringold	134.0	1035.91	Unknown	Unknown	n/a	n/a	Unknown	663991.50	2296902.20	1169.91	nm	1169.91	1169.38
00AW11	81-91	Hanford/Ringold	84.0	1071.21	Unknown	Unknown	n/a	n/a	Unknown	676061.30	2297048.50	1155.21	nm	1158.15	1157.66
00AW12	86.6-96.6	Hanford/Ringold	95.0	1056.11	Unknown	Unknown	n/a	n/a	Unknown	674889.50	2298801.70	1151.11	nm	1153.59	1153.08
00AW13	127.5-137.5	Hanford/Ringold	135.0	1045.74	Unknown	Unknown	n/a	n/a	Unknown	668528.60	2294056.20	1180.74	nm	1180.74	1179.98
00AW14	81-91	Hanford/Ringold	86.0	1065.66	Unknown	Unknown	n/a	n/a	Unknown	670580.80	2298379.60	1151.66	nm	1154.80	1153.90
99AW01	101-111	Hanford			Unknown	Unknown	n/a	n/a	Unknown	675830.206	2295820.308	1160.25	1160.23	1163.25	1162.64
99AW02	55-65	Hanford	64.0	1040.33	Unknown	Unknown	n/a	n/a	Unknown	665059.234	2300377.673	1104.55	1104.33	1107.41	1106.93
99AW03	122-132	Hanford/Ringold	124.0	1081.39	Unknown	Unknown	n/a	n/a	Unknown	666407.405	2296533.842	1175.65	1175.39	1178.60	1178.11
99AW04	48-58	Hanford	58.0	1028.80	Unknown	Unknown	n/a	n/a	Unknown	665814.034	2292529.715	1086.96	1086.80	1086.98	1086.48
99AW05	109-119	Hanford	138.0	1040.17	Unknown	Unknown	n/a	n/a	Unknown	673736.784	2293824.322	1178.31	1178.17	1178.34	1177.69
99AW06	102-112	Hanford/Ringold	110.0	1058.02	Unknown	Unknown	n/a	n/a	Unknown	671433.551	2296180.629	1168.10	1168.02	1170.94	1170.49
99AW07	65-75	Hanford	76.0	1047.61	Unknown	Unknown	n/a	n/a	Unknown	671371.606	2300233.598	1123.69	1123.61	1126.75	1126.29
99AW08	70-80	Hanford/Ringold	78.0	1067.36	4.0	1063.36	n/a	n/a	Unknown	676777.349	2299794.685	1145.57	1145.36	1145.61	1144.96
99AW09	97.5-107.5	Hanford/Ringold	102.0	1057.15	Unknown	Unknown	n/a	n/a	Unknown	668701.250	2297625.429	1159.44	1159.15	1162.12	1161.62
99AW10	120-130	Ringold	112.0	1095.29	97.0	1192.29	n/a	n/a	Unknown	685525.395	2288258.015	1207.37	1207.29	1210.08	1209.64
91AW01	118-138	Hanford/Ringold	120.0	1099.85	Unknown	Unknown	n/a	n/a	Unknown	692809.32	2288141.53	1220.35	1219.85	1222.55	1221.64
91AW02	118-138	Ringold	118.0	1101.67	Unknown	Unknown	n/a	n/a	Unknown	692746.97	2288174.74	1220.04	1219.67	1222.75	1221.75
91AW03	115-135	Hanford/Ringold	121.0	1099.30	Unknown	Unknown	n/a	n/a	Unknown	692691.72	2288118.71	1220.70	1220.30	1222.94	1221.84
91AW04	79-99	Hanford/Ringold	82.0	1084.48	18.0	1066.48	n/a	n/a	Unknown	680570.42	2294869.57	1166.94	1166.48	1169.16	1168.54
91AW05	79-99	Ringold	78.0	1089.34	Unknown	Unknown	n/a	n/a	Unknown	680405.62	2294823.99	1167.81	1167.34	1170.25	1169.28
91AW06	78-98	Hanford/Ringold	80.0	1087.48	19.5	1106.98	n/a	n/a	Unknown	680381.89	2294717.20	1167.93	1167.48	1170.08	1169.18
91AW07	81-101	Hanford	Unknown	Unknown	Unknown	Unknown	n/a	n/a	Unknown	675929.60	2295823.58	1160.63	1160.11	1162.80	1162.06
91AW08	80-100	Hanford	Unknown	Unknown	Unknown	Unknown	n/a	n/a	Unknown	675815.75	2295691.93	1161.38	1160.95	1163.86	1163.00
91AW09	81-101	Hanford	Unknown	Unknown	Unknown	Unknown	n/a	n/a	Unknown	675644.83	2295610.35	1160.24	1159.75	1162.75	1161.80
91AW10	68.5-88.5	Hanford	Unknown	Unknown	Unknown	Unknown	n/a	n/a	Unknown	672600.97	2296923.13	1150.96	1150.58	1153.34	1152.54
91AW11	71-91	Hanford	Unknown	Unknown	Unknown	Unknown	n/a	n/a	Unknown	672674.99	2296820.17	1153.02	1152.62	1155.37	1154.56
91AW12	75-95	Hanford	Unknown	Unknown	Unknown	Unknown	n/a	n/a	Unknown	672840.91	2297033.75	1156.02	1155.57	1158.42	1157.62
91AW13	138-158	Ringold	122.0	1074.26	Unknown	Unknown	n/a	n/a	Unknown	679162.61	2288961.34	1196.76	1196.26	1199.15	1198.14
91AW14	116-136	Ringold	108.0	1076.95	Unknown	Unknown	n/a	n/a	Unknown	678756.43	2291808.44	1185.56	1184.95	1187.90	1186.69
91AW15	89-109	Ringold	Unknown	Unknown	Unknown	Unknown	n/a	n/a	Unknown	678792.46	2294188.90	1165.50	1165.33	1167.37	1166.78
91AW16	69-89	Hanford/Ringold	77.0	1079.09	13.0	1066.09	n/a	n/a	Unknown	678012.19	2297830.77	1156.61	1156.09	1158.92	1158.08
91AW17	108-128	Ringold	108.0	1078.34	Unknown	Unknown	n/a	n/a	Unknown	675538.64	2292196.57	1186.83	1186.34	1189.08	1188.32
91AW18	137-157	Ringold	124.5	1070.49	Unknown	Unknown	n/a	n/a	Unknown	675779.25	2290109.45	1195.45	1194.99	1197.67	1196.90
91AW19	70-90	Hanford/Ringold	78.0	1070.44	Unknown	Unknown	n/a	n/a	Unknown	670224.97	2298613.15	1149.06	1148.44	1151.67	1150.69
Basalt Wells - USACE															
02BW01	188-192.5	Roza	122.0	1053.61	52.0	1001.61	11.5	n/a	990.11	664416.90	2266561.46	1175.94	1175.61	1178.49	1177.88
02BW02	109-118.5	Roza	77.0	1067.64	10.0	1057.64	5.0	n/a	1052.64	676773.98	2299817.38	1145.82	1144.64	1145.66	1144.74
01BW01	85-95	Priest Rapids	85.0	1068.24	trace	1067.94	Unknown	8.0	1059.94	681816.45	2299622.84	1153.58	1153.24	1153.29	1152.93
00BW01	68-78	Roza	60.5	Not Present	Not Present	1067.94	0.0	n/a	1067.94	679483.20	2302079.80	1128.44	nm	1131.10	1130.05
00BW02	87-97	Priest Rapids	82.0	Not Present	Not Present	1077.09	>12	12.0	1065.09	676692.90	2297085.10	1159.09	nm	1161.81	1161.36
00BW03	85-95	Priest Rapids	80.5	Not Present	Not Present	1076.77	>15	16.0	1060.77	677715.10	2297833.40	1157.27	nm	1160.11	1159.72
00BW04	70-80	Priest Rapids	67.0	Not Present	Not Present	1080.62	>15	17.0	1063.62	680300.60	2299075.40	1147.62	nm	1150.35	1149.97
00BW05	80-90	Priest Rapids	74.5	1074.89	0.5	1074.39	8.0	n/a	1066.39	681404.80	2299972.10	1149.39	nm	1152.30	1151.65
00BW06	180-190	Roza	122.0	1074.48	54.0	1020.48	0.0	n/a	1020.48	679185.20	2288982.90	1196.48	nm	1199.25	1198.92
00BW07	75-85	Priest Rapids	72.0	Not Present	Not Present	1075.80	20.0	n/a	1055.80	680141.20	2298256.20	1147.80	nm	1150.61	1150.23
00BW08	92-102	Priest Rapids	74.0	1091.16	22.0	1069.16	>14	15.0	1054.16	680177.00	2294583.90	1165.16	nm	1167.76	1167.43
00BW09	79.5-89.5	Priest Rapids	75.0	Not Present	Not Present	1079.85	20.0	n/a	1059.85	681887.60	2298236.50	1154.85	nm	1157.54	1157.07
00BW10	186.2-196.2	Roza	134.0	1035.82	50.0	985.82	0.0	n/a	985.82	663991.90	2296915.00	1169.82	nm	1169.82	1169.29
00BW11	107-117	Priest Rapids	71.0	1094.81	41.0	1053.81	>3	7.0	1046.81	678759.70	2294188.70	1165.81	nm	1168.78	1168.39
00BW12	101-111	Priest Rapids	80.0	Not Present	Not Present	1074.80	19.0	n/a	1055.80	678743.50	2297443.40	1154.80	nm	1157.42	1156.68
00BW13	133-143	Priest Rapids	87.0	1065.03	42.0	1023.03	>5	18.0	1005.03	670557.20	2298368.40	1152.03	nm	1154.70	1154.22

TABLE 3.2
SUMMARY OF GEOLOGIC DATA FROM BOREHOLES

Well ID	Screen Interval[1]	2003 Screen Lithology	Hanford Formation Thickness	Elevation Top of Ringold Fm.	Ringold Thickness	Elevation of Top of Basalt	Priest Rapids Thickness (measured)	Priest Rapids Thickness (inferred)[2]	Elevation of Top of Roza[3]	Northing	Easting	Monument Cap Elevation	Ground Surface Elevation	Elevation of Top of Steel Casing	Elevation of Top of PVC
00BW14	62-72	Priest Rapids	62.0	Not Present	Not Present	1079.36	10.0	n/a	1069.36	679943.00	2301538.40	1141.36	nm	1144.00	1143.59
00BW15	105.6-115.6	Priest Rapids	93.0	1058.36	12.0	1046.36	>10	13.0	1033.36	674878.90	2298780.30	1151.36	nm	1153.93	1153.46
00BW16	186.4-196.4	Priest Rapids	135.0	1045.69	52.0	993.69	>11	14.0	979.69	668534.40	2294032.70	1180.69	nm	1180.70	1180.04
99BW01	141.5-151.5	Roza	117.0	1043.21	18.0	1025.21	7.0	n/a	1018.21	675824.605	2295796.343	1160.24	1160.21	1163.14	1162.55
99BW04	4.5-14.5	Roza	8.0	Not Present	Not Present	1090.80	0.0	n/a	1090.80	692232.890	2303898.928	1099.04	1098.80	1099.04	1098.14
99BW05	130-140	Roza	59.0	1108.38	38.0	1070.38	Unknown	0.0	1070.38	690448.377	2294736.468	1167.42	1167.38	1170.42	1169.78
99BW06	5-15	Roza	7.0	Not Present	Not Present	1063.58	0.0	n/a	1063.58	676842.148	2307379.124	1070.70	1070.58	1073.84	1073.37
99BW08	10-20	Roza	7.0	Not Present	Not Present	1042.14	0.0	n/a	1042.14	663427.126	2307173.600	1049.31	1049.14	1052.09	1051.60
99BW09	110-120	Roza	64.0	1040.04	36.0	1004.04	0.0	n/a	1004.04	665057.988	2300403.364	1104.18	1104.04	1107.03	1106.43
99BW10	175-185	Priest Rapids	125.0	1050.31	48.0	1002.31	10.0	n/a	992.31	666436.125	2296528.481	1175.42	1175.31	1178.25	1177.72
99BW11	102-112	Priest Rapids	59.0	1027.96	42.0	985.96	10.0	n/a	975.96	665817.898	2292555.181	1086.86	1086.96	1086.87	1086.16
99BW12	162-172	Priest Rapids	138.0	1040.68	23.0	1017.68	>15	15.0	1002.68	673707.759	2293832.151	1178.75	1178.68	1178.76	1178.01
99BW13	157-167	Priest Rapids	106.0	1061.72	49.0	1012.72	>11	17.5	995.22	671431.563	2296204.738	1167.83	1167.72	1170.71	1170.50
99BW14	85-95	Priest Rapids	78.0	1045.96	4.0	1041.96	24.0	n/a	1017.96	671393.808	2300235.634	1124.14	1123.96	1126.98	1126.54
99BW15	90-100	PR/Roza	77.0	1068.72	8.0	1060.72	6.0	n/a	1054.72	676777.373	2299769.990	1145.82	1145.72	1145.80	1145.05
99BW16	146-156	Roza	108.0	1076.88	36.0	1040.88	0.0	n/a	1040.88	678757.638	2291832.754	1184.98	1184.88	1187.83	1187.36
99BW17	120-140	Roza	63.0	1103.98	32.0	1071.98	0.0	n/a	1071.98	690418.774	2294777.755	1166.98	1166.98	1169.48	1169.50
99BW18	143-153	Priest Rapids	102.5	1056.61	39.5	1017.11	>4	16.0	1001.11	668700.824	2297649.221	1159.21	1159.11	1162.01	1161.59
92BW01	143-153	Roza	84.0	1072.14	25.0	1047.14	Unknown	12.0	1035.14	676083.50	2297060.03	1156.32	1156.14	1159.79	1158.47
92BW02	147-157	Roza	85.0	1068.69	15.0	1053.69	Unknown	12.0	1041.69	675558.39	2297209.30	1153.95	1153.69	1157.28	1155.82
92BW03	140-150	Roza? (Abandoned)	84.0	1076.56	16.0	1060.56	Unknown	nm	nm	676235.04	2298136.45	1160.99	1160.56	1163.34	1162.36
91BW01	193-203	Roza	120.0	1100.37	50.0	1050.37	Unknown	nm	nm	692677.01	2288122.36	1220.82	1220.37	1223.14	1222.20
91BW02	137-147	Roza	82.0	1085.63	25.0	1060.63	Unknown	12.0	1048.63	680389.89	2294702.93	1168.10	1167.63	1170.35	1169.45
91BW03	170-180	Roza	120.0	1040.56	15.0	1025.56	Unknown	7.0	1018.56	675789.18	2295692.48	1160.99	1160.56	1163.34	1162.36
91BW04	178-188	Roza	94.0	1056.38	36.0	1020.38	Unknown	18.0	1002.38	672583.36	2296918.41	1150.66	1150.38	1153.24	1152.12
Alluvium Wells - Non-USACE															
Larson Wastewater Treatment Plant Wells															
MW-1	54-64	Hanford/Ringold	60	1085	10.0	1075	Unknown	Unknown	Unknown	679001.42	2300327.59	nm	nm	nm	1145.59
MW-2	64.5-74.5	Hanford/Ringold	70	1075	25.0	1050	Unknown	Unknown	Unknown	678199.37	2301376.83	nm	nm	nm	1143.59
MW-3	65-75	Hanford/Ringold	70	1073	10.0	1063	Unknown	Unknown	Unknown	678103.39	2300411.99	nm	nm	nm	1145.65
MW-4	66-76	Ringold	62	1084	13.0	1071	Unknown	Unknown	Unknown	679109.05	2301268.09	nm	nm	nm	1145.97
Boeing Wells (abandoned)															
BML-1	63-73	Hanford/Ringold	72.0	1083.20	Unknown	Unknown	Unknown	Unknown	Unknown	683807.33	2298643.27	nm	1155.20	nm	1154.70
BML-2	60-70	Hanford	71.0	1084.80	Unknown	Unknown	Unknown	Unknown	Unknown	683001.77	2298226.60	nm	1155.80	nm	1154.44
BML-3	65-75	Hanford	76.0	1077.10	Unknown	Unknown	Unknown	Unknown	Unknown	682029.55	2298212.71	nm	1153.10	nm	1155.77
BML-4	60-70	Hanford	71.0	1078.10	Unknown	Unknown	Unknown	Unknown	Unknown	685196.22	2299282.16	nm	1149.10	nm	1151.65
BML-5	62-72	Hanford	72.0	1078.10	Unknown	Unknown	Unknown	Unknown	Unknown	681418.44	2300004.38	nm	1150.10	nm	1152.75
Secor Wells															
PH1-9601	75-95	Ringold	73.0	1089.94	Unknown	Unknown	Unknown	Unknown	Unknown	nm	nm	nm	nm	nm	1165.44
PH1-9602	77-97	Ringold	77.0	1088.16	Unknown	Unknown	Unknown	Unknown	Unknown	nm	nm	nm	nm	nm	1167.66
PH1-9603	80-100	Ringold	80.0	1087.79	Unknown	Unknown	Unknown	Unknown	Unknown	nm	nm	nm	nm	nm	1170.29
City of Moses Lake Wells															
ML-03	132-909	Basalt	64.0	Unknown	16.0	Unknown	Unknown	Unknown	Unknown	658932.89	2302361.03	nm	nm	nm	nm
ML-09	705-1100	Basalt	115.0	Unknown	29.0	Unknown	Unknown	Unknown	Unknown	662058.10	2300288.79	nm	nm	nm	nm
ML-14	470-1025	Basalt	60.0	Unknown	8.0	Unknown	Unknown	Unknown	Unknown	662463.02	2303681.44	nm	nm	nm	nm
ML-21	287-709.5	Basalt	91.0	Unknown	37.0	Unknown	Unknown	Unknown	Unknown	675592.12	2292348.89	nm	nm	nm	nm
ML-22	208-725	Basalt	120.0	Unknown	80.0	Unknown	Unknown	Unknown	Unknown	678551.54	2290720.78	nm	nm	nm	nm
ML-23	548-791	Basalt	85.0	Unknown	57.0	Unknown	Unknown	Unknown	Unknown	676952.66	2294307.22	nm	nm	nm	nm
ML-24	410-730	Basalt	115.0	Unknown	39.0	Unknown	Unknown	Unknown	Unknown	668714.00	2296967.63	nm	nm	nm	nm
ML-28	258-750	Basalt	127.0	Unknown	72.0	Unknown	Unknown	Unknown	Unknown	669985.20	2295345.56	nm	nm	nm	nm
ML-29	108-134	Basalt	59.0	Unknown	46.0	Unknown	Unknown	Unknown	Unknown	682975.06	2299051.56	nm	nm	nm	nm

Notes:

1. For the City of Moses Lake wells ("ML-XX"), the screen interval is shown as the depth to the bottom of the casing to the total depth of the well.
2. Inferred Priest Rapids thicknesses were inferred from a contour map (see Figure 3-7) generated using the known values of the Priest Rapids thickness.
3. Where the value of a cell in the column titled "Priest Rapids Thickness (inferred)" shows a ">" symbol, the corresponding Roza elevation is also inferred.

n/a = not applicable
nm = not measured

TABLE 3.3
SUMMARY OF HYDROGEOLOGIC PARAMETERS

Hydrostratigraphic Unit	Representative Grain-sizes & Bedrock Type	Aquifer Thickness (ft)	Range of Hydraulic Gradients	Principal Flow Direction	Horizontal Hydraulic Conductivity (cm/sec)	Effective Porosity (%)	Seepage Velocity Ranges (ft/day)
Hanford Formation	Coarse sand to cobbles/boulders	0 to 138	0.001 to 0.005	SW	1.00E+00 to 1.00E+1[1]	25 to 40[6]	5 to 600
Ringold Formation	Silt (some clay) to fine sand	0 to >97	0.002 to 0.008 [2]	W to SW [2]	6.30E-6 to 6.00E-4 [3]	0.01 to 0.1	6.00E-5 to 0.17
Priest Rapids and/or Upper Roza 1	Fractured bedrock	0 to 75	0.001 to 0.009	SW	1.00E-2 to 1.00E+01	1 to 25[6]	0.1 to 28,500
Lower Roza 1	Massive bedrock	80[5]	Note 4	Note 4	Note 4	0.5	Note 4
Upper Roza 2 (R1/R2 interflow zone)	Fractured bedrock[5]	20[5]	Unknown	Unknown	Unknown	1 to 25[6]	Unknown

Notes:
[1] Due to variability in grain size, localized zones with permeability as low as 1.0×10^{-2} cm/s may exist.
[2] Calculated only for the northwestern portion of the study area where the water table is within the Ringold Formation.
[3] Sandy areas within the Ringold Formation may have conductivities as high as 1×10^{-2} cm/s.
[4] Packer tests conducted in the lower Roza 1 (possibly Roza 2) showed no discernible flow.
[5] These data are taken from the Skyline Replacement well and as such there is no range in values shown. However, site-wide there are likely wide variations in aquifer thickness'.
In some areas the Roza 1 could be absent entirely and the Roza 2 could be partially or entirely absent.
[6] Values for the basalt came from Terry Tolan (personal communication). Flow tops 1 to 6%; flow top breccia 6 to 25 % and flow interiors 0.5%.

TABLE 3.4 WELL COORDINATES AND ELEVATIONS							
Location ID	Northing[1]	Easting[1]	Monument Cap[2,3]	Ground Surface[4]	Floor Surface	Steel Casing[5]	PVC Casing[6]
USACE MONITORING WELLS							
02BW01	664416.90	2266561.46	1175.94	1175.61	N/A	1178.49	1177.88
02BW02	676773.98	2299817.38	1145.82	1144.64	N/A	1145.66	1144.74
01BW01	681816.45	2299622.84	1153.58	1153.24	N/A	1153.29	1152.93
00AW03	677689.700	2297837.800	1157.33	N/A	N/A	1159.90	1159.03
00AW08	680151.800	2294583.300	1165.23	N/A	N/A	1168.05	1167.70
00AW10	663991.500	2296902.200	1169.91	N/A	N/A	1169.91	1169.38
00AW11	676061.300	2297048.500	1155.21	N/A	N/A	1158.15	1157.66
00AW12	674889.500	2298801.70	1151.11	N/A	N/A	1153.59	1153.08
00AW13	668528.600	2294056.200	1180.74	N/A	N/A	1180.74	1179.98
00AW14	670580.800	2298379.600	1151.66	N/A	N/A	1154.80	1153.90
00BW01	679483.200	2302079.800	1128.44	N/A	N/A	1131.10	1130.05
00BW02	676692.900	2297085.100	1159.09	N/A	N/A	1161.81	1161.36
00BW03	667715.100	2297833.400	1157.27	N/A	N/A	1160.11	1159.72
00BW04	680300.600	2299075.400	1147.62	N/A	N/A	1150.35	1149.97
00BW05	681404.800	2299972.100	1149.39	N/A	N/A	1152.30	1151.65
00BW06	679185.200	2288982.900	1196.48	N/A	N/A	1199.25	1198.92
00BW07	680141.200	2298256.200	1147.80	N/A	N/A	1150.61	1150.23
00BW08	680177.000	2294583.900	1165.16	N/A	N/A	1167.76	1167.43
00BW09	681887.600	2298236.500	1154.85	N/A	N/A	1157.54	1157.07
00BW10	663991.900	2296915.000	1169.82	N/A	N/A	1169.82	1169.29
00BW11	678759.700	2294188.700	1165.81	N/A	N/A	1168.78	1168.39
00BW12	678743.500	2297443.400	1154.80	N/A	N/A	1157.42	1156.68
00BW13	670557.200	2298368.400	1152.03	N/A	N/A	1154.70	1154.22
00BW14	679943.000	2301538.400	1141.36	N/A	N/A	1144.00	1143.59
00BW15	674878.900	2298780.300	1151.36	N/A	N/A	1153.93	1153.46
00BW16	668534.400	2294032.700	1180.69	N/A	N/A	1180.70	1180.04
99AW01	675830.206	2295820.308	1160.25	1160.23	N/A	1163.25	1162.64
99AW02	665059.234	2300377.673	1104.55	1104.33	N/A	1107.41	1106.93
99AW03	666407.405	2296533.842	1175.65	1175.39	N/A	1178.60	1178.11
99AW04	665814.034	2292529.715	1086.96	1086.80	N/A	1086.98	1086.48
99AW05	673736.784	2293824.322	1178.31	1178.17	N/A	1178.34	1177.69
99AW06	671433.551	2296180.629	1168.10	1168.02	N/A	1170.94	1170.49
99AW07	671371.606	2300233.598	1123.69	1123.61	N/A	1126.75	1126.29
99AW08	676777.349	2299794.685	1145.57	1145.36	N/A	1145.61	1144.96
99AW09	668701.250	2297625.429	1159.44	1159.15	N/A	1162.12	1161.62
99AW10	685525.395	2288258.015	1207.37	1207.29	N/A	1210.08	1209.64
99BW01	675824.605	2295796.343	1160.24	1160.21	N/A	1163.14	1162.55
99BW04	692232.890	2303898.928	1099.04	1098.80	N/A	1099.04	1098.14
99BW05	690448.377	2294736.468	1167.42	1167.38	N/A	1170.42	1169.78
99BW06	676842.148	2307379.124	1070.70	1070.58	N/A	1073.84	1073.37
99BW08	663427.126	2307173.600	1049.31	1049.14	N/A	1052.09	1051.60
99BW09	665057.988	2300403.364	1104.18	1104.04	N/A	1107.03	1106.43
99BW10	666436.125	2296528.481	1175.42	1175.31	N/A	1178.25	1177.72
99BW11	665817.898	2292555.181	1086.86	1086.96	N/A	1086.87	1086.16
99BW12	673707.759	2293832.151	1178.75	1178.68	N/A	1178.76	1178.01
99BW13	671431.563	2296204.738	1167.83	1167.72	N/A	1170.71	1170.50
99BW14	671393.808	2300235.634	1124.14	1123.96	N/A	1126.98	1126.54
99BW15	676777.373	2299769.990	1145.82	1145.72	N/A	1145.80	1145.05
99BW16	678757.638	2291832.754	1184.98	1184.88	N/A	1187.83	1187.36
99BW17	690418.774	2294777.755	1166.98	1166.98	N/A	1169.48	1169.50

TABLE 3.4 WELL COORDINATES AND ELEVATIONS							
Location ID	Northing[1]	Easting[1]	Monument Cap[2,3]	Ground Surface[4]	Floor Surface	Steel Casing[5]	PVC Casing[6]
99BW18	668700.824	2297649.221	1159.21	1159.11	N/A	1162.01	1161.59
91AW01	692809.32	2288141.53	1220.35	1219.85	N/A	1222.55	1221.64
91AW02	692746.97	2288174.74	1220.04	1219.67	N/A	1222.75	1221.75
91AW03	692691.72	2288118.71	1220.70	1220.30	N/A	1222.94	1221.84
91AW04	680570.42	2294869.57	1166.94	1166.48	N/A	1169.16	1168.54
91AW05	680405.62	2294823.99	1167.81	1167.34	N/A	1170.25	1169.28
91AW06	680381.89	2294717.20	1167.93	1167.48	N/A	1170.08	1169.18
91AW07	675929.60	2295823.58	1160.63	1160.11	N/A	1162.80	1162.06
91AW08	675815.75	2295691.93	1161.38	1160.95	N/A	1163.86	1163.00
91AW09	675644.83	2295610.35	1160.24	1159.75	N/A	1162.75	1161.80
91AW10	672600.97	2296923.13	1150.96	1150.58	N/A	1153.34	1152.54
91AW11	672674.99	2296820.17	1153.02	1152.62	N/A	1155.37	1154.56
91AW12	672840.91	2297033.75	1156.02	1155.57	N/A	1158.42	1157.62
91AW13	679162.61	2288961.34	1196.76	1196.26	N/A	1199.15	1198.14
91AW14	678756.43	2291808.44	1185.56	1184.95	N/A	1187.90	1186.69
91AW15	678792.46	2294188.90	1165.50	1165.33	N/A	1167.37	1166.78
91AW16	678012.19	2297830.77	1156.61	1156.09	N/A	1158.92	1158.08
91AW17	675538.64	2292196.57	1186.83	1186.34	N/A	1189.08	1188.32
91AW18	675779.25	2290109.45	1195.45	1194.99	N/A	1197.67	1196.90
91AW19	670224.97	2298613.15	1149.06	1148.44	N/A	1151.67	1150.69
91BW01	692677.01	2288122.36	1220.82	1220.37	N/A	1223.14	1222.20
91BW02	680389.89	2294702.93	1168.10	1167.63	N/A	1170.35	1169.45
91BW03	675789.18	2295692.48	1160.99	1160.56	N/A	1163.34	1162.36
91BW04	672583.36	2296918.41	1150.66	1150.38	N/A	1153.24	1152.12
92BW01	676083.50	2297060.03	1156.32	1156.14	N/A	1159.79	1158.47
92BW02	675558.39	2297209.30	1153.95	1153.69	N/A	1157.28	1155.82
92BW03[7]	676235.04	2298136.45	1160.99	1160.56	N/A	1163.34	1162.36
SECOR MONITORING WELLS							
PH1-9301	680,439.80	2,294,585.47	1165.79	1165.24	N/A	1167.34	1167.07
PH1-9304	680,331.21	2,294,715.72	1164.43	1163.96	N/A	1166.63	1166.44
PH1-9402	680,428.39	2,294,538.08	1164.75	1164.40	N/A	1167.57	1167.15
PH1-9601	680,085.10	2,294,660.01	1163.20	1163.20	N/A	1165.41	1165.40
PH1-9602	680,219.77	2,294,172.13	1165.05	1165.05	N/A	1167.50	1167.61
PH1-9603	680,606.36	2,294,411.74	1168.04	1168.04	N/A	1170.30	1170.26
BOEING MONITORING WELLS[7]							
BML-1	683734.74	2298682.25	unknown	1154.20	N/A	1154.70	1154.23
BML-2	682951.68	2298228.82	unknown	1155.80	N/A	1154.44	1154.06
BML-3	681919.78	2298230.76	unknown	1153.10	N/A	1155.77	1158.45
BML-4	685382.61	2299455.50	unknown	1149.10	N/A	1151.65	1154.19
BML-5	681410.80	2299951.24	unknown	1150.10	N/A	1152.75	1155.46
MOSES LAKE CITY WELLS							
ML-3[8]	678144.00	2300528.00	N/A	N/A	1068.38	N/A	N/A
ML-7	unknown	unknown	N/A	N/A	1064.26	N/A	N/A
ML-9[8]	664224.00	2300521.00	N/A	N/A	1107.22	N/A	N/A
ML-14[8]	662505.00	2303520.00	N/A	N/A	1084.82	N/A	N/A
ML-21[8]	675575.00	2292271.00	N/A	N/A	1187.32	N/A	N/A
ML-22[8]	678522.98	2290720.78	N/A	N/A	1196.20	N/A	N/A
ML-23	677159.39	2294155.80	N/A	N/A	1168.36	N/A	N/A
ML-24[8]	669372.91	2298412.10	N/A	N/A	1166.45	N/A	N/A
ML-28[8]	670545.22	2295445.29	N/A	N/A	1182.85	N/A	N/A
ML-29[8]	682554.00	2299550.00	N/A	N/A	1154.20	N/A	N/A

TABLE 3.4 WELL COORDINATES AND ELEVATIONS							
Location ID	Northing[1]	Easting[1]	Monument Cap[2,3]	Ground Surface[4]	Floor Surface	Steel Casing[5]	PVC Casing[6]
SEWAGE LAGOON WELLS							
MW-1	679,001.00	2,300,327.00	unknown	1191.26	N/A	1194.36	1194.32
MW-2	678,199.00	2,301,876.00	unknown	1224.54	N/A	1227.04	1227.25
MW-3A	678,088.80	2,300,414.03	unknown	1216.66	N/A	1218.96	1219.11
MW-4	679,105.00	2,301,268.00	unknown	unknown	N/A	unknown	unknown
SAMPLED DOMESTIC WELLS							
WP-01	672227.171	2300128.900	N/A	N/A	1142.53	N/A	N/A
WP-02[9]	666081.014	2299871.848	N/A	N/A	N/A	N/A	N/A
WP-03	668884.767	2292259.171	N/A	N/A	1091.65	N/A	N/A
WP-04	669584.364	2291952.447	N/A	N/A	1110.02	N/A	N/A
WP-05[9]	668721.338	2301279.560	N/A	N/A	N/A	N/A	N/A
WP-06[9]	676314.282	2306284.366	N/A	N/A	N/A	N/A	N/A
WP-07[9]	679730.497	2303668.347	N/A	N/A	N/A	N/A	N/A
WP-08[9]	679777.269	2304031.813	N/A	N/A	N/A	N/A	N/A
WP-09[9]	666269.472	2293065.644	N/A	N/A	N/A	N/A	**N/A**
WP-10	667696.423	2292255.394	N/A	N/A	1085.11	N/A	N/A
WP-11[9]	669128.073	2291818.280	N/A	N/A	N/A	N/A	N/A
WP-12[9]	668588.690	2299922.652	N/A	N/A	N/A	N/A	N/A
WP-13E	663545.489	2293640.398	N/A	N/A	1076.29	N/A	N/A
WP-13W	663699.225	2293387.881	N/A	N/A	1080.43	N/A	N/A
WP-14[9]	676884.649	2300326.612	N/A	N/A	N/A	N/A	N/A
WP-15W	665833.942	2295764.346	N/A	N/A	N/A	N/A	N/A
WP-15E[9]	666243.000	2297156.000	N/A	N/A	N/A	N/A	N/A
WP-16[9]	662518.726	2294557.341	N/A	N/A	N/A	N/A	N/A
WP-17[9]	662748.681	2294312.046	N/A	N/A	N/A	N/A	N/A
WP-18N[9]	664948.215	2294230.759	N/A	N/A	N/A	N/A	N/A
WP-18S[9]	664701.369	2294303.374	N/A	N/A	N/A	N/A	N/A
WP-19[9]	668463.539	2301843.756	N/A	N/A	N/A	N/A	N/A
WP-20N[9]	665460.316	2293901.250	N/A	N/A	N/A	N/A	N/A
WP-21	663316.027	2297246.622	N/A	N/A	1165.37	N/A	N/A
WP-22	664462.942	2295405.201	N/A	N/A	1176.22	N/A	N/A
WP-23[9]	667859.000	2300004.000	N/A	N/A	N/A	N/A	N/A
WP-24	667484.871	2302698.113	N/A	N/A	1112.33	N/A	N/A
WP-25E[9]	664496.000	2295407.000	N/A	N/A	N/A	N/A	N/A
WP-25W[9]	664447.000	2295336.000	N/A	N/A	N/A	N/A	N/A
WP-26[9]	658091.000	2292156.000	N/A	N/A	N/A	N/A	N/A
WP-27	665166.070	2298018.908	N/A	N/A	1158.56	N/A	N/A
WP-28	667408.197	2300224.952	N/A	N/A	1107.60	N/A	N/A
WP-29[9]	663251.000	2293781.000	N/A	N/A	N/A	N/A	N/A
WP-30[9]	N/A	N/A	N/A	N/A	N/A	N/A	N/A
WP-31[9]	N/A	N/A	N/A	N/A	N/A	N/A	N/A
WP-32	666436.235	2299931.858	N/A	N/A	1110.20	N/A	N/A
WP-33[9]	N/A	N/A	N/A	N/A	N/A	N/A	N/A
WP-38	665093.996	2300489.705	N/A	N/A	1102.47	N/A	N/A
WP-41	662049.806	2300973.599	N/A	N/A	1116.32	N/A	N/A
WP-42E	664191.571	2294284.546	N/A	N/A	1089.07	N/A	N/A
WP-42W	663924.807	2293825.672	N/A	N/A	1086.22	N/A	N/A
WP-44N	662849.417	2296761.258	N/A	N/A	1166.51	N/A	N/A
WP-44S	662102.638	2297000.956	N/A	N/A	1166.36	N/A	N/A
WP-46	662083.164	2295052.853	N/A	N/A	1064.96	N/A	N/A
WP-50	675522.016	2299103.905	N/A	N/A	1151.28	N/A	N/A
WP-60	663271.217	2292960.407	N/A	N/A	1071.82	N/A	N/A
WP-61	665877.731	2292802.142	N/A	N/A	1088.95	N/A	N/A

TABLE 3.4
WELL COORDINATES AND ELEVATIONS

Location ID	Northing[1]	Easting[1]	Monument Cap[2,3]	Ground Surface[4]	Floor Surface	Steel Casing[5]	PVC Casing[6]
WP-63	663438.632	2294865.886	N/A	N/A	1091.41	N/A	N/A
WP-64	662875.929	2294946.872	N/A	N/A	1068.22	N/A	N/A
WP-65	670192.012	2291011.890	N/A	N/A	1092.33	N/A	N/A
WP-66	669178.967	2291867.377	N/A	N/A	1089.98	N/A	N/A
WP-67	667877.738	2291228.668	N/A	N/A	1095.46	N/A	N/A
WP-68	668619.623	2292006.553	N/A	N/A	1088.09	N/A	N/A
WP-69	668878.766	2291800.380	N/A	N/A	1088.39	N/A	N/A
WP-70	669345.388	2291513.121	N/A	N/A	1090.41	N/A	N/A
WP-71A	668184.049	2291997.354	N/A	N/A	1087.48	N/A	N/A
WP-72	668462.813	2290765.415	N/A	N/A	1093.07	N/A	N/A
WP-73	666711.545	2290345.301	N/A	N/A	1085.69	N/A	N/A
WP-74	668430.714	2292618.281	N/A	N/A	1092.98	N/A	N/A
WP-75	666225.069	2300601.846	N/A	N/A	1107.73	N/A	N/A
WP-76	666616.987	2300541.069	N/A	N/A	1105.78	N/A	N/A
WP-77	666176.667	2295149.919	N/A	N/A	1180.42	N/A	N/A
WP-78	668509.897	2303325.327	N/A	N/A	1118.26	N/A	N/A
WP-79	668649.187	2303126.036	N/A	N/A	1121.00	N/A	N/A
WP-80	668559.830	2303329.724	N/A	N/A	1118.39	N/A	N/A
WP-81	663382.381	2303081.899	N/A	N/A	1103.87	N/A	N/A
WP-82	676790.053	2299547.186	N/A	N/A	1147.43	N/A	N/A
WP-83	676858.738	2301135.978	N/A	N/A	1130.74	N/A	N/A
WP-84	677079.638	2301620.744	N/A	N/A	1133.16	N/A	N/A
WP-85	678229.543	2285649.458	N/A	N/A	1067.55	N/A	N/A
WP-86	666221.638	2293947.205	N/A	N/A	1180.64	N/A	N/A

Notes: All acronyms are defined in the acronym list.

[1] Data surveyed to nearest 100th of a foot, except those marked with an 8 or 9 footnote. Horizontal datum is NAD 27 WA South Zone.

[2] Vertical datum is NGVD 29.

[3] The survey cap (aluminum or brass cap) is embedded in the concrete pad near the ground surface around the well.

[4] The ground elevation is located at the edge of the concrete pad on the existing ground surface.

[5] The top of the steel or protective casing is located at the top of the 8-inch diameter steel casing with the hinged lid open.

[6] The top of the Poly-Vinyl Chloride (PVC) or well casing is the top of the PVC well pipe cap where the water level probe tube connects to the cap. This is the same measuring point for the "A" parameter in calculating the depth to water in the wells.

[7] 92-BW03, BML-1, BML-2, BML-3, BML-4 and BML-5 were abandoned in 2000.

[8] Estimated coordinates by digitizing Dames & Moore well location map.

[9] Coordinates determined using Trimble GeoExplorer II GPS with a horizontal precision error of six to fifteen feet.

Table 3.5
Groundwater Elevations

Well No.	Dec-98	Jan-99	Feb-99	Mar-99	Apr-99	May-99	Jun-99	Jul-99	Aug-99	Sep-99	Oct-99	Nov-99	Dec-99	Jan-00	Feb-00	Mar-00	Apr-00	Jun-00	Sep-00	Dec-00	May-02	Oct-02
PAIRED WELLS																						
91-AW1	1094.59	1094.98	1094.70	1094.67	1094.77	1095.08	1095.03	1094.93	1094.92	1094.50	1094.74	1094.22	1094.26	1094.09	1093.96	1093.63	1093.45	1093.47	1093.45	1093.43	1091.97	1092.06
91-AW2	1094.88	1095.33	1095.06	1094.99	1095.08	1095.41	1095.39	1095.28	1095.31	1094.83	1095.11	1094.62	1094.66	1094.51	1094.37	1094.04	1093.85	1093.87	1093.87	1093.84	1092.15	1092.33
91-AW3	1094.64	1095.09	1094.80	1094.71	1094.86	1095.21	1095.18	1095.07	1095.10	1094.63	1094.90	1094.29	1094.34	1094.19	1094.03	1093.70	1093.51	1093.55	1093.55	1093.54	1091.83	1092.05
91-BW1	nm	nm	nm	nm	nm	1094.83	1094.69	1094.61	1094.58	1094.29	1094.66	1094.20	1094.14	1093.90	1093.67	1093.45	1093.39	1093.48	1093.50	1093.43	1091.72	1092.30
						0.40	0.51	0.48	0.53	0.36	0.26	0.17	0.28	0.36	0.44	0.33	0.21	0.14	0.12	0.17	0.26	-0.16
91-AW4	1081.37	1081.56	1081.43	1081.49	1081.45	1081.59	1081.57	1081.49	1080.62	1080.79	1080.72	1080.47	1080.32	1080.19	1080.04	1079.87	1079.80	1079.25	1079.09	1078.83	1077.71	1077.26
91-AW5	1080.87	1081.05	1080.93	1080.95	1080.94	1081.16	1081.13	1080.89	1080.81	1080.39	1080.31	1080.06	1079.96	1079.78	1079.60	1079.43	1079.36	1079.44	1079.32	1079.08	1077.38	1076.95
91-AW6	1080.57	1080.66	1080.55	1080.59	1080.56	1080.69	1080.69	1080.67	1080.40	1079.92	1079.88	1079.62	1079.55	1079.35	1079.19	1079.07	1078.98	1078.26	1077.95	1077.68	1077.95	1076.32
91-BW2	1080.48	1081.04	1080.90	1080.91	1080.86	1081.19	1081.13	1080.88	1080.54	1080.11	1080.15	1079.87	1079.81	1079.64	1079.45	1079.26	1079.18	1079.29	1079.11	1078.88	1077.17	1076.74
	0.46	0.05	0.07	0.10	0.12	-0.04	0.00	0.14	0.07	0.26	0.15	0.18	0.13	0.13	0.16	0.20	0.20	-0.31	-0.32	-0.35	0.51	0.10
91-AW7	1073.53	1073.16	1072.75	1072.86	1073.57	1074.01	1074.18	1074.26	1074.28	1074.09	1073.85	1073.60	1073.26	1072.51	1072.09	1071.67	1071.50	1071.78	1073.73	1072.64	1070.69	1072.83
91-AW8	1073.42	1073.09	1072.68	1072.74	1073.45	1073.91	1074.12	1074.18	1074.16	1074.01	1073.77	1073.53	1073.17	1072.45	1072.02	1071.61	1071.44	1071.59	1073.53	1072.45	1070.60	1072.74
91-AW9	1073.37	1073.01	1072.60	1072.71	1073.39	1073.83	1074.04	1074.05	1073.99	1073.86	1073.61	1073.39	1073.01	1072.29	1071.86	1071.46	1071.29	1072.30	1074.24	1073.16	1070.49	1072.62
91-BW3	nm	nm	nm	nm	nm	1073.14	1073.32	1073.63	1073.71	1073.52	1073.41	1073.10	1072.71	1072.09	1071.67	1071.29	1071.18	1071.97	1073.86	1072.87	1070.33	1072.21
						0.78	0.79	0.53	0.44	0.47	0.34	0.41	0.44	0.33	0.32	0.29	0.23	-0.08	-0.02	-0.12	0.27	0.52
91-AW10	1071.07	1070.44	1070.09	1069.93	1070.40	1071.33	1072.21	1072.62	1072.90	1072.62	1072.31	1071.57	1070.98	1070.17	1069.81	1069.50	1069.64	1071.10	1072.90	1071.13	1070.17	1071.72
91-AW11	1071.24	1070.60	1070.25	1070.07	1070.57	1071.45	1072.30	1072.77	1072.99	1072.72	1072.41	1071.68	1071.11	1070.28	1069.91	1069.61	1069.75	1070.40	1072.18	1070.42	1070.28	1071.82
91-AW12	1072.10	1071.45	1071.11	1070.92	1071.44	1071.64	1072.52	1072.95	1073.21	1072.91	1072.60	1071.83	1071.24	1070.42	1070.05	1069.74	1069.91	1070.32	1072.40	1070.58	1070.45	1072.00
91-BW4	nm	nm	nm	nm	nm	1068.12	1068.54	1068.13	1068.22	1068.33	1068.67	1068.07	1067.58	1066.96	1066.68	1066.44	1066.71	1067.44	1068.87	1067.68	1066.60	1067.83
						3.35	3.80	4.65	4.82	4.42	3.77	3.62	3.53	3.33	3.24	3.18	3.06	3.17	3.62	3.03	3.70	4.02
91-AW13	1054.54	1054.64	1054.58	1054.70	1054.59	1054.78	1054.64	1054.76	1054.90	1054.73	1054.81	1054.63	1054.77	1054.81	1054.75	1054.84	1054.79	1054.78	1054.81	1054.69	1054.03	1053.80
00-BW06	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1056.44	1055.48	1053.25
																				-1.75	-1.45	0.55
91-AW14	1065.60	1066.05	1066.05	1066.33	1066.41	1066.46	1065.99	1065.13	1065.01	1064.87	1065.56	1065.60	1065.67	1065.50	1065.34	1065.30	1065.37	1064.57	1064.01	1064.57	1063.00	1062.15
99-BW16								nm	nm	nm	nm	1065.59	1065.65	1065.54	1065.37	1065.35	1065.41	1064.59	1064.73	1064.63	1062.97	-0.17
												0.01	0.01	-0.04	-0.03	-0.05	-0.04	-0.02	-0.72	-0.06	0.03	1062.32
91-AW15	1076.46	1072.55	1071.3	1071.84	1072.69	1073.42	1073.38	1073.11	1072.56	1072.81	1072.96	1072.84	1072.74	1072.47	1072.26	1071.96	1071.72	1071.58	1072.13	1072.15	1069.90	1072.79
00-BW11	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1073.18	1070.92	1075.19
																				-1.03	-1.02	-2.40
99-AW02	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1050.46	1049.23	1047.34	1046.63	1046.15	1046.11	1047.83	1050.23	1049.25	1047.01	1050.20
99-BW09	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1039.74	1039.46	1040.72	1040.53	1040.81	1040.69	1035.15	1034.31	1039.21	1033.57	1037.22
												10.72	9.77	6.62	6.10	5.34	5.42	12.68	15.92	10.04	13.44	12.98
99-AW03	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1056.38	1056.17	1055.88	1055.75	1055.62	1055.62	1056.34	1056.71	1056.18	1056.02	1056.49
99-BW10	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1045.78	1045.61	1045.83	1045.84	1045.98	1044.07	1035.74	1037.83	1044.74	1037.58	1042.29
02-BW01	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm											1044.06
												10.60	10.56	10.05	9.91	9.64	11.55	20.60	18.88	11.44	18.44	14.20
99-AW04	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1044.82	1043.49	1043.39	1043.18	1043.39	1045.49	1045.77	1046.40	1043.50	1046.13	1046.23
99-BW11	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1040.02	1039.78	1041.09	1041.95	1042.46	1040.60	1030.66	1032.90	1039.90	1034.59	1037.23
												4.80	3.70	2.30	1.23	0.93	4.89	15.11	13.50	3.60	11.54	9.00
99-AW05	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1072.01	1071.64	1070.98	1070.63	1070.26	1070.06	1070.98	1072.82	1071.82	1069.50	1071.46
99-BW12	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1065.66	1065.54	1065.30	1065.25	1065.04	1065.02	1064.14	1064.96	1065.16	1063.28	1063.94
												6.35	6.10	5.68	5.38	5.22	5.04	6.84	7.86	6.66	6.22	7.52
99-AW06	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1069.92	1069.39	1068.61	1068.22	1067.93	1067.88	1069.26	1071.00	1069.56	1068.39	1070.07
99-BW13	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1066.76	1066.31	1065.77	1065.50	1065.31	1065.46	1065.92	1067.23	1066.38	1065.16	1066.48
												3.16	3.079	2.84	2.72	2.62	2.42	3.34	3.77	3.18	3.23	3.59
99-AW07	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1068.34	1067.17	1065.67	1064.97	1064.40	1066.08	1069.82	1071.73	1067.37	1068.12	1069.39
99-BW14	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1069.14	1068.09	1066.84	1066.30	1065.88	1067.53	1070.60	1072.35	1068.35	1069.20	1070.10
												-0.8	-0.923	-1.17	-1.33	-1.48	-1.45	-0.78	-0.62	-0.98	-1.08	-0.71
99-AW08	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1075.55	1074.79	1073.92	1073.68	1073.67	1073.68	1076.00	1077.50	1074.98	1074.58	1076.11
99-BW15	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1075.38	1074.66	1073.77	1073.47	1073.14	1073.67	1075.65	1077.30	1075.16	1074.35	1075.85
02-BW02	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1073.76

Table 3.5
Groundwater Elevations

Well No.	Dec-98	Jan-99	Feb-99	Mar-99	Apr-99	May-99	Jun-99	Jul-99	Aug-99	Sep-99	Oct-99	Nov-99	Dec-99	Jan-00	Feb-00	Mar-00	Apr-00	Jun-00	Sep-00	Dec-00	May-02	Oct-02
99-AW09	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1063.91	1063.13	1062.33	1061.73	1061.37	1061.44	1064.03	1065.42	1063.29	1062.87	1064.56
99-BW18	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1058.69	1057.93	1056.81	1056.33	1055.95	1055.52	1056.64	1058.39	1057.94	1055.06	1057.97
												5.22	5.20	5.52	5.40	5.42	5.92	7.39	7.03	5.35	7.81	6.59
99-BW05	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1095.17	1094.89	1094.29	1094.00	1093.78	1094.02	1094.62	1094.62	1094.27	1092.29	1093.93
99-BW17	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1095.15	1094.88	1094.27	1093.98	1093.77	1094.00	1094.61	1094.60	1094.26	1092.28	1093.92
												0.02	0.01	0.02	0.02	0.01	0.02	0.01	0.02	0.01	0.01	0.01
00-AW03	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1079.90	1079.18	1078.48	1078.48
00-BW03	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1077.90	1077.04	1074.50	1076.12
																			2.00	2.14	3.98	2.36
00-AW08	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	Dry	Dry	Dry
00-BW08	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1079.97	1079.73	1078.08	1077.64
00-AW10	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1051.84	1050.84	1053.09
00-BW10	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1043.16	1033.90	1039.16
																				8.68	16.94	13.93
00-AW12	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1077.72	1075.31	1074.76	1076.29
00-BW15	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1077.74	1075.65	1074.44	1076.11
																			-0.02	-0.34	0.32	0.18
00-AW13	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1055.99	1053.20	1056.02
00-BW16	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1060.11	1055.94	1057.44
																				-4.12	-2.74	-1.42
00-AW14	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1071.09	1071.02	1071.98
00-BW13	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1070.91	1070.65	1071.81
																				0.18	0.37	0.17
SINGLE WELLS																						
91-AW16	1077.90	1077.58	1077.05	1077.80	1079.45	1079.07	1078.75	1077.86	1077.55	1077.22	1077.00	1077.07	1076.77	1075.97	1075.65	1075.33	1075.41	1077.15	1077.73	1077.02	1074.48	1075.86
91-AW17	1063.22	1070.61	nm	1070.07	1070.21	1070.72	1070.91	1070.97	1071.11	1070.93	1070.94	1070.59	1070.47	1070.07	1069.84	1069.28	1069.00	1069.23	1070.68	1070.39	1067.74	1069.41
91-AW18	1055.97	1056.42	1056.09	1055.81	1055.62	1055.71	1055.90	1055.89	1056.23	1055.88	1056.27	1055.56	1056.05	1055.75	1055.72	1055.19	1055.23	1055.11	1055.38	1055.64	nm	nm
91-AW19	1067.88	1066.74	1066.23	1065.67	1065.94	1067.92	1069.72	1070.69	1071.26	1070.72	1070.51	1069.08	1068.02	1066.68	1066.10	1065.60	1065.78	1068.50	1071.13	1068.34	1067.15	1069.60
92-BW1	1073.58	1073.29	1073.21	1072.90	1073.28	1073.92	1074.43	1074.81	1075.04	1074.70	1074.43	1073.90	1073.49	1072.93	1072.49	1072.07	1071.96	1072.83	1075.02	1073.94	1071.32	1073.62
92-BW2	1073.36	1073.03	1072.95	1072.65	1073.06	1073.80	1074.36	1074.85	1075.08	1074.71	1074.42	1073.80	1073.36	1072.76	1072.31	1071.80	1071.83	1072.90	1075.07	1073.82	1071.40	1073.52
99-AW01	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1073.63	1073.24	1072.52	1072.09	1071.71	1071.52	1072.54	1074.48	1073.41	1070.69	1072.84
99-BW01	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1073.39	1073.01	1072.40	1071.98	1071.60	1071.48	1072.30	1073.62	1073.21	1070.66	1072.56
99-AW10	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1085.04	1085.03	1084.93	1084.87	1084.71	1084.60	1084.46	1084.20	1083.96	1082.39	1081.95
00-AW11	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1074.98	1072.57	1075.07
99-BW04	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1094.53	1094.51	1094.53	1094.94	1095.70	1095.59	1094.88	1095.14	1095.04	1094.94	1095.09
99-BW06	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1067.63	1067.41	1067.12	1067.05	1068.18	1067.95	1067.48	1068.11	1067.41	1067.27	1067.61
99-BW08	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1044.92	1044.17	1044.00	1043.96	1045.16	1046.84	1046.14	1046.15	1044.14	1046.96	1046.30
00-BW01	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1083.70	1083.86	1084.62
00-BW02	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1077.74	1075.67	1077.39
00-BW04	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1085.13	1084.98	1083.76	1084.75
00-BW05	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1087.11	1086.92	1085.67	1086.72
00-BW07	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1081.73	1081.55	1080.12	1081.19
00-BW09	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1086.60	1086.40	1084.89	1086.13
00-BW12	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1077.51	1074.77	1076.56
00-BW14	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1083.88	1083.83	1084.65
01-BW01	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	1084.56	1085.61

Notes:
1. nm = not measured or not yet installed
2. Blank cells are for wells that were not yet installed
3. Values beneath each set of paried wells indicate differences in elevations (alluvium minus basalt).

TABLE 4.1
NO FURTHER CHARACTERIZATION SITES

Source Area Name	Source Area Number	Existing Monitoring Wells	Rationale for No Further Characterization
Liquid Disposal Area	Site 1	91AW01,91AW02, 91AW03, 91BW01	No TCE detection in groundwater No exceedances of soil parameters Re-sampled groundwater to confirm absence of TCE
Rock Landfill[2]	Site 7		Low potential as contaminant source Only used as rock disposal facility
Fire Training Area Burn Pit A	Site 10	91AW13	Existing wells adequate for site characterization
Rock Drain[3]	Site 13		Low potential as source area
Larson Municipal WWTP[4]	Site 21	99BW15, 99AW08	Existing wells adequate for site characterization. Larson WWTP wells were sampled during the 2000 field investigation
Building 2802	Site 24	91AW07,91AW08, 91AW09,91BW03, 99AW01,99BW01	Low potential as a source Existing wells adequate for site characterization
Conventional Ammunition Storage Bunkers	Site 26		Low potential as source area
TEL Disposal Site	Site 27	91AW04,91AW05, 91AW06, 91BW02	Existing data adequate for site characterization
TEL Disposal Site	Site 28	91AW07,91AW08, 91AW09, 91BW03 99AW01, 99BW01	Existing data adequate for site characterization
Low Level Radioactive Disposal Site	Site 29	91AW10,91AW11, 91AW12, 1BW04	Existing data adequate for site characterization
Bunker Disposal Area[5]	Site 30		Low potential as source area
South Burn Pit B[5]	Site 32		Location determined to be a shadow on the aerial photographs
Patton Park Landfill[5]	Site 34		The results from the current investigation including geophysics and field reconnaissance indicated no presence of buried debris, soil staining or visual disturbance.

Notes: All acronyms are defined in the acronym list.

[1] This table lists those sites that were considered NFC sites at the outset of the 2000 RI. A summary of the information that was used to screen the sites is included in Table 1.2.

[2] The rock landfill was investigated as part of the Randolph Road Base dump (No. 8).

[3] The name of Site 13 was changed to the Rock Drain as a result of field reconnaissance results. The Dumpster Wash Area is now Site 6b and 6a is the Base Closure Landfill. Site 6b is considered a landfill area and Site 13 an NFC site.

[4] The Larson Municipal WWTP wells, MW-2 and MW-4, were sampled during the 2000 investigation.

[5] Sites 29, 32 and 34 became NFC sites during the 2000 RI (2000 SCTM (Montgomery Watson, 2001a). See FCRMLW011.

TABLE 4.2
LANDFILL SOURCE AREA INVESTIGATION SUMMARY

Potential Source Area Name[1]	Groundwater Monitoring Wells[2]	EM/GPR	Number of XRF Samples Unprepared	Number of XRF Samples Prepared	Number of Soil Samples[3]	Number of Soil Gas Samples	Excavated Trenches & Lengths	PFID Documents
Site 6a – Base Closure Landfill[4]	00-BW01	18.3 Acres-EM 12,398 Sq. Ft.- GPR[4]	46	11	6	4	GA01 (50 Ft) GA02 (50 Ft) GA03 (50 Ft) GA04 (50 Ft)	S0600MLW005PFID S0600MLW013PFID S0600MLW043PFID S6A02MLWPFID001 S6A02MLWPFID002 S6A02MLWPFID003 LANDFILLS02MLWPFID001 LANDFILLS02MLWPFID002
Site 6b – Dumpster Wash Area[4]	00-BW14	18.3 Acres-EM 12,398 Sq. Ft.- GPR[4]	8	2	2	5	GA01 (75 Ft) GA02 (125 Ft) GA03 (35 Ft)	S0600MLW005PFID S0600MLW013PFID S0600MLW043PFID S6B02MLWPFID001 S6B02MLWPFID002 S6B02MLWPFID003 LANDFILLS02MLWPFID001 LANDFILLS02MLWPFID002
Site 8 – Randolph Road Landfill	92-BW01 92-BW02 00-AW11 91-AW09 91-BW03 99-BW01	30.8 Acres-EM	47	18	8	8	GA01 (35 Ft) GA02 (50 Ft) GA03 (100 Ft) GA04 (50 Ft) GA05 (75 Ft) GA06 (75 Ft)	S0800MLW007PFID S31_800MLW031PFID S0800MLW045PFID S0802MLWPFID001 S0802MLWPFID002 S0802MLWPFID003 S0802MLWPFID004 LANDFILLS02MLWPFID001 LANDFILLS02MLWPFID002
Site 20 – South Base Dump	91-AW19 00-AW14 00-BW13	16.8 Acres-EM	45	17	8	15	GA01 (50 Ft) GA02 (100 Ft) GA03 (50 Ft) GA04 (50 Ft) GA05 (150 Ft) GA06 (150 Ft) GA07 (300 Ft)	S2000MLW008PFID S2000MLW035PFID S2000MLW040PFID S2000MLW046PFID S2002MLWPFID001 S2002MLWPFID002 S2002MLWPFID003 LANDFILLS02MLWPFID001 LANDFILLS02MLWPFID002
Site 29 – Low-Level Rad Dump [5]	N/A	Radiation Survey						See Appendix C4

TABLE 4.2
LANDFILL SOURCE AREA INVESTIGATION SUMMARY

Potential Source Area Name[1]	Groundwater Monitoring Wells[2]	EM/GPR	Number of XRF Samples Unprepared	Number of XRF Samples Prepared	Number of Soil Samples[3]	Number of Soil Gas Samples	Excavated Trenches & Lengths	PFID Documents
Site 31 – 19th Avenue Base Dump	00-BW02	80.2 Acres-EM	64	19	9	20	GA01 (50 Ft) GA02 (25 Ft) GA03 (250 Ft) GA04 (100 Ft) GA05 (100 Ft) GA06 (200 Ft) GA07 (125 Ft) GA08 (100 Ft)	S31_800MLW002PFID S31_800MLW006PFID S31_800MLW031PFID S31_800MLW044PFID S3102MLWPFID001 S3102MLWPFID002 S3102MLWPFID003 LANDFILLS02MLWPFID001 LANDFILLS02MLWPFID002
Site 34 - Patton Park Landfill[5]	NA	1.0 Acres-EM	Refer to Note 5	Refer to Note 5	Refer to Note 5	Refer to Note 5	Refer to Note 5	S3400MLW009PFID S3400MLW038PFID

Notes: All acronyms are defined in the acronym list. Duplicate samples not included in number of samples.

[1] These numbers correspond to those shown in Figure 4-2.

[2] 2000 well locations were optimized to detect potential contamination using results from geophysics. Groundwater samples from these wells were analyzed for general parameters, VOCs, and other analytes, as applicable for each well.

[3] Soil samples were analyzed for metals, except one trench grab soil sample collected at Site 31 was analyzed for VOCs in 2002.

[4] During field reconnaissance, the Dumpster Wash Area was thought to be west of Site 6a, Base Closure Landfill, and not at the original location, known as Site 13. It was investigated as part of Site 6a and is referred to as Site 6b. The geophysical total values represent surveys performed at Sites 6a and 6b together.

[5] Sites 29 and 31 were changed to a NFC site during the 2000 field investigation, and so are also included on Table 4.1.

TABLE 4.3
OPEN PIT, DITCH AND DRAIN SOURCE AREA INVESTIGATION SUMMARY

Source Area Name[1]	Groundwater Monitoring Wells[2]	EM/GPR	Number of Soil Samples	Number of Active Soil Gas Samples[3]	PFID Documents
Site 3b - Aircraft Wash Rack Drain	NA	2500 Sq. Ft.-GPR	0	3	S03b00MLW017PFID
Site 3c - Aircraft Wash Rack Drain	00-BW03 00-AW03	6.5 Acres-EM 450 Sq. Ft.-GPR	0	3	S03c00MLW018PFID S03c00MLW030PFID S03c00MLW039PFID
Site 9 - Gravel Pit	99-AW10	8.2 Acres-EM	0	7	S0900MLW001PFID S0900MLW011PFID S0900MLW037PFID
Site 11 - Fire Training Area Burn Pit B	NA	EM/GPR not performed	3 soil TPH	3	S1100MLW012PFID
Site 12 - Motor Pool Drain	NA	EM/GPR not performed	3 soil TPH and metals	5	S1200MLW023PFID S1200MLW028PFID
Site 15 - 8-Place Hangar Ditch[4]	00-BW04	EM/GPR not performed	4 soil metals & VOCs	7	NA
Site 22 - Paint Hangar Leach Pit	00-BW04 00-BW05 BML-5[5]	0.1Acres-EM 27,000 Sq. Ft.-GPR	3 soil TPH, PCBs and field pH 3 soil metals Field XRF (16 XRF unprepared 6 XRF prepared)	5	S2200MLW032PFID S2200MLW042PFID S2200MLW047PFID
Site 32 – South Burn Pit[6]	NA	Refer to Note 6	Refer to Note 6	Refer to Note 6	NA

Notes: All acronyms are defined in the acronym list.
Duplicate samples not included in number of samples.

[1] These numbers correspond to those shown in Figure 4-2.

[2] Groundwater samples from these wells were analyzed for general parameters, VOCs and other analytes as applicable for each well.

[3] Soil gas samples were analyzed for VOCs.

[4] This site was characterized separately as part of an Expedited Investigation (Montgomery Watson, 2000b and 2000d).

[5] All BML wells were abandoned on October 13, 2000 by Boeing.

[6] The South Burn Pit was changed to a NFC Site during the 2000 field investigation, in accordance with FCR MLW00/011 and so is also included on Table 4.1.

TABLE 4.4
SURFACE DISCHARGE SOURCE AREA INVESTIGATION SUMMARY

Potential Source Area Name[1]	Groundwater Monitoring Wells[2]	EM/GPR	Number of Active Soil Gas Samples[3]	Number of Soil Samples	PFID Documents
Site 2 - Big Bend Community College Hangars	00BW06 91AW13	2,025 Sq. Ft.-GPR	5	0	S0200MLW015PFID
Site 3a – Aircraft Wash Rack	00BW08 00AW08	20,000 Sq. Ft.-GPR	5	0	S03a00MLW016PFID S03a00MLW029PFID
Site 4a - Port Tarmac Area A	00BW11 99BW16 91AW15 91AW14	EM/GPR not performed	9	0	S04a00MLW019PFID
Site 4b - Port Tarmac Area B	00BW07	EM/GPR not performed	4	0	S04b00MLW020PFID
Site 5 - JAL Hangar Area & Tarmac	NA	EM/GPR not performed	3	0	S0500MLW026PFID S0500MLW041PFID
Site 14 - 8 – Place Hangar[4]	00BW07	GPR performed	25	4 soil TPH, metals & VOCs	NA
Site 16 – Engine Rebuilding Facility (Bldg. 2203)	91AW15 00BW11	EM/GPR not performed	3	0	S1600MLW024PFID
Site 17 - 3-Place Hangar (Bldg. 5801) & Waste Lines	00BW09 BML-3[5]	EM/GPR not performed	5	4 soil TPH, metals & PCBs	S17MLW050PFID
Site 18 - Paint Hangar (Bldg. 5825)	00BW07 00BW04	EM/GPR not performed	4	3 soil metals & PCBs	S1800MLW027PFID
Site 19 - Liquid Oxygen Generating Plant (Bldg. 5102)[6]	01BW01	5.1 Acres-EM 1,150 Sq. Ft.-GPR	59	8 soil metals, TPH, VOCs, cPAHs & sVOCs	S1900MLW033PFID S1900MLW051PFID
Site 19b - LOX Disposal Site	NA	EM/GPR not performed	20	0	S19B02MLWPFID001
Site 23 - Engine Buildup (Bldg. 2113)	99BW16 91AW14	EM/GPR not performed	2	0	S2300MLW021PFID
Site 25 - Building 408	99BW16 91AW14	EM/GPR not performed	3	0	S2500MLW025PFID S2500MLW036PFID
Site 33 - Dump at the end of Runway 32[7]	00BW12	12.33 Acres-EM	2	9 soil TPH, 1 soil metals, VOCs, sVOCs, PCBs, Pesticides	S3300MLW003PFID S3300MLW014PFID S3300MLW034PFID
Site 35 - Stained Soil	NA	EM/GPR not performed	0	3 soil TPH, 3 soil metals Field XRF (16 XRF unprepared 5 XRF prepared)	S3500MLW022PFID S3500MLW048PFID
Site 36 - Former Skyline Auto Wrecking Yard	NA	EM/GPR not performed	8	8 soil VOCs	S3602MLWPFID001

Notes: All acronyms are defined in the acronym list.
[1] These numbers correspond to those shown in Figure 4-1.
[2] Groundwater samples from these wells were analyzed for general parameters, VOCs and other analytes, as applicable for each well.
[3] Soil gas samples were analyzed for VOCs.
[4] This site was characterized separately as part of an Expedited Investigation (Montgomery Watson, 2000b). The soil TPH data are from the Bay West sampling results (Bay West, Inc., 2000.)
[5] All BML wells were abandoned on October 13, 2000.
[6] This site was characterized during the 2000 RI and an additional Expedited Investigation in January/March 2001 (Montgomery Watson, 2001b.)
[7] Soil results from Site 33 are from the Site Environmental Assessment (Dames & Moore, 1996.) See FCR MLW00/014 for details.

TABLE 4.5
SUMMARY OF SURFACE SOIL DETECTION[1]

		Benchmark Level[2]	Site 6a & 6b				Site 8				Site 11				Site 12				Site 14[5]				Site 15				Site 17			Site 18				
			# Samples	# Detects	min[3]	max[4]	# Samples	# Detects	min[3]	max[4]	# Samples	# Detects	min[3]	max[4]	# Samples	# Detects	min[3]	max[4]	# Samples	# Detects	min[3]	max[4]	# Samples	# Detects	min[3]	max[4]	# Samples	# Detects	min[3]	max[4]	# Samples	# Detects	min[3]	max[4]
Metals (mg/kg)	Ag	EPA=5110	9	1	0.76	0.76	9	0	-	-	ns	ns	ns	ns	4	1	0.73	0.73	4	0	-	-	4	0	-	-	5	4	0 51	0 61	4	0	-	-
	As	EPA=1.6	9	8	1.1	94	9	6	0.84	2.1	ns	ns	ns	ns	4	3	0.81	1.2	4	4	1.2	1.6	4	4	1.7	5.1	5	4	1.3	5.6	4	3	1	1.4
	Ba	EPA=66,577	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Be	EPA=1,941	9	4	0 25	0.3	9	8	0.25	0.36	ns	ns	ns	ns	4	3	0.31	0.41	4	4	0.4	0.5	4	3	0.2	0.3	5	4	0 27	0.47	4	3	0 25	0 34
	Cd	EPA=451	9	8	0 35	5.4	9	5	0.32	0.73	ns	ns	ns	ns	4	3	0.32	1.3	4	4	0.2	0.3	4	4	0.5	4.6	5	2	0 64	4.9	4	3	0.48	2.3
	Cr	EPA=448	9	8	4.5	280	9	8	2 9	10	ns	ns	ns	ns	4	3	7.7	9.6	4	4	7.1	7.7	4	4	12	53.2	5	4	9.4	31	4	3	6.8	30
	Cu	EPA=40,877	9	8	16	2400	9	8	18	22	ns	ns	ns	ns	4	3	18	21	4	4	10.8	12	4	4	23.5	54.6	5	4	17	35	4	3	19	44
	Hg	EPA=307	9	2	1.3	1.3	9	3	0.58	0.94	ns	ns	ns	ns	4	0	-	-	4	0	-	-	4	2	0 21	0 27	5	1	0 28	0 28	4	2	3.2	29
	Mn	EPA=19,458	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Ni	EPA=20,439	9	8	9.5	9900	9	8	7.1	14	ns	ns	ns	ns	4	3	9	10	4	4	7.1	7.5	4	4	7.8	23	5	4	9.1	14	4	3	8.2	11
	Pb	EPA=750	9	8	50	1900	9	8	4.3 J	450	ns	ns	ns	ns	4	3	5 9	92	4	4	4	41	4	4	29	49	5	4	4.7	290	4	3	9.8	860
	Se	EPA=5,110	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Sb	EPA=409	9	1	19 J	19 J	9	0	-	-	ns	ns	ns	ns	4	0	-	-	4	0	-	-	4	0	-	-	5	0	-	-	4	0	-	-
	Tl	EPA=67	9	1	0.7 J	0.7 J	9	3	0.25	0 3	ns	ns	ns	ns	4	0	-	-	4	0	-	-	4	0	-	-	5	4	0.3	0.44	4	0	-	-
	Zn	EPA=100,000	9	8	96	1800	9	8	57 J	550	ns	ns	ns	ns	4	3	63	170	4	4	59.2	61.9	4	4	130	286	5	4	56	510	4	3	72	310
TPH-HCID (mg/kg)	Diesel2	n/a	ns	ns	ns	ns	ns	ns	ns	ns	4	3	590	1800	3	1	5700	5700	4	2	>49	>50	na	na	na	na	5	1	790	790	ns	ns	ns	ns
	Gasoline	n/a	ns	ns	ns	ns	ns	ns	ns	ns	4	0	-	-	3	0	-	-	ns	ns	ns	ns	na	na	na	na	5	0	-	-	ns	ns	ns	ns
	Oilm	n/a	ns	ns	ns	ns	ns	ns	ns	ns	4	3	1800	15000	3	2	290	25000	4	1	>97	>97	na	na	na	na	5	1	1100	1100	ns	ns	ns	ns
TPH-Gx (mg/kg)	Gro	MTCA=30	ns	ns	ns	ns	ns	ns	ns	ns	3	0	-	-	1	1	27	27	4	0	-	-	na	na	na	na	ns	ns	ns	ns	ns	ns	ns	ns
TPH-Dx extended (mg/kg)	Diesel2Dx	MTCA=2000	ns	ns	ns	ns	ns	ns	ns	ns	4	3	480 J	1600	3	2	17 J	4600	2	2	140	180	na	na	na	na	1	1	260 J	260 J	ns	ns	ns	ns
	OilmDx	MTCA=2000	ns	ns	ns	ns	ns	ns	ns	ns	4	3	1200 J	14000	3	2	180 J	18000	2	2	350	1300	na	na	na	na	1	1	440 J	440 J	ns	ns	ns	ns
cPAHs (ug/kg)	BZAA	EPA=2,100	ns	ns	ns	ns	ns	ns	ns	ns	4	2	14 J	68 J	1	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns	1	1	2000	2000	ns	ns	ns	ns
	BZAP	EPA=210	ns	ns	ns	ns	ns	ns	ns	ns	4	2	40 J	63 J	1	1	250 J	250 J	ns	ns	ns	ns	ns	ns	ns	ns	1	1	2500	2500	ns	ns	ns	ns
	BZBF	EPA=2,100	ns	ns	ns	ns	ns	ns	ns	ns	4	2	68 J	73 J	1	1	170 J	170 J	ns	ns	ns	ns	ns	ns	ns	ns	1	1	2200	2200	ns	ns	ns	ns
	BZGHIP	n/a	ns	ns	ns	ns	ns	ns	ns	ns	4	2	65 J	68 J	1	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns	1	1	2100	2100	ns	ns	ns	ns
	BZKF	EPA=21,000	ns	ns	ns	ns	ns	ns	ns	ns	4	2	36 J	77 J	1	1	160 J	160 J	ns	ns	ns	ns	ns	ns	ns	ns	1	1	2200	2200	ns	ns	ns	ns
	CHRYSENE	EPA=211,000	ns	ns	ns	ns	ns	ns	ns	ns	4	2	68 J	120 J	1	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns	1	1	2200	2200	ns	ns	ns	ns
	DBAHA	EPA=210	ns	ns	ns	ns	ns	ns	ns	ns	4	2	6.1 J	75 J	1	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns	1	0	-	-	ns	ns	ns	ns
	FLA	EPA=22,000,000	ns	ns	ns	ns	ns	ns	ns	ns	4	2	34 J	63 J	1	1	42 J	42 J	ns	ns	ns	ns	ns	ns	ns	ns	1	1	3900	3900	ns	ns	ns	ns
	INP123	EPA=2,100	ns	ns	ns	ns	ns	ns	ns	ns	4	2	51 J	70 J	1	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns	1	1	2000	2000	ns	ns	ns	ns
	PYR	EPA=29,126,000	ns	ns	ns	ns	ns	ns	ns	ns	4	2	60 J	130 J	1	1	19 J	19 J	ns	ns	ns	ns	ns	ns	ns	ns	1	1	3400	3400	ns	ns	ns	ns

TABLE 4.5
SUMMARY OF SURFACE SOIL DETECTION[1]

		Benchmark Level[2]	Site 6a & 6b				Site 8				Site 11				Site 12				Site 14[5]				Site 15				Site 17			Site 18				
			# Samples	# Detects	min[3]	max[4]	# Samples	# Detects	min[3]	max[4]	# Samples	# Detects	min[3]	max[4]	# Samples	# Detects	min[3]	max[4]	# Samples	# Detects	min[3]	max[4]	# Samples	# Detects	min[3]	max[4]	# Samples	# Detects	min[3]	max[4]	# Samples	# Detects	min[3]	max[4]
PCBs (ug/kg)	PCB1016	EPA=21,000	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	5	0	-	-	3	0	-	-
	PCB1221	EPA=740	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	5	0	-	-	3	0	-	-
	PCB1232	EPA=740	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	5	0	-	-	3	0	-	-
	PCB1242	EPA=740	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	5	0	-	-	3	0	-	-
	PCB1248	EPA=740	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	5	0	-	-	3	0	-	-
	PCB1254	EPA=740	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	5	2	100	310 J	3	2	120 J	860
	PCB1260	EPA=740	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	5	2	170	260 J	3	1	2100	2100
VOCs[7] (ug/kg)	ACE	EPA=6,036,000	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	BTBZN	EPA=240,000	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	BZ	EPA=1,300	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	BZME[8]	EPA=520,000	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	CLME	EPA=2,600	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	CYMP	EPA=1,977,000	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	IPBZ	EPA=1,977,000	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	MEK	EPA=27,102,000	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	MTLNCL	EPA=21,000	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	NAPH	EPA=188,000	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	PBZN	EPA=240,000	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	TCE	EPA=110	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	TMB124	EPA=170,000	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	TMB135	EPA=70,000	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	XYLMP	EPA=420,000	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	XYLO	EPA=420,000	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
sVOCs[7] (ug/kg)	BIS2EHP	EPA=123,000	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	DMP24	EPA=12,312,000	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	PCP	EPA=9,000	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns

Notes:
[1] All surface soil samples reporting concentrations above PQLs are included in this table.
[2] The benchmark level is equal to the EPA Region 9 Industrial Soil Preliminary Remediation Goal, or the MTCA-A Method A Industrial Soil Cleanup Levels if an EPA level does not exist.
MTCA - Washington State Model Toxics Control Act Method A Industrial Soil Cleanup Levels (WAC 173-340-745-1)
EPA - EPA Region 9 Industrial Soils Preliminary Remediation Goals 1999 (USEPA, 1999)
n/a - no MTCA or EPA cleanup level exists for that particular analyte.
[3] The minimum value is the mimimum concentration of the analyte above the PQL.
[4] The higher concentration of the primary sample and the field duplicate is reported.
[5] The TPH data are from the Bay West sampling results (Bay West, Inc., 2000.)
TPH-HCID data from Bay West reported as greater than the PQL (i.e., ">49")
[6] Defect means TPH-HC D was detected, as described in Environmental Assessment report (Dames & Moore, 1996) for site 33. See FCR - MLW00/014 for details.
[7] Only those VOCs and sVOCs with detections are displayed on table.
[8] BZME (toluene) was detected in an equipment blank at a concentration of 1,200 ug/kg during the Site 19 soil sampling.
6 indicates the concentration exceeds the MTCA or EPA benchmark level.
ns = not sampled for particular analyte
na = data not available
J = estimated value based on the chemical validation procedures used.
These procedures are described in Section 5.0, Group D Data Validation and Useability, of Volume II of the Management Plan (Montgomery Watson, 1999b).
"-" = No concentrations detected above the PQL.

cPAHs (carcinogenic Poly-Aromatic Hydrocarbons)

BZAA - Benzo(a)anthracene
BZAP - Benzo(a)pyrene
BZBF - Benzo(b)fluoranthene
BZGH P - Benzo(g,h,I)perylene
BZKF - Benzo(k)fluoranthene
CHRYSENE - Chrysene
DBAHA - Dibenzo(a,h)acridine
FLA - Fluoranthene
INP123 - Indeno(1,2,3-cd)pyrene
PYR - Pyrene

TABLE 4.5
SUMMARY OF SURFACE SOIL DETECTION[1]

		Benchmark Level[2]	Site 19				Site 20				Site 22				Site 31				Site 33[5]				Site 35				Site 36			
			# Samples	# Detects	min[3]	max[4]	# Samples	# Detects	min[3]	max[4]	# Samples	# Detects	min[3]	max[4]	# Samples	# Detects	min[3]	max[4]	# Samples	# Detects	min[3]	max[4]	# Samples	# Detects	min[3]	max[4]	# Samples	# Detects	min[3]	max[4]
Metals (mg/kg)	Ag	EPA=5110	10	0	-	-	8	5	0.69	6.3	4	0	-	-	9	2	0.7	2.1	1	0	-	-	3	0	-	-	ns	ns	ns	ns
	As	EPA=1.6	10	8	0.44	0.92	8	8	1.3	1.9	4	3	0.58	3.8	9	8	0.48 J	2.3	1	0	-	-	3	3	1.2	1 9	ns	ns	ns	ns
	Ba	EPA=66,577	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	1	1	67	67	ns	ns	ns	ns	ns	ns	ns	ns
	Be	EPA=1,941	10	1	0.27	0.27	8	8	0.26	0.39	4	0	-	-	9	6	0.31	0.35	ns	ns	ns	ns	3	1	0.29	0.29	ns	ns	ns	ns
	Cd	EPA=451	10	3	0.28	0.67	8	7	0.27	16	4	3	6.1	17	9	7	0.31	6.3	1	0	-	-	3	2	1.7	3 3	ns	ns	ns	ns
	Cr	EPA=448	10	8	2.8	4.7	8	8	6.1	67	4	3	18	440	9	8	7	210	1	1	4	4	3	3	5.2	38	ns	ns	ns	ns
	Cu	EPA=40,877	10	8	18	29	8	8	16	70	4	3	49	120	9	8	16	48	ns	ns	ns	ns	3	3	17	69	ns	ns	ns	ns
	Hg	EPA=307	10	0	-	-	8	2	0.13	0.17	4	2	0.65	0.92	9	1	0.23	0.23	1	0	-	-	3	0	-	-	ns	ns	ns	ns
	Mn	EPA=19,458	10	8	330	390	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Ni	EPA=20,439	10	8	6.5	8 5	8	8	9.1	15	4	3	3.6	27	9	8	4.1	24	ns	ns	ns	ns	3	3	8.9	14	ns	ns	ns	ns
	Pb	EPA=750	10	8	2.3	5 6	8	8	6.6	5700	4	3	42	1200	9	8	4.4 J	670	1	1	16	16	3	3	3.9	210	ns	ns	ns	ns
	Se	EPA=5,110	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	1	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns
	Sb	EPA=409	10	0	-	-	8	0	-	-	4	0	-	-	9	0	-	-	ns	ns	ns	ns	3	0	-	-	ns	ns	ns	ns
	Tl	EPA=67	10	0	-	-	8	0	-	-	4	0	-	-	9	0	-	-	ns	ns	ns	ns	3	0	-	-	ns	ns	ns	ns
	Zn	EPA=100,000	10	8	47	69	8	8	57 J	330	4	3	340	720	9	8	52 J	1000	ns	ns	ns	ns	3	3	56	250	ns	ns	ns	ns
TPH-HCID (mg/kg)	Diesel2	n/a	10	3	54	120	ns	ns	ns	ns	3	3	90	640	ns	ns	ns	ns	1	1	detect[6]	detect[6]	4	3	86	21000	ns	ns	ns	ns
	Gasoline	n/a	10	0	-	-	ns	ns	ns	ns	3	1	140	140	ns	ns	ns	ns	1	1	detect[6]	detect[6]	4	3	28	2100	ns	ns	ns	ns
	Oilm	n/a	10	6	180	1400	ns	ns	ns	ns	3	2	220	320	ns	ns	ns	ns	1	1	detect[6]	detect[6]	4	2	180	46000	ns	ns	ns	ns
TPH-Gx (mg/kg)	Gro	MTCA=30	ns	ns	ns	ns	ns	ns	ns	ns	1	1	150	150	ns	ns	ns	ns	ns	ns	ns	ns	3	1	110	110	ns	ns	ns	ns
TPH-Dx extended (mg/kg)	Diesel2Dx	MTCA=2000	7	4	14	150	ns	ns	ns	ns	3	3	68 J	320 J	ns	ns	ns	ns	9	8	60	1300	4	3	58 J	16000	ns	ns	ns	ns
	OilmDx	MTCA=2000	7	6	140	890	ns	ns	ns	ns	3	3	32 J	190 J	ns	ns	ns	ns	ns	ns	ns	ns	4	3	30 J	32000	ns	ns	ns	ns
cPAHs (ug/kg)	BZAA	EPA=2,100	7	4	1.1	13	ns	ns	ns	ns	1	1	130	130	ns	ns	ns	ns	ns	ns	ns	ns	2	0	-	-	ns	ns	ns	ns
	BZAP	EPA=210	7	1	8.6	8 6	ns	ns	ns	ns	1	1	290	290	ns	ns	ns	ns	ns	ns	ns	ns	2	0	-	-	ns	ns	ns	ns
	BZBF	EPA=2,100	7	2	7	12	ns	ns	ns	ns	1	1	480	480	ns	ns	ns	ns	ns	ns	ns	ns	2	1	68 J	68 J	ns	ns	ns	ns
	BZGHIP	n/a	7	2	6.2	11	ns	ns	ns	ns	1	1	420	420	ns	ns	ns	ns	ns	ns	ns	ns	2	0	-	-	ns	ns	ns	ns
	BZKF	EPA=21,000	7	1	7.4	7.4	ns	ns	ns	ns	1	1	430	430	ns	ns	ns	ns	ns	ns	ns	ns	2	0	-	-	ns	ns	ns	ns
	CHRYSENE	EPA=211,000	7	3	8.5	12	ns	ns	ns	ns	1	1	280	280	ns	ns	ns	ns	ns	ns	ns	ns	2	0	-	-	ns	ns	ns	ns
	DBAHA	EPA=210	7	0	-	-	ns	ns	ns	ns	1	1	100	100	ns	ns	ns	ns	ns	ns	ns	ns	2	0	-	-	ns	ns	ns	ns
	FLA	EPA=22,000,000	7	4	1.7	18	ns	ns	ns	ns	1	1	210	210	ns	ns	ns	ns	ns	ns	ns	ns	2	1	68	68	ns	ns	ns	ns
	INP123	EPA=2,100	7	3	3.4	11	ns	ns	ns	ns	1	1	500	500	ns	ns	ns	ns	ns	ns	ns	ns	2	0	-	-	ns	ns	ns	ns
	PYR	EPA=29,126,000	7	4	2.8	19	ns	ns	ns	ns	1	1	310	310	ns	ns	ns	ns	ns	ns	ns	ns	2	1	150	150	ns	ns	ns	ns

TABLE 4.5
SUMMARY OF SURFACE SOIL DETECTION[1]

		Benchmark Level[2]	Site 19				Site 20				Site 22				Site 31				Site 33[5]				Site 35				Site 36			
			# Samples	# Detects	min[3]	max[4]	# Samples	# Detects	min[3]	max[4]	# Samples	# Detects	min[3]	max[4]	# Samples	# Detects	min[3]	max[4]	# Samples	# Detects	min[3]	max[4]	# Samples	# Detects	min[3]	max[4]	# Samples	# Detects	min[3]	max[4]
PCBs (ug/kg)	PCB1016	EPA=21,000	ns	ns	ns	ns	ns	ns	ns	ns	4	0	-	-	ns	ns	ns	ns	1	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns
	PCB1221	EPA=740	ns	ns	ns	ns	ns	ns	ns	ns	4	0	-	-	ns	ns	ns	ns	1	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns
	PCB1232	EPA=740	ns	ns	ns	ns	ns	ns	ns	ns	4	0	-	-	ns	ns	ns	ns	1	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns
	PCB1242	EPA=740	ns	ns	ns	ns	ns	ns	ns	ns	4	0	-	-	ns	ns	ns	ns	1	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns
	PCB1248	EPA=740	ns	ns	ns	ns	ns	ns	ns	ns	4	0	-	-	ns	ns	ns	ns	1	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns
	PCB1254	EPA=740	ns	ns	ns	ns	ns	ns	ns	ns	4	3	10	8100	ns	ns	ns	ns	1	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns
	PCB1260	EPA=740	ns	ns	ns	ns	ns	ns	ns	ns	4	1	6.6	6.6	ns	ns	ns	ns	1	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns
VOCs[7] (ug/kg)	ACE	EPA=6,036,000	10	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns	1	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns	8	1	2200	2200
	BTBZN	EPA=240,000	10	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns	1	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns	8	1	280	280
	BZ	EPA=1,300	10	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns	1	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns	8	1	400	400
	BZME[8]	EPA=520,000	10	1	40	40	ns	ns	ns	ns	ns	ns	ns	ns	1	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns	8	1	4600	4600
	CLME	EPA=2,600	10	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns	1	1	100	100	ns	ns	ns	ns	ns	ns	ns	ns	8	0	-	-
	CYMP	EPA=1,977,000	10	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns	1	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns	8	1	180	180
	IPBZ	EPA=1,977,000	10	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns	1	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns	8	1	100	100
	MEK	EPA=27,102,000	10	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns	1	1	660	660	ns	ns	ns	ns	ns	ns	ns	ns	8	8	100	1200
	MTLNCL	EPA=21,000	10	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns	1	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns	8	3	57 U	100 U
	NAPH	EPA=188,000	10	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns	1	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns	8	5	57	2700
	PBZN	EPA=240,000	10	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns	1	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns	8	4	57	150
	TCE	EPA=110	10	2	58.1	82	ns	ns	ns	ns	ns	ns	ns	ns	1	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns	8	0	-	-
	TMB124	EPA=170,000	10	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns	1	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns	8	4	57	1300
	TMB135	EPA=70,000	10	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns	1	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns	8	4	57	300
	XYLMP	EPA=420,000	10	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns	1	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns	8	4	57	2300
	XYLO	EPA=420,000	10	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns	1	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns	8	4	57	1200
sVOCs[7] (ug/kg)	BIS2EHP	EPA=123,000	10	1	2500	2500	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	DMP24	EPA=12,312,000	10	2	150	1300	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	PCP	EPA=9,000	10	0	-	-	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	1	1	6.4	6.4	ns	ns	ns	ns	ns	ns	ns	ns

PCBs (Polychlorinated Biphenyls)

PCB1016 - Aroclor 1016
PCB1221 - Aroclor 1221
PCB1232 - Aroclor 1232
PCB1242 - Aroclor 1242
PCB1248 - Aroclor 1248
PCB1254 - Aroclor 1254
PCB1260 - Aroclor 1260

VOCs (Volatile Organic Compounds)

BZME - Toluene
TCE - Trichloroethene

sVOCs (semi-Volatile Organic Compounds)

BIS2EHP - bis-(2-ethylhexyl)phthalate
DMP24 - 2,4-Dimethylphenol
PCP - Pentachlorophenol

TABLE 4.6 SUMMARY OF SOIL GAS DETECTIONS[1]				
Constituent	**#of Samples**	**Number of Detections**	**Minimum[2] (ppbv)**	**Maximum[3] (ppbv)**
Site 2 - Big Bend Community College Hangars				
1,4-Dioxane	6	1	6	6
2-Butanone	6	2	3.3	4.9
Acetone[4]	6	4	14	20
Benzene	6	1	1.8	1.8
Carbon Disulfide	6	1	11	11
Dichloroflouromethane	6	3	1	1.5
Erythrene	6	1	5.7	5.7
Ethanol[4]	6	3	4.9	15
m,p-xylene	6	1	1.7	1.7
Toluene[4]	6	4	0.99	1.8
Trichloroethene	6	1	3.1	3.1
Trichloroflouromethane	6	3	1.4	4.4
Site 3a - Aircraft Wash Rack Drain Area A				
1,2,4-Trimethylbenzene	6	4	1.8	52
1,3,5-Trimethylbenzene	6	2	2.3	10
2-Butanone	6	3	15	36
4-Ethyltoluene	6	2	7	31
Acetone[4]	6	6	8.9	180
Benzene	6	2	6.3	23
Carbon Disulfide	6	5	11	88
Chloromethane[4]	6	1	1.7	1.7
Erythrene	6	1	27	27
Ethanol[4]	6	3	14	19
Ethylbenzene	6	2	4.1	13
Heptane	6	1	8.8	8.8
Hexane	6	1	16	16
m,p-xylene	6	3	5.6	45
o-Xylene	6	2	3.4	23
Propene	6	1	320	320
Styrene	6	1	2.9	2.9
Toluene[4]	6	3	3	24
Trichloroethene	6	1	2.6	2.6
Site 3b - Aircraft Wash Rack Drain Area B				
1,2,4-Trimethylbenzene	4	2	1.7	5
1,4-Dioxane	4	1	6.5	6.5
2-Butanone	4	2	7.5	8.1
Acetone[4]	4	4	9.9	37
Benzene	4	2	5	21
Carbon Disulfide	4	2	8.1	9
Chloroform	4	3	2.5	2.9
Chloromethane[4]	4	1	1.6	1.6
Erythrene	4	2	26	110
Ethylbenzene	4	1	2.1	2.1
Heptane	4	1	10	10
Hexane	4	1	14	14
m,p-xylene	4	1	5.4	5.4
o-Xylene	4	1	2.3	2.3
Styrene	4	1	1.9	1.9
Toluene[4]	4	3	2.4	18
Trichloroethene	4	2	7.6	39
Site 3c - Aircraft Wash Rack Drain Area C				
1,2,4-Trimethylbenzene	3	2	3.7	4.4
1,4-Dioxane	3	1	11	11
2-Butanone	3	1	11	11
Acetone[4]	3	3	17	53
Benzene	3	3	2.3	8.1
Carbon Disulfide	3	3	11	26
Chloromethane[4]	3	1	2.3	2.3
Erythrene	3	1	20	20
Ethanol[4]	3	1	17	17
m,p-xylene	3	2	2.3	2.7
Toluene[4]	3	3	2.4	9.5
Site 4a - Port Tarmac Area A				
1,2,4-Trimethylbenzene	10	5	1.7	15
1,3,5-Trimethylbenzene	10	1	5.5	5.5
2-Butanone	10	3	9.4	35
4-Ethyltoluene	10	1	13	13
Acetone[4]	10	9	9.7	49
Benzene	10	4	1.8	8
Carbon Disulfide	10	5	9.3	17
Chloromethane[4]	10	1	1.7	1.7
Erythrene	10	2	8.8	18
Ethanol[4]	10	6	6.7	23
Hexane	10	1	6.1	6.1
m,p-xylene	10	3	1.9	5.9
o-Xylene	10	1	2.3	2.3
Styrene	10	1	1.6	1.6
Tetrachloroethene	10	1	3.2	3.2
Toluene[4]	10	4	4.2	9.7
Trichloroethene	10	1	2	2

TABLE 4.6 SUMMARY OF SOIL GAS DETECTIONS[1]				
Constituent	**#of Samples**	**Number of Detections**	**Minimum[2] (ppbv)**	**Maximum[3] (ppbv)**
Site 4b - Port Tarmac Area B				
1,2,4-Trimethylbenzene	5	1	1.9	1.9
Acetone[4]	5	5	12	20
Ethanol[4]	5	3	6.7	30
m,p-xylene	5	1	2.4	2.4
Toluene[4]	5	1	2.4	2.4
Trichloroethene	5	1	2	2
Site 5 - JAL Hangar Area and Tarmac				
1,2,4-Trimethylbenzene	4	2	1.6	1.7
Acetone[4]	4	4	19	26
Carbon Disulfide	4	1	11	11
Chloroform	4	1	3.3	3.3
Ethanol[4]	4	1	7.9	7.9
Propene	4	1	9.1	9.1
Tetrachloroethene	4	1	5.5	5.5
Toluene[4]	4	3	1.7	1.9
Trichloroethene	4	1	7.2	7.2
Site 6a - Base Closure Landfill				
1,1,1-Trichloroethane	5	3	0.66	4.4
1,1-Dichloroethane	5	2	0.19	0.21
1,2,4-Trimethylbenzene	5	4	0.18	0.72
1,2-Dichloro-1,1,2,2-tetrafluoroethane	5	3	0.28	0.64
1,3,5-Trimethylbenzene	5	3	0.092	0.18
2-Butanone	5	5	1.3	5.6
2-Hexanone	5	2	0.37	0.37
4-Ethyltoluene	5	4	0.12	0.49
4-Methyl-2-pentanone	5	3	0.15	0.38
Acetone	5	5	3.8	12
Benzene	5	5	0.19	1.2
Carbon Disulfide	5	3	0.49	0.74
Carbon Tetrachloride	5	5	0.051	0.25
Chloroform	5	3	1	9.3
Chloromethane	5	3	0.071	0.24
Cyclohexane	5	1	0.24	0.24
Dichlorodifluoromethane	5	5	0.5	1
Erythrene	5	5	0.35	2.8
Ethanol	5	4	0.61	5.1
Ethylbenzene	5	4	0.1	0.34
Hexane	5	2	0.36	3
Isopropanol	5	4	0.35	0.77
m,p-xylene	5	4	0.25	1.1
o-Xylene	5	5	0.063	0.41
Propene	5	5	2.2	22
Styrene	5	5	0.073	0.14
Tetrachloroethene	5	4	0.28	1.7
Toluene	5	5	0.37	1.4
Trichloroethene	5	3	3.3	5.5
Trichloroflouromethane	5	5	0.24	110
Site 6b - Dumpster Wash Area				
1,1,1-Trichloroethane	5	1	0.78	0.78
1,2,4-Trimethylbenzene	5	5	0.23	0.38
1,3,5-Trimethylbenzene	5	2	0.091	0.095
2-Butanone	5	5	0.48	3
2-Hexanone	5	2	0.48	0.5
4-Ethyltoluene	5	5	0.15	0.26
Acetone	5	5	2.1	9.3
Benzene	5	4	0.083	0.28
Carbon Disulfide	5	2	0.16	0.26
Carbon Tetrachloride	5	5	0.079	0.11
Chloroform	5	3	0.2	0.75
Chloromethane	5	2	0.11	0.13
Dichlorodifluoromethane	5	5	0.47	0.63
Erythrene	5	4	0.13	0.35
Ethanol	5	5	0.62	2.4
Ethylbenzene	5	3	0.091	0.16
Heptane	5	3	0.16	0.33
Hexane	5	3	0.13	0.32
Isopropanol	5	5	0.12	0.47
m,p-xylene	5	5	0.24	0.59
o-Xylene	5	5	0.1	0.2
Propene	5	5	0.4	2.8
Tetrachloroethene	5	4	0.1	0.62
Toluene	5	5	0.16	0.65
Trichloroethene	5	4	0.1	0.99
Trichloroflouromethane	5	5	0.25	0.58
Site 8 - Randolph Road Base Dump				
1,1,1-Trichloroethane	9	1	0.11	0.11
1,1,2-Trichloro-1,2,2-trifluoroethane	9	2	0.098	0.13
1,2,4-Trimethylbenzene	9	9	0.2	1.7
1,3,5-Trimethylbenzene	9	3	0.16	0.43
1,4-Dioxane	9	1	1.4	1.4
2-Butanone	9	9	3.5	20
2-Hexanone	9	8	0.38	1.3
4-Ethyltoluene	9	9	0.12	0.58

TABLE 4.6 SUMMARY OF SOIL GAS DETECTIONS[1]				
Constituent	**#of Samples**	**Number of Detections**	**Minimum[2] (ppbv)**	**Maximum[3] (ppbv)**
4-Methyl-2-pentanone	9	9	0.14	2.1
Acetone	9	9	8.9	43
Bromodichloromethane	9	1	0.47	0.47
Carbon Disulfide	9	9	0.36	2.6
Carbon Tetrachloride	9	9	0.049	0.1
Chloroform	9	5	0.062	1.6
Chloromethane	9	6	0.1	0.17
Chlorotoluene	9	0	0	0
Cyclohexane	9	1	0.22	0.22
Dibromochloromethane	9	1	0.081	0.081
Dichlorodifluoromethane	9	9	0.41	0.49
Erythrene	9	9	0.21	0.8
Ethanol	9	9	1.2	4.2
Ethylbenzene	9	8	0.079	1.2
Heptane	9	9	0.087	1
Hexane	9	7	0.11	2
Isopropanol	9	9	0.29	15
m,p-xylene	9	9	0.27	6.4
o-Xylene	9	9	0.11	2.2
Propene	9	9	1.8	12
Styrene	9	1	0.073	0.073
Tetrachloroethene	9	6	0.11	4.8
Tetrahydrofuran	9	1	1.4	1.4
Toluene	9	9	0.26	3.2
Trichloroethene	9	9	1	17
Trichloroflouromethane	9	9	0.23	0.27
Site 9 - Gravel Pit				
1,2,4-Trimethylbenzene	7	3	0.98	2.2
2-Butanone	7	3	3.2	17
Acetone[4]	7	7	7.3	56
Benzene	7	2	1.4	4.5
Carbon Disulfide	7	3	4.7	15
Chloromethane[4]	7	2	0.84	1.3
Dichloroflouromethane	7	1	0.8	0.8
Erythrene	7	1	51	51
Ethanol[4]	7	4	4.1	7.1
m,p-xylene	7	4	1.2	1.8
o-Xylene	7	1	1.7	1.7
Toluene[4]	7	6	0.83	5.3
Trichloroethene	7	4	1.8	6.7
Trichloroflouromethane	7	2	1.2	2.3
Site 11 - Fire Training Area Burn Pit B				
1,2,4-Trimethylbenzene	3	3	1.4	2.8
1,3,5-Trimethylbenzene	3	1	0.94	0.94
1,4-Dioxane	3	1	4.4	4.4
2-Butanone	3	1	3.7	3.7
Acetone[4]	3	3	7.2	19
Benzene	3	1	0.91	0.91
Chloroform	3	1	4.2	4.2
Chloromethane[4]	3	1	0.8	0.8
Ethanol[4]	3	1	11	11
m,p-xylene	3	3	0.93	1.4
Toluene[4]	3	3	1.3	2.5
Trichloroethene	3	1	31	31
Site 12 - Motor Pool Drain				
1,1,1-Trichloroethane	5	1	6.2	6.2
1,2,4-Trimethylbenzene	5	5	1.8	16
1,3,5-Trimethylbenzene	5	1	6.2	6.2
2-Butanone	5	2	13	150
2-Hexanone	5	1	13	13
4-Ethyltoluene	5	1	14	14
Acetone[4]	5	5	18	66
Benzene	5	4	2	17
Carbon Disulfide	5	4	6.9	50
Chloromethane[4]	5	1	2.2	2.2
Erythrene	5	3	14	22
Ethanol[4]	5	4	6.8	33
Ethylbenzene	5	2	1.7	2.6
Hexane	5	2	6.7	8.1
m,p-xylene	5	4	2.4	6.1
o-Xylene	5	2	1.6	2.6
Propene	5	2	74	160
Styrene	5	1	3.3	3.3
Toluene[4]	5	4	2.8	16
Trichloroethene	5	1	5.4	5.4
Site 14 - 8-Place Hangar				
1,2,4-Trimethylbenzene	26	4	0.73	2.4
1,2-Dichlorobenzene	26	1	1.1	1.1
1,2-Dichloroethane	26	1	5.4	5.4
1,4-Dichlorobenzene	26	1	1.7	1.7
1,4-Dioxane	26	4	3.8	290
2-Butanone	26	5	3	12
Acetone[4]	26	24	3	46

TABLE 4.6 SUMMARY OF SOIL GAS DETECTIONS[1]				
Constituent	**#of Samples**	**Number of Detections**	**Minimum[2] (ppbv)**	**Maximum[3] (ppbv)**
Benzene	26	15	1.1	7.6
Bromomethane	26	1	2.5	2.5
Carbon Disulfide	26	13	3	39
Carbon Tetrachloride	26	1	1.1	1.1
Chloroform	26	5	0.99	1.8
Chloromethane[4]	26	15	0.74	2.4
cis-1,2-Dichloroethene	26	8	0.92	4.9
Dichloroflouromethane	26	1	0.76	0.76
Erythrene	26	16	3.4	19
Ethanol[4]	26	8	4.2	22
Ethylbenzene	26	3	0.76	1.1
Heptane	26	1	3.9	3.9
Hexane	26	2	3.4	4.6
m,p-xylene	26	15	0.73	3.4
Methylene Chloride	26	6	1	2.1
o-Xylene	26	6	0.75	2
Toluene[4]	26	19	0.78	8.1
Trichloroethene	26	18	0.98	42
Site 15 - 8-Place Hangar Ditch				
2-Butanone	7	1	3.1	3.1
Acetone[4]	7	7	3.6	21
Carbon Disulfide	7	2	3.2	9.5
Chloromethane[4]	7	2	0.81	1.7
cis-1,2-Dichloroethene	7	2	1.7	2.5
Ethanol[4]	7	1	13	13
Methylene Chloride	7	3	0.91	2.5
Toluene[4]	7	1	1.4	1.4
Trichloroethene	7	3	2.3	28
Site 16 - Engine Rebuilding Facility				
2-Butanone	3	1	8.2	8.2
Acetone[4]	3	3	13	36
Benzene	3	2	1.6	4.7
Chloroform	3	1	1.7	1.7
Erythrene	3	1	9.2	9.2
Ethanol[4]	3	1	7.1	7.1
Propene	3	1	24	24
Tetrachloroethene	3	1	4.1	4.1
Toluene[4]	3	2	1.8	4.7
Trichloroethene	3	3	2.1	10
Site 17 - 3-Place Hangar				
1,2,4-Trimethylbenzene	6	1	0.93	0.93
1,4-Dioxane	6	2	16	17
2-Butanone	6	3	3.5	4.4
Acetone[4]	6	6	8	22
Benzene	6	1	0.73	0.73
Carbon Disulfide	6	2	23	39
Chloromethane[4]	6	4	0.72	1.3
Dichloroflouromethane	6	2	0.74	0.77
Ethanol[4]	6	2	3.2	3.4
Methylene Chloride	6	6	0.75	3.8
Toluene[4]	6	1	0.91	0.91
Trichloroethene	6	1	2	2
Site 18 - Paint Hangar				
1,2,4-Trimethylbenzene	5	2	1.6	2.1
Acetone[4]	5	5	9.8	22
Benzene	5	2	2	3.1
Carbon Disulfide	5	2	11	30
Chloromethane[4]	5	1	2	2
Erythrene	5	1	10	10
Ethanol[4]	5	3	9.3	13
Ethylbenzene	5	2	4.4	6.4
m,p-xylene	5	3	2.2	28
o-Xylene	5	2	10	14
Propene	5	2	13	21
Toluene[4]	5	3	2.1	9.8
Trichloroethene	5	1	2.7	2.7
Site 19 - Liquid Oxygen Generating Plant[5]				
1,1,1-Trichloroethane	129	3	0.08	0.17
1,1,2-Trichloro-1,2,2-trifluoroethane	129	2	0.072	0.077
1,2,4-Trimethylbenzene	129	57	0.16	10
1,2-Dichloroethane	129	1	31	31
1,3,5-Trimethylbenzene	129	19	0.091	1.4
1,4-Dichlorobenzene	129	1	0.083	0.083
1,4-Dioxane	129	5	11	69
2-Butanone	129	42	1	65
2-Hexanone	129	13	0.22	3.5
4-Ethyltoluene	129	31	0.1	3.9
4-Methyl-2-pentanone	129	1	2.9	2.9
Acetone[4]	129	95	2.4	390
Benzene	129	56	0.14	52
Bromomethane	129	1	0.21	0.21
Carbon Disulfide	129	48	0.15	110
Carbon Tetrachloride	129	16	0.04	0.81
Chloroethane	129	1	0.2	0.2

TABLE 4.6 SUMMARY OF SOIL GAS DETECTIONS[1]				
Constituent	**#of Samples**	**Number of Detections**	**Minimum[2] (ppbv)**	**Maximum[3] (ppbv)**
Chloroform	129	15	0.063	18
Chloromethane[4]	129	18	0.071	1.6
cis-1,2-Dichloroethene	129	79	0.059	1100
cis-1,3-Dichloropropene	129	5	0.13	2.2
Cyclohexane	129	11	0.07	1.8
Dichloroflouromethane	129	31	0.38	0.72
Erythrene	129	43	0.15	39
Ethanol[4]	129	31	0.8	92
Ethylbenzene	129	34	0.095	76
Heptane	129	21	0.078	9.4
Hexane	129	25	0.11	16
Isopropanol	129	24	0.18	16
m,p-xylene	129	57	0.26	120
Methylene Chloride	129	47	0.086	2000
o-Xylene	129	44	0.065	180
Propene	129	53	0.99	200
Styrene	129	28	0.069	2.9
Tetrachloroethene	129	48	0.11	33
Tetrahydrofuran	129	1	2.7	2.7
Toluene[4]	129	78	0.11	49
trans-1,3-Dichloropropene	129	4	0.13	1.4
Trichloroethene	129	124	1.1	120000
Trichloroflouromethane	129	11	0.22	0.23
Site 19B - Alternate LOX Disposal Site				
1,1,2-Trichloro-1,2,2-trifluoroethane	22	9	0.07	0.074
1,1,2-Trichloroethane	22	1	0.24	0.24
1,2,4-Trimethylbenzene	22	22	0.15	1.2
1,3,5-Trimethylbenzene	22	15	0.09	0.8
1,4-Dichlorobenzene	22	1	0.11	0.11
1,4-Dioxane	22	1	0.13	0.13
2-Butanone	22	22	0.72	18
2-Hexanone	22	11	0.2	0.84
4-Ethyltoluene	22	22	0.095	1.3
4-Methyl-2-pentanone	22	9	0.18	2.3
Acetone	22	22	2.3	84
Benzene	22	22	0.14	13
Bromomethane	22	1	0.094	0.094
Carbon Disulfide	22	20	0.19	5.4
Carbon Tetrachloride	22	22	0.05	0.069
Chloroform	22	18	0.063	0.36
Chloromethane	22	20	0.17	3.8
Cyclohexane	22	17	0.09	1.5
Dichlorodifluoromethane	22	22	0.38	0.47
Erythrene	22	22	0.18	16
Ethanol	22	21	1.2	17
Ethylbenzene	22	21	0.11	4.7
Heptane	22	20	0.15	7.4
Hexane	22	21	0.13	13
Isopropanol	22	18	0.13	4.1
m,p-xylene	22	21	0.3	4.5
Methylene Chloride	22	1	0.1	0.1
o-Xylene	22	22	0.065	1.9
Propene	22	22	0.85	150
Styrene	22	21	0.071	1.5
Toluene	22	22	0.21	13
Trichloroethene	22	1	0.084	0.084
Trichloroflouromethane	22	9	0.2	0.23
Vinyl chloride	22	2	0.17	0.24
Site 20 - South Base Dump				
1,2,4-Trimethylbenzene	17	14	0.11	17
1,2-Dichloro-1,1,2,2-tetrafluoroethane	17	1	0.24	0.24
1,2-Dichlorobenzene	17	1	0.25	0.25
1,3,5-Trimethylbenzene	17	8	0.091	4.7
1,4-Dichlorobenzene	17	1	0.1	0.1
2-Butanone	17	17	1.9	130
2-Hexanone	17	15	0.21	18
4-Ethyltoluene	17	13	0.1	12
4-Methyl-2-pentanone	17	10	0.13	12
Acetone	17	17	3.4	280
Benzene	17	17	0.18	51
Bromomethane	17	1	1.6	1.6
Carbon Disulfide	17	17	0.27	14
Chloroform	17	10	0.068	0.55
Chloromethane	17	10	0.071	1.1
Cyclohexane	17	7	0.29	29
Dichlorodifluoromethane	17	17	0.39	0.54
Erythrene	17	17	0.24	93
Ethanol	17	17	0.96	290
Ethylbenzene	17	14	0.075	8.9
Heptane	17	14	0.079	27
Hexane	17	15	0.12	41
Isopropanol	17	17	0.35	26
m,p-xylene	17	14	0.21	32
o-Xylene	17	15	0.076	13
Propene	17	17	1.5	1000

TABLE 4.6 SUMMARY OF SOIL GAS DETECTIONS[1]				
Constituent	**#of Samples**	**Number of Detections**	**Minimum[2] (ppbv)**	**Maximum[3] (ppbv)**
Styrene	17	9	0.061	4.7
Tetrachloroethene	17	1	0.17	0.17
Toluene	17	17	0.19	50
Trichloroethene	17	12	0.1	57
Trichloroflouromethane	17	13	0.22	0.25
Site 22 - Paint Hangar Leach Pit				
Acetone[4]	6	5	7.2	27
Benzene	6	1	1.6	1.6
Chloromethane[4]	6	2	1.5	1.8
Ethanol[4]	6	1	11	11
Toluene[4]	6	1	1.8	1.8
Site 23 - Engine Buildup Facility				
1,1,1-Trichloroethane	2	1	4.2	4.2
1,2,4-Trimethylbenzene	2	1	1.8	1.8
2-Butanone	2	1	6.5	6.5
Acetone[4]	2	2	25	30
Benzene	2	1	1.8	1.8
Bromodichloromethane	2	1	12	12
Carbon Disulfide	2	1	12	12
Chloroform	2	1	16	16
Dichloroflouromethane	2	1	1.2	1.2
Ethanol[4]	2	1	6.8	6.8
Propene	2	1	9.5	9.5
Toluene[4]	2	1	2.4	2.4
Trichloroethene	2	1	1.1	1.1
Site 25 - Building 408				
1,2,4-Trimethylbenzene	3	2	2.7	3.6
2-Butanone	3	1	8.6	8.6
Acetone[4]	3	3	14	49
Benzene	3	1	8.6	8.6
Carbon Disulfide	3	2	6.6	35
Ethanol[4]	3	2	14	17
Heptane	3	1	7.6	7.6
Hexane	3	1	19	19
m,p-xylene	3	2	3.6	4.5
o-Xylene	3	2	1.8	2.6
Styrene	3	1	2.9	2.9
Toluene[4]	3	2	2.4	20
Trichloroethene	3	1	2	2
Trichloroflouromethane	3	1	3.2	3.2
Site 31 - 19th Avenue Base Dump				
1,1,2-Trichloro-1,2,2-trifluoroethane	21	1	0.075	0.075
1,2,4-Trimethylbenzene	21	19	0.22	2.4
1,3,5-Trimethylbenzene	21	11	0.13	0.64
1,4-Dichlorobenzene	21	9	0.074	0.5
2-Butanone	21	20	1.3	12
2-Hexanone	21	14	0.31	1.7
4-Ethyltoluene	21	19	0.16	1.6
4-Methyl-2-pentanone	21	3	0.32	0.44
Acetone	21	21	4.4	61
Benzene	21	21	0.24	17
Bromodichloromethane	21	2	0.18	0.27
Carbon Disulfide	21	21	0.35	680
Carbon Tetrachloride	21	19	0.053	1
Chloroform	21	14	0.074	7.4
Chloromethane	21	10	0.087	1.3
Cyclohexane	21	11	0.12	9.7
Dichlorodifluoromethane	21	21	0.39	0.57
Erythrene	21	20	0.2	20
Ethanol	21	19	0.64	8.7
Ethylbenzene	21	20	0.089	2.2
Heptane	21	20	0.1	16
Hexane	21	19	0.12	21
Isopropanol	21	20	0.17	16
m,p-xylene	21	19	0.35	3.5
o-Xylene	21	20	0.076	2.7
Propene	21	21	1.6	140
Styrene	21	16	0.067	0.69
Tetrachloroethene	21	11	0.094	1.9
Toluene	21	21	0.36	11
Trichloroethene	21	20	0.47	76
Trichloroflouromethane	21	18	0.21	0.29
Vinyl chloride	21	1	0.097	0.097
Site 33 - Dump at End of Runway 32				
2-Butanone	2	1	10	10
Acetone[4]	2	2	24	52
Benzene	2	1	2.2	2.2
Carbon Disulfide	2	2	18	29
Chloromethane[4]	2	1	4.3	4.3
Toluene[4]	2	1	2.4	2.4
Trichloroethene	2	1	2.8	2.8
Site 36 - Skyline Auto Wrecking Yard				
1,1,1-Trichloroethane	9	1	0.98	0.98
1,1,2-Trichloro-1,2,2-trifluoroethane	9	2	0.077	0.08

TABLE 4.6
SUMMARY OF SOIL GAS DETECTIONS[1]

Constituent	#of Samples	Number of Detections	Minimum[2] (ppbv)	Maximum[3] (ppbv)
1,1-Dichloroethene	9	1	0.12	0.12
1,2,4-Trimethylbenzene	9	9	0.13	1.1
1,3,5-Trimethylbenzene	9	2	0.29	0.31
2-Butanone	9	9	0.74	5.2
2-Hexanone	9	3	0.3	0.35
4-Ethyltoluene	9	9	0.088	0.82
4-Methyl-2-pentanone	9	1	0.21	0.21
Acetone	9	9	2.2	18
Benzene	9	7	0.11	1.8
Carbon Disulfide	9	6	0.15	2.1
Carbon Tetrachloride	9	8	0.051	0.083
Chlorobenzene	9	1	0.12	0.12
Chloroform	9	1	0.12	0.12
Chloromethane	9	4	0.073	0.36
Cyclohexane	9	2	0.13	0.2
Dichlorodifluoromethane	9	9	0.43	0.93
Erythrene	9	8	0.09	3.7
Ethanol	9	9	0.58	6.7
Ethylbenzene	9	4	0.092	0.77
Heptane	9	5	0.083	0.94
Hexane	9	3	0.1	1.4
Isopropanol	9	9	0.27	2
m,p-xylene	9	7	0.21	2.9
Methylene Chloride	9	1	0.089	0.089
o-Xylene	9	9	0.091	1.4
Propene	9	9	0.52	21
Styrene	9	6	0.068	0.78
Tetrachloroethene	9	6	0.13	2.1
Toluene	9	9	0.22	3.2
Trichloroethene	9	9	0.14	0.73
Trichloroflouromethane	9	9	0.21	0.33

Notes: [1]All soil gas samples reporting a volatile organic compound concentration above the PQL from the 2000 field investigation and the expedited investigations are included in this table.

[2]The minimum value is the minimum concentrations above the PQL. ppbv - parts per billion by volume

[3]The higher concentration of the field sample and the field duplicate is used in summary statistics.

[4]The following constituents have been identified as background/atmospheric contaminants: acetone, toluene, chloromethane, ethanol. See the 2000 Site Characterization Technical Memorandum (Montgomery Watson, 2001b) for more information.

[5]The following constituents were detected in the air or equipment blanks at the Site 19 - Liquid Oxygen Generating Plant Expedited Inve acetone, toluene, chloromethane, 1,2-dichloroethane, cis-1,2-dichloroethene, ethanol, methylene chloride, styrene, trichloroethene, 1,2,4-trimethylbenzene, m,p-xylene and o-xylene

Shaded cells indicate values below the Upper Tolerance Limit (UTL), as described in Appendix D3.

TABLE 4.7
SUMMARY OF INORGANIC GROUNDWATER AND SURFACE WATER ANALYTICAL RESULTS

Location		Alkalinity	Calcium	Chloride	Conductivity	CO_2	Dissolved Oxygen	Hardness	Nitrate	Nitrate/Nitrite as N	Nitrite	pH	Redox	Sulfate	Temperature	TOC	Turbidity	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Iron, Total	Iron, Ferrous	Lead	Magnesium	Manganese	Mercury	Nickel	Potassium	Silver	Selenium	Sodium	Thallium	Zinc
		mg/L	mg/L	mg/L	mS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	s.u.	mV	mg/L	°C	mg/L	NTU	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	mg/L	ug/L	mg/L	ug/L	ug/L	ug/L	mg/L	ug/L	ug/L	mg/L	ug/L	ug/L
GROUNDWATER SAMPLES																																				
00AW03	# Samples	1	1	1	2	1	2	1	1	ns	1	2	2	1	2	1	2	ns	ns	ns	ns	ns	ns	1	1	ns	1	ns	ns	ns	1	ns	ns	1	ns	ns
	# Detects	1	1	1	1	1	1	1	1	ns	0	1	1	1	1	1	1	ns	ns	ns	ns	ns	ns	0	1	ns	1	ns	ns	ns	1	ns	ns	1	ns	ns
	Min	140	28.6	3.3	0.176	17 2	9.55	123.5	4.6	ns	-	7.67	299	18.1	10 24	2	6.87	ns	ns	ns	ns	ns	ns	-	0	ns	14.9	ns	ns	ns	4.3	ns	ns	28.3	ns	ns
	Max	140	28.6	3.3	0.176	17 2	9.55	123.5	4.6	ns	-	7.67	299	18.1	10 24	2	6.87	ns	ns	ns	ns	ns	ns	-	0	ns	14.9	ns	ns	ns	4.3	ns	ns	28.3	ns	ns
00AW10	# Samples	1	1	1	2	1	2	1	1	ns	1	2	2	1	2	1	2	ns	ns	ns	ns	ns	ns	1	1	ns	1	ns	ns	ns	1	ns	ns	1	ns	ns
	# Detects	1	1	1	1	1	1	1	1	ns	0	1	1	1	1	0	1	ns	ns	ns	ns	ns	ns	0	1	ns	1	ns	ns	ns	1	ns	ns	1	ns	ns
	Min	160	34	11.7	0.299	44	7.89	153.5	2.1	ns	-	7.84	281.6	28.6	14.47	-	2.24	ns	ns	ns	ns	ns	ns	-	0	ns	11.8	ns	ns	ns	6.6	ns	ns	32.7	ns	ns
	Max	160	34	11.7	0.299	44	7.89	153.5	2.1	ns	-	7.84	281.6	28.6	14.47	-	2.24	ns	ns	ns	ns	ns	ns	-	0	ns	11.8	ns	ns	ns	6.6	ns	ns	32.7	ns	ns
00AW11	# Samples	2	2	2	3	2	3	2	2	ns	2	3	3	2	3	2	3	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2
	# Detects	2	2	2	1	1	1	1	2	ns	0	1	1	2	1	0	1	0	2	0	0	0	0	0	1	0	2	1	0	0	2	0	0	2	0	0
	Min	270	53.3	11 6	0.188	18 6	10.27	258.5	4.4	ns	-	7.33	312.1	31.5	14.71	-	1.02	-	6	-	-	-	-	-	0	-	24.2	6	-	-	6.7	-	-	38	-	-
	Max	280	64.2	13 5	0.188	18 6	10.27	258.5	4.9	ns	-	7.33	312.1	32.2	14.71	-	1.02	-	6	-	-	-	-	-	0	-	26	6	-	-	8	-	-	41.4	-	-
00AW12	# Samples	2	2	2	3	2	3	2	2	ns	2	3	3	2	3	2	3	ns	ns	ns	ns	ns	ns	2	2	ns	2	ns	ns	ns	2	ns	ns	2	ns	ns
	# Detects	2	2	2	1	1	1	1	2	ns	0	1	1	2	1	2	1	ns	ns	ns	ns	ns	ns	0	1	ns	2	ns	ns	ns	2	ns	ns	2	ns	ns
	Min	220	49.6	8.6	0.337	37 8	0.4	192	1	ns	-	7.16	342.3	19	15 36	1.9	1.06	ns	ns	ns	ns	ns	ns	-	0	ns	18.9	ns	ns	ns	8.1	ns	ns	31.8	ns	ns
	Max	250	56.9	22 2	0.337	37 8	0.4	192	2.5	ns	-	7.16	342.3	25.2	15 36	1.9	1.06	ns	ns	ns	ns	ns	ns	-	0	ns	22.1	ns	ns	ns	8.8	ns	ns	37.2	ns	ns
00AW13	# Samples	2	2	2	3	2	3	2	2	ns	2	3	3	2	3	2	3	ns	ns	ns	ns	ns	ns	2	2	ns	2	ns	ns	ns	2	ns	ns	2	ns	ns
	# Detects	2	2	2	1	1	1	1	2	ns	0	1	1	2	1	0	1	ns	ns	ns	ns	ns	ns	0	1	ns	2	ns	ns	ns	2	ns	ns	2	ns	ns
	Min	240	42.2	6.9	0.537	20 2	8.25	223.5	1.8	ns	-	7.02	119	24.8	14.45	-	1.83	ns	ns	ns	ns	ns	ns	-	0	ns	24.5	ns	ns	ns	6.9	ns	ns	31.1	ns	ns
	Max	250	51.4	8.3	0.537	20 2	8.25	223.5	2	ns	-	7.02	119	25.1	14.45	-	1.83	ns	ns	ns	ns	ns	ns	-	0	ns	25.6	ns	ns	ns	8.3	ns	ns	33.4	ns	ns
00AW14	# Samples	2	2	2	3	2	3	2	2	ns	2	3	3	2	3	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	# Detects	2	2	2	1	1	1	1	2	ns	0	1	1	2	1	2	1	0	0	0	0	0	0	0	1	0	2	2	0	0	2	0	0	2	0	0
	Min	200	64.1	7.3	0.503	14.4	8.65	289.5	1.7	ns	-	6.89	163.7	27.6	14.79	1.7	9.47	-	-	-	-	-	-	-	0	-	18.2	15	-	-	6.6	-	-	17.6	-	-
	Max	260	69.3	8.6	0.503	14.4	8.65	289.5	4.8	ns	-	6.89	163.7	31.8	14.79	3.1	9.47	-	-	-	-	-	-	-	0	-	19.5	45	-	-	7	-	-	19.8	-	-
00BW01	# Samples	2	2	2	3	2	3	2	2	ns	2	3	3	2	3	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	# Detects	2	2	2	1	1	1	1	2	ns	0	1	1	2	1	0	1	0	0	0	0	0	0	0	1	0	2	1	0	0	2	0	0	2	0	0
	Min	220	44.6	6.2	0.232	16 9	9.73	200.5	1.3	ns	-	7.83	274.1	25.2	13 99	-	1.079	-	-	-	-	-	-	-	0	-	21.1	22	-	-	5.3	-	-	29.3	-	-
	Max	230	45.7	7.6	0.232	16 9	9.73	200.5	1.4	ns	-	7.83	274.1	26.9	13 99	-	1.079	-	-	-	-	-	-	-	0	-	21.4	22	-	-	5.7	-	-	30.1	-	-
00BW02	# Samples	2	2	2	3	2	3	2	2	ns	2	3	3	2	3	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	# Detects	2	2	2	1	1	1	1	2	ns	0	1	1	2	1	0	1	0	0	0	0	0	0	1	1	0	2	2	0	0	2	0	0	2	0	1
	Min	310	54.3	9.2	0.204	19 8	9.19	256	2	ns	-	7.33	319.7	30.1	15 85	-	2	-	-	-	-	-	-	0 09	0	-	30.3	4	-	-	7.1	-	-	49.6	-	40
	Max	320	60.3	9.6	0.204	19 8	9.19	256	5.4	ns	-	7.33	319.7	35.2	15 85	-	2	-	-	-	-	-	-	0 09	0	-	31	122	-	-	7.2	-	-	53.7	-	40
00BW03	# Samples	2	2	2	3	2	3	2	2	ns	2	3	3	2	3	2	3	ns	ns	ns	ns	ns	ns	2	2	ns	2	ns	ns	ns	2	ns	ns	2	ns	ns
	# Detects	2	2	2	1	1	1	1	2	ns	0	1	1	2	1	0	1	ns	ns	ns	ns	ns	ns	0	1	ns	2	ns	ns	ns	2	ns	ns	2	ns	ns
	Min	160	25.5	7.5	0.163	12.7	6.61	146.5	3.1	ns	-	7.71	269.1	20	10 98	-	1.14	ns	ns	ns	ns	ns	ns	-	0	ns	18.6	ns	ns	ns	3	ns	ns	21.2	ns	ns
	Max	160	28.3	8.1	0.163	12.7	6.61	146.5	3.4	ns	-	7.71	269.1	20.1	10 98	-	1.14	ns	ns	ns	ns	ns	ns	-	0	ns	19.3	ns	ns	ns	3.9	ns	ns	23.1	ns	ns
00BW04	# Samples	2	2	2	3	2	3	2	2	ns	2	3	3	2	3	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	# Detects	2	2	2	1	1	1	1	2	ns	0	1	1	2	1	1	1	0	1	0	0	0	0	0	1	0	2	0	0	0	2	0	0	2	0	0
	Min	210	45.8	7.2	0.31	16 6	0.59	182.5	1	ns	-	7.81	307.6	24.4	14 55	1.5	0.86	-	5	-	-	-	-	-	0	-	17.9	-	-	-	7	-	-	23.2	-	-
	Max	220	46.4	8.2	0.31	16 6	0.59	182.5	1.1	ns	-	7.81	307.6	26.8	14 55	1.5	0.86	-	5	-	-	-	-	-	0	-	18.2	-	-	-	7.2	-	-	24.6	-	-
00BW05	# Samples	2	2	2	3	2	3	2	2	ns	2	3	3	2	3	2	3	2	2	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2
	# Detects	2	2	2	1	1	1	1	2	ns	0	1	1	2	1	1	1	0	0	0	0	0	0	0	1	0	2	0	0	0	2	0	0	2	0	0
	Min	220	50.7	6.8	0.373	85	0.2	211.5	1	ns	-	7.66	308.5	23.6	15 33	1.9	1.06	-	-	-	-	-	-	-	0	-	20.2	-	-	-	7.4	-	-	26	-	-
	Max	240	52.6	9.1	0.373	85	0.2	211.5	1.2	ns	-	7.66	308.5	28.9	15 33	1.9	1.06	-	-	-	-	-	-	-	0	-	20.6	-	-	-	7.8	-	-	28.3	-	-
00BW06	# Samples	2	2	2	3	2	3	2	2	ns	2	3	3	2	3	2	3	ns	ns	ns	ns	ns	ns	2	2	ns	2	ns	ns	ns	2	ns	ns	2	ns	ns
	# Detects	2	2	2	1	1	1	1	2	ns	0	1	1	2	1	0	1	ns	ns	ns	ns	ns	ns	1	1	ns	2	ns	ns	ns	2	ns	ns	2	ns	ns
	Min	140	31.5	6.7	0.177	16 5	8.09	139	4.7	ns	-	7.89	232.5	24.4	13 99	-	1.186	ns	ns	ns	ns	ns	ns	0 06	0	ns	15.1	ns	ns	ns	3.2	ns	ns	23	ns	ns
	Max	140	32.6	7.6	0.177	16 5	8.09	139	5.4	ns	-	7.89	232.5	25.9	13 99	-	1.186	ns	ns	ns	ns	ns	ns	0 06	0	ns	15.6	ns	ns	ns	3.3	ns	ns	23.1	ns	ns
00BW07	# Samples	2	2	2	3	2	3	2	2	ns	2	3	3	2	3	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	# Detects	2	2	2	1	1	1	1	2	ns	0	1	1	2	1	0	1	0	0	0	0	0	0	0	1	0	2	1	0	0	2	0	0	2	0	1
	Min	220	41.7	7	0.317	17.4	0.39	205	1.1	ns	-	7.72	286.9	25.2	13.71	-	0.88	-	-	-	-	-	-	-	0	-	16.6	48	-	-	4.9	-	-	27.3	-	20
	Max	230	49.5	7.1	0.317	17.4	0.39	205	1.3	ns	-	7.72	286.9	26.4	13.71	-	0.88	-	-	-	-	-	-	-	0	-	19.5	48	-	-	6.3	-	-	30.2	-	20
00BW08	# Samples	2	2	2	3	2	3	2	2	ns	2	3	3	2	3	2	3	ns	ns	ns	ns	ns	ns	2	2	ns	2	ns	ns	ns	2	ns	ns	2	ns	ns
	# Detects	2	2	2	1	1	1	1	2	ns	0	1	1	2	1	1	1	ns	ns	ns	ns	ns	ns	0	1	ns	2	ns	ns	ns	2	ns	ns	2	ns	ns
	Min	210	42.5	4.9	0.236	16 5	0.31	183.5	3.4	ns	-	7.47	306	20.8	99.9	1.6	3.97	ns	ns	ns	ns	ns	ns	-	0	ns	22.5	ns	ns	ns	5.2	ns	ns	31.1	ns	ns
	Max	210	42.7	5.2	0.236	16 5	0.31	183.5	5.2	ns	-	7.47	306	24.9	99.9	1.6	3.97	ns	ns	ns	ns	ns	ns	-	0	ns	22.5	ns	ns	ns	5.2	ns	ns	31.2	ns	ns
00BW09	# Samples	2	2	2	2	2	2	2	2	ns	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	# Detects	2	2	2	1	1	1	1	2	ns	0	1	1	2	1	1	1	0	0	0	0	0	0	0	1	0	2	0	0	0	2	0	0	2	0	0
	Min	230	52.7	8	0.404	93 5	0.16	207.5	1.8	ns	-	7.61	257	26.4	16	2.2	3.9	-	-	-	-	-	-	-	0	-	20.6	-	-	-	6.2	-	-	29.1	-	-
	Max	230	53.5	8.4	0.404	93 5	0.16	207.5	2.1	ns	-	7.61	257	27.5	16	2.2	3.9	-	-	-	-	-	-	-	0	-	20.8	-	-	-	6.3	-	-	29.9	-	-
00BW10	# Samples	2	2	2	3	2	3	2	2	ns	2	3	3	2	3	2	3	ns	ns	ns	ns	ns	ns	2	2	ns	2	ns	ns	ns	2	ns	ns	2	ns	ns
	# Detects	2	2	2	2	1	1	1	2	ns	0	1	1	2	2	1	1	ns	ns	ns	ns	ns	ns	0	1	ns	2	ns	ns	ns	2	ns	ns	2	ns	ns
	Min	160	33.6	10 9	0.3836	10 9	8.97	200.5	2.3	ns	-	7.59	297	25.2	13 03	1.7	3.25	ns	ns	ns	ns	ns	ns	-	0	ns	11.7	ns	ns	ns	6.6	ns	ns	31.7	ns	ns
	Max	230	49.2	10 9	0.414	10 9	8.97	200.5	5.2	ns	-	7.59	297	28.3	14 95	1.7	3.25	ns	ns	ns	ns	ns	ns	-	0	ns	15	ns	ns	ns	8.5	ns	ns	50.8	ns	ns

TABLE 4.7
SUMMARY OF INORGANIC GROUNDWATER AND SURFACE WATER ANALYTICAL RESULTS

Location		Alkalinity	Calcium	Chloride	Conductivity	CO_2	Dissolved Oxygen	Hardness	Nitrate	Nitrate/Nitrite as N	Nitrite	pH	Redox	Sulfate	Temperature	TOC	Turbidity	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Iron, Total	Iron, Ferrous	Lead	Magnesium	Manganese	Mercury	Nickel	Potassium	Silver	Selenium	Sodium	Thallium	Zinc
		mg/L	mg/L	mg/L	mS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	s.u.	mV	mg/L	°C	mg/L	NTU	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	mg/L	ug/L	mg/L	ug/L	ug/L	ug/L	mg/L	ug/L	ug/L	mg/L	ug/L	ug/L
00BW11	# Samples	2	2	2	3	2	3	2	2	ns	2	3	3	2	3	2	3	ns	ns	ns	ns	ns	ns	2	2	ns	2	ns	ns	ns	2	ns	ns	2	ns	ns
	# Detects	2	2	2	1	1	1	1	2	ns	0	1	1	2	1	2	1	ns	ns	ns	ns	ns	ns	1	1	ns	2	ns	ns	ns	2	ns	ns	2	ns	ns
	Min	380	55.1	12.7	0.355	4.2	1.15	292.5	0.4	ns	-	7.57	241	12.3	12 38	2.7	1.034	ns	ns	ns	ns	ns	ns	0 08	0	ns	29.3	ns	ns	ns	9.3	ns	ns	41.5	ns	ns
	Max	390	70 3	20.7	0.355	4.2	1.15	292.5	0.6	ns	-	7.57	241	22.6	12 38	4.1	1.034	ns	ns	ns	ns	ns	ns	0 08	0	ns	37.3	ns	ns	ns	23	ns	ns	64.4	ns	ns
00BW12	# Samples	2	2	2	3	2	3	2	2	ns	2	3	3	2	3	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	# Detects	2	2	2	1	1	1	1	2	ns	0	1	1	2	1	0	1	0	0	0	0	0	0	0	1	0	2	2	0	0	2	0	0	2	0	2
	Min	140	30 8	7.2	0.235	16 6	9.85	135.5	2	ns	-	7.85	278.6	22.2	15 31	-	2.73	-	-	-	-	-	-	-	0	-	13.2	132	-	-	3.8	-	-	22.4	-	10
	Max	160	31 5	7.8	0.235	16 6	9.85	135.5	2.2	ns	-	7.85	278.6	23.5	15 31	-	2.73	-	-	-	-	-	-	-	0	-	13.8	158	-	-	4.4	-	-	25.3	-	20
00BW13	# Samples	2	2	2	3	2	3	2	2	ns	2	3	3	2	3	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	# Detects	2	2	2	1	1	1	1	2	ns	0	1	1	2	1	0	1	0	0	0	0	0	0	1	1	0	2	2	0	0	2	0	0	2	0	2
	Min	140	23 9	18 3	0.285	13	9.13	126.5	1.1	ns	-	7.55	313.2	40.6	14.42	-	2.1	-	-	-	-	-	-	0 06	0	-	11.6	93	-	-	6.1	-	-	35	-	370
	Max	140	30.4	28 6	0.285	13	9.13	126.5	1.9	ns	-	7.55	313.2	48.3	14.42	-	2.1	-	-	-	-	-	-	0 06	0	-	13.7	175	-	-	8.6	-	-	46.9	-	420
00BW14	# Samples	2	2	2	3	2	3	2	2	ns	2	3	3	2	3	2	3	ns	ns	ns	ns	ns	ns	2	2	ns	2	ns	ns	ns	2	ns	ns	2	ns	ns
	# Detects	2	2	2	1	1	1	1	2	ns	0	1	1	2	1	0	1	ns	ns	ns	ns	ns	ns	1	1	ns	2	ns	ns	ns	2	ns	ns	2	ns	ns
	Min	190	39 3	7.2	0.21	15 6	10.83	181	2.4	ns	-	7.86	261.8	27.8	14.19	-	0.854	ns	ns	ns	ns	ns	ns	0 09	0	ns	20.4	ns	ns	ns	4.5	ns	ns	27.8	ns	ns
	Max	200	39.4	8.3	0.21	15 6	10.83	181	2.8	ns	-	7.86	261.8	28.1	14.19	-	0.854	ns	ns	ns	ns	ns	ns	0 09	0	ns	20.5	ns	ns	ns	4.6	ns	ns	27.8	ns	ns
00BW15	# Samples	2	2	2	3	2	3	2	2	ns	2	3	3	2	3	2	3	ns	ns	ns	ns	ns	ns	2	2	ns	2	ns	ns	ns	2	ns	ns	2	ns	ns
	# Detects	2	2	2	1	1	1	1	2	ns	0	1	1	2	1	0	1	ns	ns	ns	ns	ns	ns	0	1	ns	2	ns	ns	ns	2	ns	ns	2	ns	ns
	Min	140	28 8	10	0.257	12 6	1.02	131	3	ns	-	7.6	327.7	21.7	16.42	-	0.16	ns	ns	ns	ns	ns	ns	-	0	ns	14.7	ns	ns	ns	4.9	ns	ns	25	ns	ns
	Max	140	30	10 3	0.257	12 6	1.02	131	3.4	ns	-	7.6	327.7	22.9	16.42	-	0.16	ns	ns	ns	ns	ns	ns	-	0	ns	15.1	ns	ns	ns	5	ns	ns	26.5	ns	ns
00BW16	# Samples	2	2	2	3	2	3	2	2	ns	2	3	3	2	3	2	3	ns	ns	ns	ns	ns	ns	2	2	ns	2	ns	ns	ns	2	ns	ns	2	ns	ns
	# Detects	2	2	2	1	1	1	1	2	ns	0	1	1	2	1	0	1	ns	ns	ns	ns	ns	ns	0	1	ns	2	ns	ns	ns	2	ns	ns	2	ns	ns
	Min	140	28.1	7.4	0.347	15.4	6.87	135	1.9	ns	-	6.83	121.7	20.3	15 32	-	1.95	ns	ns	ns	ns	ns	ns	-	0	ns	12.8	ns	ns	ns	5.4	ns	ns	27.6	ns	ns
	Max	160	33 9	8.4	0.347	15.4	6.87	135	2.4	ns	-	6.83	121.7	36	15 32	-	1.95	ns	ns	ns	ns	ns	ns	-	0	ns	15.1	ns	ns	ns	5.6	ns	ns	31.1	ns	ns
01BW01	# Samples	ns	ns	ns	2	1	2	1	ns	ns	ns	2	2	ns	2	ns	2	1	1	1	1	1	1	ns	1	1	ns	1	1	1	ns	1	1	ns	1	1
	# Detects	ns	ns	ns	0	0	0	0	ns	ns	ns	0	0	ns	0	ns	0	0	0	0	0	0	0	ns	0	0	ns	1	0	0	ns	0	0	ns	0	0
	Min	ns	ns	ns	-	-	-	-	ns	ns	ns	-	-	ns	-	ns	-	-	-	-	-	-	-	ns	0	-	ns	15	-	-	ns	-	-	ns	-	-
	Max	ns	ns	ns	-	-	-	-	ns	ns	ns	-	-	ns	-	ns	-	-	-	-	-	-	-	ns	0	-	ns	15	-	-	ns	-	-	ns	-	-
02BW01	# Samples	1	1	1	1	1	1	1	1	ns	1	1	1	1	1	1	1	ns	ns	ns	ns	ns	ns	1	1	ns	1	ns	ns	ns	1	ns	ns	1	ns	ns
	# Detects	1	1	1	0	0	0	0	1	ns	0	0	0	1	0	1	0	ns	ns	ns	ns	ns	ns	1	0	ns	1	ns	ns	ns	1	ns	ns	1	ns	ns
	Min	146	31.1	6.23	-	-	-	-	2.73	ns	-	-	-	22.7	-	0.5	-	ns	ns	ns	ns	ns	ns	0.0057	0	ns	12.4	ns	ns	ns	6.32	ns	ns	25.3	ns	ns
	Max	146	31.1	6.23	-	-	-	-	2.73	ns	-	-	-	22.7	-	0.5	-	ns	ns	ns	ns	ns	ns	0.0057	0	ns	12.4	ns	ns	ns	6.32	ns	ns	25.3	ns	ns
02BW02	# Samples	2	2	2	1	1	1	1	2	ns	2	1	1	2	1	2	1	ns	ns	ns	ns	ns	ns	2	1	ns	2	ns	ns	ns	2	ns	ns	2	ns	ns
	# Detects	2	2	2	0	0	0	0	2	ns	2	0	0	2	0	2	0	ns	ns	ns	ns	ns	ns	2	0	ns	2	ns	ns	ns	2	ns	ns	2	ns	ns
	Min	138	30 3	13.1	-	-	-	-	2.41	ns	0.17	-	-	47.5	-	29.7	-	ns	ns	ns	ns	ns	ns	0.0075	0	ns	13.7	ns	ns	ns	5.48	ns	ns	35.7	ns	ns
	Max	139	31.1	13 2	-	-	-	-	2.46	ns	0.18	-	-	47.8	-	30 2	-	ns	ns	ns	ns	ns	ns	0.0089	0	ns	14	ns	ns	ns	5.87	ns	ns	36.7	ns	ns
91AW01	# Samples	1	1	1	4	3	4	3	ns	1	ns	4	4	1	4	ns	4	1	1	1	1	1	1	1	3	1	1	1	1	1	1	1	1	1	1	1
	# Detects	1	1	1	3	2	3	2	ns	1	ns	3	3	1	3	ns	3	0	1	0	0	0	0	0	2	0	1	0	0	0	1	0	0	1	0	0
	Min	110	24 5	6.45	0.154	9.8	8.65	93	ns	3.74	ns	7.93	1.6	27.6	13 01	ns	0.48	-	8.9	-	-	-	-	-	0	-	8.68	-	-	-	4.28	-	-	26	-	-
	Max	110	24 5	6.45	0.399	13.1	11.52	103.5	ns	3.74	ns	8.04	245.4	27.6	16 85	ns	0.734	-	8.9	-	-	-	-	-	0	-	8.68	-	-	-	4.28	-	-	26	-	-
91AW02	# Samples	1	1	1	4	3	4	3	ns	1	ns	4	4	1	4	ns	4	1	1	1	1	1	1	1	3	1	1	1	1	1	1	1	1	1	1	1
	# Detects	1	1	1	3	2	3	2	ns	1	ns	3	3	1	3	ns	3	0	1	0	0	0	0	0	2	0	1	0	0	0	1	0	0	1	0	0
	Min	108	25 5	8.24	0.166	10 5	9.09	106	ns	4.33	ns	7.88	0.1	32.7	12.45	ns	0.38	-	6	-	-	-	-	-	0	-	9.18	-	-	-	3.87	-	-	26.8	-	-
	Max	108	25 5	8.24	0.429	11 3	11.9	107.5	ns	4.33	ns	8.01	275.7	32.7	16.18	ns	1.336	-	6	-	-	-	-	-	0	-	9.18	-	-	-	3.87	-	-	26.8	-	-
91AW03	# Samples	4	4	4	4	3	4	3	3	1	3	4	4	4	4	ns	4	4	4	4	4	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4
	# Detects	4	4	4	3	2	3	2	3	1	0	3	3	4	3	ns	3	0	4	0	0	0	0	0	2	0	4	0	0	0	4	0	0	4	0	0
	Min	100	4.78	8.1	0.171	10	9.31	103	4.4	5.51	-	7.91	2.6	33.8	12.45	ns	0.49	-	8	-	-	-	-	-	0	-	9.37	-	-	-	3.9	-	-	30.3	-	-
	Max	110	26.7	9.5	0.451	12.1	12	121	5	5.51	-	8.03	297.1	38.3	15.49	ns	2.45	-	10	-	-	-	-	-	0	-	10.2	-	-	-	4.1	-	-	32	-	-
91AW05	# Samples	5	5	5	5	4	5	4	5	ns	4	5	5	5	5	5	5	ns	ns	ns	ns	ns	ns	5	4	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	# Detects	5	5	5	4	3	4	3	5	ns	0	4	4	5	4	1	4	ns	ns	ns	ns	ns	ns	0	3	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	Min	186	37 5	4.2	0.335	18 8	0.41	178.5	6.1	ns	-	7.68	-2.9	19.2	13 85	8.68	0.674	ns	ns	ns	ns	ns	ns	-	0	ns	18.8	ns	ns	ns	4.8	ns	ns	25.8	ns	ns
	Max	210	40 9	5	0.397	22 6	8.7	200	8 03	ns	-	7.79	356.4	24.6	16 07	8.68	2.1	ns	ns	ns	ns	ns	ns	-	0	ns	19.8	ns	ns	ns	5.15	ns	ns	28.8	ns	ns
91AW09	# Samples	5	5	5	6	4	6	4	3	2	3	6	6	5	6	5	6	ns	ns	ns	ns	ns	ns	5	4	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	# Detects	5	5	5	4	3	4	3	3	2	0	4	4	5	4	2	4	ns	ns	ns	ns	ns	ns	1	3	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	Min	210	44 3	7.8	0.345	14	9.23	203.5	1.3	1.25	-	7.4	0.3	24.7	11.4	2.2	0.1	ns	ns	ns	ns	ns	ns	0.137	0	ns	17.9	ns	ns	ns	6.8	ns	ns	25.1	ns	ns
	Max	230	50.1	10.7	0.45	20.4	10.9	279	1.5	1.7	-	7.59	329	31.4	15 31	2.27	0.65	ns	ns	ns	ns	ns	ns	0.137	0	ns	20.6	ns	ns	ns	7.2	ns	ns	26.8	ns	ns
91AW10	# Samples	5	5	5	5	4	5	4	4	1	3	5	5	5	5	5	5	ns	ns	ns	ns	ns	ns	5	4	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	# Detects	5	5	5	4	3	4	3	4	1	0	4	4	5	4	4	4	ns	ns	ns	ns	ns	ns	1	3	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	Min	240	50.1	9.1	0.362	33.4	0.16	228	1.8	1.93	-	6.95	5	26.8	11.4	1.5	0.16	ns	ns	ns	ns	ns	ns	0.12	0	ns	19.6	ns	ns	ns	7.7	ns	ns	29	ns	ns
	Max	300	57 5	12.7	0.5	49 6	10.82	246	2.4	1.93	-	7.2	371	30.1	14.17	24.1	0.812	ns	ns	ns	ns	ns	ns	0.12	0	ns	21.6	ns	ns	ns	8.29	ns	ns	31.3	ns	ns
91AW13	# Samples	5	5	5	5	4	5	4	4	1	3	5	5	5	5	5	5	ns	ns	ns	ns	ns	ns	5	4	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	# Detects	5	5	5	4	3	4	3	4	1	0	4	4	5	4	3	4	ns	ns	ns	ns	ns	ns	0	3	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	Min	180	42.1	11 6	0.3	9	2.5	188	5.3	6.13	-	7.74	-0.2	34.6	13.8	1.9	0.22	ns	ns	ns	ns	ns	ns	-	0	ns	18.6	ns	ns	ns	3.4	ns	ns	31.7	ns	ns
	Max	210	45.7	14 6	0.425	18 6	9.8	209	7.6	6.13	-	7.92	329	43.6	16 05	12 5	0.78	ns	ns	ns	ns	ns	ns	-	0	ns	19.7	ns	ns	ns	3.5	ns	ns	34.7	ns	ns

TABLE 4.7
SUMMARY OF INORGANIC GROUNDWATER AND SURFACE WATER ANALYTICAL RESULTS

Location		Alkalinity	Calcium	Chloride	Conductivity	CO_2	Dissolved Oxygen	Hardness	Nitrate	Nitrate/Nitrite as N	Nitrite	pH	Redox	Sulfate	Temperature	TOC	Turbidity	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Iron, Total	Iron, Ferrous	Lead	Magnesium	Manganese	Mercury	Nickel	Potassium	Silver	Selenium	Sodium	Thallium	Zinc
		mg/L	mg/L	mg/L	mS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	s.u.	mV	mg/L	°C	mg/L	NTU	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	mg/L	ug/L	mg/L	ug/L	ug/L	ug/L	mg/L	ug/L	ug/L	mg/L	ug/L	ug/L
91AW14	# Samples	5	5	5	5	4	5	4	4	1	3	5	5	5	5	5	5	1	ns	1	1	1	1	5	4	ns	5	1	ns	1	5	1	ns	5	ns	1
	# Detects	5	5	5	4	3	4	3	4	1	0	4	4	5	4	2	4	0	ns	0	0	0	0	0	3	ns	5	0	ns	0	5	0	ns	5	ns	0
	Min	246	45 8	15 2	0.37	13.7	5.6	238.5	4.1	3.84	-	7.44	-4.1	47.2	13.3	2.9	0.4	-	ns	-	-	-	-	-	0	ns	25.9	-	ns	-	4.24	-	ns	44.2	ns	-
	Max	280	53 3	18.2	0.555	80	9.81	271.5	4.7	3.84	-	7.63	288	55	15 91	11 6	4.5	-	ns	-	-	-	-	-	0	ns	29.4	-	ns	-	4.9	-	ns	48.8	ns	-
91AW15	# Samples	5	5	5	6	4	6	4	5	ns	4	6	6	5	6	5	6	ns	ns	ns	ns	ns	ns	5	4	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	# Detects	5	5	5	4	3	4	3	5	ns	0	4	4	5	4	5	4	ns	ns	ns	ns	ns	ns	2	3	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	Min	360	65.1	9.3	0.42	24 8	1.26	308	0.6	ns	-	7.18	-43.7	4.4	13.6	2.1	0.2	ns	ns	ns	ns	ns	ns	0 05	0	ns	33.7	ns	ns	ns	5	ns	ns	35.4	ns	ns
	Max	380	70 8	15.2	0.621	40 3	2.8	328.5	0 92	ns	-	7.4	283	8.6	15.44	25.1	0.697	ns	ns	ns	ns	ns	ns	0.0504	0	ns	34.6	ns	ns	ns	5.2	ns	ns	38.6	ns	ns
91AW16	# Samples	5	5	5	5	4	5	4	5	ns	4	5	5	5	5	5	5	3	3	3	3	3	3	5	4	3	5	3	3	3	5	3	3	5	3	3
	# Detects	5	5	5	4	3	4	3	5	ns	0	4	4	5	4	2	4	0	0	0	0	0	0	0	3	0	5	0	0	0	5	0	0	5	0	0
	Min	238	51.1	7.4	0.351	10 3	7.98	227	2.4	ns	-	7.35	2.6	27	9.7	1.6	1.26	-	-	-	-	-	-	-	0	-	20.2	-	-	-	7.8	-	-	29.4	-	-
	Max	251	54 9	10.1	0.452	50 3	10.4	241	3.4	ns	-	7.41	351	32.7	18 38	4.13	1.72	-	-	-	-	-	-	-	0	-	22.3	-	-	-	8.02	-	-	31.5	-	-
91AW17	# Samples	5	5	5	5	4	5	4	4	1	3	5	5	5	5	5	5	ns	ns	ns	ns	ns	ns	5	4	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	# Detects	5	5	5	4	3	4	3	4	1	0	4	4	5	4	2	4	ns	ns	ns	ns	ns	ns	0	3	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	Min	194	45 3	9.2	0.406	16 3	3.78	186	5.8	7.22	-	7.66	-2.7	38.2	12.4	8.47	0.26	ns	ns	ns	ns	ns	ns	-	0	ns	17.3	ns	ns	ns	5.1	ns	ns	38.3	ns	ns
	Max	210	50.7	10.7	0.52	22 2	10.7	205	8.7	7.22	-	7.72	351	45	15.2	11	1.66	ns	ns	ns	ns	ns	ns	-	0	ns	20	ns	ns	ns	5.8	ns	ns	42.2	ns	ns
91AW18	# Samples	5	5	5	5	4	5	4	4	1	3	5	5	5	5	5	5	ns	ns	ns	ns	ns	ns	5	4	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	# Detects	5	5	5	4	3	4	3	4	1	0	4	4	5	4	2	4	ns	ns	ns	ns	ns	ns	0	3	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	Min	170	38 2	17.4	0.384	13.1	-13.2	193.5	5	5.62	-	7.8	-1.2	49.4	13 97	1.7	0.17	ns	ns	ns	ns	ns	ns	-	0	ns	21.9	ns	ns	ns	5.4	ns	ns	31.1	ns	ns
	Max	180	45 5	20.2	0.51	17 9	18.3	202	6.3	5.62	-	7.85	320	56.5	15.77	8.12	0.61	ns	ns	ns	ns	ns	ns	-	0	ns	25	ns	ns	ns	6	ns	ns	35.4	ns	ns
91AW19	# Samples	5	5	5	5	4	5	4	4	1	3	5	5	5	5	5	5	3	3	3	3	3	3	5	4	3	5	3	3	3	5	3	3	5	3	3
	# Detects	5	5	5	4	3	4	3	4	1	0	4	4	5	4	2	4	0	1	0	0	0	0	0	3	0	5	0	0	0	5	0	0	5	0	0
	Min	200	47 6	3.8	0.249	16.4	8.59	180	1.6	2.33	-	7.05	10	16.9	12.4	13 9	0.66	-	6	-	-	-	-	-	0	-	13.6	-	-	-	7.5	-	-	17.7	-	-
	Max	300	73.1	6.7	0.52	30.1	10.5	273	2.5	2.33	-	7.3	297	24	15.12	23	1.57	-	6	-	-	-	-	-	0	-	20.1	-	-	-	8.53	-	-	30	-	-
91BW01	# Samples	4	4	4	4	3	4	3	3	1	3	4	4	4	4	ns	4	4	4	4	4	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4
	# Detects	4	4	4	3	2	3	2	3	1	0	3	3	4	3	ns	3	0	4	0	0	0	0	1	2	0	4	0	0	0	4	0	0	4	0	0
	Min	110	24 3	5.9	0.152	11	8.5	101.5	3.1	3.81	-	7.92	-1.2	15.5	13.17	ns	0.51	-	5	-	-	-	-	0.0626	0	-	9.29	-	-	-	2.9	-	-	21.7	-	-
	Max	110	27.1	6.7	0.401	12.7	11.15	128.5	3.6	3.81	-	8	303.4	18.2	16 34	ns	0.98	-	6	-	-	-	-	0.0626	0	-	9.78	-	-	-	3.3	-	-	22.9	-	-
91BW02	# Samples	5	5	5	5	4	5	4	5	ns	4	5	5	5	5	5	5	ns	ns	ns	ns	ns	ns	5	4	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	# Detects	5	5	5	4	3	4	3	5	ns	0	4	4	5	4	1	4	ns	ns	ns	ns	ns	ns	0	3	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	Min	120	24 3	5.8	0.254	15.1	1.34	116.5	5	ns	-	7.9	-3.7	17.5	11.8	4.41	0.55	ns	ns	ns	ns	ns	ns	-	0	ns	12.5	ns	ns	ns	5	ns	ns	21.1	ns	ns
	Max	140	29 2	6.8	0.304	17 9	8.1	162	6.3	ns	-	8.09	351	22.7	17 09	4.41	2.25	ns	ns	ns	ns	ns	ns	-	0	ns	14.2	ns	ns	ns	5.5	ns	ns	23.7	ns	ns
91BW03	# Samples	5	5	5	6	4	6	4	3	2	3	6	6	5	6	5	6	ns	ns	ns	ns	ns	ns	5	4	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	# Detects	5	5	5	4	3	4	3	3	2	0	4	4	5	4	2	4	ns	ns	ns	ns	ns	ns	0	3	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	Min	190	40.4	8	0.342	13.1	6.87	193	4.6	5.67	-	7.6	1	24.1	12.7	7.8	-	ns	ns	ns	ns	ns	ns	-	0	ns	18.1	ns	ns	ns	4.3	ns	ns	23.2	ns	ns
	Max	200	49 6	9.5	0.497	18 2	10.8	195.5	5.4	6 2	-	7.77	363	29.4	17.2	11 6	6.2	ns	ns	ns	ns	ns	ns	-	0	ns	20.9	ns	ns	ns	5	ns	ns	25.5	ns	ns
91BW04	# Samples	5	5	5	6	4	6	3	4	1	3	6	6	5	6	5	6	ns	ns	ns	ns	ns	ns	5	4	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	# Detects	5	5	5	4	3	4	3	3	1	0	4	4	5	4	2	4	ns	ns	ns	ns	ns	ns	1	3	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	Min	202	37.4	5.7	0.313	15.1	0.37	176.5	1.9	2.05	-	7.5	-4.5	21.5	12.6	8	0.39	ns	ns	ns	ns	ns	ns	0.0759	0	ns	18.4	ns	ns	ns	4.7	ns	ns	24.7	ns	ns
	Max	260	43.1	6.4	0.43	22.1	9.81	219.5	2	2.05	-	7.79	370	26.2	14 99	8.46	1.3	ns	ns	ns	ns	ns	ns	0.0759	0	ns	20.6	ns	ns	ns	5.5	ns	ns	31.6	ns	ns
92BW01	# Samples	5	5	5	6	4	6	4	4	2	4	6	6	5	6	5	6	3	3	3	3	3	3	5	5	3	5	3	3	3	5	3	3	5	3	3
	# Detects	5	5	5	4	3	4	3	4	2	0	4	4	5	4	2	4	0	3	0	0	0	0	0	3	0	5	0	0	0	5	0	0	5	0	0
	Min	147	30	9.8	0.283	9.8	10.14	148	5.9	5 9	-	7.76	-4	27.5	13.6	7.7	0.4	-	6	-	-	-	-	-	0	-	17.4	-	-	-	4.9	-	-	25.3	-	-
	Max	150	34.7	11.5	0.46	12 8	11.09	158.5	8 82	8 9	-	7.81	373	30	16 56	14 3	1.55	-	6	-	-	-	-	-	0	-	19.4	-	-	-	5.4	-	-	27.7	-	-
92BW02	# Samples	5	5	5	6	4	6	4	3	2	3	6	6	5	6	5	6	3	3	3	3	3	3	5	4	3	5	3	3	3	5	3	3	5	3	3
	# Detects	5	5	5	4	3	4	3	3	2	0	4	4	5	4	2	4	0	3	0	0	0	0	0	3	0	5	0	0	0	5	0	0	5	0	0
	Min	117	26 9	9.4	0.259	9.7	9.35	130.5	4.8	6.44	-	7.77	-2.6	24.5	13.3	5	0.59	-	5	-	-	-	-	-	0	-	14.5	-	-	-	4.5	-	-	22	-	-
	Max	120	30.4	12.5	0.394	13 9	12.4	136.5	5.2	6.7	-	7.9	365	26.9	16.12	6.97	5.28	-	6	-	-	-	-	-	0	-	15.9	-	-	-	5	-	-	24.1	-	-
99AW01	# Samples	5	5	5	6	4	6	4	4	1	3	6	6	5	6	5	6	ns	ns	ns	ns	ns	ns	5	4	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	# Detects	5	5	5	4	3	4	3	4	1	0	4	4	5	4	3	4	ns	ns	ns	ns	ns	ns	0	3	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	Min	210	43 6	7.7	0.329	18 2	0.42	200.5	1.4	1.46	-	7.43	-2	24.7	13 08	1.9	0.14	ns	ns	ns	ns	ns	ns	-	0	ns	17.5	ns	ns	ns	6.4	ns	ns	25.3	ns	ns
	Max	224	50.4	10.7	0.495	21 2	10.3	224.5	1.7	1.46	-	7.6	382.1	31.1	14 84	14 6	0.56	ns	ns	ns	ns	ns	ns	-	0	ns	20.6	ns	ns	ns	7.41	ns	ns	26.3	ns	ns
99AW02	# Samples	5	5	5	5	4	5	4	4	1	3	5	5	5	5	5	5	ns	ns	ns	ns	ns	ns	5	4	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	# Detects	5	5	5	4	3	4	3	4	1	0	4	4	5	4	2	4	ns	ns	ns	ns	ns	ns	1	3	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	Min	214	49 9	7.9	0.384	13.7	7.33	194.5	3.9	5.98	-	7.38	3.3	21.5	11.6	1.6	0.33	ns	ns	ns	ns	ns	ns	0.0621	0	ns	15.8	ns	ns	ns	6.2	ns	ns	27.6	ns	ns
	Max	230	59 2	10.9	0.552	22 9	12.4	212	4.6	5.98	-	7.6	334	29.9	15.4	14 9	1.036	ns	ns	ns	ns	ns	ns	0.0621	0	ns	17.9	ns	ns	ns	6.82	ns	ns	32.5	ns	ns
99AW03	# Samples	5	5	5	6	4	6	4	4	1	3	6	6	5	6	5	6	ns	ns	ns	ns	ns	ns	5	4	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	# Detects	5	5	5	4	3	4	3	4	1	0	4	4	5	4	2	4	ns	ns	ns	ns	ns	ns	0	3	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	Min	250	53.4	6.7	0.451	18 9	6.15	236.5	3.1	4.4	-	7.43	8.2	21.8	12.7	9.8	0.22	ns	ns	ns	ns	ns	ns	-	0	ns	24	ns	ns	ns	7.2	ns	ns	26.5	ns	ns
	Max	272	59 8	8.51	0.562	23 6	9.89	247	4.1	4.4	-	7.53	309.8	48	14.7	21 6	0.96	ns	ns	ns	ns	ns	ns	-	0	ns	25.6	ns	ns	ns	7.5	ns	ns	28.4	ns	ns
99AW04	# Samples	5	5	5	5	4	5	4	5	ns	4	5	5	5	5	5	5	ns	ns	ns	ns	ns	ns	5	4	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	# Detects	5	5	5	4	3	4	3	5	ns	0	4	4	5	4	5	4	ns	ns	ns	ns	ns	ns	0	3	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	Min	249	51.7	9.1	0.414	24 2	8.68	221.5	2.2	ns	-	7.18	-1.2	27	12.48	1.7	0.26	ns	ns	ns	ns	ns	ns	-	0	ns	19.3	ns	ns	ns	8.3	ns	ns	32.9	ns	ns
	Max	280	69.4	17.8	0.587	27.1	12.3	292.5	2.9	ns	-	7.3	383.1	34.1	13 94	9.6	1.3	ns	ns	ns	ns	ns	ns	-	0	ns	24.5	ns	ns	ns	10.1	ns	ns	38.9	ns	ns

TABLE 4.7
SUMMARY OF INORGANIC GROUNDWATER AND SURFACE WATER ANALYTICAL RESULTS

Location		Alkalinity	Calcium	Chloride	Conductivity	CO_2	Dissolved Oxygen	Hardness	Nitrate	Nitrate/Nitrite as N	Nitrite	pH	Redox	Sulfate	Temperature	TOC	Turbidity	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Iron, Total	Iron, Ferrous	Lead	Magnesium	Manganese	Mercury	Nickel	Potassium	Silver	Selenium	Sodium	Thallium	Zinc
		mg/L	mg/L	mg/L	mS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	s.u.	mV	mg/L	°C	mg/L	NTU	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	mg/L	ug/L	mg/L	ug/L	ug/L	ug/L	mg/L	ug/L	ug/L	mg/L	ug/L	ug/L
99AW05	# Samples	5	5	5	5	4	5	4	5	ns	4	5	5	5	5	5	5	ns	ns	ns	ns	ns	ns	5	4	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	# Detects	5	5	5	4	3	4	3	5	ns	0	4	4	5	4	3	4	ns	ns	ns	ns	ns	ns	0	3	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	Min	210	44 3	8.41	0.354	18.1	3.64	195	1.4	ns	-	7.49	-3.8	23.7	13 21	2.2	0.46	ns	ns	ns	ns	ns	ns	-	0	ns	17.2	ns	ns	ns	6.63	ns	ns	25.6	ns	ns
	Max	228	52	10	0.471	18 3	10.1	218.5	1.74	ns	-	7.64	371	29.2	14.9	11 5	3.22	ns	ns	ns	ns	ns	ns	-	0	ns	19.4	ns	ns	ns	7.3	ns	ns	27.4	ns	ns
99AW06	# Samples	5	5	4	5	4	5	4	4	1	3	5	5	5	5	5	5	ns	ns	ns	ns	ns	ns	5	4	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	# Detects	5	5	4	4	3	4	3	4	1	0	4	4	5	4	5	4	ns	ns	ns	ns	ns	ns	0	3	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	Min	228	47 5	7.9	0.428	16 9	9.39	203	1.4	2 2	-	7.03	3.3	24.5	12 92	1.5	0.15	ns	ns	ns	ns	ns	ns	-	0	ns	17.4	ns	ns	ns	7.1	ns	ns	24.5	ns	ns
	Max	260	56.7	11.7	0.6	23.1	10.19	261.5	2.5	2 2	-	7.22	387.3	28.8	15.6	12.7	264	ns	ns	ns	ns	ns	ns	-	0	ns	21.8	ns	ns	ns	8.02	ns	ns	29	ns	ns
99AW07	# Samples	5	5	5	5	4	5	4	4	1	3	5	5	5	5	5	5	ns	ns	ns	ns	ns	ns	5	4	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	# Detects	5	5	5	4	3	4	3	4	1	0	4	4	5	4	4	4	ns	ns	ns	ns	ns	ns	0	3	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	Min	170	38 9	5.6	0.148	11 6	9.34	177.5	1.2	3.26	-	6.82	6.1	19.6	11 85	2	0.16	ns	ns	ns	ns	ns	ns	-	0	ns	14.3	ns	ns	ns	6.3	ns	ns	19.9	ns	ns
	Max	206	50.1	8.4	0.433	26.7	10.65	196	6.6	3.26	-	7.1	370.5	24	15 64	10 6	0.95	ns	ns	ns	ns	ns	ns	-	0	ns	19.3	ns	ns	ns	7.22	ns	ns	23.5	ns	ns
99AW08	# Samples	5	5	5	5	4	5	4	4	1	3	5	5	5	5	5	5	ns	ns	ns	ns	ns	ns	5	4	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	# Detects	5	5	5	4	3	4	3	4	1	0	4	4	5	4	5	4	ns	ns	ns	ns	ns	ns	0	3	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	Min	184	32 3	41.4	0.227	20 3	0.53	145	3.3	4.77	-	6.41	2.6	10.1	13.7	2.3	0.33	ns	ns	ns	ns	ns	ns	-	0	ns	13.8	ns	ns	ns	15 6	ns	ns	58.2	ns	ns
	Max	270	38 5	63.7	0.69	41.1	6.18	167	17.7	4.77	-	6.6	408	68.4	15 87	8.5	1.14	ns	ns	ns	ns	ns	ns	-	0	ns	15.8	ns	ns	ns	17 5	ns	ns	101	ns	ns
99AW09	# Samples	5	5	5	6	4	6	4	4	1	3	6	6	5	6	5	6	ns	ns	ns	ns	ns	ns	5	4	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	# Detects	5	5	5	4	3	4	3	3	1	0	4	4	5	4	3	4	ns	ns	ns	ns	ns	ns	1	3	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	Min	260	48.4	5.1	0.394	15 9	8.19	230	1.8	2.36	-	7.5	-0.5	17.8	13.3	1.5	0.08	ns	ns	ns	ns	ns	ns	0.112	0	ns	24.5	ns	ns	ns	5.4	ns	ns	28.3	ns	ns
	Max	270	51 8	6.1	0.673	17.7	9.4	236	2.2	2.36	-	7.82	354	22.7	15.46	18 5	0.86	ns	ns	ns	ns	ns	ns	0.112	0	ns	26.8	ns	ns	ns	5.9	ns	ns	31	ns	ns
99AW10	# Samples	5	5	5	5	4	5	4	4	1	3	5	5	5	5	5	5	1	1	1	1	1	1	5	4	1	5	1	1	1	5	1	1	5	1	1
	# Detects	5	5	5	3	3	3	3	4	1	0	3	3	5	3	2	3	0	1	0	0	0	0	0	3	0	5	1	0	0	5	0	0	5	0	0
	Min	97	20.7	7.8	0.115	12 5	8.8	98	3.8	3.97	-	7.6	226.3	23	9.7	7.38	0.49	-	5.7	-	-	-	-	-	0	-	8.87	76.4	-	-	3.2	-	-	21.6	-	-
	Max	106	25.4	9.3	0.27	14 6	12.8	105.5	4.2	3.97	-	7.92	328	31.1	18.12	7.4	2.7	-	5.7	-	-	-	-	-	0	-	10.2	76.4	-	-	3.5	-	-	28.9	-	-
99BW01	# Samples	5	5	5	6	4	6	4	4	1	3	6	6	5	6	5	6	ns	ns	ns	ns	ns	ns	5	4	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	# Detects	5	5	5	4	3	4	3	4	1	0	4	4	5	4	2	4	ns	ns	ns	ns	ns	ns	0	3	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	Min	177	38	8.1	0.338	12 6	9.24	187	4.4	4 8	-	7.47	-2.3	24.3	13 27	7.68	0.31	ns	ns	ns	ns	ns	ns	-	0	ns	18.4	ns	ns	ns	4.1	ns	ns	24.7	ns	ns
	Max	200	47.1	10	0.461	19.1	11.05	193	5.6	4 8	-	7.83	382.6	29.5	15.13	8.3	0.65	ns	ns	ns	ns	ns	ns	-	0	ns	20.8	ns	ns	ns	5.1	ns	ns	27.4	ns	ns
99BW04	# Samples	2	2	2	2	1	2	1	2	ns	1	2	2	2	2	2	2	1	1	1	1	1	1	2	1	1	2	1	1	1	2	1	1	2	1	1
	# Detects	2	2	2	1	2	1	2	ns	0	2	2	2	2	2	2	2	0	1	0	0	0	0	0	1	0	2	1	1	0	2	0	0	2	0	0
	Min	260	46 6	3.29	0.426	25 6	1.3	231.5	0.3	ns	-	7.1	-4	3 93	8.1	3.6	0.32	-	6.7	-	-	-	-	-	0	-	19.8	600	0.42	-	6.8	-	-	25.5	-	-
	Max	284	53 9	5.8	0.43	25 6	2.59	231.5	0 55	ns	-	7.2	387	17.9	12.46	7.95	3.34	-	6.7	-	-	-	-	-	0	-	24.5	600	0.42	-	7.02	-	-	31.8	-	-
99BW05	# Samples	5	5	5	5	4	5	4	5	ns	4	5	5	5	5	3	5	4	4	4	4	4	4	5	4	4	5	4	4	4	5	4	4	5	4	4
	# Detects	5	5	5	4	3	4	3	5	ns	1	4	4	5	4	2	4	0	0	0	0	0	0	1	3	0	5	3	0	0	5	0	0	5	0	4
	Min	230	49 9	5.05	0.153	12 9	6.52	214.5	3.1	ns	0.216	7.54	-1.3	23.1	13.3	1.9	0.62	-	-	-	-	-	-	0.1	0	-	18.7	7	-	-	5	-	-	28	-	30
	Max	248	56	5.8	0.46	19 3	10.2	219	4	ns	0.216	7.7	344	30.9	17.17	16 2	3.29	-	-	-	-	-	-	0.1	0	-	20.1	14	-	-	5.47	-	-	29.7	-	150
99BW06	# Samples	2	2	2	2	1	2	1	1	1	ns	2	2	2	2	2	2	ns	ns	ns	ns	ns	ns	2	1	ns	2	ns	ns	ns	2	ns	ns	2	ns	ns
	# Detects	2	2	2	2	1	2	1	1	1	ns	2	2	2	2	2	2	ns	ns	ns	ns	ns	ns	0	1	ns	2	ns	ns	ns	2	ns	ns	2	ns	ns
	Min	318	62 9	15 8	0.587	23 9	4.28	286.5	4.2	3.66	ns	7.11	-4.3	41.6	8.28	3.3	0.41	ns	ns	ns	ns	ns	ns	-	0	ns	27	ns	ns	ns	6.2	ns	ns	48.6	ns	ns
	Max	324	68 3	16.1	0.609	23 9	5.81	286.5	4.2	3.66	ns	7.15	379.8	43.9	13 37	22 3	0.62	ns	ns	ns	ns	ns	ns	-	0	ns	31	ns	ns	ns	7.03	ns	ns	53	ns	ns
99BW08	# Samples	2	2	2	2	1	2	1	1	1	ns	2	2	2	2	2	2	ns	ns	ns	ns	ns	ns	2	1	ns	2	ns	ns	ns	2	ns	ns	2	ns	ns
	# Detects	2	2	2	2	1	2	1	1	1	ns	2	2	2	2	2	2	ns	ns	ns	ns	ns	ns	0	1	ns	2	ns	ns	ns	2	ns	ns	2	ns	ns
	Min	436	65 5	19 9	0.809	40 9	1.6	574.5	3.7	2.64	ns	7.1	2.8	89.3	9 2	7.4	0.58	ns	ns	ns	ns	ns	ns	-	0	ns	35.2	ns	ns	ns	9	ns	ns	104	ns	ns
	Max	586	119	61.4	1.3	40 9	5.24	574.5	3.7	2.64	ns	7.31	384	266	12 38	40	1.34	ns	ns	ns	ns	ns	ns	-	0	ns	70.7	ns	ns	ns	9.96	ns	ns	167	ns	ns
99BW09	# Samples	5	5	5	5	4	5	4	4	1	3	5	5	5	5	5	5	ns	ns	ns	ns	ns	ns	5	4	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	# Detects	5	5	5	4	3	4	3	4	1	0	4	4	5	4	2	4	ns	ns	ns	ns	ns	ns	0	3	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	Min	140	24	4.5	0.385	10.4	1.68	92.5	3	4.08	-	7.4	-6	37.4	10.9	4.1	0.58	ns	ns	ns	ns	ns	ns	-	0	ns	7.84	ns	ns	ns	8.1	ns	ns	46.8	ns	ns
	Max	154	27 2	21.1	0.51	25 6	5.6	109	3.9	4.08	-	7.68	301	97.8	17.6	9.07	6.12	ns	ns	ns	ns	ns	ns	-	0	ns	8.8	ns	ns	ns	15 5	ns	ns	70.1	ns	ns
99BW10	# Samples	5	5	5	6	4	6	4	4	1	3	6	6	5	6	5	6	ns	ns	ns	ns	ns	ns	5	4	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	# Detects	5	5	5	4	3	4	3	4	1	0	4	4	5	4	2	4	ns	ns	ns	ns	ns	ns	0	3	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	Min	130	27 6	5.9	0.282	15.1	7.26	125	2.3	2.77	-	7.5	2.1	19.2	11.9	3	0.28	ns	ns	ns	ns	ns	ns	-	0	ns	11.1	ns	ns	ns	5	ns	ns	20.5	ns	ns
	Max	142	33 5	7.9	0.399	19 2	10.15	129	2.9	2.77	-	7.72	338	24.4	18.8	4.78	0.768	ns	ns	ns	ns	ns	ns	-	0	ns	13.1	ns	ns	ns	5.7	ns	ns	24.1	ns	ns
99BW11	# Samples	5	5	5	5	4	5	4	5	ns	4	5	5	5	5	5	5	ns	ns	ns	ns	ns	ns	5	4	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	# Detects	5	5	5	4	3	4	3	5	ns	0	4	4	5	4	3	4	ns	ns	ns	ns	ns	ns	1	3	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	Min	193	40.4	8.7	0.365	15.4	9.29	167.5	2.8	ns	-	7.46	-3	26.4	12 36	1.6	0.35	ns	ns	ns	ns	ns	ns	0.0984	0	ns	17.6	ns	ns	ns	7.5	ns	ns	30.8	ns	ns
	Max	240	51 5	16.2	0.519	22 5	13.22	243.5	4.5	ns	-	7.6	371.5	32.4	14 98	20 3	20.2	ns	ns	ns	ns	ns	ns	0.0984	0	ns	22.7	ns	ns	ns	8.33	ns	ns	38.4	ns	ns
99BW12	# Samples	5	5	5	6	4	6	4	5	ns	4	6	6	5	6	5	6	ns	ns	ns	ns	ns	ns	5	4	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	# Detects	5	5	5	4	3	4	3	5	ns	0	4	4	5	4	2	4	ns	ns	ns	ns	ns	ns	0	3	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	Min	180	41 9	5.4	0.304	11 6	5.08	154	1.6	ns	-	7.61	-5.1	21.1	12.44	8	0.46	ns	ns	ns	ns	ns	ns	-	0	ns	12.7	ns	ns	ns	3.5	ns	ns	23	ns	ns
	Max	190	48 5	7.5	0.387	17 5	9.94	205	1 93	ns	-	7.74	363.1	24.1	16.46	16 9	2.15	ns	ns	ns	ns	ns	ns	-	0	ns	13.5	ns	ns	ns	3.84	ns	ns	26.3	ns	ns
99BW13	# Samples	5	5	5	5	4	5	4	4	1	3	5	5	5	5	5	5	ns	ns	ns	ns	ns	ns	5	4	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	# Detects	5	5	5	4	3	4	3	4	1	0	4	4	5	4	2	4	ns	ns	ns	ns	ns	ns	0	3	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	Min	166	30 8	5.3	0.284	9.3	8.99	143.5	2	2.39	-	7.65	-2.4	20.3	12.18	5.8	0.31	ns	ns	ns	ns	ns	ns	-	0	ns	15.5	ns	ns	ns	4.6	ns	ns	25.2	ns	ns
	Max	180	35 9	8.74	0.38	16	9.5	172	2.1	2.39	-	7.9	365.7	27	16 85	8.52	0.976	ns	ns	ns	ns	ns	ns	-	0	ns	17.1	ns	ns	ns	5.7	ns	ns	30.1	ns	ns

TABLE 4.7
SUMMARY OF INORGANIC GROUNDWATER AND SURFACE WATER ANALYTICAL RESULTS

Location		Alkalinity	Calcium	Chloride	Conductivity	CO_2	Dissolved Oxygen	Hardness	Nitrate	Nitrate/Nitrite as N	Nitrite	pH	Redox	Sulfate	Temperature	TOC	Turbidity	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Iron, Total	Iron, Ferrous	Lead	Magnesium	Manganese	Mercury	Nickel	Potassium	Silver	Selenium	Sodium	Thallium	Zinc
		mg/L	mg/L	mg/L	mS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	s.u.	mV	mg/L	°C	mg/L	NTU	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	mg/L	ug/L	mg/L	ug/L	ug/L	ug/L	mg/L	ug/L	ug/L	mg/L	ug/L	ug/L
99BW14	# Samples	5	5	5	5	4	5	4	1	1	3	5	5	5	5	5	5	ns	ns	ns	ns	ns	ns	5	4	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	# Detects	5	5	5	4	3	4	3	4	1	0	4	4	5	4	3	4	ns	ns	ns	ns	ns	ns	0	3	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	Min	228	49 9	9.1	0.201	17 2	6.63	226.5	6.1	7.71	-	7.5	-1.8	25.2	10.75	1.6	0.31	ns	ns	ns	ns	ns	ns	-	0	ns	24.4	ns	ns	ns	5.1	ns	ns	25.9	ns	ns
	Max	240	53.7	10.8	0.506	23.1	7.08	238.5	7.1	7.71	-	7.83	369.2	31.8	16 99	17.1	1.39	ns	ns	ns	ns	ns	ns	-	0	ns	25.2	ns	ns	ns	5.71	ns	ns	28.6	ns	ns
99BW15	# Samples	5	5	5	6	4	6	4	4	1	3	6	6	5	6	5	6	ns	ns	ns	ns	ns	ns	5	4	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	# Detects	5	5	5	4	3	4	3	4	1	0	4	4	5	4	3	4	ns	ns	ns	ns	ns	ns	1	3	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	Min	162	36.4	20	0.171	14 2	9.64	172	4.8	5 8	-	7.6	-1.1	29.3	12 29	1.7	0.26	ns	ns	ns	ns	ns	ns	0.0528	0	ns	18	ns	ns	ns	5.4	ns	ns	30.7	ns	ns
	Max	180	41 6	23.4	0.457	17 6	9.82	186	5.7	5 8	-	7.69	374.2	36.7	15.74	8.85	0.692	ns	ns	ns	ns	ns	ns	0.0528	0	ns	19.3	ns	ns	ns	5.8	ns	ns	35.5	ns	ns
99BW16	# Samples	5	4	5	6	4	6	4	4	1	3	6	6	5	6	5	6	1	ns	1	1	1	1	4	4	ns	4	1	ns	1	4	1	ns	4	ns	1
	# Detects	5	4	5	4	3	4	3	4	1	0	4	4	5	4	2	4	0	ns	0	0	0	0	1	3	ns	4	1	ns	0	4	0	ns	4	ns	0
	Min	182	44.4	12 6	0.33	12.1	3.9	240.5	6.2	6.22	-	7.7	-6.7	31.6	13.5	8.9	0.436	-	ns	-	-	-	-	0.072	0	ns	27.9	21.9	ns	-	4.1	-	ns	24.7	ns	-
	Max	222	50 3	15.3	0.499	19.7	8.96	266.5	8.1	6.22	-	7.81	304	44.7	16.77	9.63	2.03	-	ns	-	-	-	-	0.072	0	ns	29.9	21.9	ns	-	5.43	-	ns	25.4	ns	-
99BW17	# Samples	2	2	2	2	1	2	1	2	ns	1	2	2	2	2	2	2	1	1	1	1	1	1	2	1	1	2	1	1	1	2	1	1	2	1	1
	# Detects	2	2	2	2	1	2	1	2	ns	0	2	2	2	2	2	2	0	0	0	0	0	0	0	1	0	2	0	0	0	2	0	0	2	0	1
	Min	241	50 8	5	0.446	18 2	8.8	226.5	4.1	ns	-	7.68	-1.7	22	13.6	2	0.25	-	-	-	-	-	-	-	0	-	19	-	-	-	5.1	-	-	26.9	-	360
	Max	244	51 5	5.5	0.47	18 2	11.2	226.5	4 25	ns	-	7.7	360	23.2	14 37	8.3	0.48	-	-	-	-	-	-	-	0	-	19.2	-	-	-	5.64	-	-	29	-	360
99BW18	# Samples	5	5	5	6	4	6	4	4	1	3	6	6	5	6	5	6	ns	ns	ns	ns	ns	ns	5	4	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	# Detects	5	5	5	4	3	4	3	4	1	0	4	4	5	4	3	4	ns	ns	ns	ns	ns	ns	0	3	ns	5	ns	ns	ns	5	ns	ns	5	ns	ns
	Min	164	30 2	4.8	0.327	12 9	7.36	164	2.4	2.96	-	7.48	-2	24.4	12 62	1.5	0.17	ns	ns	ns	ns	ns	ns	-	0	ns	18.1	ns	ns	ns	4.8	ns	ns	23	ns	ns
	Max	190	35	25.7	0.55	16.7	8.79	234.5	3.2	2.96	-	7.94	356.1	46.1	16 82	10 3	0.683	ns	ns	ns	ns	ns	ns	-	0	ns	20.7	ns	ns	ns	11 8	ns	ns	35.9	ns	ns
BML04	# Samples	3	3	3	3	2	3	2	3	ns	3	3	3	3	3	1	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3
	# Detects	3	3	3	3	2	3	2	3	ns	0	3	3	3	3	1	3	0	0	0	0	0	0	0	2	0	3	0	0	0	3	0	0	3	0	0
	Min	188	44 6	8	0.144	17 5	9.05	216	0.8	ns	-	7.22	1.5	24.4	13	1.9	0.65	-	-	-	-	-	-	-	0	-	16.6	-	-	-	8.14	-	-	21.3	-	-
	Max	230	52 9	9.6	0.367	22 8	24.5	236	1 08	ns	-	7.61	294.3	27	14.72	1.9	1.51	-	-	-	-	-	-	-	0	-	19.8	-	-	-	9.2	-	-	23.6	-	-
MW02	# Samples	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	ns	ns	ns	ns	ns	ns	1	1	ns	1	ns	ns	ns	1	ns	ns	1	ns	ns
	# Detects	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	ns	ns	ns	ns	ns	ns	0	1	ns	1	ns	ns	ns	1	ns	ns	1	ns	ns
	Min	200	24 3	29 2	0.52	33.7	6.81	104.5	1.3	1 3	-	6.94	204	20.8	15.2	2.6	3.3	ns	ns	ns	ns	ns	ns	-	0	ns	11.2	ns	ns	ns	11 3	ns	ns	61.4	ns	ns
	Max	200	24 3	29.2	0.52	33.7	6.81	104.5	1.3	1 3	-	6.94	204	20.8	15.2	2.6	3.3	ns	ns	ns	ns	ns	ns	-	0	ns	11.2	ns	ns	ns	11 3	ns	ns	61.4	ns	ns
MW04	# Samples	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	ns	ns	ns	ns	ns	ns	1	1	ns	1	ns	ns	ns	1	ns	ns	1	ns	ns
	# Detects	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	ns	ns	ns	ns	ns	ns	0	1	ns	1	ns	ns	ns	1	ns	ns	1	ns	ns
	Min	240	52.4	9.4	0.53	21.7	8.58	210.5	3.9	3 9	-	7.63	210	33.2	14.9	-	1.4	ns	ns	ns	ns	ns	ns	-	0	ns	21.4	ns	ns	ns	6.4	ns	ns	30.2	ns	ns
SURFACE WATER SAMPLES																																				
WS01	# Samples	1	1	1	ns	ns	ns	ns	ns	1	ns	ns	ns	1	ns	ns	ns	ns	ns	ns	ns	ns	ns	1	ns	ns	1	ns	ns	ns	1	ns	ns	1	ns	ns
	# Detects	1	1	1	ns	ns	ns	ns	ns	1	ns	ns	ns	1	ns	ns	ns	ns	ns	ns	ns	ns	ns	1	ns	ns	1	ns	ns	ns	1	ns	ns	1	ns	ns
	Min	216	45 5	9.89	ns	ns	ns	ns	ns	2.17	ns	ns	ns	30.1	ns	ns	ns	ns	ns	ns	ns	ns	ns	0 22	ns	ns	17.3	ns	ns	ns	6.78	ns	ns	27.3	ns	ns
	Max	216	45 5	9.89	ns	ns	ns	ns	ns	2.17	ns	ns	ns	30.1	ns	ns	ns	ns	ns	ns	ns	ns	ns	0 22	ns	ns	17.3	ns	ns	ns	6.78	ns	ns	27.3	ns	ns
WC01	# Samples	1	1	1	ns	ns	ns	ns	ns	1	ns	ns	ns	1	ns	ns	ns	ns	ns	ns	ns	ns	ns	1	ns	ns	1	ns	ns	ns	ns	ns	ns	1	ns	ns
	# Detects	1	1	1	ns	ns	ns	ns	ns	1	ns	ns	ns	1	ns	ns	ns	ns	ns	ns	ns	ns	ns	0	ns	ns	1	ns	ns	ns	ns	ns	ns	1	ns	ns
	Min	282	59 2	5.62	ns	ns	ns	ns	ns	1.51	ns	ns	ns	22.7	ns	ns	ns	ns	ns	ns	ns	ns	ns	ND	ns	ns	27.4	ns	ns	ns	6.1	ns	ns	22.7	ns	ns
	Max	282	59 2	5.62	ns	ns	ns	ns	ns	1.51	ns	ns	ns	22.7	ns	ns	ns	ns	ns	ns	ns	ns	ns	ND	ns	ns	27.4	ns	ns	ns	6.1	ns	ns	22.7	ns	ns
WC02	# Samples	1	1	1	ns	ns	ns	ns	ns	1	ns	ns	ns	1	ns	ns	ns	ns	ns	ns	ns	ns	ns	1	ns	ns	1	ns	ns	ns	ns	ns	ns	1	ns	ns
	# Detects	1	1	1	ns	ns	ns	ns	ns	1	ns	ns	ns	1	ns	ns	ns	ns	ns	ns	ns	ns	ns	0	ns	ns	1	ns	ns	ns	ns	ns	ns	1	ns	ns
	Min	298	61 6	5.52	ns	ns	ns	ns	ns	1.66	ns	ns	ns	22.1	ns	ns	ns	ns	ns	ns	ns	ns	ns	ND	ns	ns	28.7	ns	ns	ns	5.67	ns	ns	22.1	ns	ns
	Max	298	61 6	5.52	ns	ns	ns	ns	ns	1.66	ns	ns	ns	22.1	ns	ns	ns	ns	ns	ns	ns	ns	ns	ND	ns	ns	28.7	ns	ns	ns	5.67	ns	ns	22.1	ns	ns
WC03	# Samples	1	1	1	ns	ns	ns	ns	ns	1	ns	ns	ns	1	ns	ns	ns	ns	ns	ns	ns	ns	ns	1	ns	ns	1	ns	ns	ns	ns	ns	ns	1	ns	ns
	# Detects	1	1	1	ns	ns	ns	ns	ns	1	ns	ns	ns	1	ns	ns	ns	ns	ns	ns	ns	ns	ns	0	ns	ns	1	ns	ns	ns	ns	ns	ns	1	ns	ns
	Min	298	59	6.43	ns	ns	ns	ns	ns	1.45	ns	ns	ns	24	ns	ns	ns	ns	ns	ns	ns	ns	ns	ND	ns	ns	28.6	ns	ns	ns	6.69	ns	ns	24.3	ns	ns
	Max	298	59	6.43	ns	ns	ns	ns	ns	1.45	ns	ns	ns	24	ns	ns	ns	ns	ns	ns	ns	ns	ns	ND	ns	ns	28.6	ns	ns	ns	6.69	ns	ns	24.3	ns	ns
WC04	# Samples	1	1	1	ns	ns	ns	ns	ns	1	ns	ns	ns	1	ns	ns	ns	ns	ns	ns	ns	ns	ns	1	ns	ns	1	ns	ns	ns	ns	ns	ns	1	ns	ns
	# Detects	1	1	1	ns	ns	ns	ns	ns	1	ns	ns	ns	1	ns	ns	ns	ns	ns	ns	ns	ns	ns	0	ns	ns	1	ns	ns	ns	ns	ns	ns	1	ns	ns
	Min	280	60.7	7.81	ns	ns	ns	ns	ns	2.65	ns	ns	ns	31.3	ns	ns	ns	ns	ns	ns	ns	ns	ns	ND	ns	ns	29.8	ns	ns	ns	6.49	ns	ns	23.9	ns	ns
	Max	280	60.7	7.81	ns	ns	ns	ns	ns	2.65	ns	ns	ns	31.3	ns	ns	ns	ns	ns	ns	ns	ns	ns	ND	ns	ns	29.8	ns	ns	ns	6.49	ns	ns	23.9	ns	ns

TABLE 4.8

SUMMARY OF GROUNDWATER TCE DETECTIONS [1, 2, 3, 4]

	November 1999 TCE Concentration (µg/L)	March 2000 TCE Concentration (µg/L)	June 2000 TCE Concentration (µg/L)	Sep/Oct 2000 TCE Concentration (µg/L)	Jan/Feb 2001 TCE Concentration (µg/L)	Oct/Nov 2002, Jan 2003 TCE Concentration (µg/L)	Average TCE Concentration (Nov. 99 to Jan '03)[8]
Alluvium Monitoring Wells							
00AW11	NS	NS	NS	3	5.1	3.9 [1]	4 0
99AW09	3.9 [1]	4	3.6 [1]	3.6 [1]	4.0 [1]	2.6	3 8
99AW10	0 96	1.1 [1]	1.2	1.4	1.4 [1]	1.3	1 2
99AW01	<0 5	0.52	0.8	<0.5	0.6	1.2 J	0.60
91AW15	0.59 [1]	<1.0	0.6	0.6	0.6	0.35 [1,6]	0.54
99AW03	<0 5	0.7 [1]	0.6	<0.5 [1]	0.7	0.38	0.50
91AW14	0.55 [1]	<1.0	<0.5	0.5	0 5	0.38	0.46
91AW09	<0.5 [3]	0.52	0.6	0.4	<0.5	0.78	0.40
Basalt Monitoring Wells							
91BW03	47	53	60	50	61.3 [1]	42 [1]	52.2
99BW01	39 [1]	48	55 [1]	49	47	40 J	46.3
99BW18	37	24	26	25 J	23	16	27.0
92BW01	22	24	27	27.7	30 [1]	26 J	26.1
00BW12	NS	NS	NS	28 J	18	18	23.0
99BW10	17	19	22	18	21	16	19.4
02BW01	NS	NS	NS	NS	NS	19 [6]	19.0
99BW15[9]	10	11 [1]	14 [1]	13 [3]	12	9.4	12.0
99BW16	3 8	5.2 [1]	5.6	5.1 [1]	5.1	3.8	5 0
92BW02	2	2.5 [1]	3.6 [1]	2.5 [1]	2.7	2.9	2.7
00BW15	NS	NS	NS	1	1 3	1.4	1 2
99BW12	1	0.83 [1]	0.8	1	1 8	2.1	1.1
00BW07	NS	NS	NS	0.8	1 [1]	<0.5	0.68
02BW02	NS	NS	NS	NS	NS	0 58 [1,6,7]	0.58
00BW16	NS	NS	NS	1	<0.5 [1]	<0.5	0 5
00BW02	NS	NS	NS	<0.5 [1]	0.6	0.25	0.43
91BW04	<0 5	<1.0	<0.5 [1]	0.5 [1]	0 5	0.41	0.4

Domestic Wells

Well	1999 TCE Concentration (ug/L)	2000/2001 TCE Concentration (ug/L)	2002/2003 TCE Concentration (ug/L)	Average TCE Concentration (Nov. 99 to Jan '03)
WP-15E	NS	28	NS	28.0
WP-15W	NS	5.1	NS	5.1
WP-14	NS	7.9 [1]	<0.5 [5]	4.1
WP-70	3.1	4.2	<0.5 [5]	2 5
WP-77	2	NS	2.9	2 0
WP-86	2.4	1.3 [1]	<0.5 [5]	1 3
WP-74	1 2	NS	NS	1 2
WP-83	1 3	1.6	<0.5 [5]	1.1
WP-18N	NS	1	0.4	1 0
WP-52	NS	NS	0.98	1 0
WP-71B	NS	0.8	0.6	0.80
WP-03	0.75	NS	NS	0.75
WP-04	0.75	NS	NS	0.75
WP-57	NS	NS	0.58	0.58
WP-18S	NS	0.6	0.42 [1]	0.51
WP-54	NS	NS	0.31 [1]	0.31
WP-09	NS	<0.5	0.2	0.25
WP-13W	<0 5	<0.5	0.32	0.25
WP-68	<0.5 [1]	NS	0.4	0.25
WP-71A	<0.5 [1]	NS	0.63	0.25
WP-47	NS	NS	0.15	0.15

Notes:

1 The higher concentration of the primary sample and the field duplicate is reported
2 NS = Not Sampled
3 <0 5 = concentration detected at less than the PQL
4 A concentration flagged with a J indicates the result was estimated
5 Domestic well sample was collected after the whole-house carbon filter
6 Samples collected in January 2003
7 A confirmation sample collected in February 2003 reported 0 27 µg/L
8 The average concentration was calculated using one-half the PQL for non-detects
9 Of the TCE daughter products, only one (cis-1,2-dichloroethene) was detected in only one well (99-BW15), as shown on Table 4 9

TABLE 4.9
Summary of Other Groundwater Detections[1]

Well	Date	Volatile Organic Compounds																												Metals			
		ACE	BDCME	BRME	BTBZN	BTBZS	BTBZT	BZ	BZME	CDS	CLEA	CLME	DBCME	DBCP	DCE12C	FC11	FC12	HXO2	IPBZ	MEK	MIBK	MTLNCL	NAPH	PCE	TBME	TBUTMEE	TCLME	TMB124	TMB135	As	Hg	Mn	Zn
Benchmark Level[3]		EPA=610	EPA=0.18	EPA=8.7	EPA=240	EPA=240	EPA=240	EPA=0.34	EPA=720	EPA=1,000	EPA=4.6	EPA=1.5	EPA=0.13	EPA=0.048	EPA=61	EPA=1,300	EPA=390	na	EPA=660	EPA=1,900	EPA=160	EPA=4.3	EPA=6.2	EPA=660	EPA=8.5	EPA=13	EPA=6.2	EPA=12	EPA=12	EPA=0.045	EPA=11	EPA=880	MTCA=11,000
Alluvium Wells																																	
00AW11	10/9/2000																													6		6	
00AW11	1/31/01																													6			
00AW13	10/30/2000								1.3																								
00AW14	10/30/2000																															15	
00AW14	1/23/01																															45	
91AW01	11/8/1999																													8.9			
91AW01	6/19/2000															1.4																	
91AW02	11/8/1999																													6			
91AW02	6/19/2000															1.2																	
91AW03	11/8/1999																													8.5			
91AW03	6/19/2000																													9			
91AW03	9/28/2000																													10			
91AW03	1/24/01																													8			
91AW09	11/12/1999								1																								
91AW14	10/28/2002		0.61										0.37													0.3							
91AW15	11/10/1999				1.8	11																					3.5	6 5					
91AW15	3/8/2000				1.9	10																					2.3	5.4					
91AW15	6/13/2000				3.3	13													2.5								3.4	6 9					
91AW15	9/21/2000				1.6	12													1								1.5	3 8					
91AW15	1/18/01																											1 8					
91AW15	1/13/2003	4.3 UJ		0.67 UJ		7.5	0.52	0 28				0.3 U							0.46								0 64	1 2					
91AW16	6/21/2000															1.4																	
91AW19	6/14/2000																													6			
99AW01	11/1/2002										0.36																						
99AW03	11/1/2002																					0.18 U											
99AW09	10/30/2002								0.27 U			0 24													8.1 UJ								
99AW10	11/19/1999																													5.7		76.4	
99AW10	10/28/2002											0.23 U																					
Basalt Wells																																	
02BW01	1/14/2003			0.58 UJ								0.36 U																					
02BW02	1/15/2003	19000		0.57 U								0.22 U						0.46		1.4		0.42 U				0.78							
01BW01	5/31/01																															15	
00BW01	10/6/2000																															22	
00BW01	10/30/2002								0.24 U																								
00BW02	10/9/2000																															122	40
00BW02	1/30/01																															4	
00BW02	10/29/2002											0.27 U																					
00BW04	1/29/01																													5			
00BW04	10/30/2002																					0.18 U											
00BW07	9/19/2000																															48	20
00BW08	10/28/2002									0 33																							
00BW11	10/6/2000					8.4																											
00BW11	1/17/01					7.8																											
00BW11	11/1/2002					5.5	0.5	0.43				0.21 U																					
00BW12	10/5/2000																															132	20
00BW12	1/30/01																															158	10
00BW13	10/5/2000																															93	420
00BW13	1/23/01																															175	370
00BW14	1/13/2003																					0.18 U											
91BW01	11/8/1999																													5.4			
91BW01	6/19/2000																													6			
91BW01	9/28/2000																													5			
91BW01	1/24/01																													6			
91BW03	11/1/2002																					0.2 U											
91BW04	10/31/2002								0.29 U																								
92BW01	6/20/2000															1.9														6			
92BW01	9/27/2000																													6			
92BW01	1/31/01																													6			
92BW02	6/20/2000															2.1														5			
92BW02	9/27/2000																													6			
92BW02	1/31/01																													6			
92BW02	10/31/2002																								40 U								
99BW04	11/9/1999																													6.7	0.42 J	600	
99BW05	11/9/1999																															14	150
99BW05	6/21/2000																															8	40
99BW05	10/9/2000																															7	40
99BW05	1/25/01																																30
99BW10	11/1/2002																					0.17 U											
99BW11	6/20/2000															2.2																	
99BW15	11/18/1999														3																		
99BW15	3/15/2000														2.8																		
99BW15	6/15/2000														3.7																		
99BW15	10/4/2000														3.7																		
99BW15	1/18/01														3.4																		
99BW15	10/30/2002														2.6							0.19											
99BW16	11/19/1999																															21.9	
99BW16	10/28/2002													0.86				0.42			0.52		0.2				0.24						
99BW17	11/9/1999																																360
99BW18	10/30/2002																								16 U								

TABLE 4.9
Summary of Other Groundwater Detections[1]

Well	Date	Volatile Organic Compounds																												Metals			
		ACE	BDCME	BRME	BTBZN	BTBZS	BTBZT	BZ	BZME	CDS	CLEA	CLME	DBCME	DBCP	DCE12C	FC11	FC12	HXO2	IPBZ	MEK	MIBK	MTLNCL	NAPH	PCE	TBME	TBUTMEE	TCLME	TMB124	TMB135	As	Hg	Mn	Zn
Benchmark Level[3]		EPA=610	EPA=0.18	EPA=8.7	EPA=240	EPA=240	EPA=240	EPA=0.34	EPA=720	EPA=1,000	EPA=4.6	EPA=1.5	EPA=0.13	EPA=0.048	EPA=61	EPA=1,300	EPA=390	na	EPA=660	EPA=1,900	EPA=160	EPA=4.3	EPA=6.2	EPA=660	EPA=8.5	EPA=13	EPA=6.2	EPA=12	EPA=12	EPA=0.045	EPA=11	EPA=880	MTCA=11,000
Domestic Wells																																	
WP-09	11/18/2002																							0.38									
WP-11	6/22/2000															**2.4**																	
WP-12	6/22/2000															**2**																	
WP-13E	1/6/2003		0.38										0.52									0 27 U			0.47		0.19 U						
WP-14	6/23/2000														**2.2**																		
WP-14	11/19/2002											0.25 U			0.85																		
WP-18N	1/6/2003	10 UJ																			8.6	0.2 U											
WP-18S	1/6/2003											0.23 U									0.5	0 23 U											
WP-34	11/14/2002								0.14																								
WP-35	1/6/2003	4.1 UJ																0.61		1.2	0.65	0.18 U											
WP-40	11/14/2002								0.2																								
WP-45	11/14/2002								0.12																								
WP-47	11/13/2002								0.17																								
WP-49	11/15/2002								0.15 U																								
WP-51	11/13/2002								0.15																								
WP-52	11/15/2002																0.37																
WP-53	11/15/2002								0.15 U													1 3											
WP-54	11/14/2002								0.14													0.42											
WP-55	11/13/2002								0.19																								
WP-56	11/20/2002											0.21 U																					
WP-57	11/14/2002								0.16						0.13																		
WP-58	11/18/2002								0.16																								
WP-68	11/18/2002								0.11																								
WP-71	11/15/2002								0.16 U																								

Notes:
[1]All units are in µg/L.
[2]PQL - Practical Quantitation Limit
[3]The benchmark level is equal to the EPA Region 9 Industrial Soil Preliminary Remediation Goal, or the MTCA-Method A Industrial Soil Cleanup Levels if an EPA level does not exist.
MTCA - Washington State Model Toxics Control Act Method A Groundwater Cleanup Levels (WAC 173-340-720-1)
EPA - EPA Region 9 Tap Water Preliminary Remediation Goals 2000 (USEPA, 2000)
6 indicates the concentration exceeds the MTCA or EPA cleanup level.
J - concentration estimated
U-non-detect
UJ - non-detect and PQL estimated

Volatile Organic Compounds
ACE = Acetone
BDCME = Bromodichloromethane
BRME = Bromomethane
BTBZN = n-Butylbenzene
BTBZS = sec-Butylbenzene
BTBZT = tert-Butylbenzene
BZ = Benzene
BZME = Toluene
CDS = Carbon disulfide
CLEA = Chloroethane
CLME = Chloromethane
DBCME = Dibromochloromethane
DBCP = 1,2-Dibromo-3-chloropropane
DCE12C = cis-1,2-Dichloroethene
FC11 = Trichlorofluoromethane
FC12 = Dichlorodifluoromethane
HXO2 = 2-Hexanone
PBZ = Isopropylbenzene
MEK = 2-Butanone
MIBK = 4-Methyl-2-pentanone
MTLNCL = Methylene chloride
NAPH = Naphthalene
PCE = Tetrachloroethene
TBME = Bromoform
TBUTMEE = Methyl-t-butyl ether
TCLME = Chloroform
TMB124 = 1,2,4-Trimethylbenzene
TMB135 = 1,3,5-Trimethylbenzene

Metals
As = Arsenic
Mn = Manganese
Zn = Zinc
Hg = Mercury

TABLE 4.10 COMPARISON OF TCE CONCENTRATIONS IN PAIRED WELLS		
Well ID	**Screen Lithology**	**TCE (mg/L)**
99-AW08	Hanford/Ringold	< 0.5
99-BW15	PR/Roza	9.4
02-BW02	Roza	0.58
99-AW01	Hanford	1.2J
91-BW03	Roza	42
99-BW01	Roza	40J
99-AW03	Hanford/Ringold	0.38
99-BW10	Priest Rapids	16
02-BW01	Roza	19

TABLE 4-11

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Acetone	Bromodichloro methane	Bromobenzene	Bromomethane	n-butylbenzene	sec-butylbenzene	tert-butylbenzene	Benzene	Toluene
Residential PRG (ug/kg)		56,000	820	28000	3900	240,000	220,000	390,000	600	520000
Industrial PRG		200,000	1800	92000	13000	240,000	220,000	390,000	1300	520000
00MLW001SS7C	3/22/2000	500	150	50	500	50	50	50	100	50
00MLW002SS8C	3/22/2000	500	150	50	500	50	50	50	100	50
00MLW003SS8C	3/22/2000	500	150	50	500	50	50	50	100	50
00MLW200SS8C	3/22/2000	500	150	50	500	50	50	50	100	50
00MLW325ST	3/21/2000	500	150	50	500	50	50	50	100	50
00MLW326ST	3/21/2000	500	150	50	500	50	50	50	100	50
00MLW327ST	3/22/2000	500	150	50	500	50	50	50	100	50
00MLW328ST	3/22/2000	500	150	50	500	50	50	50	100	50
00MLW329ST	3/23/2000	500	150	50	500	50	50	50	100	50
00MLW330ST	3/23/2000	500	150	50	500	50	50	50	100	50
01MLW001SO01BW01(20)	4/17/2001	690 UJ	150	140	500	270 UJ	140 UJ	140	140	140
01MLW001SS001S19	1/16/2001	500 UJ	150	53	500	110	53	53	100	53
01MLW001SS002S19	1/16/2001	500 UJ	150	58	500	120	58	58	100	58
01MLW001SS003S19	1/16/2001	500 UJ	150	56	500	110	56	56	100	56
01MLW001SS004S19	1/18/2001	500 UJ	150 UJ	52	500 UJ	100	52	52	100 UJ	52 UJ
01MLW001SS005S19	1/18/2001	500 UJ	150 UJ	50	500 UJ	91	50	50	100 UJ	50 UJ
01MLW001SS006S19	1/18/2001	500 UJ	150 UJ	59	500 UJ	120	59	59	100 UJ	59 UJ
01MLW001SS007S19	1/18/2001	500 UJ	150	50	500 UJ	92	50	50	100	50
01MLW001SS008S19	1/18/2001	500 UJ	150	53	500	110	53	53	100	
01MLW002SO01BW01(25)	4/17/2001	630 UJ	150	130	500	250 UJ	130 UJ	130	130	130
01MLW003SO01BW01(30)	4/17/2001	640 UJ	150	130	500	260 UJ	130 UJ	130	130	130
01MLW004SO01BW01(35)	4/17/2001	610 UJ	150	120	500	250 UJ	120 UJ	120	120	120
01MLW005SO01BW01(40)	4/18/2001	650 UJ	150	130	500	260 UJ	130 UJ	130	130	130
01MLW006SO01BW01(55)	4/18/2001	500 UJ	150	57	500	110 UJ	57 UJ	57	100	57
01MLW007SO01BW01(60)	4/18/2001	640 UJ	150	130	500	260 UJ	130 UJ	130	130	130
01MLW201SS003S19	1/16/2001	500 UJ	150	50	500	97	50	50	100	50
01MLW202SS007S19	1/18/2001	500 UJ	150	50	500	100	50	50	100	50
01MLW204SO01BW01(35)	4/17/2001	590 UJ	150	120	500	240 UJ	120 UJ	120	120	120
01MLW207SO01BW01(60)	4/18/2001	680 UJ	150	140	500	270 UJ	140 UJ	140	140	140

[a] - PRG is for a mixture of the compound.

TABLE 4-11

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Carbon disulfide	Chlorobenzene	Chloroethane	Chloromethane	Carbon tetrachloride	Dibromoethane	Dibromochloro methane	Dibromochloro propane	1,1-Dichloroethane
Residential PRG (ug/kg)		360000	150000	3000	1200	250	6.9	1100	450	510000
Industrial PRG		720000	530000	6200	2600	550	28	2600	2000	1700000
00MLW001SS7C	3/22/2000	500	50	50	250	50		100	150	50
00MLW002SS8C	3/22/2000	500	50	50	250	50		100	150	50
00MLW003SS8C	3/22/2000	500	50	50	250	50		100	150	50
00MLW200SS8C	3/22/2000	500	50	50	250	50		100	150	50
00MLW325ST	3/21/2000	500	50	50	250	50		100	150	50
00MLW326ST	3/21/2000	500	50	50	250	50		100	150	50
00MLW327ST	3/22/2000	500	50	50	250	50		100	150	50
00MLW328ST	3/22/2000	500	50	50	250	50		100	150	50
00MLW329ST	3/23/2000	500	50	50	250	50		100	150	50
00MLW330ST	3/23/2000	500	50	50	250	50		100	150	50
01MLW001SO01BW01(20)	4/17/2001	500	140	140	250	140	**140**	140	**690**	140
01MLW001SS001S19	1/16/2001	500	53	53	250	53		100	270	53
01MLW001SS002S19	1/16/2001	500	58	58	250	58		100	290	58
01MLW001SS003S19	1/16/2001	500	56	56	250	56		100	280	56
01MLW001SS004S19	1/18/2001	500 UJ	52	52 UJ	250 UJ	52 UJ		100	260	52 UJ
01MLW001SS005S19	1/18/2001	500 UJ	50	50 UJ	250 UJ	50 UJ		100	230	50 UJ
01MLW001SS006S19	1/18/2001	500 UJ	59	59 UJ	250 UJ	59 UJ		100	300	59 UJ
01MLW001SS007S19	1/18/2001	500 UJ	50	50 UJ	250 UJ	50		100	230	50 UJ
01MLW001SS008S19	1/18/2001	500	53	53	250	53		100	270	53
01MLW002SO01BW01(25)	4/17/2001	500	130	130	250	130	**130**	130	**630**	130
01MLW003SO01BW01(30)	4/17/2001	500	130	130	250	130	**130**	130	**640**	130
01MLW004SO01BW01(35)	4/17/2001	500	120	120	250	120	**120**	120	**610**	120
01MLW005SO01BW01(40)	4/18/2001	500	130	130	250	130	**130**	130	**650**	130
01MLW006SO01BW01(55)	4/18/2001	500	57	57	250	57	**57**	100	280	57
01MLW007SO01BW01(60)	4/18/2001	500	130	130	250	130	**130**	130	**640**	130
01MLW201SS003S19	1/16/2001	500	50	50	250	50		100	240	50
01MLW202SS007S19	1/18/2001	500	50	50	250	50		100	250	50
01MLW204SO01BW01(35)	4/17/2001	500	120	120	250	120	**120**	120	**590**	120
01MLW207SO01BW01(60)	4/18/2001	500	140	140	250	140	**140**	140	**680**	140

[a] - PRG is for a mixture of the compound.

TABLE 4-11

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		1,2-Dichloroethane	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	1,1-Dichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	cis-1,2-Dichloropropene	trans-1,2-Dichloropropene	1,2-Dichloropropane
Residential PRG (ug/kg)		280	370000	16000	3400	120000	43000	69000	780[a]	780[a]	340
Industrial PRG		600	370000	63000	7900	410000	150000	230000	1800[a]	1800[a]	740
00MLW001SS7C	3/22/2000	50	100	100	100	50	50	50	50	150	50
00MLW002SS8C	3/22/2000	50	100	100	100	50	50	50	50	150	50
00MLW003SS8C	3/22/2000	50	100	100	100	50	50	50	50	150	50
00MLW200SS8C	3/22/2000	50	100	100	100	50	50	50	50	150	50
00MLW325ST	3/21/2000	50	100	100	100	50	50	50	2	150	50
00MLW326ST	3/21/2000	50	100	100	100	50	50	50	2	150	50
00MLW327ST	3/22/2000	50	100	100	100	50	50	50	2	150	50
00MLW328ST	3/22/2000	50	100	100	100	50	50	50	2	150	50
00MLW329ST	3/23/2000	50	100	100	100	50	50	50	2	150	50
00MLW330ST	3/23/2000	50	100	100	100	50	50	50	2	150	50
01MLW001SO01BW01(20)	4/17/2001	140	140	140	140	140	140	140	69	150	140
01MLW001SS001S19	1/16/2001	53	100	100	100	53	53	53	27	150	53
01MLW001SS002S19	1/16/2001	58	100	100	100	58	58	58	29	150	58
01MLW001SS003S19	1/16/2001	56	100	100	100	56	56	56	28	150	56
01MLW001SS004S19	1/18/2001	52 UJ	100	100	100	52 UJ	52 UJ	52 UJ	26 UJ	150	52 UJ
01MLW001SS005S19	1/18/2001	50 UJ	100	100	100	50 UJ	50 UJ	50 UJ	23 UJ	150	50 UJ
01MLW001SS006S19	1/18/2001	59 UJ	100	100	100	59 UJ	59 UJ	59 UJ	30 UJ	150	59 UJ
01MLW001SS007S19	1/18/2001	50	100	100	100	50 UJ	50 UJ	50 UJ	23	150	50
01MLW001SS008S19	1/18/2001	53	100	100	100	53	53	53	27	150	53
01MLW002SO01BW01(25)	4/17/2001	130	130	130	130	130	130	130	63	150	130
01MLW003SO01BW01(30)	4/17/2001	130	130	130	130	130	130	130	64	150	130
01MLW004SO01BW01(35)	4/17/2001	120	120	120	120	120	120	120	61	150	120
01MLW005SO01BW01(40)	4/18/2001	130	130	130	130	130	130	130	65	150	130
01MLW006SO01BW01(55)	4/18/2001	57	100	100	100	57	57	57	28	150	57
01MLW007SO01BW01(60)	4/18/2001	130	130	130	130	130	130	130	64	150	130
01MLW201SS003S19	1/16/2001	50	100	100	100	50	50	50	24	150	50
01MLW202SS007S19	1/18/2001	50	100	100	100	50	50	50	25	150	50
01MLW204SO01BW01(35)	4/17/2001	120	120	120	120	120	120	120	59	150	120
01MLW207SO01BW01(60)	4/18/2001	140	140	140	140	140	140	140	68	150	140

[a] - PRG is for a mixture of the compound.

TABLE 4-11

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND
(Page 4 of 7)

		1,3-Dichloropropane	Ethylbenzene	Freon 11	Freon 12	Hexachlorobutadiene	Hexachlorobenzene	Hexachloroethane	MEK	MIBK
Residential PRG (ug/kg)		780	8900	390,000	94000	6200	300	35000	7,300,000	790,000
Industrial PRG		1800	20000	2,000,000	310000	22000	1100	120,000	27,000,000	2,800,000
00MLW001SS7C	3/22/2000	50	50	50	50	150			500	500
00MLW002SS8C	3/22/2000	50	50	50	50	150			500	500
00MLW003SS8C	3/22/2000	50	50	50	50	150			500	500
00MLW200SS8C	3/22/2000	50	50	50	50	150			500	500
00MLW325ST	3/21/2000	50	50	50	50	150			500	500
00MLW326ST	3/21/2000	50	50	50	50	150			500	500
00MLW327ST	3/22/2000	50	50	50	50	150			500	500
00MLW328ST	3/22/2000	50	50	50	50	150			500	500
00MLW329ST	3/23/2000	50	50	50	50	150			500	500
00MLW330ST	3/23/2000	50	50	50	50	150			500	500
01MLW001SO01BW01(20)	4/17/2001	140	140	140	140	690			690	690
01MLW001SS001S19	1/16/2001	53	53	53	53	270	**660**	660	500	500
01MLW001SS002S19	1/16/2001	58	58	58	58	290	**660**	660	500	500
01MLW001SS003S19	1/16/2001	56	56	56	56	280	**660**	660	500	500
01MLW001SS004S19	1/18/2001	52	52	52 UJ	52 UJ	260	**660**	660	500 UJ	500 UJ
01MLW001SS005S19	1/18/2001	50	50	50 UJ	50 UJ	230	**660**	660	500 UJ	500 UJ
01MLW001SS006S19	1/18/2001	59	59	59 UJ	59 UJ	300	**660**	1100	500 UJ	500 UJ
01MLW001SS007S19	1/18/2001	50	50	50 UJ	50 UJ	230	**660**	660	500 UJ	500
01MLW001SS008S19	1/18/2001	53	53	53	53	270	**660**	660	500	500
01MLW002SO01BW01(25)	4/17/2001	130	130	130	130	630			630	630
01MLW003SO01BW01(30)	4/17/2001	130	130	130	130	640			640	640
01MLW004SO01BW01(35)	4/17/2001	120	120	120	120	610			610	610
01MLW005SO01BW01(40)	4/18/2001	130	130	130	130	650			650	650
01MLW006SO01BW01(55)	4/18/2001	57	57	57	57	280			500	500
01MLW007SO01BW01(60)	4/18/2001	130	130	130	130	640			640	640
01MLW201SS003S19	1/16/2001	50	50	50	50	240	**660**	660	500	500
01MLW202SS007S19	1/18/2001	50	50	50	50	250	**660**	660	500	500
01MLW204SO01BW01(35)	4/17/2001	120	120	120	120	590			590	590
01MLW207SO01BW01(60)	4/18/2001	140	140	140	140	680			680	680

[a] - PRG is for a mixture of the compound.

TABLE 4-11

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Methylene chloride	Naphthalene	n-Propylbenzene	1,1,2,2-Tetrachloroethane	Tetrachloroethene	Styrene	Bromoform	MTBE	1,1,12-Tetrachloroethane
Residential PRG (ug/kg)		9100	56000	240,000	410	1500	1,700,000	62000	62000	3200
Industrial PRG		21000	190,000	240,000	930	3400	1,700,000	220,000	160,000	7300
00MLW001SS7C	3/22/2000	250	250	50	50	50	50	150		50
00MLW002SS8C	3/22/2000	250	250	50	50	50	50	150		50
00MLW003SS8C	3/22/2000	250	250	50	50	50	50	150		50
00MLW200SS8C	3/22/2000	250	250	50	50	50	50	150		50
00MLW325ST	3/21/2000	250	250	50	50	50	50	150		50
00MLW326ST	3/21/2000	250	250	50	50	50	50	150		50
00MLW327ST	3/22/2000	250	250	50	50	50	50	150		50
00MLW328ST	3/22/2000	250	250	50	50	50	50	150		50
00MLW329ST	3/23/2000	250	250	50	50	50	50	150		50
00MLW330ST	3/23/2000	250	250	50	50	50	50	150		50
01MLW001SO01BW01(20)	4/17/2001	410 UJ	690	140 UJ	140	140	140	150	69	140
01MLW001SS001S19	1/16/2001	250	270 UJ	53	53	53	53	150	27	53
01MLW001SS002S19	1/16/2001	250	290 UJ	58	58	58	58	150	29	58
01MLW001SS003S19	1/16/2001	250	280 UJ	56	56	56	56	150	28	56
01MLW001SS004S19	1/18/2001	250 UJ	260 UJ	52	52	52	52	150	26 UJ	52
01MLW001SS005S19	1/18/2001	250 UJ	250 UJ	50	50	50	50	150	23 UJ	50
01MLW001SS006S19	1/18/2001	250 UJ	300 UJ	59	59	59	59	150	30 UJ	59
01MLW001SS007S19	1/18/2001	250 UJ	250 UJ	50	50	50	50	150	23 UJ	50
01MLW001SS008S19	1/18/2001	250	270 UJ	53	53	53	53	150	27	53
01MLW002SO01BW01(25)	4/17/2001	380 UJ	630	130 UJ	130	130	130	150	63	130
01MLW003SO01BW01(30)	4/17/2001	380 UJ	640	130 UJ	130	130	130	150	64	130
01MLW004SO01BW01(35)	4/17/2001	370 UJ	610	120	120	120	120	150	61	120
01MLW005SO01BW01(40)	4/18/2001	390 UJ	650	130	130	130	130	150	65	130
01MLW006SO01BW01(55)	4/18/2001	250 UJ	280	57	57	57	57	150	28	57
01MLW007SO01BW01(60)	4/18/2001	380 UJ	640	130	130	130	130	150	64	130
01MLW201SS003S19	1/16/2001	250	250 UJ	50	50	50	50	150	24	50
01MLW202SS007S19	1/18/2001	250	250 UJ	50	50	50	50	150	25	50
01MLW204SO01BW01(35)	4/17/2001	350 UJ		120UJ	120	120	120	150	59	120
01MLW207SO01BW01(60)	4/18/2001	410 UJ		140	140	140	140	150	68	140

[a] - PRG is for a mixture of the compound.

TABLE 4-11

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND
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		1,1,1-Trichloroethane	1,1,2-Trichloroethane	1,2,4-Trichlorobenzene	TCE	Chloroform	1,2,3-Trichloropropane	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	Vinyl acetate
Residential PRG (ug/kg)		1,200,000	7300	650,000	53	3600	5	52000	21000	430,000
Industrial PRG		1,200,000	1600	3,000,000	110	12000	11	170,000	70,000	1,400,000
00MLW001SS7C	3/22/2000	50	50	250	50	50	2	100	50	500
00MLW002SS8C	3/22/2000	50	50	250	50	50	2	100	50	500
00MLW003SS8C	3/22/2000	50	50	250	50	50	2	100	50	500
00MLW200SS8C	3/22/2000	50	50	250	50	50	2	100	50	500
00MLW325ST	3/21/2000	50	50	250	50	50	2	100	50	500
00MLW326ST	3/21/2000	50	50	250	50	50	2	100	50	500
00MLW327ST	3/22/2000	50	50	250	50	50	2	100	50	500
00MLW328ST	3/22/2000	50	50	250	50	50	2	100	50	500
00MLW329ST	3/23/2000	50	50	250	50	50	2	100	50	500
00MLW330ST	3/23/2000	50	50	250	50	50	2	100	50	500
01MLW001SO01BW01(20)	4/17/2001	140	140	690	**140**	140	**69**	140	140	690
01MLW001SS001S19	1/16/2001	53	53	270	53	53	**27**	100	53	500
01MLW001SS002S19	1/16/2001	58	58	290		58	**29**	100	58	500
01MLW001SS003S19	1/16/2001	56	56	280		56	**28**	100	56	500
01MLW001SS004S19	1/18/2001	52 UJ	52 UJ	260	52 UJ	52 UJ	**26**	100	52	500 UJ
01MLW001SS005S19	1/18/2001	50 UJ	50 UJ	250	50 UJ	50 UJ	**23**	100	50	500 UJ
01MLW001SS006S19	1/18/2001	59 UJ	59 UJ	300	59 UJ	59 UJ	**30**	100	59	500 UJ
01MLW001SS007S19	1/18/2001	50 UJ	50	250	50	50 UJ	**23**	100	50	500 UJ
01MLW001SS008S19	1/18/2001	53	53	270		53	**27**	100	53	500
01MLW002SO01BW01(25)	4/17/2001	130	130	630	**130**	130	**63**	130	130	630
01MLW003SO01BW01(30)	4/17/2001	130	130	640	**130**	130	**64**	130	130	640
01MLW004SO01BW01(35)	4/17/2001	120	120	610	**120**	120	**61**	120	120	610
01MLW005SO01BW01(40)	4/18/2001	130	130	650	**130**	130	**65**	130	130	650
01MLW006SO01BW01(55)	4/18/2001	57	57	280	57	57	**28**	100	57	500
01MLW007SO01BW01(60)	4/18/2001	130	130	640	**130**	130	**64**	130	130	640
01MLW201SS003S19	1/16/2001	50	50	250	50	50	**24**	100	50	500
01MLW202SS007S19	1/18/2001	50	50	250	50	50	**25**	100	50	500
01MLW204SO01BW01(35)	4/17/2001	120	120	590	**120**	120	**59**	120	120	590
01MLW207SO01BW01(60)	4/18/2001	140	140	680	**140**	140	**68**	140	140	680

[a] - PRG is for a mixture of the compound.

TABLE 4-11

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Vinyl chloride	m,p-Xylenes	o-Xylene
Residential PRG (ug/kg)		79	270000[a]	270000[a]
Industrial PRG		750	420000[a]	420000[a]
00MLW001SS7C	3/22/2000	2	50	50
00MLW002SS8C	3/22/2000	2	50	50
00MLW003SS8C	3/22/2000	2	50	50
00MLW200SS8C	3/22/2000	2	50	50
00MLW325ST	3/21/2000	2	50	50
00MLW326ST	3/21/2000	2	50	50
00MLW327ST	3/22/2000	2	50	50
00MLW328ST	3/22/2000	2	50	50
00MLW329ST	3/23/2000	2	50	50
00MLW330ST	3/23/2000	2	50	50
01MLW001SO01BW01(20)	4/17/2001	69	140	140
01MLW001SS001S19	1/16/2001	27	53	53
01MLW001SS002S19	1/16/2001	29	58	58
01MLW001SS003S19	1/16/2001	28	56	56
01MLW001SS004S19	1/18/2001	26 UJ	52	52
01MLW001SS005S19	1/18/2001	23 UJ	50	50
01MLW001SS006S19	1/18/2001	30 UJ	59	59
01MLW001SS007S19	1/18/2001	23 UJ	50	50
01MLW001SS008S19	1/18/2001	27	53	53
01MLW002SO01BW01(25)	4/17/2001	63	130	130
01MLW003SO01BW01(30)	4/17/2001	64	130	130
01MLW004SO01BW01(35)	4/17/2001	61	120	120
01MLW005SO01BW01(40)	4/18/2001	65	130	130
01MLW006SO01BW01(55)	4/18/2001	28	57	57
01MLW007SO01BW01(60)	4/18/2001	64	130	130
01MLW201SS003S19	1/16/2001	24	50	50
01MLW202SS007S19	1/18/2001	25	50	50
01MLW204SO01BW01(35)	4/17/2001	59	120	120
01MLW207SO01BW01(60)	4/18/2001	68	140	140

[a] - PRG is for a mixture of the compound.

TABLE 4-12

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - SVOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND
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		Acenaphthene	Anthracene	bis(2-Chloroethyl) ether	bis(2-Chloroisopropyl) ether	bis(2-Ethylhexyl)phthalate	Benzo(a)anthracene	Benzoic acid	Benzo(a)pyrene
Residential PRG (mg/kg)		3700	22000	0.21	2.9	35	0.62	100,000	0.062
Industrial PRG		2900	100,000	0.55	7.4	120	2.1	100,000	0.21
00MLW001SS001S08	8/30/2000	-	-	-	-	-	-	-	-
00MLW001SS001S11	8/16/2000	-	-	-	-	-	**0.98 UJ**	-	**0.98 UJ**
	9/8/2000	-	-	-	-	-	-	-	-
00MLW001SS002S12	8/16/2000	-	-	-	-	-	0.047 UJ	-	-
00MLW001SS003S11	8/16/2000	-	-	-	-	-	0.05	-	0.05
00MLW001SS003S35	8/17/2000	-	-	-	-	-	**0.14 UJ**	-	**0.14 UJ**
00MLW001SS7C	3/22/2000	-	-	-	-	-	-	-	-
00MLW002SS8C	3/22/2000	-	-	-	-	-	-	-	-
00MLW003SS8C	3/22/2000	-	-	-	-	-	-	-	-
00MLW004SS11C	3/22/2000	-	-	-	-	-	-	-	-
00MLW200SS8C	3/22/2000	-	-	-	-	-	-	-	-
00MLW201SS002S11	8/16/2000	-	-	-	-	-	-	-	-
00MLW201SS003S35	8/17/2000	-	-	-	-	-	0.14	-	**0.14**
01MLW001SO01BW01(20)	4/17/2001	-	-	-	-	-	-	-	-
01MLW001SS001S19	1/16/2001	0.66	0.66	**0.66**	0.66	0.66	**0.66**	3.3	0.0061
01MLW001SS002S19	1/16/2001	0.66	0.66	**0.66**	0.66	0.66	**0.66**	3.3	0.0061
01MLW001SS003S19	1/16/2001	0.66	0.66	**0.66**	0.66	0.66	**0.66**	3.3	0.0061
01MLW001SS004S19	1/18/2001	0.66	0.66	**0.66**	0.66	0.66	**0.66**	3.3 UJ	0.0061
01MLW001SS005S19	1/18/2001	0.66	0.66	**0.66**	0.66	0.66	**0.66**	3.3 UJ	0.0061
01MLW001SS006S19	1/18/2001	0.66	0.66	**1.1**	0.66	0.66	**0.66**	5.3 UJ	0.0061
01MLW001SS007S19	1/18/2001	0.66	0.66	**0.66**	0.66	0.66	**0.66**	3.3 UJ	0.0061
01MLW001SS008S19	1/18/2001	0.66	0.66	**0.66**	0.66	-	**0.66**	3.3 UJ	0.0061 UJ
01MLW002SO01BW01(25)	4/17/2001	-	-	-	-	-	-	-	-
01MLW003SO01BW01(30)	4/17/2001	-	-	-	-	-	-	-	-
01MLW004SO01BW01(35)	4/17/2001	-	-	-	-	-	-	-	-
01MLW005SO01BW01(40)	4/18/2001	-	-	-	-	-	-	-	-
01MLW006SO01BW01(55)	4/18/2001	-	-	-	-	-	-	-	-
01MLW007SO01BW01(60)	4/18/2001	-	-	-	-	-	-	-	-
01MLW201SS003S19	1/16/2001	0.66	0.66	**0.66**	0.66	0.66	**0.66**	3.3	0.0061
01MLW202SS007S19	1/18/2001	0.66	0.66	**0.66**	0.66	0.66	**0.66**	3.3 UJ	0.0061
01MLW204SO01BW01(35)	4/17/2001	-	-	-	-	-	-	-	-
01MLW207SO01BW01(60)	4/18/2001	-	-	-	-	-	-	-	-

[a] - PRG is for a mixture of the compound.
Units are mg/kg
UJ - The practical quantitation limit is an estimated limit.

TABLE 4-12

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - SVOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND
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		Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzyl alcohol	Chrysene	4-Chloroaniline	2-Chlorophenol	2-Chloronaphthalene	Dibenzo(a,h)anthracene	Dibenzofuran
Residential PRG (mg/kg)		0.62	6.2	18000	62	240	63	4900	0.062	290
Industrial PRG		2.1	21	10,000	210	2500	240	23000	0.21	3100
00MLW001SS001S08	8/30/2000	-	-	-	-	-	-	-	-	-
00MLW001SS001S11	8/16/2000	**0.98 UJ**	0.98 UJ	-	0.98 UJ	-	-	-	**0.98 UJ**	-
	9/8/2000	-	-	-	-	-	-	-	-	-
00MLW001SS002S12	8/16/2000	-	-	-	0.047 UJ	-	-	-	0.047 UJ	-
00MLW001SS003S11	8/16/2000	0.05	0.05	-	0.05	-	-	-	0.05	-
00MLW001SS003S35	8/17/2000	0.15	0.14 UJ	-	0.14 UJ	-	-	-	**0.14 UJ**	-
00MLW001SS7C	3/22/2000	-	-	-	-	-	-	-	-	-
00MLW002SS8C	3/22/2000	-	-	-	-	-	-	-	-	-
00MLW003SS8C	3/22/2000	-	-	-	-	-	-	-	-	-
00MLW004SS11C	3/22/2000	-	-	-	-	-	-	-	-	-
00MLW200SS8C	3/22/2000	-	-	-	-	-	-	-	-	-
00MLW201SS002S11	8/16/2000	-	-	-	-	-	-	-	-	-
00MLW201SS003S35	8/17/2000	0.14	0.14	-	0.14	-	-	-	**0.14**	-
01MLW001SO01BW01(20)	4/17/2001	-	-	-	-	-	-	-	-	-
01MLW001SS001S19	1/16/2001	0.0065	0.0054	1.3	0.0066	1.3	0.66	0.00066	0.01	0.66
01MLW001SS002S19	1/16/2001	0.0065	0.0054	1.3	-	1.3	0.66	0.00066	0.01 UJ	0.66
01MLW001SS003S19	1/16/2001	0.0065	0.0054	1.3	0.0066	1.3	0.66	0.00066	0.01	0.66
01MLW001SS004S19	1/18/2001	0.02	0.0054	1.3	0.0066	1.3	0.66	0.00066	0.01	0.66
01MLW001SS005S19	1/18/2001	**0.66**	0.66	1.3	0.66	1.3	0.66	0.00066	**0.66**	0.66
01MLW001SS006S19	1/18/2001	0.011	0.011	2.6	0.021	1.6	0.66	0.00066	0.011	0.66
01MLW001SS007S19	1/18/2001	**0.66**	0.66	1.3	0.66	1.3	0.66	0.00066	**0.66**	0.66
01MLW001SS008S19	1/18/2001	0.0065 UJ	0.0054	1.3	0.021	1.3	0.66	0.00066	0.01 UJ	0.66
01MLW002SO01BW01(25)	4/17/2001	-	-	-	-	-	-	-	-	-
01MLW003SO01BW01(30)	4/17/2001	-	-	-	-	-	-	-	-	-
01MLW004SO01BW01(35)	4/17/2001	-	-	-	-	-	-	-	-	-
01MLW005SO01BW01(40)	4/18/2001	-	-	-	-	-	-	-	-	-
01MLW006SO01BW01(55)	4/18/2001	-	-	-	-	-	-	-	-	-
01MLW007SO01BW01(60)	4/18/2001	-	-	-	-	-	-	-	-	-
01MLW201SS003S19	1/16/2001	**6.5**	5.4	1.3	0.0066	1.3	0.66	0.00066	0.01	0.66
01MLW202SS007S19	1/18/2001	**0.66**	**0.66**	1.3	0.66	1.3	0.66	0.00066	**0.66**	0.66
01MLW204SO01BW01(35)	4/17/2001	-	-	-	-	-	-	-	-	-
01MLW207SO01BW01(60)	4/18/2001	-	-	-	-	-	-	-	-	-

[a] - PRG is for a mixture of the compound.
Units are mg/kg
UJ - The practical quantitation limit is an estim

TABLE 4-12

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - SVOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND
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		3,3'-Dichlorobenzidine	2,4-Dichlorophenol	Diethylphthalate	2,4-Dimethylphenol	Dimethyl phthalate	Di-n-octyl phthalate	2,4-Dinitrophenol	2,4-Dinitrotoluene	2,6-Dinitrotoluene	Fluoranthene
Residential PRG (mg/kg)		1.1	180	49000	1200	100,000	2400	120	0.72[a]	0.72[a]	2300
Industrial PRG		3.8	1800	100,000	12000	100,000	25000	1200	2.5a	2.5a	22000
00MLW001SS001S08	8/30/2000	-	-	-	-	-	-	-	-	-	-
00MLW001SS001S11	8/16/2000	-	-	-	-	-	-	-	-	-	0.98 UJ
	9/8/2000	-	-	-	-	-	-	-	-	-	-
00MLW001SS002S12	8/16/2000	-	-	-	-	-	-	-	-	-	-
00MLW001SS003S11	8/16/2000	-	-	-	-	-	-	-	-	-	-
00MLW001SS003S35	8/17/2000	-	-	-	-	-	-	-	-	-	-
00MLW001SS7C	3/22/2000	-	-	-	-	-	-	-	-	-	-
00MLW002SS8C	3/22/2000	-	-	-	-	-	-	-	-	-	-
00MLW003SS8C	3/22/2000	-	-	-	-	-	-	-	-	-	-
00MLW004SS11C	3/22/2000	-	-	-	-	-	-	-	-	-	-
00MLW200SS8C	3/22/2000	-	-	-	-	-	-	-	-	-	-
00MLW201SS002S11	8/16/2000	-	-	-	-	-	-	-	-	-	-
00MLW201SS003S35	8/17/2000	-	-	-	-	-	-	-	-	-	-
01MLW001SO01BW01(20)	4/17/2001	-	-	-	-	-	-	-	-	-	-
01MLW001SS001S19	1/16/2001	**1.3**	0.66	0.66	0.66	0.66	0.66	3.3 UJ	**0.87**	**0.87**	0.0066
01MLW001SS002S19	1/16/2001	**1.3**	0.66	0.66	0.66	0.66	0.66	3.3 UJ	0.66	0.66	0.66
01MLW001SS003S19	1/16/2001	**1.3**	0.66	0.66	-	0.66	0.66	3.3 UJ	0.66	0.66	0.0066
01MLW001SS004S19	1/18/2001	**1.3**	0.66	0.66	0.66	0.66	0.66	3.3 UJ	0.66	0.66	0.02
01MLW001SS005S19	1/18/2001	**1.3**	0.66	0.66	0.66	0.66	0.66	3.3 UJ	0.66	0.66	0.66
01MLW001SS006S19	1/18/2001	**2.6**	1.6	0.66	1.6	0.66	0.66	3.3 UJ	**2.6**	**2.6**	0.021
01MLW001SS007S19	1/18/2001	**1.3**	0.66	0.66	0.66	0.66	0.66	3.3 UJ	0.66	0.66	0.66
01MLW001SS008S19	1/18/2001	**1.3**	0.66	0.66	-	0.66	0.66	3.3 UJ	0.66	0.66	0.66
01MLW002SO01BW01(25)	4/17/2001	-	-	-	-	-	-	-	-	-	-
01MLW003SO01BW01(30)	4/17/2001	-	-	-	-	-	-	-	-	-	-
01MLW004SO01BW01(35)	4/17/2001	-	-	-	-	-	-	-	-	-	-
01MLW005SO01BW01(40)	4/18/2001	-	-	-	-	-	-	-	-	-	-
01MLW006SO01BW01(55)	4/18/2001	-	-	-	-	-	-	-	-	-	-
01MLW007SO01BW01(60)	4/18/2001	-	-	-	-	-	-	-	-	-	-
01MLW201SS003S19	1/16/2001	**1.3**	0.66	0.66	0.66	0.66	0.66	3.3 UJ	0.66	0.66	0.0066
01MLW202SS007S19	1/18/2001	**1.3**	0.66	0.66	0.66	0.66	0.66	3.3 UJ	0.66	0.66	0.66
01MLW204SO01BW01(35)	4/17/2001	-	-	-	-	-	-	-	-	-	-
01MLW207SO01BW01(60)	4/18/2001	-	-	-	-	-	-	-	-	-	-

[a] - PRG is for a mixture of the compound.
Units are mg/kg
UJ - The practical quantitation limit is an estim

TABLE 4-12

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - SVOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND
(Page 4 of 5)

		Hexachlorocyclopentadiene	Hexachlorobenzene	Hexachloroethane	Indeno(1,2,3-dc)pyrene	Isophorone	2-Methylphenol	4-Methylphenol	n-Nitrosodiphenylamine	n-Nitroso-di-n-propylamine
Residential PRG (mg/kg)		370	0.3	35	0.62	510	3100	310	99	0.069
Industrial PRG		3700	1.1	120	2.1	1800	31,000	3100	350	0.25
00MLW001SS001S08	8/30/2000	-	-	-	-	-	-	-	-	-
00MLW001SS001S11	8/16/2000	-	-	-	**0.98 UJ**	-	-	-	-	-
	9/8/2000	-	-	-	-	-	-	-	-	-
00MLW001SS002S12	8/16/2000	-	-	-	0.047 UJ	-	-	-	-	-
00MLW001SS003S11	8/16/2000	-	-	-	0.05	-	-	-	-	-
00MLW001SS003S35	8/17/2000	-	-	-	0.14 UJ	-	-	-	-	-
00MLW001SS7C	3/22/2000	-	-	-	-	-	-	-	-	-
00MLW002SS8C	3/22/2000	-	-	-	-	-	-	-	-	-
00MLW003SS8C	3/22/2000	-	-	-	-	-	-	-	-	-
00MLW004SS11C	3/22/2000	-	-	-	-	-	-	-	-	-
00MLW200SS8C	3/22/2000	-	-	-	-	-	-	-	-	-
00MLW201SS002S11	8/16/2000	-	-	-	-	-	-	-	-	-
00MLW201SS003S35	8/17/2000	-	-	-	0.14	-	-	-	-	-
01MLW001SO01BW01(20)	4/17/2001	-	-	-	-	-	-	-	-	-
01MLW001SS001S19	1/16/2001	0.87	**0.66**	0.66	0.0097	0.66	0.66	0.66	0.66	**0.66**
01MLW001SS002S19	1/16/2001	0.66	**0.66**	0.66	0.0097 UJ	0.66	0.66	0.66	0.66	**0.66**
01MLW001SS003S19	1/16/2001	0.66	**0.66**	0.66	0.0097	0.66	0.66	0.66	0.66	**0.66**
01MLW001SS004S19	1/18/2001	0.66	**0.66**	0.66	**0.66**	0.66	0.66	0.66	0.66	**0.66**
01MLW001SS005S19	1/18/2001	0.66	**0.66**	0.66	**0.66**	0.66	0.66	0.66	0.66	**0.66**
01MLW001SS006S19	1/18/2001	2.6	**0.66**	1.1	0.021	0.66	1.1	0.66	0.66	**1.1**
01MLW001SS007S19	1/18/2001	0.66	**0.66**	0.66	**0.66**	0.66	0.66	0.66	0.66	**0.66**
01MLW001SS008S19	1/18/2001	0.66	**0.66**	0.66	0.021	0.66	0.66	0.66	0.66	**0.66**
01MLW002SO01BW01(25)	4/17/2001	-	-	-	-	-	-	-	-	-
01MLW003SO01BW01(30)	4/17/2001	-	-	-	-	-	-	-	-	-
01MLW004SO01BW01(35)	4/17/2001	-	-	-	-	-	-	-	-	-
01MLW005SO01BW01(40)	4/18/2001	-	-	-	-	-	-	-	-	-
01MLW006SO01BW01(55)	4/18/2001	-	-	-	-	-	-	-	-	-
01MLW007SO01BW01(60)	4/18/2001	-	-	-	-	-	-	-	-	-
01MLW201SS003S19	1/16/2001	0.66	**0.66**	0.66	0.0097	0.66	0.66	0.66	0.66	**0.66**
01MLW202SS007S19	1/18/2001	0.66	**0.66**	0.66	**0.66**	0.66	0.66	0.66	0.66	**0.66**
01MLW204SO01BW01(35)	4/17/2001	-	-	-	-	-	-	-	-	-
01MLW207SO01BW01(60)	4/18/2001	-	-	-	-	-	-	-	-	-

[a] - PRG is for a mixture of the compound.
Units are mg/kg
UJ - The practical quantitation limit is an estim

TABLE 4-12

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - SVOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND
(Page 5 of 5)

		2-Nitrolaniline	Nitrobenzene	n-Propylbenzene	Pentachlorphenol	Phenol	Pyrene	2,4,5-Trichlorophenol	2,4,6-Trichlorophenol
Residential PRG (mg/kg)		1.7	20	240	3	3700	2300	6100	6.1
Industrial PRG		18	100	2400	9	100,000	2900	62000	62
00MLW001SS001S08	8/30/2000	-	-	-	-	-	-	-	-
00MLW001SS001S11	8/16/2000	-	-	-	-	-	0.98 UJ	-	-
	9/8/2000	-	-	-	-	-	-	-	-
00MLW001SS002S12	8/16/2000	-	-	-	-	-	-	-	-
00MLW001SS003S11	8/16/2000	-	-	-	-	-	0.05	-	-
00MLW001SS003S35	8/17/2000	-	-	-	-	-	0.15	-	-
00MLW001SS7C	3/22/2000	-	-	0.05	-	-	-	-	-
00MLW002SS8C	3/22/2000	-	-	0.05	-	-	-	-	-
00MLW003SS8C	3/22/2000	-	-	0.05	-	-	-	-	-
00MLW004SS11C	3/22/2000	-	-	0.05	-	-	-	-	-
00MLW200SS8C	3/22/2000	-	-	0.05	-	-	-	-	-
00MLW201SS002S11	8/16/2000	-	-	-	-	-	-	-	-
00MLW201SS003S35	8/17/2000	-	-	-	-	-	-	-	-
01MLW001SO01BW01(20)	4/17/2001	-	-	0.14 UJ	-	-	-	-	-
01MLW001SS001S19	1/16/2001	**3.3**	-	0.053	**3 3**	0.66	0.0066	0.87	0.87
01MLW001SS002S19	1/16/2001	**3.3**	0.66	0.058	**3 3**	0.66	0.0066	0.66	0.66
01MLW001SS003S19	1/16/2001	**3.3**	0.66	0.056	**3 3**	0.66	0.0066	0.66	0.66
01MLW001SS004S19	1/18/2001	**3.3**	0.66	0.052	**3 3**	0.66	0.02	0.66	0.66
01MLW001SS005S19	1/18/2001	**3.3**	0.66	0.05	**3 3**	0.66	0.0066	0.66	0.66
01MLW001SS006S19	1/18/2001	**3.3**	0.66	0.059	**3 3**	1.1	0.021	2.6	2.6
01MLW001SS007S19	1/18/2001	**3.3**	0.66	0.05	**3.3 UJ**	0.66	0.66	0.66	0.66
01MLW001SS008S19	1/18/2001	**3.3**	0.66	0.053	**3 3**	0.66	0.66	0.66	0.66
01MLW002SO01BW01(25)	4/17/2001	-	0.66	0.13 UJ	-	-	-	-	-
01MLW003SO01BW01(30)	4/17/2001	-	-	0.13 UJ	-	-	-	-	-
01MLW004SO01BW01(35)	4/17/2001	-	-	0.12	-	-	-	-	-
01MLW005SO01BW01(40)	4/18/2001	-	-	0.13	-	-	-	-	-
01MLW006SO01BW01(55)	4/18/2001	-	-	0.057	-	-	-	-	-
01MLW007SO01BW01(60)	4/18/2001	-	-	0.13	-	-	-	-	-
01MLW201SS003S19	1/16/2001	**3.3**	-	0.05	**3 3**	0.66	0.0066	0.66	0.66
01MLW202SS007S19	1/18/2001	**3.3**	0.66	0.05	**3 3**	0.66	0.66	0.66	0.66
01MLW204SO01BW01(35)	4/17/2001	-	0.66	0.12 UJ	-	-	-	-	-
01MLW207SO01BW01(60)	4/18/2001	-	-	0.14	-	-	-	-	-

[a] - PRG is for a mixture of the compound.
Units are mg/kg
UJ - The practical quantitation limit is an estim

TABLE 4-13

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - PCBs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND
(Page 1 of 1)

		PCB1016	PCB1221	PCB1232	PCB1242	PCB1248	PCB1254	PCB1260
Residential PRG (ug/kg)		3900	220	220	220	220	220	220
Industrial PRG		21000	740	740	740	740	740	740
SAMPID	LOGDATE							
00MLW001SS001S17	10/12/00	12	24	12	12	12	12	12
00MLW001SS001S18	8/17/00	35	69	35	35	35	35	-
00MLW001SS001S22	8/17/00	12	24	12	12	12	-	-
00MLW001SS002S18	8/17/00	12 UJ	24 UJ	12 UJ	12 UJ	12 UJ	-	72.4 UJ
00MLW001SS002S22	8/17/00	35	69	35	35	35	-	478
00MLW001SS003S17	10/12/00	12	24	12	12	12	-	-
00MLW001SS003S18	8/17/00	36	71	36	36	36	-	**440**
00MLW001SS003S22	8/17/00	840	**1700**	**840**	**840**	**840**	-	**2990**
00MLW001SS004S17	10/12/00	12 UJ	24 UJ	12 UJ	12 UJ	12 UJ	12 UJ	12 UJ
00MLW201SS001S22	8/17/00	12 UJ	24 UJ	12 UJ	12 UJ	12 UJ	-	12 UJ
00MLW201SS004S17	10/12/00	12	24	12	12	12	12	12

Units are ug/kg
UJ - The practical quantitation limit is an estimated limit.

TABLE 4-14

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - TPH
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		DIESEL2	GASOLINE
Washington Soil Clean up Method A		200	100
SAMPID	LOGDATE		
00MLW001SS001S11	8/16/00		50
	9/8/00		5
00MLW001SS001S12	8/16/00	10 UJ	20
00MLW001SS001S17	10/12/00	50	20
00MLW001SS002S11	8/16/00		20
	9/8/00		5
00MLW001SS002S12	8/16/00		**200**
00MLW001SS002S17	10/12/00		44
00MLW001SS002S22	8/17/00		20
00MLW001SS003S11	8/16/00		20
00MLW001SS003S12	8/16/00	50	20
00MLW001SS003S17	10/12/00	50	20
00MLW001SS003S22	8/17/00		20
00MLW001SS003S35	8/17/00		**520**
	9/8/00		5
00MLW001SS004S17	10/12/00		20
00MLW201SS002S11	8/16/00		51
	9/8/00		5
	9/8/00		5
00MLW201SS004S17	10/12/00	50	20
01MLW001SO01BW01(20)	4/17/01		5
01MLW001SS001S19	1/16/01	50	20
01MLW001SS002S19	1/16/01		20
01MLW001SS003S19	1/16/01		20
01MLW001SS004S19	1/18/01	10	20
01MLW001SS005S19	1/18/01	50	20
01MLW001SS006S19	1/18/01	26	20
01MLW001SS007S19	1/18/01	50	20
01MLW001SS008S19	1/18/01		20
01MLW002SO01BW01(25)	4/17/01	10 UJ	5
01MLW003SO01BW01(30)	4/17/01		5
01MLW005SO01BW01(40)	4/18/01	10 UJ	6
01MLW006SO01BW01(55)	4/18/01	10 UJ	5
01MLW007SO01BW01(60)	4/18/01	10	6
01MLW201SS003S19	1/16/01	50	20
01MLW202SS007S19	1/18/01	50	20
01MLW204SO01BW01(35)	4/17/01		5
01MLW207SO01BW01(60)	4/18/01	10	6

Units are mg/kg
UJ - The practical quantitation limit is an estimated limit.

TABLE 4-15

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - METALS
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND
(Page 1 of 2)

		AG	AS	BE	CD	HG	SB	SE	TL
Residential PRG (mg/kg)		390	22	150	37	23	31	390	5.2
Industrial PRG		5100	260	1900	450	307	410	5100	67
SAMPID	LOGDATE								
00MLW001SOUST	3/21/00	0.3				0.05		1	0 2
00MLW001SS001S06	8/30/00	7.3		2.4			2.5	120	0.47
00MLW001SS001S08	8/30/00	0.5	0 25		0.25	0.1	2.5	5	
00MLW001SS001S12	8/16/00					0.1		5.2 UJ	0.25
00MLW001SS001S17	10/12/00				0.25	0.1		5	
00MLW001SS001S18	8/17/00	0.5						5 UJ	0.25
00MLW001SS001S20	8/30/00	0.5			0.25	0.1		5	0.25
00MLW001SS001S31-8	8/30/00					0.1	2.5	5	0.25
00MLW001SS002S06	8/30/00	0.5		0.25		0.1	2.5	5	0.25
00MLW001SS002S08	8/30/00	0.5	0 25		0.25	0.1	2.5	5	
00MLW001SS002S12	8/16/00	0.76				0.1		13	0.25
00MLW001SS002S17	10/12/00							5	
00MLW001SS002S18	8/17/00	0.76				0.1		13	0.25
00MLW001SS002S20	8/30/00					0.1		5	0.25
00MLW001SS002S31-8	8/30/00	0.5			0.25	0.1	2.5	5	0.25
00MLW001SS003S06	8/30/00	0.5		0.25			2.5	5	0.52
00MLW001SS003S08	8/30/00	0.5				0.1	2.5	5	0.25
00MLW001SS003S12	8/16/00	0.74				0.1		12	0.25
00MLW001SS003S17	10/12/00					0.1		5	
00MLW001SS003S18	8/17/00	0.5		0.25				5.5 UJ	0.25
00MLW001SS003S20	8/30/00	0.5				0.1	2.5 UJ	5	0.25
00MLW001SS003S31-8	8/30/00	0.5	0.25 UJ	0.25		0.1	2.5	5	0.25
00MLW001SS004S06	8/30/00	0.5				0.1	2.5 UJ	5	
00MLW001SS004S08	8/30/00	0.5					2.5 UJ	5	
00MLW001SS004S17	10/12/00	0.5			0.25	0.1	2.5 UJ	5	
00MLW001SS004S20	8/30/00					0.1	2.5 UJ	5	0.25
00MLW001SS004S22	8/31/00	0.5		0.25		0.1	2.5 UJ	5	0.25
00MLW001SS004S31-8	8/30/00	0.5				0.1	2.5 UJ	5	0.25
00MLW001SS004S35	8/31/00	0.5		0.25		0.1	2.5 UJ	5	0.25
00MLW001SS005S06	8/30/00	0.5		0.25		0.1	2.5 UJ	5	0.25
00MLW001SS005S08	8/30/00	0.5						5	0.25
00MLW001SS005S20	8/30/00					0.1		5	0.25
00MLW001SS005S22	8/31/00	0.5		0.25			2.5 UJ	5	0.25
00MLW001SS005S31-8	8/30/00	0.5				0.1	2.5 UJ	5	0.25
00MLW001SS005S35	8/31/00	0.5				0.1	2.5 UJ	5	0.25
00MLW001SS006S06	8/30/00	0.5				0.1	2.5 UJ	5	0.25
00MLW001SS006S08	8/30/00	0.5					2.5 UJ	5	0.25
00MLW001SS006S20	8/30/00	0.5				0.1		5	0.25
00MLW001SS006S22	8/31/00	0.5		0.25			2.5 UJ	5	0.25

TABLE 4-15

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - METALS
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND
(Page 2 of 2)

		AG	AS	BE	CD	HG	SB	SE	TL
Residential PRG (mg/kg)		390	22	150	37	23	31	390	5.2
Industrial PRG		5100	260	1900	450	307	410	5100	67
00MLW001SS006S31-8	8/30/00						2.5 UJ	5	0.25
00MLW001SS006S35	8/31/00	0.72		0.25	0.48	0.1	2.5 UJ	12	0.25
00MLW001SS007S06	8/30/00					0.1		5.4	0.27
00MLW001SS007S08	8/30/00	0.5			0.25	0.1	2.5 UJ	5	0.25
00MLW001SS007S20	8/30/00						2.5 UJ	5	0.25
00MLW001SS007S31-8	8/30/00	0.5		0.25		0.1	2.5 UJ	5	0.25
00MLW001SS008S06	8/30/00	0.5				0.1	2.5 UJ	5	0.25
00MLW001SS008S08	8/30/00	0.5				0.1	2.5 UJ	5	0.25
00MLW001SS008S20	8/30/00							5	0.25
00MLW001SS008S31-8	8/30/00	0.5				0.1	2.5 UJ	5	0.25
00MLW001SS7C	3/22/00	0.3				0.04	0.2	1	0.2
00MLW002SOUST	3/21/00	0.3				0.05	0.2	1	0 2
00MLW002SS8C	3/22/00	0.4		0.1		0.05	0.2	1	0.2
00MLW003SOUST	3/21/00	0.3				0.05	0.2	1	0 2
00MLW003SS8C	3/22/00	0.3					0.2	1	0.2
00MLW004SOUST	3/21/00	0.3				0.04	0.2	1	0 2
00MLW004SS11C	3/22/00	0.3					0.2	1	0.2
00MLW201SS001S12	8/16/00					0.1		5.1 UJ	0.25
00MLW201SS003S18	8/17/00	0.5						5.3 UJ	0.25
00MLW201SS004S06	8/30/00	0.5		0.25		0.1	2.5 UJ	5	0 5
00MLW201SS004S17	10/12/00				0.25	0.1	2.5	5	
00MLW201SS006S22	8/31/00	0.5		0.25			2.5 UJ	5	0.25
00MLW201SS006S31-8	8/30/00						2.5 UJ	5	0.25
00MLW201SS007S08	8/30/00	0.5			0.25	0.1	2.5 UJ	5	0.25
01MLW001SS001S19	1/16/01	0.5		0.25	0.25	0.1	2.5	5	0.25
01MLW001SS002S19	1/16/01	0.5		0.25		0.1	2.5	5 UJ	0.25
01MLW001SS003S19	1/16/01	0.5		0.25		0.1		5	0.25
01MLW001SS004S19	1/18/01	0.5		0.25	0.25	0.1	2.5	5	0.25
01MLW001SS005S19	1/18/01	0.5		0.25	0.25	0.1	2.5	5	0.25
01MLW001SS006S19	1/18/01	0.5		0.25	0.25	0.1	2.5	5	0.25
01MLW001SS007S19	1/18/01	0.5			0.25	0.1		5 UJ	0.25
01MLW001SS008S19	1/18/01	0.5		0.25		0.1	2.5	5	0.25
01MLW201SS003S19	1/16/01	0.5		0.25		0.1	2.5	5	0.25
01MLW202SS007S19	1/18/01	0.5			0.25	0.1	2.5	5	0.25

Units are mg/kg
UJ - The practical quantitation limit is an estimated limit.

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Acetone	Bromodichloromethane	Bromoform	Bromomethane	n-Buty benzene	sec-Butylbenzene	tert-Buty benzene	Benzene	Toluene	Carbon disulfide	Carbon disulfide
Washington MCL[1]		**-**	**300**	**5,000**	**-**	**-**	**-**	**-**	**1000**	**-**	**-**	**-**
Federal MCL[2]		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**5**	**1000**	**-**	**-**
MTCA[3]		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**5000**	**40,000**	**-**	**-**
Tap Water PRG[4]		**610,000**	**180**	**8,500**	**8700**	**240,000**	**240,000**	**240,000**	**340**	**720,000**	**1,000,000**	**1,000,000**
00MLW001WG91AW05	3/7/2000	10	1	1	1	1	1	1	1	1	-	10
00MLW001WG91AW10	3/13/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WG91AW13	3/8/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WG91AW14	3/8/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WG91AW15	3/8/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WG91AW16	3/7/2000	10	1	1	1	1	-	1	1	1	-	10
00MLW001WG91AW17	3/9/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WG91AW18	3/9/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WG91AW19	3/13/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WG91BW02	3/7/2000	10	1	1	1	1	1	1	1	1	-	10
00MLW001WG91BW03	3/17/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WG91BW04	3/13/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WG92BW02	3/17/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WG99AW01	3/14/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WG99AW02	3/16/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WG99AW03	3/10/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WG99AW05	3/9/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WG99AW06	3/13/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WG99AW07	3/15/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WG99AW08	3/15/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WG99AW09	3/10/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WG99AW10	3/14/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WG99BW01	3/14/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WG99BW04	3/16/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WG99BW05	3/20/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WG99BW06	3/16/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WG99BW08	3/16/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WG99BW09	3/10/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WG99BW10	3/10/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WG99BW11	3/14/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WG99BW12	3/9/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WG99BW13	3/13/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WG99BW16	3/8/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WG99BW17	3/20/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WG99BW18	3/10/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WP02	6/6/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WP05	6/6/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WP06	6/7/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WP07	6/7/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WP08	6/7/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WP09	6/7/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WP11	6/22/2000	10	1	1	1	1	1	1	1	1	10	-

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Acetone	Bromodichloromethane	Bromoform	Bromomethane	n-Buty benzene	sec-Butylbenzene	tert-Buty benzene	Benzene	Toluene	Carbon disulfide	Carbon disulfide
Washington MCL[1]		**-**	**300**	**5,000**	**-**	**-**	**-**	**-**	**1000**	**-**	**-**	**-**
Federal MCL[2]		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**5**	**1000**	**-**	**-**
MTCA[3]		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**5000**	**40,000**	**-**	**-**
Tap Water PRG[4]		**610,000**	**180**	**8,500**	**8700**	**240,000**	**240,000**	**240,000**	**340**	**720,000**	**1,000,000**	**1,000,000**
00MLW001WP12	6/22/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WP13E	6/6/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WP13W	6/6/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WP14	6/23/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WP15W	6/23/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WP16	6/23/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WP17	6/23/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WP18N	6/23/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WP18S	6/23/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WP19	6/26/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WP20	6/26/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WP70	6/22/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WP71	6/22/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WP82	6/7/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WP83	6/7/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW001WP86	6/6/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG91AW01	6/19/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG91AW02	6/19/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG91AW03	6/19/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG91AW05	6/8/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG91AW09	6/16/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG91AW10	6/8/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG91AW13	6/13/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG91AW14	6/15/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG91AW15	6/13/2000	10	1	1	1	-	-	1	1	1	10	-
00MLW002WG91AW16	6/21/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG91AW17	6/12/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG91AW18	6/12/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG91AW19	6/14/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG91BW01	6/19/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG91BW02	6/8/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG91BW03	6/16/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG91BW04	6/8/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG92BW01	6/20/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG92BW02	6/20/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG99AW01	6/16/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG99AW02	6/13/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG99AW03	6/14/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG99AW04	6/20/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG99AW05	6/12/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG99AW06	6/14/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG99AW07	6/15/2000	10	1	1	1	1	1	1	1	1	10	-

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Acetone	Bromodichloromethane	Bromoform	Bromomethane	n-Buty benzene	sec-Butylbenzene	tert-Buty benzene	Benzene	Toluene	Carbon disulfide	Carbon disulfide
Washington MCL[1]		**-**	**300**	**5,000**	**-**	**-**	**-**	**-**	**1000**	**-**	**-**	**-**
Federal MCL[2]		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**5**	**1000**	**-**	**-**
MTCA[3]		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**5000**	**40,000**	**-**	**-**
Tap Water PRG[4]		**610,000**	**180**	**8,500**	**8700**	**240,000**	**240,000**	**240,000**	**340**	**720,000**	**1,000,000**	**1,000,000**
00MLW002WG99AW08	6/15/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG99AW09	6/13/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG99AW10	6/19/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG99BW01	6/16/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG99BW05	6/21/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG99BW09	6/13/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG99BW10	6/14/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG99BW11	6/20/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG99BW12	6/12/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG99BW13	6/14/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG99BW14	6/16/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG99BW15	6/15/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG99BW16	6/21/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WG99BW18	6/13/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WGBML04	6/21/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WP15E	9/18/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WP23	8/17/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WP25E	8/17/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WP25W	8/17/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WP26	8/30/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW002WP29	8/30/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG00AW03	9/25/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG00AW10	10/12/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG00AW11	10/9/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG00AW12	9/19/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG00AW13	10/30/2000	10	1	1	1	1	1	1	1	-	10	-
00MLW003WG00AW14	10/30/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG00BW01	10/6/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG00BW02	10/9/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG00BW03	9/25/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG00BW04	9/19/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG00BW05	9/18/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG00BW06	10/6/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG00BW07	9/19/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG00BW08	9/25/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG00BW09	9/18/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG00BW10	10/12/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG00BW11	10/6/2000	10	1	1	1	1	-	1	1	1	10	-
00MLW003WG00BW12	10/5/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG00BW13	10/5/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG00BW14	10/6/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG00BW15	9/19/2000	10	1	1	1	1	1	1	1	1	10	-

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Acetone	Bromodichloromethane	Bromoform	Bromomethane	n-Buty benzene	sec-Butylbenzene	tert-Buty benzene	Benzene	Toluene	Carbon disulfide	Carbon disulfide
Washington MCL[1]		**-**	**300**	**5,000**	**-**	**-**	**-**	**-**	**1000**	**-**	**-**	**-**
Federal MCL[2]		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**5**	**1000**	**-**	**-**
MTCA[3]		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**5000**	**40,000**	**-**	**-**
Tap Water PRG[4]		**610,000**	**180**	**8,500**	**8700**	**240,000**	**240,000**	**240,000**	**340**	**720,000**	**1,000,000**	**1,000,000**
00MLW003WG00BW16	10/30/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG91AW01	9/28/2000	-	1	1	1	1	1	1	1	1	10	-
00MLW003WG91AW02	9/28/2000	-	1	1	1	1	1	1	1	1	10	-
00MLW003WG91AW03	9/28/2000	-	1	1	1	1	1	1	1	1	10	-
00MLW003WG91AW05	9/20/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG91AW09	9/21/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG91AW10	9/20/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG91AW13	9/21/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG91AW14	9/21/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG91AW15	9/21/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG91AW16	10/5/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG91AW17	9/22/2000	-	1	1	1	1	1	1	1	1	10	-
00MLW003WG91AW18	9/22/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG91AW19	10/5/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG91BW01	9/28/2000	-	1	1	1	1	1	1	1	1	10	-
00MLW003WG91BW02	9/20/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG91BW03	9/26/2000	-	1	1	1	1	1	1	1	1	10	-
00MLW003WG91BW04	9/20/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG92BW01	9/27/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG92BW02	9/27/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG99AW01	9/20/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG99AW02	9/26/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG99AW03	9/26/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG99AW04	9/27/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG99AW05	9/22/2000	-	1	1	1	1	1	1	1	1	10	-
00MLW003WG99AW06	10/3/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG99AW07	10/4/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG99AW08	10/4/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG99AW09	10/3/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG99AW10	10/4/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG99BW01	9/22/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG99BW05	10/9/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG99BW09	9/26/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG99BW10	9/26/2000	-	1	1	1	1	-	1	1	1	10	-
00MLW003WG99BW11	9/27/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG99BW12	9/22/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG99BW13	10/12/2000	10	1	1	1	1	-	1	1	1	10	-
00MLW003WG99BW14	10/4/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG99BW15	10/4/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG99BW16	9/21/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WG99BW18	10/3/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WGBML04	10/9/2000	10	1	1	1	1	1	1	1	1	10	-

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Acetone	Bromodichloromethane	Bromoform	Bromomethane	n-Buty benzene	sec-Butylbenzene	tert-Buty benzene	Benzene	Toluene	Carbon disulfide	Carbon disulfide
Washington MCL[1]		**-**	**300**	**5,000**	**-**	**-**	**-**	**-**	**1000**	**-**	**-**	**-**
Federal MCL[2]		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**5**	**1000**	**-**	**-**
MTCA[3]		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**5000**	**40,000**	**-**	**-**
Tap Water PRG[4]		**610,000**	**180**	**8,500**	**8700**	**240,000**	**240,000**	**240,000**	**340**	**720,000**	**1,000,000**	**1,000,000**
00MLW003WGMW02	9/6/2000	10	1	1	1	1	1	1	1	1	10	-
00MLW003WGMW04	9/6/2000	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG00AW03	2/2/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG00AW11	1/31/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG00AW12	1/31/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG00AW13	2/5/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG00AW14	1/23/2001	-	1	1	1	1	1	1	1	1	10	-
01MLW001WG00BW01	1/29/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG00BW02	1/30/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG00BW03	1/30/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG00BW04	1/29/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG00BW05	1/29/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG00BW06	1/25/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG00BW07	1/29/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG00BW08	1/19/2001	-	1	1	1	1	1	1	1	1	10	-
01MLW001WG00BW09	1/25/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG00BW10	2/5/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG00BW11	1/17/2001	10	1	1	1	1	-	1	1	1	10	-
01MLW001WG00BW12	1/30/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG00BW13	1/23/2001	-	1	1	1	1	1	1	1	1	10	-
01MLW001WG00BW14	1/29/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG00BW15	1/31/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG00BW16	2/1/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG91AW01	1/24/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG91AW02	1/24/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG91AW03	1/24/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG91AW05	1/19/2001	-	1	1	1	1	1	1	1	1	10	-
01MLW001WG91AW09	1/22/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG91AW10	1/23/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG91AW13	1/25/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG91AW14	1/19/2001	-	1	1	1	1	1	1	1	1	10	-
01MLW001WG91AW15	1/18/2001	10	1	1	1	1	-	1	1	1	10	-
01MLW001WG91AW16	1/30/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG91AW17	1/26/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG91AW18	1/26/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG91AW19	1/23/2001	-	1	1	1	1	1	1	1	1	10	-
01MLW001WG91BW01	1/24/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG91BW02	1/19/2001	-	1	1	1	1	1	1	1	1	10	-
01MLW001WG91BW03	2/2/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG91BW04	1/23/2001	-	1	1	1	1	1	1	1	1	10	-
01MLW001WG92BW01	1/31/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG92BW02	1/31/2001	10	1	1	1	1	1	1	1	1	10	-

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Acetone	Bromodichloromethane	Bromoform	Bromomethane	n-Buty benzene	sec-Butylbenzene	tert-Buty benzene	Benzene	Toluene	Carbon disulfide	Carbon disulfide
Washington MCL[1]		**-**	**300**	**5,000**	**-**	**-**	**-**	**-**	**1000**	**-**	**-**	**-**
Federal MCL[2]		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**5**	**1000**	**-**	**-**
MTCA[3]		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**5000**	**40,000**	**-**	**-**
Tap Water PRG[4]		**610,000**	**180**	**8,500**	**8700**	**240,000**	**240,000**	**240,000**	**340**	**720,000**	**1,000,000**	**1,000,000**
01MLW001WG99AW01	1/24/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG99AW02	2/1/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG99AW03	2/1/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG99AW04	2/5/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG99AW05	1/26/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG99AW06	1/22/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG99AW07	1/18/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG99AW08	1/18/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG99AW09	1/22/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG99AW10	1/24/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG99BW01	1/25/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG99BW05	1/25/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG99BW09	2/1/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG99BW10	2/1/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG99BW11	2/5/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG99BW12	1/26/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG99BW13	1/22/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG99BW14	1/18/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG99BW15	1/18/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WG99BW16	1/19/2001	-	1	1	1	1	1	1	1	1	10	-
01MLW001WG99BW18	1/22/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WP30	1/30/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WP31	1/31/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW001WP33	1/31/2001	10	1	1	1	1	1	1	1	1	10	-
01MLW002WG01BW01	5/31/2001	10	1	1	1	1	1	1	1	1	10	-
99MLW001WG91AW05	11/10/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG91AW09	11/12/1999	10	1	1	1	1	1	1	1	-	10	10
99MLW001WG91AW10	11/12/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG91AW13	11/11/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG91AW14	11/19/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG91AW15	11/10/1999	10	1	1	1	-	-	1	1	1	10	10
99MLW001WG91AW16	11/10/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG91AW17	11/12/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG91AW18	11/11/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG91AW19	11/11/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG91BW02	11/10/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG91BW03	11/12/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG91BW04	11/12/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG92BW01	11/17/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG92BW02	11/16/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG99AW01	11/12/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG99AW02	11/15/1999	10	1	1	1	1	1	1	1	1	10	10

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Acetone	Bromodichloromethane	Bromoform	Bromomethane	n-Buty benzene	sec-Butylbenzene	tert-Buty benzene	Benzene	Toluene	Carbon disulfide	Carbon disulfide
Washington MCL[1]		**-**	**300**	**5,000**	**-**	**-**	**-**	**-**	**1000**	**-**	**-**	**-**
Federal MCL[2]		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**5**	**1000**	**-**	**-**
MTCA[3]		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**5000**	**40,000**	**-**	**-**
Tap Water PRG[4]		**610,000**	**180**	**8,500**	**8700**	**240,000**	**240,000**	**240,000**	**340**	**720,000**	**1,000,000**	**1,000,000**
99MLW001WG99AW03	11/15/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG99AW04	11/17/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG99AW05	11/17/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG99AW06	11/16/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG99AW07	11/18/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG99AW08	11/18/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG99AW09	11/16/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG99BW01	11/11/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG99BW02	11/19/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG99BW04	11/9/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG99BW05	11/9/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG99BW06	11/18/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG99BW08	11/15/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG99BW09	11/15/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG99BW10	11/15/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG99BW11	11/17/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG99BW12	11/17/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG99BW13	11/16/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG99BW14	11/18/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG99BW15	11/18/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG99BW16	11/19/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG99BW17	11/9/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WG99BW18	11/16/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WGBML04	11/9/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WP13(1)	7/26/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WP86	11/19/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW001WS01	11/22/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW002WP13	7/26/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW003WP44(1)	7/26/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW004WP21	7/26/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW005WP60	7/26/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW006WP61	7/26/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW007WP42	7/26/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW008WP42	7/26/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW009WP22	7/27/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW010WP46	7/27/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW011WP63	7/27/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW012WP64	7/27/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW013WP04	7/27/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW014WP44	7/27/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW014WP65	7/28/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW015WP66	7/28/1999	10	1	1	1	1	1	1	1	1	10	10

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Acetone	Bromodichloromethane	Bromoform	Bromomethane	n-Buty benzene	sec-Butylbenzene	tert-Buty benzene	Benzene	Toluene	Carbon disulfide	Carbon disulfide
Washington MCL[1]		**-**	**300**	**5,000**	**-**	**-**	**-**	**-**	**1000**	**-**	**-**	**-**
Federal MCL[2]		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**5**	**1000**	**-**	**-**
MTCA[3]		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**5000**	**40,000**	**-**	**-**
Tap Water PRG[4]		**610,000**	**180**	**8,500**	**8700**	**240,000**	**240,000**	**240,000**	**340**	**720,000**	**1,000,000**	**1,000,000**
99MLW016WP67	7/28/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW017WP68	7/28/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW018WP69	7/28/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW019WP70	7/28/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW020WP71	7/28/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW021WP10	7/28/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW022WP03	7/28/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW023WP01	7/29/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW024WP72	7/29/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW025WP73	7/29/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW026WP74	7/29/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW027WP27	7/29/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW028WP28	7/29/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW029WP24	7/29/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW030WP75	7/29/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW031WP76	7/29/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW032WP32	7/29/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW033WP77	7/29/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW034WP41	7/30/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW035WP78	7/30/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW036WP79	7/30/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW037WP80	7/30/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW038WP81	7/30/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW039WP50	7/30/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW040WP82	7/30/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW041WP83	7/30/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW042WP84	7/30/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW047WP38	7/31/1999	10	1	1	1	1	1	1	1	1	10	10
99MLW048WP85	7/31/1999	10	1	1	1	1	1	1	1	1	10	10

units are Micrograms per liter (µg/l)
Bold text indicates an exceedence of a regulatory level

[1] Source: Washington State Maximum Contaminant Levels, WAC 173-200
[2] Source: National Drinking Water Regulations Maximum Contaminant Levels (EPA 816-F-02-013 July 2002)
[3] Source: Washington State Model Toxics Control Act (MTCA) Method A Groundwater Cleanup Levels (WAC 173-340-900)
[4] Source: USEPA Region 9 Preliminary Remediation Goals (PRGs) 2002 (USEPA, 2002)

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Chlorobenzene	Chlorobenzene	2-Chlorotoluene	Chloroethane	Chloromethane	Carbon tetrachloride		Dibromchloromethane	Dibromochloropropane
Washington MCL[1]		**-**	**-**	**-**	**-**	**-**	**300**		**500**	**-**
Federal MCL[2]		**100**	**100**	**-**	**-**	**-**	**5**		**-**	**0.2**
MTCA[3]		**-**	**-**	**-**	**-**	**-**	**-**		**-**	**-**
Tap Water PRG[4]		**110,000**	**110,000**	**120,000**	**4,600**	**1,500**	**170**		**130**	**48**
00MLW001WG91AW05	3/7/2000	10	1	1	1	5	-	-	2	**3**
00MLW001WG91AW10	3/13/2000	10	1	1	1	5	1	-	1	**3**
00MLW001WG91AW13	3/8/2000	10	1	1	1	5	1	-	1	**3**
00MLW001WG91AW14	3/8/2000	10	1	1	1	5	1	-	1	**3**
00MLW001WG91AW15	3/8/2000	10	1	1	1	5	1	-	1	**3**
00MLW001WG91AW16	3/7/2000	10	1	1	1	5	-	-	2	**3**
00MLW001WG91AW17	3/9/2000	10	1	1	1	5	1	-	1	**3**
00MLW001WG91AW18	3/9/2000	10	1	1	1	5	1	-	1	**3**
00MLW001WG91AW19	3/13/2000	10	1	1	1	5	1	-	1	**3**
00MLW001WG91BW02	3/7/2000	10	1	1	1	5	-	-	2	**3**
00MLW001WG91BW03	3/17/2000	10	1	1	1	5	1	-	1	**3**
00MLW001WG91BW04	3/13/2000	10	1	1	1	5	1	-	1	**3**
00MLW001WG92BW02	3/17/2000	10	1	1	1	5	1	-	1	**3**
00MLW001WG99AW01	3/14/2000	10	1	1	1	5	1	-	1	**3**
00MLW001WG99AW02	3/16/2000	10	1	1	1	5	1	-	1	**3**
00MLW001WG99AW03	3/10/2000	10	1	1	1	5	1	-	1	**3**
00MLW001WG99AW05	3/9/2000	10	1	1	1	5	1	-	1	**3**
00MLW001WG99AW06	3/13/2000	10	1	1	1	5	1	-	1	**3**
00MLW001WG99AW07	3/15/2000	10	1	1	1	5	1	-	1	**3**
00MLW001WG99AW08	3/15/2000	10	1	1	1	5	1	-	1	**3**
00MLW001WG99AW09	3/10/2000	10	1	1	1	5	1	-	1	**3**
00MLW001WG99AW10	3/14/2000	10	1	1	1	5	1	-	1	**3**
00MLW001WG99BW01	3/14/2000	10	1	1	1	5	1	-	1	**3**
00MLW001WG99BW04	3/16/2000	10	1	1	1	5	1	-	1	**3**
00MLW001WG99BW05	3/20/2000	10	1	1	1	5	1	-	1	**3**
00MLW001WG99BW06	3/16/2000	10	1	1	1	5	1	-	1	**3**
00MLW001WG99BW08	3/16/2000	10	1	1	1	5	1	-	1	**3**
00MLW001WG99BW09	3/10/2000	10	1	1	1	5	1	-	1	**3**
00MLW001WG99BW10	3/10/2000	10	1	1	1	5	1	-	1	**3**
00MLW001WG99BW11	3/14/2000	10	1	1	1	5	1	-	1	**3**
00MLW001WG99BW12	3/9/2000	10	1	1	1	5	1	-	1	**3**
00MLW001WG99BW13	3/13/2000	10	1	1	1	5	1	-	1	**3**
00MLW001WG99BW16	3/8/2000	10	1	1	1	5	1	-	1	**3**
00MLW001WG99BW17	3/20/2000	10	1	1	1	5	1	-	1	**3**
00MLW001WG99BW18	3/10/2000	10	1	1	1	5	1	-	1	**3**
00MLW001WP02	6/6/2000	-	1	1	1	5	1	-	2	**3**
00MLW001WP05	6/6/2000	-	1	1	1	5	1	-	2	**3**
00MLW001WP06	6/7/2000	-	1	1	1	5	1	-	2	**3**
00MLW001WP07	6/7/2000	-	1	1	1	5	1	-	2	**3**
00MLW001WP08	6/7/2000	-	1	1	1	5	1	-	2	**3**
00MLW001WP09	6/7/2000	-	1	1	1	5	1	-	2	**3**
00MLW001WP11	6/22/2000	-	1	1	1	5	1	-	2	**3**

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Chlorobenzene	Chlorobenzene	2-Chlorotoluene	Chloroethane	Chloromethane	Carbon tetrachloride		Dibromchloromethane	Dibromochloropropane
Washington MCL[1]		**-**	**-**	**-**	**-**	**-**	**300**		**500**	**-**
Federal MCL[2]		**100**	**100**	**-**	**-**	**-**	**5**		**-**	**0.2**
MTCA[3]		**-**	**-**	**-**	**-**	**-**	**-**		**-**	**-**
Tap Water PRG[4]		**110,000**	**110,000**	**120,000**	**4,600**	**1,500**	**170**		**130**	**48**
00MLW001WP12	6/22/2000	-	1	1	1	5	1	-	2	**3**
00MLW001WP13E	6/6/2000	-	1	1	1	5	1	-	2	**3**
00MLW001WP13W	6/6/2000	-	1	1	1	5	1	-	2	**3**
00MLW001WP14	6/23/2000	-	1	1	1	5	1	-	2	**3**
00MLW001WP15W	6/23/2000	-	1	1	1	5	1	-	2	**3**
00MLW001WP16	6/23/2000	-	1	1	1	5	1	-	2	**3**
00MLW001WP17	6/23/2000	-	1	1	1	5	1	-	2	**3**
00MLW001WP18N	6/23/2000	-	1	1	1	5	1	-	2	**3**
00MLW001WP18S	6/23/2000	-	1	1	1	5	1	-	2	**3**
00MLW001WP19	6/26/2000	-	1	1	1	5	1	-	2	**3**
00MLW001WP20	6/26/2000	-	1	1	1	5	1	-	2	**3**
00MLW001WP70	6/22/2000	-	1	1	1	5	1	-	2	**3**
00MLW001WP71	6/22/2000	-	1	1	1	5	1	-	2	**3**
00MLW001WP82	6/7/2000	-	1	1	1	5	1	-	2	**3**
00MLW001WP83	6/7/2000	-	1	1	1	5	1	-	2	**3**
00MLW001WP86	6/6/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG91AW01	6/19/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG91AW02	6/19/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG91AW03	6/19/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG91AW05	6/8/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG91AW09	6/16/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG91AW10	6/8/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG91AW13	6/13/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG91AW14	6/15/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG91AW15	6/13/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG91AW16	6/21/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG91AW17	6/12/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG91AW18	6/12/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG91AW19	6/14/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG91BW01	6/19/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG91BW02	6/8/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG91BW03	6/16/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG91BW04	6/8/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG92BW01	6/20/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG92BW02	6/20/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG99AW01	6/16/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG99AW02	6/13/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG99AW03	6/14/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG99AW04	6/20/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG99AW05	6/12/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG99AW06	6/14/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG99AW07	6/15/2000	-	1	1	1	5	1	-	2	**3**

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Chlorobenzene	Chlorobenzene	2-Chlorotoluene	Chloroethane	Chloromethane	Carbon tetrachloride		Dibromchloromethane	Dibromochloropropane
Washington MCL[1]		**-**	**-**	**-**	**-**	**-**	**300**		**500**	**-**
Federal MCL[2]		**100**	**100**	**-**	**-**	**-**	**5**		**-**	**0.2**
MTCA[3]		**-**	**-**	**-**	**-**	**-**	**-**		**-**	**-**
Tap Water PRG[4]		**110,000**	**110,000**	**120,000**	**4,600**	**1,500**	**170**		**130**	**48**
00MLW002WG99AW08	6/15/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG99AW09	6/13/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG99AW10	6/19/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG99BW01	6/16/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG99BW05	6/21/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG99BW09	6/13/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG99BW10	6/14/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG99BW11	6/20/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG99BW12	6/12/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG99BW13	6/14/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG99BW14	6/16/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG99BW15	6/15/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG99BW16	6/21/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WG99BW18	6/13/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WGBML04	6/21/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WP15E	9/18/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WP23	8/17/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WP25E	8/17/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WP25W	8/17/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WP26	8/30/2000	-	1	1	1	5	1	-	2	**3**
00MLW002WP29	8/30/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG00AW03	9/25/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG00AW10	10/12/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG00AW11	10/9/2000	-	1	1	1	5	-	-	2	**3**
00MLW003WG00AW12	9/19/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG00AW13	10/30/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG00AW14	10/30/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG00BW01	10/6/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG00BW02	10/9/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG00BW03	9/25/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG00BW04	9/19/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG00BW05	9/18/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG00BW06	10/6/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG00BW07	9/19/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG00BW08	9/25/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG00BW09	9/18/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG00BW10	10/12/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG00BW11	10/6/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG00BW12	10/5/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG00BW13	10/5/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG00BW14	10/6/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG00BW15	9/19/2000	-	1	1	1	5	1	-	2	**3**

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Chlorobenzene	Chlorobenzene	2-Chlorotoluene	Chloroethane	Chloromethane	Carbon tetrachloride		Dibromchloromethane	Dibromochloropropane
Washington MCL[1]		**-**	**-**	**-**	**-**	**-**	**300**		**500**	**-**
Federal MCL[2]		**100**	**100**	**-**	**-**	**-**	**5**		**-**	**0.2**
MTCA[3]		**-**	**-**	**-**	**-**	**-**	**-**		**-**	**-**
Tap Water PRG[4]		**110,000**	**110,000**	**120,000**	**4,600**	**1,500**	**170**		**130**	**48**
00MLW003WG00BW16	10/30/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG91AW01	9/28/2000	-	1	1	1	5	1	-	2	-
00MLW003WG91AW02	9/28/2000	-	1	1	1	5	1	-	2	-
00MLW003WG91AW03	9/28/2000	-	1	1	1	5	1	-	2	-
00MLW003WG91AW05	9/20/2000	-	1	1	1	5	1	1	2	**3**
00MLW003WG91AW09	9/21/2000	-	1	1	1	5	1	1	2	**3**
00MLW003WG91AW10	9/20/2000	-	1	1	1	5	1	1	2	**3**
00MLW003WG91AW13	9/21/2000	-	1	1	1	5	1	1	2	**3**
00MLW003WG91AW14	9/21/2000	-	1	1	1	5	1	1	2	**3**
00MLW003WG91AW15	9/21/2000	-	1	1	1	5	1	1	2	**3**
00MLW003WG91AW16	10/5/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG91AW17	9/22/2000	-	1	1	1	5	1	-	2	-
00MLW003WG91AW18	9/22/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG91AW19	10/5/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG91BW01	9/28/2000	-	1	1	1	5	1	-	2	-
00MLW003WG91BW02	9/20/2000	-	1	1	1	5	1	1	2	**3**
00MLW003WG91BW03	9/26/2000	-	1	1	1	5	1	1	2	**3**
00MLW003WG91BW04	9/20/2000	-	1	1	1	5	1	1	2	**3**
00MLW003WG92BW01	9/27/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG92BW02	9/27/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG99AW01	9/20/2000	-	1	1	1	5	1	1	2	**3**
00MLW003WG99AW02	9/26/2000	-	1	1	1	5	1	1	2	**3**
00MLW003WG99AW03	9/26/2000	-	1	1	1	5	1	1	2	**3**
00MLW003WG99AW04	9/27/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG99AW05	9/22/2000	-	1	1	1	5	1	-	2	-
00MLW003WG99AW06	10/3/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG99AW07	10/4/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG99AW08	10/4/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG99AW09	10/3/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG99AW10	10/4/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG99BW01	9/22/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG99BW05	10/9/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG99BW09	9/26/2000	-	1	1	1	5	1	1	2	**3**
00MLW003WG99BW10	9/26/2000	-	1	1	1	5	1	1	2	**3**
00MLW003WG99BW11	9/27/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG99BW12	9/22/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG99BW13	10/12/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG99BW14	10/4/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG99BW15	10/4/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WG99BW16	9/21/2000	-	1	1	1	5	1	1	2	**3**
00MLW003WG99BW18	10/3/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WGBML04	10/9/2000	-	1	1	1	5	1	-	2	**3**

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Chlorobenzene	Chlorobenzene	2-Chlorotoluene	Chloroethane	Chloromethane	Carbon tetrachloride		Dibromchloromethane	Dibromochloropropane
Washington MCL[1]		**-**	**-**	**-**	**-**	**-**	**300**		**500**	**-**
Federal MCL[2]		**100**	**100**	**-**	**-**	**-**	**5**		**-**	**0.2**
MTCA[3]		**-**	**-**	**-**	**-**	**-**	**-**		**-**	**-**
Tap Water PRG[4]		**110,000**	**110,000**	**120,000**	**4,600**	**1,500**	**170**		**130**	**48**
00MLW003WGMW02	9/6/2000	-	1	1	1	5	1	-	2	**3**
00MLW003WGMW04	9/6/2000	-	1	1	1	5	1	-	2	**3**
01MLW001WG00AW03	2/2/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG00AW11	1/31/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG00AW12	1/31/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG00AW13	2/5/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG00AW14	1/23/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG00BW01	1/29/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG00BW02	1/30/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG00BW03	1/30/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG00BW04	1/29/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG00BW05	1/29/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG00BW06	1/25/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG00BW07	1/29/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG00BW08	1/19/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG00BW09	1/25/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG00BW10	2/5/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG00BW11	1/17/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG00BW12	1/30/2001	-	1	1	1	5	1	-	2	**-**
01MLW001WG00BW13	1/23/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG00BW14	1/29/2001	-	1	1	1	5	1	-	2	**-**
01MLW001WG00BW15	1/31/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG00BW16	2/1/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG91AW01	1/24/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG91AW02	1/24/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG91AW03	1/24/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG91AW05	1/19/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG91AW09	1/22/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG91AW10	1/23/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG91AW13	1/25/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG91AW14	1/19/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG91AW15	1/18/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG91AW16	1/30/2001	-	1	1	1	5	1	-	2	**-**
01MLW001WG91AW17	1/26/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG91AW18	1/26/2001	-	1	1	1	5	1	-	2	**-**
01MLW001WG91AW19	1/23/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG91BW01	1/24/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG91BW02	1/19/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG91BW03	2/2/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG91BW04	1/23/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG92BW01	1/31/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG92BW02	1/31/2001	-	1	1	1	5	1	-	2	**3**

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Chlorobenzene	Chlorobenzene	2-Chlorotoluene	Chloroethane	Chloromethane	Carbon tetrachloride		Dibromchloromethane	Dibromochloropropane
Washington MCL[1]		**-**	**-**	**-**	**-**	**-**	**300**		**500**	**-**
Federal MCL[2]		**100**	**100**	**-**	**-**	**-**	**5**		**-**	**0.2**
MTCA[3]		**-**	**-**	**-**	**-**	**-**	**-**		**-**	**-**
Tap Water PRG[4]		**110,000**	**110,000**	**120,000**	**4,600**	**1,500**	**170**		**130**	**48**
01MLW001WG99AW01	1/24/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG99AW02	2/1/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG99AW03	2/1/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG99AW04	2/5/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG99AW05	1/26/2001	-	1	1	1	5	1	-	2	**-**
01MLW001WG99AW06	1/22/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG99AW07	1/18/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG99AW08	1/18/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG99AW09	1/22/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG99AW10	1/24/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG99BW01	1/25/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG99BW05	1/25/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG99BW09	2/1/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG99BW10	2/1/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG99BW11	2/5/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG99BW12	1/26/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG99BW13	1/22/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG99BW14	1/18/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG99BW15	1/18/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG99BW16	1/19/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WG99BW18	1/22/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WP30	1/30/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WP31	1/31/2001	-	1	1	1	5	1	-	2	**3**
01MLW001WP33	1/31/2001	-	1	1	1	5	1	-	2	**3**
01MLW002WG01BW01	5/31/2001	-	1	1	1	5	1	1	2	**3**
99MLW001WG91AW05	11/10/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG91AW09	11/12/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG91AW10	11/12/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG91AW13	11/11/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG91AW14	11/19/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG91AW15	11/10/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG91AW16	11/10/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG91AW17	11/12/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG91AW18	11/11/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG91AW19	11/11/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG91BW02	11/10/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG91BW03	11/12/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG91BW04	11/12/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG92BW01	11/17/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG92BW02	11/16/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG99AW01	11/12/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG99AW02	11/15/1999	-	1	1	1	5	1	-	2	**3**

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Chlorobenzene	Chlorobenzene	2-Chlorotoluene	Chloroethane	Chloromethane	Carbon tetrachloride		Dibromchloromethane	Dibromochloropropane
Washington MCL[1]		**-**	**-**	**-**	**-**	**-**	**300**		**500**	**-**
Federal MCL[2]		**100**	**100**	**-**	**-**	**-**	**5**		**-**	**0.2**
MTCA[3]		**-**	**-**	**-**	**-**	**-**	**-**		**-**	**-**
Tap Water PRG[4]		**110,000**	**110,000**	**120,000**	**4,600**	**1,500**	**170**		**130**	**48**
99MLW001WG99AW03	11/15/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG99AW04	11/17/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG99AW05	11/17/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG99AW06	11/16/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG99AW07	11/18/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG99AW08	11/18/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG99AW09	11/16/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG99BW01	11/11/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG99BW02	11/19/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG99BW04	11/9/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG99BW05	11/9/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG99BW06	11/18/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG99BW08	11/15/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG99BW09	11/15/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG99BW10	11/15/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG99BW11	11/17/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG99BW12	11/17/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG99BW13	11/16/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG99BW14	11/18/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG99BW15	11/18/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG99BW16	11/19/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG99BW17	11/9/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WG99BW18	11/16/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WGBML04	11/9/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WP13(1)	7/26/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WP86	11/19/1999	-	1	1	1	5	1	-	2	**3**
99MLW001WS01	11/22/1999	-	1	1	1	5	1	-	2	**3**
99MLW002WP13	7/26/1999	-	1	1	1	5	1	-	2	**3**
99MLW003WP44(1)	7/26/1999	-	1	1	1	5	1	-	2	**3**
99MLW004WP21	7/26/1999	-	1	1	1	5	1	-	2	**3**
99MLW005WP60	7/26/1999	-	1	1	1	5	1	-	2	**3**
99MLW006WP61	7/26/1999	-	1	1	1	5	1	-	2	**3**
99MLW007WP42	7/26/1999	-	1	1	1	5	1	-	2	**3**
99MLW008WP42	7/26/1999	-	1	1	1	5	1	-	2	**3**
99MLW009WP22	7/27/1999	-	1	1	1	5	1	-	2	**3**
99MLW010WP46	7/27/1999	-	1	1	1	5	1	-	2	**3**
99MLW011WP63	7/27/1999	-	1	1	1	5	1	-	2	**3**
99MLW012WP64	7/27/1999	-	1	1	1	5	1	-	2	**3**
99MLW013WP04	7/27/1999	-	1	1	1	5	1	-	2	**3**
99MLW014WP44	7/27/1999	-	1	1	1	5	1	-	2	**3**
99MLW014WP65	7/28/1999	-	1	1	1	5	1	-	2	**3**
99MLW015WP66	7/28/1999	-	1	1	1	5	1	-	2	**3**

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Chlorobenzene	Chlorobenzene	2-Chlorotoluene	Chloroethane	Chloromethane	Carbon tetrachloride		Dibromchloromethane	Dibromochloropropane
Washington MCL[1]		**-**	**-**	**-**	**-**	**-**	**300**		**500**	**-**
Federal MCL[2]		**100**	**100**	**-**	**-**	**-**	**5**		**-**	**0.2**
MTCA[3]		**-**	**-**	**-**	**-**	**-**	**-**		**-**	**-**
Tap Water PRG[4]		**110,000**	**110,000**	**120,000**	**4,600**	**1,500**	**170**		**130**	**48**
99MLW016WP67	7/28/1999	-	1	1	1	5	1	-	2	**3**
99MLW017WP68	7/28/1999	-	1	1	1	5	1	-	2	**3**
99MLW018WP69	7/28/1999	-	1	1	1	5	1	-	2	**3**
99MLW019WP70	7/28/1999	-	1	1	1	5	1	-	2	**3**
99MLW020WP71	7/28/1999	-	1	1	1	5	1	-	2	**3**
99MLW021WP10	7/28/1999	-	1	1	1	5	1	-	2	**3**
99MLW022WP03	7/28/1999	-	1	1	1	5	1	-	2	**3**
99MLW023WP01	7/29/1999	-	1	1	1	5	1	-	2	**3**
99MLW024WP72	7/29/1999	-	1	1	1	5	1	-	2	**3**
99MLW025WP73	7/29/1999	-	1	1	1	5	1	-	2	**3**
99MLW026WP74	7/29/1999	-	1	1	1	5	1	-	2	**3**
99MLW027WP27	7/29/1999	-	1	1	1	5	1	-	2	**3**
99MLW028WP28	7/29/1999	-	1	1	1	5	1	-	2	**3**
99MLW029WP24	7/29/1999	-	1	1	1	5	1	-	2	**3**
99MLW030WP75	7/29/1999	-	1	1	1	5	1	-	2	**3**
99MLW031WP76	7/29/1999	-	1	1	1	5	1	-	2	**3**
99MLW032WP32	7/29/1999	-	1	1	1	5	1	-	2	**3**
99MLW033WP77	7/29/1999	-	1	1	1	5	1	-	2	**3**
99MLW034WP41	7/30/1999	-	1	1	1	5	1	-	2	**3**
99MLW035WP78	7/30/1999	-	1	1	1	5	1	-	2	**3**
99MLW036WP79	7/30/1999	-	1	1	1	5	1	-	2	**3**
99MLW037WP80	7/30/1999	-	1	1	1	5	1	-	2	**3**
99MLW038WP81	7/30/1999	-	1	1	1	5	1	-	2	**3**
99MLW039WP50	7/30/1999	-	1	1	1	5	1	-	2	**3**
99MLW040WP82	7/30/1999	-	1	1	1	5	1	-	2	**3**
99MLW041WP83	7/30/1999	-	1	1	1	5	1	-	2	**3**
99MLW042WP84	7/30/1999	-	1	1	1	5	1	-	2	**3**
99MLW047WP38	7/31/1999	-	1	1	1	5	1	-	2	**3**
99MLW048WP85	7/31/1999	-	1	1	1	5	1	-	2	**3**

units are Micrograms per liter (µg/l)
Bold text indicates an exceedence of a regulato

[1] Source: Washington State Maximum Contam
[2] Source: National Drinking Water Regulation
[3] Source: Washington State Model Toxics Con
[4] Source: USEPA Region 9 Preliminary Reme

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		1,1-Dichloroethane	1,2-Dichloroethane	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	1,1-Dichloroethene	cis-1,2-Dichoroethene	trans-1,2-Dichoroethene
Washington MCL[1]		**1,000**	**500**	**-**	**-**	**4,000**	**-**	**-**	**-**
Federal MCL[2]		**-**	**5**	**600**	**-**	**75**	**7**	**70**	**100**
MTCA[3]		**-**	**5,000**	**-**	**-**	**-**	**-**	**-**	**-**
Tap Water PRG[4]		**810,000**	**120**	**370,000**	**5,500**	**500**	**340,000**	**61,000**	**120,000**
00MLW001WG91AW05	3/7/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW001WG91AW10	3/13/2000	1	1	2	2	2	1	1	1
00MLW001WG91AW13	3/8/2000	1	1	2	2	2	1	1	1
00MLW001WG91AW14	3/8/2000	1	1	2	2	2	1	1	1
00MLW001WG91AW15	3/8/2000	1	1	2	2	2	1	1	1
00MLW001WG91AW16	3/7/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW001WG91AW17	3/9/2000	1	1	2	2	2	1	1	1
00MLW001WG91AW18	3/9/2000	1	1	2	2	2	1	1	1
00MLW001WG91AW19	3/13/2000	1	1	2	2	2	1	1	1
00MLW001WG91BW02	3/7/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW001WG91BW03	3/17/2000	1	1	2	2	2	1	1	1
00MLW001WG91BW04	3/13/2000	1	1	2	2	2	1	1	1
00MLW001WG92BW02	3/17/2000	1	1	2	2	2	1	1	1
00MLW001WG99AW01	3/14/2000	1	1	2	2	2	1	1	1
00MLW001WG99AW02	3/16/2000	1	1	2	2	2	1	1	1
00MLW001WG99AW03	3/10/2000	1	1	2	2	2	1	1	1
00MLW001WG99AW05	3/9/2000	1	1	2	2	2	1	1	1
00MLW001WG99AW06	3/13/2000	1	1	2	2	2	1	1	1
00MLW001WG99AW07	3/15/2000	1	1	2	2	2	1	1	1
00MLW001WG99AW08	3/15/2000	1	1	2	2	2	1	1	1
00MLW001WG99AW09	3/10/2000	1	1	2	2	2	1	1	1
00MLW001WG99AW10	3/14/2000	1	1	2	2	2	1	1	1
00MLW001WG99BW01	3/14/2000	1	1	2	2	2	1	1	1
00MLW001WG99BW04	3/16/2000	1	1	2	2	2	1	1	1
00MLW001WG99BW05	3/20/2000	1	1	2	2	2	1	1	1
00MLW001WG99BW06	3/16/2000	1	1	2	2	2	1	1	1
00MLW001WG99BW08	3/16/2000	1	1	2	2	2	1	1	1
00MLW001WG99BW09	3/10/2000	1	1	2	2	2	1	1	1
00MLW001WG99BW10	3/10/2000	1	1	2	2	2	1	1	1
00MLW001WG99BW11	3/14/2000	1	1	2	2	2	1	1	1
00MLW001WG99BW12	3/9/2000	1	1	2	2	2	1	1	1
00MLW001WG99BW13	3/13/2000	1	1	2	2	2	1	1	1
00MLW001WG99BW16	3/8/2000	1	1	2	2	2	1	1	1
00MLW001WG99BW17	3/20/2000	1	1	2	2	2	1	1	1
00MLW001WG99BW18	3/10/2000	1	1	2	2	2	1	1	1
00MLW001WP02	6/6/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW001WP05	6/6/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW001WP06	6/7/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW001WP07	6/7/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW001WP08	6/7/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW001WP09	6/7/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW001WP11	6/22/2000	1	0 5	2	2	2	1	0 5	0 5

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		1,1-Dichloroethane	1,2-Dichloroethane	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	1,1-Dichloroethene	cis-1,2-Dichoroethene	trans-1,2-Dichoroethene
Washington MCL[1]		**1,000**	**500**	**-**	**-**	**4,000**	**-**	**-**	**-**
Federal MCL[2]		**-**	**5**	**600**	**-**	**75**	**7**	**70**	**100**
MTCA[3]		**-**	**5,000**	**-**	**-**	**-**	**-**	**-**	**-**
Tap Water PRG[4]		**810,000**	**120**	**370,000**	**5,500**	**500**	**340,000**	**61,000**	**120,000**
00MLW001WP12	6/22/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW001WP13E	6/6/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW001WP13W	6/6/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW001WP14	6/23/2000	1	0 5	2	2	2	1	-	0 5
00MLW001WP15W	6/23/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW001WP16	6/23/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW001WP17	6/23/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW001WP18N	6/23/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW001WP18S	6/23/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW001WP19	6/26/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW001WP20	6/26/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW001WP70	6/22/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW001WP71	6/22/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW001WP82	6/7/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW001WP83	6/7/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW001WP86	6/6/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG91AW01	6/19/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG91AW02	6/19/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG91AW03	6/19/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG91AW05	6/8/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG91AW09	6/16/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG91AW10	6/8/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG91AW13	6/13/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG91AW14	6/15/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG91AW15	6/13/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG91AW16	6/21/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG91AW17	6/12/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG91AW18	6/12/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG91AW19	6/14/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG91BW01	6/19/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG91BW02	6/8/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG91BW03	6/16/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG91BW04	6/8/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG92BW01	6/20/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG92BW02	6/20/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG99AW01	6/16/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG99AW02	6/13/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG99AW03	6/14/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG99AW04	6/20/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG99AW05	6/12/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG99AW06	6/14/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG99AW07	6/15/2000	1	0 5	2	2	2	1	0 5	0 5

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		1,1-Dichloroethane	1,2-Dichloroethane	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	1,1-Dichloroethene	cis-1,2-Dichoroethene	trans-1,2-Dichoroethene
Washington MCL[1]		**1,000**	**500**	**-**	**-**	**4,000**	**-**	**-**	**-**
Federal MCL[2]		**-**	**5**	**600**	**-**	**75**	**7**	**70**	**100**
MTCA[3]		**-**	**5,000**	**-**	**-**	**-**	**-**	**-**	**-**
Tap Water PRG[4]		**810,000**	**120**	**370,000**	**5,500**	**500**	**340,000**	**61,000**	**120,000**
00MLW002WG99AW08	6/15/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG99AW09	6/13/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG99AW10	6/19/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG99BW01	6/16/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG99BW05	6/21/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG99BW09	6/13/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG99BW10	6/14/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG99BW11	6/20/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG99BW12	6/12/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG99BW13	6/14/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG99BW14	6/16/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG99BW15	6/15/2000	1	0 5	2	2	2	1	-	0 5
00MLW002WG99BW16	6/21/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WG99BW18	6/13/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WGBML04	6/21/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WP15E	9/18/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WP23	8/17/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WP25E	8/17/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WP25W	8/17/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WP26	8/30/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW002WP29	8/30/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG00AW03	9/25/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG00AW10	10/12/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG00AW11	10/9/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG00AW12	9/19/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG00AW13	10/30/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG00AW14	10/30/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG00BW01	10/6/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG00BW02	10/9/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG00BW03	9/25/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG00BW04	9/19/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG00BW05	9/18/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG00BW06	10/6/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG00BW07	9/19/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG00BW08	9/25/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG00BW09	9/18/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG00BW10	10/12/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG00BW11	10/6/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG00BW12	10/5/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG00BW13	10/5/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG00BW14	10/6/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG00BW15	9/19/2000	1	0 5	2	2	2	1	0 5	0 5

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		1,1-Dichloroethane	1,2-Dichloroethane	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	1,1-Dichloroethene	cis-1,2-Dichoroethene	trans-1,2-Dichoroethene
Washington MCL[1]		**1,000**	**500**	**-**	**-**	**4,000**	**-**	**-**	**-**
Federal MCL[2]		**-**	**5**	**600**	**-**	**75**	**7**	**70**	**100**
MTCA[3]		**-**	**5,000**	**-**	**-**	**-**	**-**	**-**	**-**
Tap Water PRG[4]		**810,000**	**120**	**370,000**	**5,500**	**500**	**340,000**	**61,000**	**120,000**
00MLW003WG00BW16	10/30/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG91AW01	9/28/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG91AW02	9/28/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG91AW03	9/28/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG91AW05	9/20/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG91AW09	9/21/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG91AW10	9/20/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG91AW13	9/21/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG91AW14	9/21/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG91AW15	9/21/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG91AW16	10/5/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG91AW17	9/22/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG91AW18	9/22/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG91AW19	10/5/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG91BW01	9/28/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG91BW02	9/20/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG91BW03	9/26/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG91BW04	9/20/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG92BW01	9/27/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG92BW02	9/27/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG99AW01	9/20/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG99AW02	9/26/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG99AW03	9/26/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG99AW04	9/27/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG99AW05	9/22/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG99AW06	10/3/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG99AW07	10/4/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG99AW08	10/4/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG99AW09	10/3/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG99AW10	10/4/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG99BW01	9/22/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG99BW05	10/9/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG99BW09	9/26/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG99BW10	9/26/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG99BW11	9/27/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG99BW12	9/22/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG99BW13	10/12/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG99BW14	10/4/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG99BW15	10/4/2000	1	0 5	2	2	2	1	-	0 5
00MLW003WG99BW16	9/21/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WG99BW18	10/3/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WGBML04	10/9/2000	1	0 5	2	2	2	1	0 5	0 5

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		1,1-Dichloroethane	1,2-Dichloroethane	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	1,1-Dichloroethene	cis-1,2-Dichoroethene	trans-1,2-Dichoroethene
Washington MCL[1]		**1,000**	**500**	**-**	**-**	**4,000**	**-**	**-**	**-**
Federal MCL[2]		**-**	**5**	**600**	**-**	**75**	**7**	**70**	**100**
MTCA[3]		**-**	**5,000**	**-**	**-**	**-**	**-**	**-**	**-**
Tap Water PRG[4]		**810,000**	**120**	**370,000**	**5,500**	**500**	**340,000**	**61,000**	**120,000**
00MLW003WGMW02	9/6/2000	1	0 5	2	2	2	1	0 5	0 5
00MLW003WGMW04	9/6/2000	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG00AW03	2/2/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG00AW11	1/31/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG00AW12	1/31/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG00AW13	2/5/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG00AW14	1/23/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG00BW01	1/29/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG00BW02	1/30/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG00BW03	1/30/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG00BW04	1/29/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG00BW05	1/29/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG00BW06	1/25/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG00BW07	1/29/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG00BW08	1/19/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG00BW09	1/25/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG00BW10	2/5/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG00BW11	1/17/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG00BW12	1/30/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG00BW13	1/23/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG00BW14	1/29/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG00BW15	1/31/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG00BW16	2/1/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG91AW01	1/24/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG91AW02	1/24/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG91AW03	1/24/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG91AW05	1/19/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG91AW09	1/22/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG91AW10	1/23/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG91AW13	1/25/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG91AW14	1/19/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG91AW15	1/18/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG91AW16	1/30/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG91AW17	1/26/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG91AW18	1/26/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG91AW19	1/23/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG91BW01	1/24/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG91BW02	1/19/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG91BW03	2/2/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG91BW04	1/23/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG92BW01	1/31/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG92BW02	1/31/2001	1	0 5	2	2	2	1	0 5	0 5

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		1,1-Dichloroethane	1,2-Dichloroethane	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	1,1-Dichloroethene	cis-1,2-Dichoroethene	trans-1,2-Dichoroethene
Washington MCL[1]		**1,000**	**500**	**-**	**-**	**4,000**	**-**	**-**	**-**
Federal MCL[2]		**-**	**5**	**600**	**-**	**75**	**7**	**70**	**100**
MTCA[3]		**-**	**5,000**	**-**	**-**	**-**	**-**	**-**	**-**
Tap Water PRG[4]		**810,000**	**120**	**370,000**	**5,500**	**500**	**340,000**	**61,000**	**120,000**
01MLW001WG99AW01	1/24/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG99AW02	2/1/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG99AW03	2/1/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG99AW04	2/5/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG99AW05	1/26/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG99AW06	1/22/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG99AW07	1/18/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG99AW08	1/18/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG99AW09	1/22/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG99AW10	1/24/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG99BW01	1/25/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG99BW05	1/25/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG99BW09	2/1/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG99BW10	2/1/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG99BW11	2/5/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG99BW12	1/26/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG99BW13	1/22/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG99BW14	1/18/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG99BW15	1/18/2001	1	0 5	2	2	2	1	-	0 5
01MLW001WG99BW16	1/19/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WG99BW18	1/22/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WP30	1/30/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WP31	1/31/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW001WP33	1/31/2001	1	0 5	2	2	2	1	0 5	0 5
01MLW002WG01BW01	5/31/2001	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG91AW05	11/10/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG91AW09	11/12/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG91AW10	11/12/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG91AW13	11/11/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG91AW14	11/19/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG91AW15	11/10/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG91AW16	11/10/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG91AW17	11/12/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG91AW18	11/11/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG91AW19	11/11/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG91BW02	11/10/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG91BW03	11/12/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG91BW04	11/12/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG92BW01	11/17/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG92BW02	11/16/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG99AW01	11/12/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG99AW02	11/15/1999	1	0 5	2	2	2	1	0 5	0 5

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		1,1-Dichloroethane	1,2-Dichloroethane	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	1,1-Dichloroethene	cis-1,2-Dichoroethene	trans-1,2-Dichoroethene
Washington MCL[1]		**1,000**	**500**	**-**	**-**	**4,000**	**-**	**-**	**-**
Federal MCL[2]		**-**	**5**	**600**	**-**	**75**	**7**	**70**	**100**
MTCA[3]		**-**	**5,000**	**-**	**-**	**-**	**-**	**-**	**-**
Tap Water PRG[4]		**810,000**	**120**	**370,000**	**5,500**	**500**	**340,000**	**61,000**	**120,000**
99MLW001WG99AW03	11/15/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG99AW04	11/17/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG99AW05	11/17/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG99AW06	11/16/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG99AW07	11/18/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG99AW08	11/18/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG99AW09	11/16/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG99BW01	11/11/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG99BW02	11/19/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG99BW04	11/9/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG99BW05	11/9/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG99BW06	11/18/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG99BW08	11/15/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG99BW09	11/15/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG99BW10	11/15/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG99BW11	11/17/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG99BW12	11/17/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG99BW13	11/16/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG99BW14	11/18/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG99BW15	11/18/1999	1	0 5	2	2	2	1	-	0 5
99MLW001WG99BW16	11/19/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG99BW17	11/9/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WG99BW18	11/16/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WGBML04	11/9/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WP13(1)	7/26/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WP86	11/19/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW001WS01	11/22/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW002WP13	7/26/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW003WP44(1)	7/26/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW004WP21	7/26/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW005WP60	7/26/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW006WP61	7/26/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW007WP42	7/26/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW008WP42	7/26/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW009WP22	7/27/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW010WP46	7/27/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW011WP63	7/27/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW012WP64	7/27/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW013WP04	7/27/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW014WP44	7/27/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW014WP65	7/28/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW015WP66	7/28/1999	1	0 5	2	2	2	1	0 5	0 5

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		1,1-Dichloroethane	1,2-Dichloroethane	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	1,1-Dichloroethene	cis-1,2-Dichoroethene	trans-1,2-Dichoroethene
Washington MCL[1]		**1,000**	**500**	**-**	**-**	**4,000**	**-**	**-**	**-**
Federal MCL[2]		**-**	**5**	**600**	**-**	**75**	**7**	**70**	**100**
MTCA[3]		**-**	**5,000**	**-**	**-**	**-**	**-**	**-**	**-**
Tap Water PRG[4]		**810,000**	**120**	**370,000**	**5,500**	**500**	**340,000**	**61,000**	**120,000**
99MLW016WP67	7/28/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW017WP68	7/28/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW018WP69	7/28/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW019WP70	7/28/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW020WP71	7/28/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW021WP10	7/28/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW022WP03	7/28/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW023WP01	7/29/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW024WP72	7/29/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW025WP73	7/29/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW026WP74	7/29/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW027WP27	7/29/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW028WP28	7/29/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW029WP24	7/29/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW030WP75	7/29/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW031WP76	7/29/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW032WP32	7/29/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW033WP77	7/29/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW034WP41	7/30/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW035WP78	7/30/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW036WP79	7/30/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW037WP80	7/30/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW038WP81	7/30/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW039WP50	7/30/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW040WP82	7/30/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW041WP83	7/30/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW042WP84	7/30/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW047WP38	7/31/1999	1	0 5	2	2	2	1	0 5	0 5
99MLW048WP85	7/31/1999	1	0 5	2	2	2	1	0 5	0 5

units are Micrograms per liter (µg/l)
Bold text indicates an exceedence of a regulato

[1] Source: Washington State Maximum Contam
[2] Source: National Drinking Water Regulation
[3] Source: Washington State Model Toxics Con
[4] Source: USEPA Region 9 Preliminary Reme

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		cis-1,3-Dichloropropene	transs-1,3-Dichloropropene	1,2-Dichloropropane	Ethylbenzene	Ethylene dibromide	Freon 11	Freon 12	Hexachlorobutadiene	Methyl ethyl ketone
Washington MCL[1]		**200**	**200**	**600**		**1**	**-**	**-**	**-**	**-**
Federal MCL[2]		**-**	**-**	**5**	**-**	**-**	**-**	**-**	**-**	**-**
MTCA[3]		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Tap Water PRG[4]		**400**	**400**	**160**	**2.9**	**0.76**	**1,300,000**	**390,000**	**860**	**1,900,000**
00MLW001WG91AW05	3/7/2000	3	3	1	1	1	1	1	3	10
00MLW001WG91AW10	3/13/2000	3	3	1	1	1	1	1	3	10
00MLW001WG91AW13	3/8/2000	3	3	1	1	1	1	1	3	10
00MLW001WG91AW14	3/8/2000	3	3	1	1	1	1	1	3	10
00MLW001WG91AW15	3/8/2000	3	3	1	1	1	1	1	3	10
00MLW001WG91AW16	3/7/2000	3	3	1	1	1	1	1	3	10
00MLW001WG91AW17	3/9/2000	3	3	1	1	1	1	1	3	10
00MLW001WG91AW18	3/9/2000	3	3	1	1	1	1	1	3	10
00MLW001WG91AW19	3/13/2000	3	3	1	1	1	1	1	3	10
00MLW001WG91BW02	3/7/2000	3	3	1	1	1	1	1	3	10
00MLW001WG91BW03	3/17/2000	3	3	1	1	1	1	1	3	10
00MLW001WG91BW04	3/13/2000	3	3	1	1	1	1	1	3	10
00MLW001WG92BW02	3/17/2000	3	3	1	1	1	1	1	3	10
00MLW001WG99AW01	3/14/2000	3	3	1	1	1	1	1	3	10
00MLW001WG99AW02	3/16/2000	3	3	1	1	1	1	1	3	10
00MLW001WG99AW03	3/10/2000	3	3	1	1	1	1	1	3	10
00MLW001WG99AW05	3/9/2000	3	3	1	1	1	1	1	3	10
00MLW001WG99AW06	3/13/2000	3	3	1	1	1	1	1	3	10
00MLW001WG99AW07	3/15/2000	3	3	1	1	1	1	1	3	10
00MLW001WG99AW08	3/15/2000	3	3	1	1	1	1	1	3	10
00MLW001WG99AW09	3/10/2000	3	3	1	1	1	1	1	3	10
00MLW001WG99AW10	3/14/2000	3	3	1	1	1	1	1	3	10
00MLW001WG99BW01	3/14/2000	3	3	1	1	1	1	1	3	10
00MLW001WG99BW04	3/16/2000	3	3	1	1	1	1	1	3	10
00MLW001WG99BW05	3/20/2000	3	3	1	1	1	1	1	3	10
00MLW001WG99BW06	3/16/2000	3	3	1	1	1	1	1	3	10
00MLW001WG99BW08	3/16/2000	3	3	1	1	1	1	1	3	10
00MLW001WG99BW09	3/10/2000	3	3	1	1	1	1	1	3	10
00MLW001WG99BW10	3/10/2000	3	3	1	1	1	1	1	3	10
00MLW001WG99BW11	3/14/2000	3	3	1	1	1	1	1	3	10
00MLW001WG99BW12	3/9/2000	3	3	1	1	1	1	1	3	10
00MLW001WG99BW13	3/13/2000	3	3	1	1	1	1	1	3	10
00MLW001WG99BW16	3/8/2000	3	3	1	1	1	1	1	3	10
00MLW001WG99BW17	3/20/2000	3	3	1	1	1	1	1	3	10
00MLW001WG99BW18	3/10/2000	3	3	1	1	1	1	1	3	10
00MLW001WP02	6/6/2000	3	3	1	1	1	1	1	3	10
00MLW001WP05	6/6/2000	3	3	1	1	1	1	1	3	10
00MLW001WP06	6/7/2000	3	3	1	1	1	1	1	3	10
00MLW001WP07	6/7/2000	3	3	1	1	1	1	1	3	10
00MLW001WP08	6/7/2000	3	3	1	1	1	1	1	3	10
00MLW001WP09	6/7/2000	3	3	1	1	1	1	1	3	10
00MLW001WP11	6/22/2000	3	3	1	1	1	-	1	3	10

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		cis-1,3-Dichloropropene	transs-1,3-Dichloropropene	1,2-Dichloropropane	Ethylbenzene	Ethylene dibromide	Freon 11	Freon 12	Hexachlorobutadiene	Methyl ethyl ketone
Washington MCL[1]		**200**	**200**	**600**		**1**	**-**	**-**	**-**	**-**
Federal MCL[2]		**-**	**-**	**5**	**-**	**-**	**-**	**-**	**-**	**-**
MTCA[3]		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Tap Water PRG[4]		**400**	**400**	**160**	**2.9**	**0.76**	**1,300,000**	**390,000**	**860**	**1,900,000**
00MLW001WP12	6/22/2000	3	3	1	1	1	-	1	3	10
00MLW001WP13E	6/6/2000	3	3	1	1	1	1	1	3	10
00MLW001WP13W	6/6/2000	3	3	1	1	1	1	1	3	10
00MLW001WP14	6/23/2000	3	3	1	1	1	1	1	3	10
00MLW001WP15W	6/23/2000	3	3	1	1	1	1	1	3	10
00MLW001WP16	6/23/2000	3	3	1	1	1	1	1	3	10
00MLW001WP17	6/23/2000	3	3	1	1	1	1	1	3	10
00MLW001WP18N	6/23/2000	3	3	1	1	1	1	1	3	10
00MLW001WP18S	6/23/2000	3	3	1	1	1	1	1	3	10
00MLW001WP19	6/26/2000	3	3	1	1	1	1	1	3	10
00MLW001WP20	6/26/2000	3	3	1	1	1	1	1	3	10
00MLW001WP70	6/22/2000	3	3	1	1	1	1	1	3	10
00MLW001WP71	6/22/2000	3	3	1	1	1	1	1	3	10
00MLW001WP82	6/7/2000	3	3	1	1	1	1	1	3	10
00MLW001WP83	6/7/2000	3	3	1	1	1	1	1	3	10
00MLW001WP86	6/6/2000	3	3	1	1	1	1	1	3	10
00MLW002WG91AW01	6/19/2000	3	3	1	1	1	-	1	3	10
00MLW002WG91AW02	6/19/2000	3	3	1	1	1	-	1	3	10
00MLW002WG91AW03	6/19/2000	3	3	1	1	1	1	1	3	10
00MLW002WG91AW05	6/8/2000	3	3	1	1	1	1	1	3	10
00MLW002WG91AW09	6/16/2000	3	3	1	1	1	1	1	3	10
00MLW002WG91AW10	6/8/2000	3	3	1	1	1	1	1	3	10
00MLW002WG91AW13	6/13/2000	3	3	1	1	1	1	1	3	10
00MLW002WG91AW14	6/15/2000	3	3	1	1	1	1	1	3	10
00MLW002WG91AW15	6/13/2000	3	3	1	1	1	1	1	3	10
00MLW002WG91AW16	6/21/2000	3	3	1	1	1	-	1	3	10
00MLW002WG91AW17	6/12/2000	3	3	1	1	1	1	1	3	10
00MLW002WG91AW18	6/12/2000	3	3	1	1	1	1	1	3	10
00MLW002WG91AW19	6/14/2000	3	3	1	1	1	1	1	3	10
00MLW002WG91BW01	6/19/2000	3	3	1	1	1	1	1	3	10
00MLW002WG91BW02	6/8/2000	3	3	1	1	1	1	1	3	10
00MLW002WG91BW03	6/16/2000	3	3	1	1	1	1	1	3	10
00MLW002WG91BW04	6/8/2000	3	3	1	1	1	1	1	3	10
00MLW002WG92BW01	6/20/2000	3	3	1	1	1	-	1	3	10
00MLW002WG92BW02	6/20/2000	3	3	1	1	1	-	1	3	10
00MLW002WG99AW01	6/16/2000	3	3	1	1	1	1	1	3	10
00MLW002WG99AW02	6/13/2000	3	3	1	1	1	1	1	3	10
00MLW002WG99AW03	6/14/2000	3	3	1	1	1	1	1	3	10
00MLW002WG99AW04	6/20/2000	3	3	1	1	1	1	1	3	10
00MLW002WG99AW05	6/12/2000	3	3	1	1	1	1	1	3	10
00MLW002WG99AW06	6/14/2000	3	3	1	1	1	1	1	3	10
00MLW002WG99AW07	6/15/2000	3	3	1	1	1	1	1	3	10

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		cis-1,3-Dichloropropene	transs-1,3-Dichloropropene	1,2-Dichloropropane	Ethylbenzene	Ethylene dibromide	Freon 11	Freon 12	Hexachlorobutadiene	Methyl ethyl ketone
Washington MCL[1]		**200**	**200**	**600**		**1**	**-**	**-**	**-**	**-**
Federal MCL[2]		**-**	**-**	**5**	**-**	**-**	**-**	**-**	**-**	**-**
MTCA[3]		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Tap Water PRG[4]		**400**	**400**	**160**	**2.9**	**0.76**	**1,300,000**	**390,000**	**860**	**1,900,000**
00MLW002WG99AW08	6/15/2000	3	3	1	1	1	1	1	3	10
00MLW002WG99AW09	6/13/2000	3	3	1	1	1	1	1	3	10
00MLW002WG99AW10	6/19/2000	3	3	1	1	1	1	1	3	10
00MLW002WG99BW01	6/16/2000	3	3	1	1	1	1	1	3	10
00MLW002WG99BW05	6/21/2000	3	3	1	1	1	1	1	3	10
00MLW002WG99BW09	6/13/2000	3	3	1	1	1	1	1	3	10
00MLW002WG99BW10	6/14/2000	3	3	1	1	1	1	1	3	10
00MLW002WG99BW11	6/20/2000	3	3	1	1	1	-	1	3	10
00MLW002WG99BW12	6/12/2000	3	3	1	1	1	1	1	3	10
00MLW002WG99BW13	6/14/2000	3	3	1	1	1	1	1	3	10
00MLW002WG99BW14	6/16/2000	3	3	1	1	1	1	1	3	10
00MLW002WG99BW15	6/15/2000	3	3	1	1	1	1	1	3	10
00MLW002WG99BW16	6/21/2000	3	3	1	1	1	1	1	3	10
00MLW002WG99BW18	6/13/2000	3	3	1	1	1	1	1	3	10
00MLW002WGBML04	6/21/2000	3	3	1	1	1	1	1	3	10
00MLW002WP15E	9/18/2000	3	3	1	1	1	1	1	3	10
00MLW002WP23	8/17/2000	3	3	1	1	1	1	1	3	10
00MLW002WP25E	8/17/2000	3	3	1	1	1	1	1	3	10
00MLW002WP25W	8/17/2000	3	3	1	1	1	1	1	3	10
00MLW002WP26	8/30/2000	3	3	1	1	1	1	1	3	10
00MLW002WP29	8/30/2000	3	3	1	1	1	1	1	3	10
00MLW003WG00AW03	9/25/2000	3	3	1	1	1	1	1	3	10
00MLW003WG00AW10	10/12/2000	3	3	1	1	1	1	1	3	10
00MLW003WG00AW11	10/9/2000	3	3	1	1	1	1	1	3	10
00MLW003WG00AW12	9/19/2000	3	3	1	1	1	1	1	3	10
00MLW003WG00AW13	10/30/2000	3	3	1	1	1	1	1	3	10
00MLW003WG00AW14	10/30/2000	3	3	1	1	1	1	1	3	10
00MLW003WG00BW01	10/6/2000	3	3	1	1	1	1	1	3	10
00MLW003WG00BW02	10/9/2000	3	3	1	1	1	1	1	3	10
00MLW003WG00BW03	9/25/2000	3	3	1	1	1	1	1	3	10
00MLW003WG00BW04	9/19/2000	3	3	1	1	1	1	1	3	10
00MLW003WG00BW05	9/18/2000	3	3	1	1	1	1	1	3	10
00MLW003WG00BW06	10/6/2000	3	3	1	1	1	1	1	3	10
00MLW003WG00BW07	9/19/2000	3	3	1	1	1	1	1	3	10
00MLW003WG00BW08	9/25/2000	3	3	1	1	1	1	1	3	10
00MLW003WG00BW09	9/18/2000	3	3	1	1	1	1	1	3	10
00MLW003WG00BW10	10/12/2000	3	3	1	1	1	1	1	3	10
00MLW003WG00BW11	10/6/2000	3	3	1	1	1	1	1	3	10
00MLW003WG00BW12	10/5/2000	3	3	1	1	1	1	1	3	10
00MLW003WG00BW13	10/5/2000	3	3	1	1	1	1	1	3	10
00MLW003WG00BW14	10/6/2000	3	3	1	1	1	1	1	3	10
00MLW003WG00BW15	9/19/2000	3	3	1	1	1	1	1	3	10

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		cis-1,3-Dichloropropene	transs-1,3-Dichloropropene	1,2-Dichloropropane	Ethylbenzene	Ethylene dibromide	Freon 11	Freon 12	Hexachlorobutadiene	Methyl ethyl ketone
Washington MCL[1]		**200**	**200**	**600**		**1**	**-**	**-**	**-**	**-**
Federal MCL[2]		**-**	**-**	**5**	**-**	**-**	**-**	**-**	**-**	**-**
MTCA[3]		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Tap Water PRG[4]		**400**	**400**	**160**	**2.9**	**0.76**	**1,300,000**	**390,000**	**860**	**1,900,000**
00MLW003WG00BW16	10/30/2000	3	3	1	1	1	1	1	3	10
00MLW003WG91AW01	9/28/2000	3	3	1	1	1	1	1	3	-
00MLW003WG91AW02	9/28/2000	3	3	1	1	1	1	1	3	-
00MLW003WG91AW03	9/28/2000	3	3	1	1	1	1	1	3	-
00MLW003WG91AW05	9/20/2000	3	3	1	1	1	1	1	3	10
00MLW003WG91AW09	9/21/2000	3	3	1	1	1	1	1	3	10
00MLW003WG91AW10	9/20/2000	3	3	1	1	1	1	1	3	10
00MLW003WG91AW13	9/21/2000	3	3	1	1	1	1	1	3	10
00MLW003WG91AW14	9/21/2000	3	3	1	1	1	1	1	3	10
00MLW003WG91AW15	9/21/2000	3	3	1	1	1	1	1	3	10
00MLW003WG91AW16	10/5/2000	3	3	1	1	1	1	1	3	10
00MLW003WG91AW17	9/22/2000	3	3	1	1	1	1	1	3	10
00MLW003WG91AW18	9/22/2000	3	3	1	1	1	1	1	3	10
00MLW003WG91AW19	10/5/2000	3	3	1	1	1	1	1	3	10
00MLW003WG91BW01	9/28/2000	3	3	1	1	1	1	1	3	-
00MLW003WG91BW02	9/20/2000	3	3	1	1	1	1	1	3	10
00MLW003WG91BW03	9/26/2000	3	3	1	1	1	1	1	3	10
00MLW003WG91BW04	9/20/2000	3	3	1	1	1	1	1	3	10
00MLW003WG92BW01	9/27/2000	3	3	1	1	1	1	1	3	10
00MLW003WG92BW02	9/27/2000	3	3	1	1	1	1	1	3	10
00MLW003WG99AW01	9/20/2000	3	3	1	1	1	1	1	3	10
00MLW003WG99AW02	9/26/2000	3	3	1	1	1	1	1	3	10
00MLW003WG99AW03	9/26/2000	3	3	1	1	1	1	1	3	10
00MLW003WG99AW04	9/27/2000	3	3	1	1	1	1	1	3	10
00MLW003WG99AW05	9/22/2000	3	3	1	1	1	1	1	3	10
00MLW003WG99AW06	10/3/2000	3	3	1	1	1	1	1	3	10
00MLW003WG99AW07	10/4/2000	3	3	1	1	1	1	1	3	10
00MLW003WG99AW08	10/4/2000	3	3	1	1	1	1	1	3	10
00MLW003WG99AW09	10/3/2000	3	3	1	1	1	1	1	3	10
00MLW003WG99AW10	10/4/2000	3	3	1	1	1	1	1	3	10
00MLW003WG99BW01	9/22/2000	3	3	1	1	1	1	1	3	10
00MLW003WG99BW05	10/9/2000	3	3	1	1	1	1	1	3	10
00MLW003WG99BW09	9/26/2000	3	3	1	1	1	1	1	3	10
00MLW003WG99BW10	9/26/2000	3	3	1	1	1	1	1	3	10
00MLW003WG99BW11	9/27/2000	3	3	1	1	1	1	1	3	10
00MLW003WG99BW12	9/22/2000	3	3	1	1	1	1	1	3	10
00MLW003WG99BW13	10/12/2000	3	3	1	1	1	1	1	3	10
00MLW003WG99BW14	10/4/2000	3	3	1	1	1	1	1	3	10
00MLW003WG99BW15	10/4/2000	3	3	1	1	1	1	1	3	10
00MLW003WG99BW16	9/21/2000	3	3	1	1	1	1	1	3	10
00MLW003WG99BW18	10/3/2000	3	3	1	1	1	1	1	3	10
00MLW003WGBML04	10/9/2000	3	3	1	1	1	1	1	3	10

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		cis-1,3-Dichloropropene	transs-1,3-Dichloropropene	1,2-Dichloropropane	Ethylbenzene	Ethylene dibromide	Freon 11	Freon 12	Hexachlorobutadiene	Methyl ethyl ketone
Washington MCL[1]		**200**	**200**	**600**		**1**	**-**	**-**	**-**	**-**
Federal MCL[2]		**-**	**-**	**5**	**-**	**-**	**-**	**-**	**-**	**-**
MTCA[3]		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Tap Water PRG[4]		**400**	**400**	**160**	**2.9**	**0.76**	**1,300,000**	**390,000**	**860**	**1,900,000**
00MLW003WGMW02	9/6/2000	3	3	1	1	1	1	1	3	10
00MLW003WGMW04	9/6/2000	3	3	1	1	1	1	1	3	10
01MLW001WG00AW03	2/2/2001	1	3	1	1	1	1	1	3	10
01MLW001WG00AW11	1/31/2001	1	3	1	1	1	1	1	3	10
01MLW001WG00AW12	1/31/2001	1	3	1	1	1	1	1	3	10
01MLW001WG00AW13	2/5/2001	1	3	1	1	1	1	1	3	10
01MLW001WG00AW14	1/23/2001	1	3	1	1	1	1	1	3	10
01MLW001WG00BW01	1/29/2001	1	3	1	1	1	1	1	3	10
01MLW001WG00BW02	1/30/2001	1	3	1	1	1	1	1	3	10
01MLW001WG00BW03	1/30/2001	1	3	1	1	1	1	1	3	10
01MLW001WG00BW04	1/29/2001	1	3	1	1	1	1	1	3	10
01MLW001WG00BW05	1/29/2001	1	3	1	1	1	1	1	3	10
01MLW001WG00BW06	1/25/2001	1	3	1	1	1	1	1	3	10
01MLW001WG00BW07	1/29/2001	1	3	1	1	1	1	1	3	10
01MLW001WG00BW08	1/19/2001	1	3	1	1	1	1	1	3	10
01MLW001WG00BW09	1/25/2001	1	3	1	1	1	1	1	3	10
01MLW001WG00BW10	2/5/2001	1	3	1	1	1	1	1	3	10
01MLW001WG00BW11	1/17/2001	1	3	1	1	1	1	1	3	10
01MLW001WG00BW12	1/30/2001	1	3	1	1	1	1	1	3	10
01MLW001WG00BW13	1/23/2001	1	3	1	1	1	1	1	3	10
01MLW001WG00BW14	1/29/2001	1	3	1	1	1	1	1	3	10
01MLW001WG00BW15	1/31/2001	1	3	1	1	1	1	1	3	10
01MLW001WG00BW16	2/1/2001	1	3	1	1	1	1	1	3	10
01MLW001WG91AW01	1/24/2001	1	3	1	1	1	1	1	3	10
01MLW001WG91AW02	1/24/2001	1	3	1	1	1	1	1	3	10
01MLW001WG91AW03	1/24/2001	1	3	1	1	1	1	1	3	10
01MLW001WG91AW05	1/19/2001	1	3	1	1	1	1	1	3	10
01MLW001WG91AW09	1/22/2001	1	3	1	1	1	1	1	3	10
01MLW001WG91AW10	1/23/2001	1	3	1	1	1	1	1	3	10
01MLW001WG91AW13	1/25/2001	1	3	1	1	1	1	1	3	10
01MLW001WG91AW14	1/19/2001	1	3	1	1	1	1	1	3	10
01MLW001WG91AW15	1/18/2001	1	3	1	1	1	1	1	3	10
01MLW001WG91AW16	1/30/2001	1	3	1	1	1	1	1	3	10
01MLW001WG91AW17	1/26/2001	1	3	1	1	1	1	1	3	10
01MLW001WG91AW18	1/26/2001	1	3	1	1	1	1	1	3	10
01MLW001WG91AW19	1/23/2001	1	3	1	1	1	1	1	3	10
01MLW001WG91BW01	1/24/2001	1	3	1	1	1	1	1	3	10
01MLW001WG91BW02	1/19/2001	1	3	1	1	1	1	1	3	10
01MLW001WG91BW03	2/2/2001	1	3	1	1	1	1	1	3	10
01MLW001WG91BW04	1/23/2001	1	3	1	1	1	1	1	3	10
01MLW001WG92BW01	1/31/2001	1	3	1	1	1	1	1	3	10
01MLW001WG92BW02	1/31/2001	1	3	1	1	1	1	1	3	10

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		cis-1,3-Dichloropropene	transs-1,3-Dichloropropene	1,2-Dichloropropane	Ethylbenzene	Ethylene dibromide	Freon 11	Freon 12	Hexachlorobutadiene	Methyl ethyl ketone
Washington MCL[1]		**200**	**200**	**600**		**1**	**-**	**-**	**-**	**-**
Federal MCL[2]		**-**	**-**	**5**	**-**	**-**	**-**	**-**	**-**	**-**
MTCA[3]		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Tap Water PRG[4]		**400**	**400**	**160**	**2.9**	**0.76**	**1,300,000**	**390,000**	**860**	**1,900,000**
01MLW001WG99AW01	1/24/2001	1	3	1	1	1	1	1	3	10
01MLW001WG99AW02	2/1/2001	1	3	1	1	1	1	1	3	10
01MLW001WG99AW03	2/1/2001	1	3	1	1	1	1	1	3	10
01MLW001WG99AW04	2/5/2001	1	3	1	1	1	1	1	3	10
01MLW001WG99AW05	1/26/2001	1	3	1	1	1	1	1	3	10
01MLW001WG99AW06	1/22/2001	1	3	1	1	1	1	1	3	10
01MLW001WG99AW07	1/18/2001	1	3	1	1	1	1	1	3	10
01MLW001WG99AW08	1/18/2001	1	3	1	1	1	1	1	3	10
01MLW001WG99AW09	1/22/2001	1	3	1	1	1	1	1	3	10
01MLW001WG99AW10	1/24/2001	1	3	1	1	1	1	1	3	10
01MLW001WG99BW01	1/25/2001	1	3	1	1	1	1	1	3	10
01MLW001WG99BW05	1/25/2001	1	3	1	1	1	1	1	3	10
01MLW001WG99BW09	2/1/2001	1	3	1	1	1	1	1	3	10
01MLW001WG99BW10	2/1/2001	1	3	1	1	1	1	1	3	10
01MLW001WG99BW11	2/5/2001	1	3	1	1	1	1	1	3	10
01MLW001WG99BW12	1/26/2001	1	3	1	1	1	1	1	3	10
01MLW001WG99BW13	1/22/2001	1	3	1	1	1	1	1	3	10
01MLW001WG99BW14	1/18/2001	1	3	1	1	1	1	1	3	10
01MLW001WG99BW15	1/18/2001	1	3	1	1	1	1	1	3	10
01MLW001WG99BW16	1/19/2001	1	3	1	1	1	1	1	3	10
01MLW001WG99BW18	1/22/2001	1	3	1	1	1	1	1	3	10
01MLW001WP30	1/30/2001	1	3	1	1	1	1	1	3	10
01MLW001WP31	1/31/2001	1	3	1	1	1	1	1	3	10
01MLW001WP33	1/31/2001	1	3	1	1	1	1	1	3	10
01MLW002WG01BW01	5/31/2001	1	3	1	1	1	1	1	3	10
99MLW001WG91AW05	11/10/1999	3	3	1	1	1	1	1	3	10
99MLW001WG91AW09	11/12/1999	3	3	1	1	1	1	1	3	10
99MLW001WG91AW10	11/12/1999	3	3	1	1	1	1	1	3	10
99MLW001WG91AW13	11/11/1999	3	3	1	1	1	1	1	3	10
99MLW001WG91AW14	11/19/1999	3	3	1	1	1	1	1	3	10
99MLW001WG91AW15	11/10/1999	3	3	1	1	1	1	1	3	10
99MLW001WG91AW16	11/10/1999	3	3	1	1	1	1	1	3	10
99MLW001WG91AW17	11/12/1999	3	3	1	1	1	1	1	3	10
99MLW001WG91AW18	11/11/1999	3	3	1	1	1	1	1	3	10
99MLW001WG91AW19	11/11/1999	3	3	1	1	1	1	1	3	10
99MLW001WG91BW02	11/10/1999	3	3	1	1	1	1	1	3	10
99MLW001WG91BW03	11/12/1999	3	3	1	1	1	1	1	3	10
99MLW001WG91BW04	11/12/1999	3	3	1	1	1	1	1	3	10
99MLW001WG92BW01	11/17/1999	3	3	1	1	1	1	1	3	10
99MLW001WG92BW02	11/16/1999	3	3	1	1	1	1	1	3	10
99MLW001WG99AW01	11/12/1999	3	3	1	1	1	1	1	3	10
99MLW001WG99AW02	11/15/1999	3	3	1	1	1	1	1	3	10

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		cis-1,3-Dichloropropene	transs-1,3-Dichloropropene	1,2-Dichloropropane	Ethylbenzene	Ethylene dibromide	Freon 11	Freon 12	Hexachlorobutadiene	Methyl ethyl ketone
Washington MCL[1]		**200**	**200**	**600**		**1**	**-**	**-**	**-**	**-**
Federal MCL[2]		**-**	**-**	**5**	**-**	**-**	**-**	**-**	**-**	**-**
MTCA[3]		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Tap Water PRG[4]		**400**	**400**	**160**	**2.9**	**0.76**	**1,300,000**	**390,000**	**860**	**1,900,000**
99MLW001WG99AW03	11/15/1999	3	3	1	1	1	1	1	3	10
99MLW001WG99AW04	11/17/1999	3	3	1	1	1	1	1	3	10
99MLW001WG99AW05	11/17/1999	3	3	1	1	1	1	1	3	10
99MLW001WG99AW06	11/16/1999	3	3	1	1	1	1	1	3	10
99MLW001WG99AW07	11/18/1999	3	3	1	1	1	1	1	3	10
99MLW001WG99AW08	11/18/1999	3	3	1	1	1	1	1	3	10
99MLW001WG99AW09	11/16/1999	3	3	1	1	1	1	1	3	10
99MLW001WG99BW01	11/11/1999	3	3	1	1	1	1	1	3	10
99MLW001WG99BW02	11/19/1999	3	3	1	1	1	1	1	3	10
99MLW001WG99BW04	11/9/1999	3	3	1	1	1	1	1	3	10
99MLW001WG99BW05	11/9/1999	3	3	1	1	1	1	1	3	10
99MLW001WG99BW06	11/18/1999	3	3	1	1	1	1	1	3	10
99MLW001WG99BW08	11/15/1999	3	3	1	1	1	1	1	3	10
99MLW001WG99BW09	11/15/1999	3	3	1	1	1	1	1	3	10
99MLW001WG99BW10	11/15/1999	3	3	1	1	1	1	1	3	10
99MLW001WG99BW11	11/17/1999	3	3	1	1	1	1	1	3	10
99MLW001WG99BW12	11/17/1999	3	3	1	1	1	1	1	3	10
99MLW001WG99BW13	11/16/1999	3	3	1	1	1	1	1	3	10
99MLW001WG99BW14	11/18/1999	3	3	1	1	1	1	1	3	10
99MLW001WG99BW15	11/18/1999	3	3	1	1	1	1	1	3	10
99MLW001WG99BW16	11/19/1999	3	3	1	1	1	1	1	3	10
99MLW001WG99BW17	11/9/1999	3	3	1	1	1	1	1	3	10
99MLW001WG99BW18	11/16/1999	3	3	1	1	1	1	1	3	10
99MLW001WGBML04	11/9/1999	3	3	1	1	1	1	1	3	10
99MLW001WP13(1)	7/26/1999	3	3	1	1	1	1	1	3	10
99MLW001WP86	11/19/1999	3	3	1	1	1	1	1	3	10
99MLW001WS01	11/22/1999	3	3	1	1	1	1	1	3	10
99MLW002WP13	7/26/1999	3	3	1	1	1	1	1	3	10
99MLW003WP44(1)	7/26/1999	3	3	1	1	1	1	1	3	10
99MLW004WP21	7/26/1999	3	3	1	1	1	1	1	3	10
99MLW005WP60	7/26/1999	3	3	1	1	1	1	1	3	10
99MLW006WP61	7/26/1999	3	3	1	1	1	1	1	3	10
99MLW007WP42	7/26/1999	3	3	1	1	1	1	1	3	10
99MLW008WP42	7/26/1999	3	3	1	1	1	1	1	3	10
99MLW009WP22	7/27/1999	3	3	1	1	1	1	1	3	10
99MLW010WP46	7/27/1999	3	3	1	1	1	1	1	3	10
99MLW011WP63	7/27/1999	3	3	1	1	1	1	1	3	10
99MLW012WP64	7/27/1999	3	3	1	1	1	1	1	3	10
99MLW013WP04	7/27/1999	3	3	1	1	1	1	1	3	10
99MLW014WP44	7/27/1999	3	3	1	1	1	1	1	3	10
99MLW014WP65	7/28/1999	3	3	1	1	1	1	1	3	10
99MLW015WP66	7/28/1999	3	3	1	1	1	1	1	3	10

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		cis-1,3-Dichloropropene	transs-1,3-Dichloropropene	1,2-Dichloropropane	Ethylbenzene	Ethylene dibromide	Freon 11	Freon 12	Hexachlorobutadiene	Methyl ethyl ketone
Washington MCL[1]		**200**	**200**	**600**		**1**	**-**	**-**	**-**	**-**
Federal MCL[2]		**-**	**-**	**5**	**-**	**-**	**-**	**-**	**-**	**-**
MTCA[3]		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Tap Water PRG[4]		**400**	**400**	**160**	**2.9**	**0.76**	**1,300,000**	**390,000**	**860**	**1,900,000**
99MLW016WP67	7/28/1999	3	3	1	1	1	1	1	3	10
99MLW017WP68	7/28/1999	3	3	1	1	1	1	1	3	10
99MLW018WP69	7/28/1999	3	3	1	1	1	1	1	3	10
99MLW019WP70	7/28/1999	3	3	1	1	1	1	1	3	10
99MLW020WP71	7/28/1999	3	3	1	1	1	1	1	3	10
99MLW021WP10	7/28/1999	3	3	1	1	1	1	1	3	10
99MLW022WP03	7/28/1999	3	3	1	1	1	1	1	3	10
99MLW023WP01	7/29/1999	3	3	1	1	1	1	1	3	10
99MLW024WP72	7/29/1999	3	3	1	1	1	1	1	3	10
99MLW025WP73	7/29/1999	3	3	1	1	1	1	1	3	10
99MLW026WP74	7/29/1999	3	3	1	1	1	1	1	3	10
99MLW027WP27	7/29/1999	3	3	1	1	1	1	1	3	10
99MLW028WP28	7/29/1999	3	3	1	1	1	1	1	3	10
99MLW029WP24	7/29/1999	3	3	1	1	1	1	1	3	10
99MLW030WP75	7/29/1999	3	3	1	1	1	1	1	3	10
99MLW031WP76	7/29/1999	3	3	1	1	1	1	1	3	10
99MLW032WP32	7/29/1999	3	3	1	1	1	1	1	3	10
99MLW033WP77	7/29/1999	3	3	1	1	1	1	1	3	10
99MLW034WP41	7/30/1999	3	3	1	1	1	1	1	3	10
99MLW035WP78	7/30/1999	3	3	1	1	1	1	1	3	10
99MLW036WP79	7/30/1999	3	3	1	1	1	1	1	3	10
99MLW037WP80	7/30/1999	3	3	1	1	1	1	1	3	10
99MLW038WP81	7/30/1999	3	3	1	1	1	1	1	3	10
99MLW039WP50	7/30/1999	3	3	1	1	1	1	1	3	10
99MLW040WP82	7/30/1999	3	3	1	1	1	1	1	3	10
99MLW041WP83	7/30/1999	3	3	1	1	1	1	1	3	10
99MLW042WP84	7/30/1999	3	3	1	1	1	1	1	3	10
99MLW047WP38	7/31/1999	3	3	1	1	1	1	1	3	10
99MLW048WP85	7/31/1999	3	3	1	1	1	1	1	3	10

units are Micrograms per liter (µg/l)
Bold text indicates an exceedence of a regulato

[1] Source: Washington State Maximum Contam
[2] Source: National Drinking Water Regulation
[3] Source: Washington State Model Toxics Con
[4] Source: USEPA Region 9 Preliminary Reme

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Methyl isobutyl ketone	Methylene chloride	Naphthalene	Propylbenzene	etrachlo	Tetrachloroethene	Styrene	Bromoform	1,1,1,2-Tetrachloroethane
Washington MCL[1]		**-**	**5,000**	**-**	**-**	**-**	**800**	**-**	**5,000**	**-**
Federal MCL[2]		**-**	**5**	**-**	**-**	**-**	**5**	**100**	**-**	**-**
MTCA[3]		**-**	**5,000**	**-**	**-**	**-**	**5,000**	**-**	**-**	**-**
Tap Water PRG[4]		**160,000**	**4,300**	**62,000**	**240,000**	**55**	**660**	**1,600,000**	**8,500**	**430**
00MLW001WG91AW05	3/7/2000	10	5	5	1	1	1	1	3	1
00MLW001WG91AW10	3/13/2000	10	5	5	1	1	1	1	3	1
00MLW001WG91AW13	3/8/2000	10	5	5	1	1	1	1	3	1
00MLW001WG91AW14	3/8/2000	10	5	5	1	1	1	1	3	1
00MLW001WG91AW15	3/8/2000	10	5	5	1	1	1	1	3	1
00MLW001WG91AW16	3/7/2000	10	5	5	1	1	1	1	3	1
00MLW001WG91AW17	3/9/2000	10	5	5	1	1	1	1	3	1
00MLW001WG91AW18	3/9/2000	10	5	5	1	1	1	1	3	1
00MLW001WG91AW19	3/13/2000	10	5	5	1	1	1	1	3	1
00MLW001WG91BW02	3/7/2000	10	5	5	1	1	1	1	3	1
00MLW001WG91BW03	3/17/2000	10	5	5	1	1	1	1	3	1
00MLW001WG91BW04	3/13/2000	10	5	5	1	1	1	1	3	1
00MLW001WG92BW02	3/17/2000	10	5	5	1	1	1	1	3	1
00MLW001WG99AW01	3/14/2000	10	5	5	1	1	1	1	3	1
00MLW001WG99AW02	3/16/2000	10	5	5	1	1	1	1	3	1
00MLW001WG99AW03	3/10/2000	10	5	5	1	1	1	1	3	1
00MLW001WG99AW05	3/9/2000	10	5	5	1	1	1	1	3	1
00MLW001WG99AW06	3/13/2000	10	5	5	1	1	1	1	3	1
00MLW001WG99AW07	3/15/2000	10	5	5	1	1	1	1	3	1
00MLW001WG99AW08	3/15/2000	10	5	5	1	1	1	1	3	1
00MLW001WG99AW09	3/10/2000	10	5	5	1	1	1	1	3	1
00MLW001WG99AW10	3/14/2000	10	5	5	1	1	1	1	3	1
00MLW001WG99BW01	3/14/2000	10	5	5	1	1	1	1	3	1
00MLW001WG99BW04	3/16/2000	10	5	5	1	1	1	1	3	1
00MLW001WG99BW05	3/20/2000	10	5	5	1	1	1	1	3	1
00MLW001WG99BW06	3/16/2000	10	5	5	1	1	1	1	3	1
00MLW001WG99BW08	3/16/2000	10	5	5	1	1	1	1	3	1
00MLW001WG99BW09	3/10/2000	10	5	5	1	1	1	1	3	1
00MLW001WG99BW10	3/10/2000	10	5	5	1	1	1	1	3	1
00MLW001WG99BW11	3/14/2000	10	5	5	1	1	1	1	3	1
00MLW001WG99BW12	3/9/2000	10	5	5	1	1	1	1	3	1
00MLW001WG99BW13	3/13/2000	10	5	5	1	1	1	1	3	1
00MLW001WG99BW16	3/8/2000	10	5	5	1	1	1	1	3	1
00MLW001WG99BW17	3/20/2000	10	5	5	1	1	1	1	3	1
00MLW001WG99BW18	3/10/2000	10	5	5	1	1	1	1	3	1
00MLW001WP02	6/6/2000	10	5	5	1	1	1	1	3	1
00MLW001WP05	6/6/2000	10	5	5	1	1	1	1	3	1
00MLW001WP06	6/7/2000	10	5	5	1	1	1	1	3	1
00MLW001WP07	6/7/2000	10	5	5	1	1	1	1	3	1
00MLW001WP08	6/7/2000	10	5	5	1	1	1	1	3	1
00MLW001WP09	6/7/2000	10	5	5	1	1	1	1	3	1
00MLW001WP11	6/22/2000	10	5	5	1	1	1	1	3	1

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Methyl isobutyl ketone	Methylene chloride	Naphthalene	Propylbenzene	etrachlo	Tetrachloroethene	Styrene	Bromoform	1,1,1,2-Tetrachloroethane
Washington MCL[1]		**-**	**5,000**	**-**	**-**	**-**	**800**	**-**	**5,000**	**-**
Federal MCL[2]		**-**	**5**	**-**	**-**	**-**	**5**	**100**	**-**	**-**
MTCA[3]		**-**	**5,000**	**-**	**-**	**-**	**5,000**	**-**	**-**	**-**
Tap Water PRG[4]		**160,000**	**4,300**	**62,000**	**240,000**	**55**	**660**	**1,600,000**	**8,500**	**430**
00MLW001WP12	6/22/2000	10	5	5	1	1	1	1	3	1
00MLW001WP13E	6/6/2000	10	5	5	1	1	1	1	3	1
00MLW001WP13W	6/6/2000	10	5	5	1	1	1	1	3	1
00MLW001WP14	6/23/2000	10	5	5	1	1	1	1	3	1
00MLW001WP15W	6/23/2000	10	5	5	1	1	1	1	3	1
00MLW001WP16	6/23/2000	10	5	5	1	1	1	1	3	1
00MLW001WP17	6/23/2000	10	5	5	1	1	1	1	3	1
00MLW001WP18N	6/23/2000	10	5	5	1	1	1	1	3	1
00MLW001WP18S	6/23/2000	10	5	5	1	1	1	1	3	1
00MLW001WP19	6/26/2000	10	5	5	1	1	1	1	3	1
00MLW001WP20	6/26/2000	10	5	5	1	1	1	1	3	1
00MLW001WP70	6/22/2000	10	5	5	1	1	1	1	3	1
00MLW001WP71	6/22/2000	10	5	5	1	1	1	1	3	1
00MLW001WP82	6/7/2000	10	5	5	1	1	1	1	3	1
00MLW001WP83	6/7/2000	10	5	5	1	1	1	1	3	1
00MLW001WP86	6/6/2000	10	5	5	1	1	1	1	3	1
00MLW002WG91AW01	6/19/2000	10	5	5	1	1	1	1	3	1
00MLW002WG91AW02	6/19/2000	10	5	5	1	1	1	1	3	1
00MLW002WG91AW03	6/19/2000	10	5	5	1	1	1	1	3	1
00MLW002WG91AW05	6/8/2000	10	5	5	1	1	1	1	3	1
00MLW002WG91AW09	6/16/2000	10	5	5	1	1	1	1	3	1
00MLW002WG91AW10	6/8/2000	10	5	5	1	1	1	1	3	1
00MLW002WG91AW13	6/13/2000	10	5	5	1	1	1	1	3	1
00MLW002WG91AW14	6/15/2000	10	5	5	1	1	1	1	3	1
00MLW002WG91AW15	6/13/2000	10	5	5	1	1	1	1	3	1
00MLW002WG91AW16	6/21/2000	10	5	5	1	1	1	1	3	1
00MLW002WG91AW17	6/12/2000	10	5	5	1	1	1	1	3	1
00MLW002WG91AW18	6/12/2000	10	5	5	1	1	1	1	3	1
00MLW002WG91AW19	6/14/2000	10	5	5	1	1	1	1	3	1
00MLW002WG91BW01	6/19/2000	10	5	5	1	1	1	1	3	1
00MLW002WG91BW02	6/8/2000	10	5	5	1	1	1	1	3	1
00MLW002WG91BW03	6/16/2000	10	5	5	1	1	1	1	3	1
00MLW002WG91BW04	6/8/2000	10	5	5	1	1	1	1	3	1
00MLW002WG92BW01	6/20/2000	10	5	5	1	1	1	1	3	1
00MLW002WG92BW02	6/20/2000	10	5	5	1	1	1	1	3	1
00MLW002WG99AW01	6/16/2000	10	5	5	1	1	1	1	3	1
00MLW002WG99AW02	6/13/2000	10	5	5	1	1	1	1	3	1
00MLW002WG99AW03	6/14/2000	10	5	5	1	1	1	1	3	1
00MLW002WG99AW04	6/20/2000	10	5	5	1	1	1	1	3	1
00MLW002WG99AW05	6/12/2000	10	5	5	1	1	1	1	3	1
00MLW002WG99AW06	6/14/2000	10	5	5	1	1	1	1	3	1
00MLW002WG99AW07	6/15/2000	10	5	5	1	1	1	1	3	1

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Methyl isobutyl ketone	Methylene chloride	Naphthalene	Propylbenzene	etrachlo	Tetrachloroethene	Styrene	Bromoform	1,1,1,2-Tetrachloroethane
Washington MCL[1]		**-**	**5,000**	**-**	**-**	**-**	**800**	**-**	**5,000**	**-**
Federal MCL[2]		**-**	**5**	**-**	**-**	**-**	**5**	**100**	**-**	**-**
MTCA[3]		**-**	**5,000**	**-**	**-**	**-**	**5,000**	**-**	**-**	**-**
Tap Water PRG[4]		**160,000**	**4,300**	**62,000**	**240,000**	**55**	**660**	**1,600,000**	**8,500**	**430**
00MLW002WG99AW08	6/15/2000	10	5	5	1	1	1	1	3	1
00MLW002WG99AW09	6/13/2000	10	5	5	1	1	1	1	3	1
00MLW002WG99AW10	6/19/2000	10	5	5	1	1	1	1	3	1
00MLW002WG99BW01	6/16/2000	10	5	5	1	1	1	1	3	1
00MLW002WG99BW05	6/21/2000	10	5	5	1	1	1	1	3	1
00MLW002WG99BW09	6/13/2000	10	5	5	1	1	1	1	3	1
00MLW002WG99BW10	6/14/2000	10	5	5	1	1	1	1	3	1
00MLW002WG99BW11	6/20/2000	10	5	5	1	1	1	1	3	1
00MLW002WG99BW12	6/12/2000	10	5	5	1	1	1	1	3	1
00MLW002WG99BW13	6/14/2000	10	5	5	1	1	1	1	3	1
00MLW002WG99BW14	6/16/2000	10	5	5	1	1	1	1	3	1
00MLW002WG99BW15	6/15/2000	10	5	5	1	1	1	1	3	1
00MLW002WG99BW16	6/21/2000	10	5	5	1	1	1	1	3	1
00MLW002WG99BW18	6/13/2000	10	5	5	1	1	1	1	3	1
00MLW002WGBML04	6/21/2000	10	5	5	1	1	1	1	3	1
00MLW002WP15E	9/18/2000	10	5	5	1	1	1	1	3	1
00MLW002WP23	8/17/2000	10	5	5	1	1	1	1	3	1
00MLW002WP25E	8/17/2000	10	5	5	1	1	1	1	3	1
00MLW002WP25W	8/17/2000	10	5	5	1	1	1	1	3	1
00MLW002WP26	8/30/2000	10	5	5	1	1	1	1	3	1
00MLW002WP29	8/30/2000	10	5	5	1	1	1	1	3	1
00MLW003WG00AW03	9/25/2000	10	5	5	1	1	1	1	3	1
00MLW003WG00AW10	10/12/2000	10	5	5	1	1	1	1	3	1
00MLW003WG00AW11	10/9/2000	10	5	5	1	1	1	1	3	1
00MLW003WG00AW12	9/19/2000	10	5	5	1	1	1	1	3	1
00MLW003WG00AW13	10/30/2000	10	5	5	1	1	1	1	3	1
00MLW003WG00AW14	10/30/2000	10	5	5	1	1	1	1	3	1
00MLW003WG00BW01	10/6/2000	10	5	5	1	1	1	1	3	1
00MLW003WG00BW02	10/9/2000	10	5	5	1	1	1	1	3	1
00MLW003WG00BW03	9/25/2000	10	5	5	1	1	1	1	3	1
00MLW003WG00BW04	9/19/2000	10	5	5	1	1	1	1	3	1
00MLW003WG00BW05	9/18/2000	10	5	5	1	1	1	1	3	1
00MLW003WG00BW06	10/6/2000	10	5	5	1	1	1	1	3	1
00MLW003WG00BW07	9/19/2000	10	5	5	1	1	1	1	3	1
00MLW003WG00BW08	9/25/2000	10	5	5	1	1	1	1	3	1
00MLW003WG00BW09	9/18/2000	10	5	5	1	1	1	1	3	1
00MLW003WG00BW10	10/12/2000	10	5	5	1	1	1	1	3	1
00MLW003WG00BW11	10/6/2000	10	5	5	1	1	1	1	3	1
00MLW003WG00BW12	10/5/2000	10	5	5	1	1	1	1	3	1
00MLW003WG00BW13	10/5/2000	10	5	5	1	1	1	1	3	1
00MLW003WG00BW14	10/6/2000	10	5	5	1	1	1	1	3	1
00MLW003WG00BW15	9/19/2000	10	5	5	1	1	1	1	3	1

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Methyl isobutyl ketone	Methylene chloride	Naphthalene	Propylbenzene	etrachlo	Tetrachloroethene	Styrene	Bromoform	1,1,1,2-Tetrachloroethane
Washington MCL[1]		**-**	**5,000**	**-**	**-**	**-**	**800**	**-**	**5,000**	**-**
Federal MCL[2]		**-**	**5**	**-**	**-**	**-**	**5**	**100**	**-**	**-**
MTCA[3]		**-**	**5,000**	**-**	**-**	**-**	**5,000**	**-**	**-**	**-**
Tap Water PRG[4]		**160,000**	**4,300**	**62,000**	**240,000**	**55**	**660**	**1,600,000**	**8,500**	**430**
00MLW003WG00BW16	10/30/2000	10	5	5	1	1	1	1	3	1
00MLW003WG91AW01	9/28/2000	-	5	5	1	1	1	1	-	1
00MLW003WG91AW02	9/28/2000	-	5	5	1	1	1	1	-	1
00MLW003WG91AW03	9/28/2000	-	5	5	1	1	1	1	-	1
00MLW003WG91AW05	9/20/2000	10	5	5	1	1	1	1	3	1
00MLW003WG91AW09	9/21/2000	10	5	5	1	1	1	1	3	1
00MLW003WG91AW10	9/20/2000	10	5	5	1	1	1	1	3	1
00MLW003WG91AW13	9/21/2000	10	5	5	1	1	1	1	3	1
00MLW003WG91AW14	9/21/2000	10	5	5	1	1	1	1	3	1
00MLW003WG91AW15	9/21/2000	10	5	5	1	1	1	1	3	1
00MLW003WG91AW16	10/5/2000	10	5	5	1	1	1	1	3	1
00MLW003WG91AW17	9/22/2000	-	5	5	1	1	1	1	3	1
00MLW003WG91AW18	9/22/2000	10	5	5	1	1	1	1	3	1
00MLW003WG91AW19	10/5/2000	10	5	5	1	1	1	1	3	1
00MLW003WG91BW01	9/28/2000	-	5	5	1	1	1	1	-	1
00MLW003WG91BW02	9/20/2000	10	5	5	1	1	1	1	3	1
00MLW003WG91BW03	9/26/2000	10	5	5	1	1	1	1	3	1
00MLW003WG91BW04	9/20/2000	10	5	5	1	1	1	1	3	1
00MLW003WG92BW01	9/27/2000	10	5	5	1	1	1	1	3	1
00MLW003WG92BW02	9/27/2000	10	5	5	1	1	1	1	3	1
00MLW003WG99AW01	9/20/2000	10	5	5	1	1	1	1	3	1
00MLW003WG99AW02	9/26/2000	10	5	5	1	1	1	1	3	1
00MLW003WG99AW03	9/26/2000	10	5	5	1	1	1	1	3	1
00MLW003WG99AW04	9/27/2000	10	5	5	1	1	1	1	3	1
00MLW003WG99AW05	9/22/2000	-	5	5	1	1	1	1	3	1
00MLW003WG99AW06	10/3/2000	10	5	5	1	1	1	1	3	1
00MLW003WG99AW07	10/4/2000	10	5	5	1	1	1	1	3	1
00MLW003WG99AW08	10/4/2000	10	5	5	1	1	1	1	3	1
00MLW003WG99AW09	10/3/2000	10	5	5	1	1	1	1	3	1
00MLW003WG99AW10	10/4/2000	10	5	5	1	1	1	1	3	1
00MLW003WG99BW01	9/22/2000	10	5	5	1	1	1	1	3	1
00MLW003WG99BW05	10/9/2000	10	5	5	1	1	1	1	3	1
00MLW003WG99BW09	9/26/2000	10	5	5	1	1	1	1	3	1
00MLW003WG99BW10	9/26/2000	10	5	5	1	1	1	1	3	1
00MLW003WG99BW11	9/27/2000	10	5	5	1	1	1	1	3	1
00MLW003WG99BW12	9/22/2000	10	5	5	1	1	1	1	3	1
00MLW003WG99BW13	10/12/2000	10	5	5	1	1	1	1	3	1
00MLW003WG99BW14	10/4/2000	10	5	5	1	1	1	1	3	1
00MLW003WG99BW15	10/4/2000	10	5	5	1	1	1	1	3	1
00MLW003WG99BW16	9/21/2000	10	5	5	1	1	1	1	3	1
00MLW003WG99BW18	10/3/2000	10	5	5	1	1	1	1	3	1
00MLW003WGBML04	10/9/2000	10	5	5	1	1	1	1	3	1

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Methyl isobutyl ketone	Methylene chloride	Naphthalene	Propylbenzene	etrachlo	Tetrachloroethene	Styrene	Bromoform	1,1,1,2-Tetrachloroethane
Washington MCL[1]		**-**	**5,000**	**-**	**-**	**-**	**800**	**-**	**5,000**	**-**
Federal MCL[2]		**-**	**5**	**-**	**-**	**-**	**5**	**100**	**-**	**-**
MTCA[3]		**-**	**5,000**	**-**	**-**	**-**	**5,000**	**-**	**-**	**-**
Tap Water PRG[4]		**160,000**	**4,300**	**62,000**	**240,000**	**55**	**660**	**1,600,000**	**8,500**	**430**
00MLW003WGMW02	9/6/2000	10	5	5	1	1	1	1	3	1
00MLW003WGMW04	9/6/2000	10	5	5	1	1	1	1	3	1
01MLW001WG00AW03	2/2/2001	10	5	5	1	1	1	1	3	1
01MLW001WG00AW11	1/31/2001	10	5	5	1	1	1	1	3	1
01MLW001WG00AW12	1/31/2001	10	5	5	1	1	1	1	3	1
01MLW001WG00AW13	2/5/2001	10	5	5	1	1	1	1	3	1
01MLW001WG00AW14	1/23/2001	10	5	5	1	1	1	1	3	1
01MLW001WG00BW01	1/29/2001	10	5	5	1	1	1	1	3	1
01MLW001WG00BW02	1/30/2001	10	5	5	1	1	1	1	3	1
01MLW001WG00BW03	1/30/2001	10	5	5	1	1	1	1	3	1
01MLW001WG00BW04	1/29/2001	10	5	5	1	1	1	1	3	1
01MLW001WG00BW05	1/29/2001	10	5	5	1	1	1	1	3	1
01MLW001WG00BW06	1/25/2001	10	5	5	1	1	1	1	3	1
01MLW001WG00BW07	1/29/2001	10	5	5	1	1	1	1	3	1
01MLW001WG00BW08	1/19/2001	10	5	5	1	1	1	1	3	1
01MLW001WG00BW09	1/25/2001	10	5	5	1	1	1	1	3	1
01MLW001WG00BW10	2/5/2001	10	5	5	1	1	1	1	3	1
01MLW001WG00BW11	1/17/2001	10	5	5	1	1	1	1	3	1
01MLW001WG00BW12	1/30/2001	10	5	5	1	1	1	1	3	1
01MLW001WG00BW13	1/23/2001	10	5	5	1	1	1	1	3	1
01MLW001WG00BW14	1/29/2001	10	5	5	1	1	1	1	3	1
01MLW001WG00BW15	1/31/2001	10	5	5	1	1	1	1	3	1
01MLW001WG00BW16	2/1/2001	10	5	5	1	1	1	1	3	1
01MLW001WG91AW01	1/24/2001	10	5	5	1	1	1	1	3	1
01MLW001WG91AW02	1/24/2001	10	5	5	1	1	1	1	3	1
01MLW001WG91AW03	1/24/2001	10	5	5	1	1	1	1	3	1
01MLW001WG91AW05	1/19/2001	10	5	5	1	1	1	1	3	1
01MLW001WG91AW09	1/22/2001	10	5	5	1	1	1	1	3	1
01MLW001WG91AW10	1/23/2001	10	5	5	1	1	1	1	3	1
01MLW001WG91AW13	1/25/2001	10	5	5	1	1	1	1	3	1
01MLW001WG91AW14	1/19/2001	10	5	5	1	1	1	1	3	1
01MLW001WG91AW15	1/18/2001	10	5	5	1	1	1	1	3	1
01MLW001WG91AW16	1/30/2001	10	5	5	1	1	1	1	3	1
01MLW001WG91AW17	1/26/2001	10	5	5	1	1	1	1	3	1
01MLW001WG91AW18	1/26/2001	10	5	5	1	1	1	1	3	1
01MLW001WG91AW19	1/23/2001	10	5	5	1	1	1	1	3	1
01MLW001WG91BW01	1/24/2001	10	5	5	1	1	1	1	3	1
01MLW001WG91BW02	1/19/2001	10	5	5	1	1	1	1	3	1
01MLW001WG91BW03	2/2/2001	10	5	5	1	1	1	1	3	1
01MLW001WG91BW04	1/23/2001	10	5	5	1	1	1	1	3	1
01MLW001WG92BW01	1/31/2001	10	5	5	1	1	1	1	3	1
01MLW001WG92BW02	1/31/2001	10	5	5	1	1	1	1	3	1

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Methyl isobutyl ketone	Methylene chloride	Naphthalene	Propylbenzene	etrachlo	Tetrachloroethene	Styrene	Bromoform	1,1,1,2-Tetrachloroethane
Washington MCL[1]		**-**	**5,000**	**-**	**-**	**-**	**800**	**-**	**5,000**	**-**
Federal MCL[2]		**-**	**5**	**-**	**-**	**-**	**5**	**100**	**-**	**-**
MTCA[3]		**-**	**5,000**	**-**	**-**	**-**	**5,000**	**-**	**-**	**-**
Tap Water PRG[4]		**160,000**	**4,300**	**62,000**	**240,000**	**55**	**660**	**1,600,000**	**8,500**	**430**
01MLW001WG99AW01	1/24/2001	10	5	5	1	1	1	1	3	1
01MLW001WG99AW02	2/1/2001	10	5	5	1	1	1	1	3	1
01MLW001WG99AW03	2/1/2001	10	5	5	1	1	1	1	3	1
01MLW001WG99AW04	2/5/2001	10	5	5	1	1	1	1	3	1
01MLW001WG99AW05	1/26/2001	10	5	5	1	1	1	1	3	1
01MLW001WG99AW06	1/22/2001	10	5	5	1	1	1	1	3	1
01MLW001WG99AW07	1/18/2001	10	5	5	1	1	1	1	3	1
01MLW001WG99AW08	1/18/2001	10	5	5	1	1	1	1	3	1
01MLW001WG99AW09	1/22/2001	10	5	5	1	1	1	1	3	1
01MLW001WG99AW10	1/24/2001	10	5	5	1	1	1	1	3	1
01MLW001WG99BW01	1/25/2001	10	5	5	1	1	1	1	3	1
01MLW001WG99BW05	1/25/2001	10	5	5	1	1	1	1	3	1
01MLW001WG99BW09	2/1/2001	10	5	5	1	1	1	1	3	1
01MLW001WG99BW10	2/1/2001	10	5	5	1	1	1	1	3	1
01MLW001WG99BW11	2/5/2001	10	5	5	1	1	1	1	3	1
01MLW001WG99BW12	1/26/2001	10	5	5	1	1	1	1	3	1
01MLW001WG99BW13	1/22/2001	10	5	5	1	1	1	1	3	1
01MLW001WG99BW14	1/18/2001	10	5	5	1	1	1	1	3	1
01MLW001WG99BW15	1/18/2001	10	5	5	1	1	1	1	3	1
01MLW001WG99BW16	1/19/2001	10	5	5	1	1	1	1	3	1
01MLW001WG99BW18	1/22/2001	10	5	5	1	1	1	1	3	1
01MLW001WP30	1/30/2001	10	5	5	1	1	1	1	3	1
01MLW001WP31	1/31/2001	10	5	5	1	1	1	1	3	1
01MLW001WP33	1/31/2001	10	5	5	1	1	1	1	3	1
01MLW002WG01BW01	5/31/2001	10	5	5	1	1	1	1	3	1
99MLW001WG91AW05	11/10/1999	10	5	5	1	1	1	1	3	1
99MLW001WG91AW09	11/12/1999	10	5	5	1	1	1	1	3	1
99MLW001WG91AW10	11/12/1999	10	5	5	1	1	1	1	3	1
99MLW001WG91AW13	11/11/1999	10	5	5	1	1	1	1	3	1
99MLW001WG91AW14	11/19/1999	10	5	5	1	1	1	1	3	1
99MLW001WG91AW15	11/10/1999	10	5	5	1	1	1	1	3	1
99MLW001WG91AW16	11/10/1999	10	5	5	1	1	1	1	3	1
99MLW001WG91AW17	11/12/1999	10	5	5	1	1	1	1	3	1
99MLW001WG91AW18	11/11/1999	10	5	5	1	1	1	1	3	1
99MLW001WG91AW19	11/11/1999	10	5	5	1	1	1	1	3	1
99MLW001WG91BW02	11/10/1999	10	5	5	1	1	1	1	3	1
99MLW001WG91BW03	11/12/1999	10	5	5	1	1	1	1	3	1
99MLW001WG91BW04	11/12/1999	10	5	5	1	1	1	1	3	1
99MLW001WG92BW01	11/17/1999	10	5	5	1	1	1	1	3	1
99MLW001WG92BW02	11/16/1999	10	5	5	1	1	1	1	3	1
99MLW001WG99AW01	11/12/1999	10	5	5	1	1	1	1	3	1
99MLW001WG99AW02	11/15/1999	10	5	5	1	1	1	1	3	1

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Methyl isobutyl ketone	Methylene chloride	Naphthalene	Propylbenzene	etrachlo	Tetrachloroethene	Styrene	Bromoform	1,1,1,2-Tetrachloroethane
Washington MCL[1]		**-**	**5,000**	**-**	**-**	**-**	**800**	**-**	**5,000**	**-**
Federal MCL[2]		**-**	**5**	**-**	**-**	**-**	**5**	**100**	**-**	**-**
MTCA[3]		**-**	**5,000**	**-**	**-**	**-**	**5,000**	**-**	**-**	**-**
Tap Water PRG[4]		**160,000**	**4,300**	**62,000**	**240,000**	**55**	**660**	**1,600,000**	**8,500**	**430**
99MLW001WG99AW03	11/15/1999	10	5	5	1	1	1	1	3	1
99MLW001WG99AW04	11/17/1999	10	5	5	1	1	1	1	3	1
99MLW001WG99AW05	11/17/1999	10	5	5	1	1	1	1	3	1
99MLW001WG99AW06	11/16/1999	10	5	5	1	1	1	1	3	1
99MLW001WG99AW07	11/18/1999	10	5	5	1	1	1	1	3	1
99MLW001WG99AW08	11/18/1999	10	5	5	1	1	1	1	3	1
99MLW001WG99AW09	11/16/1999	10	5	5	1	1	1	1	3	1
99MLW001WG99BW01	11/11/1999	10	5	5	1	1	1	1	3	1
99MLW001WG99BW02	11/19/1999	10	5	5	1	1	1	1	3	1
99MLW001WG99BW04	11/9/1999	10	5	5	1	1	1	1	3	1
99MLW001WG99BW05	11/9/1999	10	5	5	1	1	1	1	3	1
99MLW001WG99BW06	11/18/1999	10	5	5	1	1	1	1	3	1
99MLW001WG99BW08	11/15/1999	10	5	5	1	1	1	1	3	1
99MLW001WG99BW09	11/15/1999	10	5	5	1	1	1	1	3	1
99MLW001WG99BW10	11/15/1999	10	5	5	1	1	1	1	3	1
99MLW001WG99BW11	11/17/1999	10	5	5	1	1	1	1	3	1
99MLW001WG99BW12	11/17/1999	10	5	5	1	1	1	1	3	1
99MLW001WG99BW13	11/16/1999	10	5	5	1	1	1	1	3	1
99MLW001WG99BW14	11/18/1999	10	5	5	1	1	1	1	3	1
99MLW001WG99BW15	11/18/1999	10	5	5	1	1	1	1	3	1
99MLW001WG99BW16	11/19/1999	10	5	5	1	1	1	1	3	1
99MLW001WG99BW17	11/9/1999	10	5	5	1	1	1	1	3	1
99MLW001WG99BW18	11/16/1999	10	5	5	1	1	1	1	3	1
99MLW001WGBML04	11/9/1999	10	5	5	1	1	1	1	3	1
99MLW001WP13(1)	7/26/1999	10	5	5	1	1	1	1	3	1
99MLW001WP86	11/19/1999	10	5	5	1	1	1	1	3	1
99MLW001WS01	11/22/1999	10	5	5	1	1	1	1	3	1
99MLW002WP13	7/26/1999	10	5	5	1	1	1	1	3	1
99MLW003WP44(1)	7/26/1999	10	5	5	1	1	1	1	3	1
99MLW004WP21	7/26/1999	10	5	5	1	1	1	1	3	1
99MLW005WP60	7/26/1999	10	5	5	1	1	1	1	3	1
99MLW006WP61	7/26/1999	10	5	5	1	1	1	1	3	1
99MLW007WP42	7/26/1999	10	5	5	1	1	1	1	3	1
99MLW008WP42	7/26/1999	10	5	5	1	1	1	1	3	1
99MLW009WP22	7/27/1999	10	5	5	1	1	1	1	3	1
99MLW010WP46	7/27/1999	10	5	5	1	1	1	1	3	1
99MLW011WP63	7/27/1999	10	5	5	1	1	1	1	3	1
99MLW012WP64	7/27/1999	10	5	5	1	1	1	1	3	1
99MLW013WP04	7/27/1999	10	5	5	1	1	1	1	3	1
99MLW014WP44	7/27/1999	10	5	5	1	1	1	1	3	1
99MLW014WP65	7/28/1999	10	5	5	1	1	1	1	3	1
99MLW015WP66	7/28/1999	10	5	5	1	1	1	1	3	1

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Methyl isobutyl ketone	Methylene chloride	Naphthalene	Propylbenzene	etrachlo	Tetrachloroethene	Styrene	Bromoform	1,1,1,2-Tetrachloroethane
Washington MCL[1]		**-**	**5,000**	**-**	**-**	**-**	**800**	**-**	**5,000**	**-**
Federal MCL[2]		**-**	**5**	**-**	**-**	**-**	**5**	**100**	**-**	**-**
MTCA[3]		**-**	**5,000**	**-**	**-**	**-**	**5,000**	**-**	**-**	**-**
Tap Water PRG[4]		**160,000**	**4,300**	**62,000**	**240,000**	**55**	**660**	**1,600,000**	**8,500**	**430**
99MLW016WP67	7/28/1999	10	5	5	1	1	1	1	3	1
99MLW017WP68	7/28/1999	10	5	5	1	1	1	1	3	1
99MLW018WP69	7/28/1999	10	5	5	1	1	1	1	3	1
99MLW019WP70	7/28/1999	10	5	5	1	1	1	1	3	1
99MLW020WP71	7/28/1999	10	5	5	1	1	1	1	3	1
99MLW021WP10	7/28/1999	10	5	5	1	1	1	1	3	1
99MLW022WP03	7/28/1999	10	5	5	1	1	1	1	3	1
99MLW023WP01	7/29/1999	10	5	5	1	1	1	1	3	1
99MLW024WP72	7/29/1999	10	5	5	1	1	1	1	3	1
99MLW025WP73	7/29/1999	10	5	5	1	1	1	1	3	1
99MLW026WP74	7/29/1999	10	5	5	1	1	1	1	3	1
99MLW027WP27	7/29/1999	10	5	5	1	1	1	1	3	1
99MLW028WP28	7/29/1999	10	5	5	1	1	1	1	3	1
99MLW029WP24	7/29/1999	10	5	5	1	1	1	1	3	1
99MLW030WP75	7/29/1999	10	5	5	1	1	1	1	3	1
99MLW031WP76	7/29/1999	10	5	5	1	1	1	1	3	1
99MLW032WP32	7/29/1999	10	5	5	1	1	1	1	3	1
99MLW033WP77	7/29/1999	10	5	5	1	1	1	1	3	1
99MLW034WP41	7/30/1999	10	5	5	1	1	1	1	3	1
99MLW035WP78	7/30/1999	10	5	5	1	1	1	1	3	1
99MLW036WP79	7/30/1999	10	5	5	1	1	1	1	3	1
99MLW037WP80	7/30/1999	10	5	5	1	1	1	1	3	1
99MLW038WP81	7/30/1999	10	5	5	1	1	1	1	3	1
99MLW039WP50	7/30/1999	10	5	5	1	1	1	1	3	1
99MLW040WP82	7/30/1999	10	5	5	1	1	1	1	3	1
99MLW041WP83	7/30/1999	10	5	5	1	1	1	1	3	1
99MLW042WP84	7/30/1999	10	5	5	1	1	1	1	3	1
99MLW047WP38	7/31/1999	10	5	5	1	1	1	1	3	1
99MLW048WP85	7/31/1999	10	5	5	1	1	1	1	3	1

units are Micrograms per liter (µg/l)
Bold text indicates an exceedence of a regulato

[1] Source: Washington State Maximum Contam
[2] Source: National Drinking Water Regulation
[3] Source: Washington State Model Toxics Con
[4] Source: USEPA Region 9 Preliminary Reme

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		1,1,1-Trichoroethane	1,1,2-Trichoroethane	1,2,4-Trichlorobenzene	Trichloroethene	Chloroform	1,2,3-Trichloropropane	1,2,4-Trimethylbenzene
Washington MCL[1]		**200**	**-**	**-**	**80**	**7,000**	**-**	**-**
Federal MCL[2]		**200**	**5**	**-**	**5**	**-**	**-**	**-**
MTCA[3]		**200,000**	**-**	**-**	**5,000**	**-**	**-**	**-**
Tap Water PRG[4]		**3,200,000**	**200**	**12,000**	**28**	**6,200**	**5.6**	**12,000**
00MLW001WG91AW05	3/7/2000	1	1	5	0 5	1	1	1
00MLW001WG91AW10	3/13/2000	1	1	5	1	1	1	1
00MLW001WG91AW13	3/8/2000	1	1	5	1	1	1	1
00MLW001WG91AW14	3/8/2000	1	1	5	1	1	1	1
00MLW001WG91AW15	3/8/2000	1	1	5	1	1	1	1
00MLW001WG91AW16	3/7/2000	1	1	5	0 5	1	1	1
00MLW001WG91AW17	3/9/2000	1	1	5	1	1	1	1
00MLW001WG91AW18	3/9/2000	1	1	5	1	1	1	1
00MLW001WG91AW19	3/13/2000	1	1	5	1	1	1	1
00MLW001WG91BW02	3/7/2000	1	1	5	0 5	1	1	1
00MLW001WG91BW03	3/17/2000	1	1	5	-	1	1	1
00MLW001WG91BW04	3/13/2000	1	1	5	1	1	1	1
00MLW001WG92BW02	3/17/2000	1	1	5	-	1	1	1
00MLW001WG99AW01	3/14/2000	1	1	5	-	1	1	1
00MLW001WG99AW02	3/16/2000	1	1	5	1	1	1	1
00MLW001WG99AW03	3/10/2000	1	1	5	-	1	1	1
00MLW001WG99AW05	3/9/2000	1	1	5	1	1	1	1
00MLW001WG99AW06	3/13/2000	1	1	5	1	1	1	1
00MLW001WG99AW07	3/15/2000	1	1	5	1	1	1	1
00MLW001WG99AW08	3/15/2000	1	1	5	1	1	1	1
00MLW001WG99AW09	3/10/2000	1	1	5	-	1	1	1
00MLW001WG99AW10	3/14/2000	1	1	5	-	1	1	1
00MLW001WG99BW01	3/14/2000	1	1	5	-	1	1	1
00MLW001WG99BW04	3/16/2000	1	1	5	1	1	1	1
00MLW001WG99BW05	3/20/2000	1	1	5	1	1	1	1
00MLW001WG99BW06	3/16/2000	1	1	5	1	1	1	1
00MLW001WG99BW08	3/16/2000	1	1	5	1	1	1	1
00MLW001WG99BW09	3/10/2000	1	1	5	1	1	1	1
00MLW001WG99BW10	3/10/2000	1	1	5	-	1	1	1
00MLW001WG99BW11	3/14/2000	1	1	5	1	1	1	1
00MLW001WG99BW12	3/9/2000	1	1	5	1	1	1	1
00MLW001WG99BW13	3/13/2000	1	1	5	1	1	1	1
00MLW001WG99BW16	3/8/2000	1	1	5	-	1	1	1
00MLW001WG99BW17	3/20/2000	1	1	5	1	1	1	1
00MLW001WG99BW18	3/10/2000	1	1	5	-	1	1	1
00MLW001WP02	6/6/2000	1	1	5	0 5	1	1	1
00MLW001WP05	6/6/2000	1	1	5	0 5	1	1	1
00MLW001WP06	6/7/2000	1	1	5	0 5	1	1	1
00MLW001WP07	6/7/2000	1	1	5	0 5	1	1	1
00MLW001WP08	6/7/2000	1	1	5	0 5	1	1	1
00MLW001WP09	6/7/2000	1	1	5	0 5	1	1	1
00MLW001WP11	6/22/2000	1	1	5	0 5	1	1	1

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		1,1,1-Trichoroethane	1,1,2-Trichoroethane	1,2,4-Trichlorobenzene	Trichloroethene	Chloroform	1,2,3-Trichloropropane	1,2,4-Trimethylbenzene
Washington MCL[1]		**200**	**-**	**-**	**80**	**7,000**	**-**	**-**
Federal MCL[2]		**200**	**5**	**-**	**5**	**-**	**-**	**-**
MTCA[3]		**200,000**	**-**	**-**	**5,000**	**-**	**-**	**-**
Tap Water PRG[4]		**3,200,000**	**200**	**12,000**	**28**	**6,200**	**5.6**	**12,000**
00MLW001WP12	6/22/2000	1	1	5	0 5	1	1	1
00MLW001WP13E	6/6/2000	1	1	5	0 5	1	1	1
00MLW001WP13W	6/6/2000	1	1	5	0 5	1	1	1
00MLW001WP14	6/23/2000	1	1	5	-	1	1	1
00MLW001WP15W	6/23/2000	1	1	5	-	1	1	1
00MLW001WP16	6/23/2000	1	1	5	0 5	1	1	1
00MLW001WP17	6/23/2000	1	1	5	0 5	1	1	1
00MLW001WP18N	6/23/2000	1	1	5	-	1	1	1
00MLW001WP18S	6/23/2000	1	1	5	-	1	1	1
00MLW001WP19	6/26/2000	1	1	5	0 5	1	1	1
00MLW001WP20	6/26/2000	1	1	5	0 5	1	1	1
00MLW001WP70	6/22/2000	1	1	5	-	1	1	1
00MLW001WP71	6/22/2000	1	1	5	-	1	1	1
00MLW001WP82	6/7/2000	1	1	5	0 5	1	1	1
00MLW001WP83	6/7/2000	1	1	5	-	1	1	1
00MLW001WP86	6/6/2000	1	1	5	-	1	1	1
00MLW002WG91AW01	6/19/2000	1	1	5	0 5	1	1	1
00MLW002WG91AW02	6/19/2000	1	1	5	0 5	1	1	1
00MLW002WG91AW03	6/19/2000	1	1	5	0 5	1	1	1
00MLW002WG91AW05	6/8/2000	1	1	5	0 5	1	1	1
00MLW002WG91AW09	6/16/2000	1	1	5	-	1	1	1
00MLW002WG91AW10	6/8/2000	1	1	5	0 5	1	1	1
00MLW002WG91AW13	6/13/2000	1	1	5	0 5	1	1	1
00MLW002WG91AW14	6/15/2000	1	1	5	0 5	1	1	1
00MLW002WG91AW15	6/13/2000	1	1	5	-	1	1	-
00MLW002WG91AW16	6/21/2000	1	1	5	0 5	1	1	1
00MLW002WG91AW17	6/12/2000	1	1	5	0 5	1	1	1
00MLW002WG91AW18	6/12/2000	1	1	5	0 5	1	1	1
00MLW002WG91AW19	6/14/2000	1	1	5	0 5	1	1	1
00MLW002WG91BW01	6/19/2000	1	1	5	0 5	1	1	1
00MLW002WG91BW02	6/8/2000	1	1	5	0 5	1	1	1
00MLW002WG91BW03	6/16/2000	1	1	5	-	1	1	1
00MLW002WG91BW04	6/8/2000	1	1	5	0 5	1	1	1
00MLW002WG92BW01	6/20/2000	1	1	5	-	1	1	1
00MLW002WG92BW02	6/20/2000	1	1	5	-	1	1	1
00MLW002WG99AW01	6/16/2000	1	1	5	-	1	1	1
00MLW002WG99AW02	6/13/2000	1	1	5	0 5	1	1	1
00MLW002WG99AW03	6/14/2000	1	1	5	-	1	1	1
00MLW002WG99AW04	6/20/2000	1	1	5	0 5	1	1	1
00MLW002WG99AW05	6/12/2000	1	1	5	0 5	1	1	1
00MLW002WG99AW06	6/14/2000	1	1	5	0 5	1	1	1
00MLW002WG99AW07	6/15/2000	1	1	5	0 5	1	1	1

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		1,1,1-Trichoroethane	1,1,2-Trichoroethane	1,2,4-Trichlorobenzene	Trichloroethene	Chloroform	1,2,3-Trichloropropane	1,2,4-Trimethylbenzene
Washington MCL[1]		**200**	**-**	**-**	**80**	**7,000**	**-**	**-**
Federal MCL[2]		**200**	**5**	**-**	**5**	**-**	**-**	**-**
MTCA[3]		**200,000**	**-**	**-**	**5,000**	**-**	**-**	**-**
Tap Water PRG[4]		**3,200,000**	**200**	**12,000**	**28**	**6,200**	**5.6**	**12,000**
00MLW002WG99AW08	6/15/2000	1	1	5	0 5	1	1	1
00MLW002WG99AW09	6/13/2000	1	1	5	-	1	1	1
00MLW002WG99AW10	6/19/2000	1	1	5	-	1	1	1
00MLW002WG99BW01	6/16/2000	1	1	5	-	1	1	1
00MLW002WG99BW05	6/21/2000	1	1	5	0 5	1	1	1
00MLW002WG99BW09	6/13/2000	1	1	5	0 5	1	1	1
00MLW002WG99BW10	6/14/2000	1	1	5	-	1	1	1
00MLW002WG99BW11	6/20/2000	1	1	5	0 5	1	1	1
00MLW002WG99BW12	6/12/2000	1	1	5	-	1	1	1
00MLW002WG99BW13	6/14/2000	1	1	5	0 5	1	1	1
00MLW002WG99BW14	6/16/2000	1	1	5	0 5	1	1	1
00MLW002WG99BW15	6/15/2000	1	1	5	-	1	1	1
00MLW002WG99BW16	6/21/2000	1	1	5	-	1	1	1
00MLW002WG99BW18	6/13/2000	1	1	5	-	1	1	1
00MLW002WGBML04	6/21/2000	1	1	5	0 5	1	1	1
00MLW002WP15E	9/18/2000	1	1	5	-	1	1	1
00MLW002WP23	8/17/2000	1	1	5	0 5	1	1	1
00MLW002WP25E	8/17/2000	1	1	5	0 5	1	1	1
00MLW002WP25W	8/17/2000	1	1	5	0 5	1	1	1
00MLW002WP26	8/30/2000	1	1	5	0 5	1	1	1
00MLW002WP29	8/30/2000	1	1	5	0 5	1	1	1
00MLW003WG00AW03	9/25/2000	1	1	5	0 5	1	1	1
00MLW003WG00AW10	10/12/2000	1	1	5	0 5	1	1	1
00MLW003WG00AW11	10/9/2000	1	1	5	-	1	1	1
00MLW003WG00AW12	9/19/2000	1	1	5	0 5	1	1	1
00MLW003WG00AW13	10/30/2000	1	1	5	0 5	1	1	1
00MLW003WG00AW14	10/30/2000	1	1	5	0 5	1	1	1
00MLW003WG00BW01	10/6/2000	1	1	5	0 5	1	1	1
00MLW003WG00BW02	10/9/2000	1	1	5	0 5	1	1	1
00MLW003WG00BW03	9/25/2000	1	1	5	0 5	1	1	1
00MLW003WG00BW04	9/19/2000	1	1	5	0 5	1	1	1
00MLW003WG00BW05	9/18/2000	1	1	5	0 5	1	1	1
00MLW003WG00BW06	10/6/2000	1	1	5	0 5	1	1	1
00MLW003WG00BW07	9/19/2000	1	1	5	-	1	1	1
00MLW003WG00BW08	9/25/2000	1	1	5	0 5	1	1	1
00MLW003WG00BW09	9/18/2000	1	1	5	0 5	1	1	1
00MLW003WG00BW10	10/12/2000	1	1	5	0 5	1	1	1
00MLW003WG00BW11	10/6/2000	1	1	5	0 5	1	1	1
00MLW003WG00BW12	10/5/2000	1	1	5	-	1	1	1
00MLW003WG00BW13	10/5/2000	1	1	5	0 5	1	1	1
00MLW003WG00BW14	10/6/2000	1	1	5	0 5	1	1	1
00MLW003WG00BW15	9/19/2000	1	1	5	-	1	1	1

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		1,1,1-Trichoroethane	1,1,2-Trichoroethane	1,2,4-Trichlorobenzene	Trichloroethene	Chloroform	1,2,3-Trichloropropane	1,2,4-Trimethylbenzene
Washington MCL[1]		**200**	**-**	**-**	**80**	**7,000**	**-**	**-**
Federal MCL[2]		**200**	**5**	**-**	**5**	**-**	**-**	**-**
MTCA[3]		**200,000**	**-**	**-**	**5,000**	**-**	**-**	**-**
Tap Water PRG[4]		**3,200,000**	**200**	**12,000**	**28**	**6,200**	**5.6**	**12,000**
00MLW003WG00BW16	10/30/2000	1	1	5	0 5	1	1	1
00MLW003WG91AW01	9/28/2000	1	1	5	0 5	1	1	1
00MLW003WG91AW02	9/28/2000	1	1	5	0 5	1	1	1
00MLW003WG91AW03	9/28/2000	1	1	5	0 5	1	1	1
00MLW003WG91AW05	9/20/2000	1	1	5	0 5	1	1	1
00MLW003WG91AW09	9/21/2000	1	1	5	-	1	1	1
00MLW003WG91AW10	9/20/2000	1	1	5	0 5	1	1	1
00MLW003WG91AW13	9/21/2000	1	1	5	0 5	1	1	1
00MLW003WG91AW14	9/21/2000	1	1	5	-	1	1	1
00MLW003WG91AW15	9/21/2000	1	1	5	-	1	1	1
00MLW003WG91AW16	10/5/2000	1	1	5	0 5	1	1	1
00MLW003WG91AW17	9/22/2000	1	1	5	0 5	1	1	1
00MLW003WG91AW18	9/22/2000	1	1	5	0 5	1	1	1
00MLW003WG91AW19	10/5/2000	1	1	5	0 5	1	1	1
00MLW003WG91BW01	9/28/2000	1	1	5	0 5	1	1	1
00MLW003WG91BW02	9/20/2000	1	1	5	0 5	1	1	1
00MLW003WG91BW03	9/26/2000	1	1	5	-	1	1	1
00MLW003WG91BW04	9/20/2000	1	1	5	-	1	1	1
00MLW003WG92BW01	9/27/2000	1	1	5	-	1	1	1
00MLW003WG92BW02	9/27/2000	1	1	5	-	1	1	1
00MLW003WG99AW01	9/20/2000	1	1	5	0 5	1	1	1
00MLW003WG99AW02	9/26/2000	1	1	5	0 5	1	1	1
00MLW003WG99AW03	9/26/2000	1	1	5	0 5	1	1	1
00MLW003WG99AW04	9/27/2000	1	1	5	0 5	1	1	1
00MLW003WG99AW05	9/22/2000	1	1	5	0 5	1	1	1
00MLW003WG99AW06	10/3/2000	1	1	5	0 5	1	1	1
00MLW003WG99AW07	10/4/2000	1	1	5	0 5	1	1	1
00MLW003WG99AW08	10/4/2000	1	1	5	0 5	1	1	1
00MLW003WG99AW09	10/3/2000	1	1	5	-	1	1	1
00MLW003WG99AW10	10/4/2000	1	1	5	-	1	1	1
00MLW003WG99BW01	9/22/2000	1	1	5	0 5	1	1	1
00MLW003WG99BW05	10/9/2000	1	1	5	0 5	1	1	1
00MLW003WG99BW09	9/26/2000	1	1	5	0 5	1	1	1
00MLW003WG99BW10	9/26/2000	1	1	5	-	1	1	1
00MLW003WG99BW11	9/27/2000	1	1	5	0 5	1	1	1
00MLW003WG99BW12	9/22/2000	1	1	5	0 5	1	1	1
00MLW003WG99BW13	10/12/2000	1	1	5	0 5	1	1	1
00MLW003WG99BW14	10/4/2000	1	1	5	0 5	1	1	1
00MLW003WG99BW15	10/4/2000	1	1	5	-	1	1	1
00MLW003WG99BW16	9/21/2000	1	1	5	-	1	1	1
00MLW003WG99BW18	10/3/2000	1	1	5	-	1	1	1
00MLW003WGBML04	10/9/2000	1	1	5	0 5	1	1	1

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		1,1,1-Trichoroethane	1,1,2-Trichoroethane	1,2,4-Trichlorobenzene	Trichloroethene	Chloroform	1,2,3-Trichloropropane	1,2,4-Trimethylbenzene
Washington MCL[1]		**200**	**-**	**-**	**80**	**7,000**	**-**	**-**
Federal MCL[2]		**200**	**5**	**-**	**5**	**-**	**-**	**-**
MTCA[3]		**200,000**	**-**	**-**	**5,000**	**-**	**-**	**-**
Tap Water PRG[4]		**3,200,000**	**200**	**12,000**	**28**	**6,200**	**5.6**	**12,000**
00MLW003WGMW02	9/6/2000	1	1	5	0 5	1	1	1
00MLW003WGMW04	9/6/2000	1	1	5	0 5	1	1	1
01MLW001WG00AW03	2/2/2001	1	1	5	0 5	1	1	1
01MLW001WG00AW11	1/31/2001	1	1	5	-	1	1	1
01MLW001WG00AW12	1/31/2001	1	1	5	0 5	1	1	1
01MLW001WG00AW13	2/5/2001	1	1	5	0 5	1	1	1
01MLW001WG00AW14	1/23/2001	1	1	5	0 5	1	1	1
01MLW001WG00BW01	1/29/2001	1	1	5	0 5	1	1	1
01MLW001WG00BW02	1/30/2001	1	1	5	-	1	1	1
01MLW001WG00BW03	1/30/2001	1	1	5	0 5	1	1	1
01MLW001WG00BW04	1/29/2001	1	1	5	0 5	1	1	1
01MLW001WG00BW05	1/29/2001	1	1	5	0 5	1	1	1
01MLW001WG00BW06	1/25/2001	1	1	5	0 5	1	1	1
01MLW001WG00BW07	1/29/2001	1	1	5	-	1	1	1
01MLW001WG00BW08	1/19/2001	1	1	5	0 5	1	1	1
01MLW001WG00BW09	1/25/2001	1	1	5	0 5	1	1	1
01MLW001WG00BW10	2/5/2001	1	1	5	0 5	1	1	1
01MLW001WG00BW11	1/17/2001	1	1	5	0 5	1	1	1
01MLW001WG00BW12	1/30/2001	1	1	5	-	1	1	1
01MLW001WG00BW13	1/23/2001	1	1	5	0 5	1	1	1
01MLW001WG00BW14	1/29/2001	1	1	5	0 5	1	1	1
01MLW001WG00BW15	1/31/2001	1	1	5	-	1	1	1
01MLW001WG00BW16	2/1/2001	1	1	5	0 5	1	1	1
01MLW001WG91AW01	1/24/2001	1	1	5	0 5	1	1	1
01MLW001WG91AW02	1/24/2001	1	1	5	0 5	1	1	1
01MLW001WG91AW03	1/24/2001	1	1	5	0 5	1	1	1
01MLW001WG91AW05	1/19/2001	1	1	5	0 5	1	1	1
01MLW001WG91AW09	1/22/2001	1	1	5	0 5	1	1	1
01MLW001WG91AW10	1/23/2001	1	1	5	0 5	1	1	1
01MLW001WG91AW13	1/25/2001	1	1	5	0 5	1	1	1
01MLW001WG91AW14	1/19/2001	1	1	5	-	1	1	1
01MLW001WG91AW15	1/18/2001	1	1	5	-	1	1	1
01MLW001WG91AW16	1/30/2001	1	1	5	0 5	1	1	1
01MLW001WG91AW17	1/26/2001	1	1	5	0 5	1	1	1
01MLW001WG91AW18	1/26/2001	1	1	5	0 5	1	1	1
01MLW001WG91AW19	1/23/2001	1	1	5	0 5	1	1	1
01MLW001WG91BW01	1/24/2001	1	1	5	0 5	1	1	1
01MLW001WG91BW02	1/19/2001	1	1	5	0 5	1	1	1
01MLW001WG91BW03	2/2/2001	1	1	5	-	1	1	1
01MLW001WG91BW04	1/23/2001	1	1	5	-	1	1	1
01MLW001WG92BW01	1/31/2001	1	1	5	-	1	1	1
01MLW001WG92BW02	1/31/2001	1	1	5	-	1	1	1

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		1,1,1-Trichoroethane	1,1,2-Trichoroethane	1,2,4-Trichlorobenzene	Trichloroethene	Chloroform	1,2,3-Trichloropropane	1,2,4-Trimethylbenzene
Washington MCL[1]		**200**	**-**	**-**	**80**	**7,000**	**-**	**-**
Federal MCL[2]		**200**	**5**	**-**	**5**	**-**	**-**	**-**
MTCA[3]		**200,000**	**-**	**-**	**5,000**	**-**	**-**	**-**
Tap Water PRG[4]		**3,200,000**	**200**	**12,000**	**28**	**6,200**	**5.6**	**12,000**
01MLW001WG99AW01	1/24/2001	1	1	5	-	1	1	1
01MLW001WG99AW02	2/1/2001	1	1	5	0 5	1	1	1
01MLW001WG99AW03	2/1/2001	1	1	5	-	1	1	1
01MLW001WG99AW04	2/5/2001	1	1	5	0 5	1	1	1
01MLW001WG99AW05	1/26/2001	1	1	5	0 5	1	1	1
01MLW001WG99AW06	1/22/2001	1	1	5	0 5	1	1	1
01MLW001WG99AW07	1/18/2001	1	1	5	0 5	1	1	1
01MLW001WG99AW08	1/18/2001	1	1	5	0 5	1	1	1
01MLW001WG99AW09	1/22/2001	1	1	5	-	1	1	1
01MLW001WG99AW10	1/24/2001	1	1	5	-	1	1	1
01MLW001WG99BW01	1/25/2001	1	1	5	-	1	1	1
01MLW001WG99BW05	1/25/2001	1	1	5	0 5	1	1	1
01MLW001WG99BW09	2/1/2001	1	1	5	0 5	1	1	1
01MLW001WG99BW10	2/1/2001	1	1	5	-	1	1	1
01MLW001WG99BW11	2/5/2001	1	1	5	0 5	1	1	1
01MLW001WG99BW12	1/26/2001	1	1	5	-	1	1	1
01MLW001WG99BW13	1/22/2001	1	1	5	0 5	1	1	1
01MLW001WG99BW14	1/18/2001	1	1	5	0 5	1	1	1
01MLW001WG99BW15	1/18/2001	1	1	5	-	1	1	1
01MLW001WG99BW16	1/19/2001	1	1	5	-	1	1	1
01MLW001WG99BW18	1/22/2001	1	1	5	-	1	1	1
01MLW001WP30	1/30/2001	1	1	5	0 5	1	1	1
01MLW001WP31	1/31/2001	1	1	5	0 5	1	1	1
01MLW001WP33	1/31/2001	1	1	5	0 5	1	1	1
01MLW002WG01BW01	5/31/2001	1	1	5	0 5	1	1	1
99MLW001WG91AW05	11/10/1999	1	1	5	0 5	1	1	1
99MLW001WG91AW09	11/12/1999	1	1	5	0 5	1	1	1
99MLW001WG91AW10	11/12/1999	1	1	5	0 5	1	1	1
99MLW001WG91AW13	11/11/1999	1	1	5	0 5	1	1	1
99MLW001WG91AW14	11/19/1999	1	1	5	-	1	1	1
99MLW001WG91AW15	11/10/1999	1	1	5	-	1	1	-
99MLW001WG91AW16	11/10/1999	1	1	5	0 5	1	1	1
99MLW001WG91AW17	11/12/1999	1	1	5	0 5	1	1	1
99MLW001WG91AW18	11/11/1999	1	1	5	0 5	1	1	1
99MLW001WG91AW19	11/11/1999	1	1	5	0 5	1	1	1
99MLW001WG91BW02	11/10/1999	1	1	5	0 5	1	1	1
99MLW001WG91BW03	11/12/1999	1	1	5	-	1	1	1
99MLW001WG91BW04	11/12/1999	1	1	5	0 5	1	1	1
99MLW001WG92BW01	11/17/1999	1	1	5	-	1	1	1
99MLW001WG92BW02	11/16/1999	1	1	5	-	1	1	1
99MLW001WG99AW01	11/12/1999	1	1	5	0 5	1	1	1
99MLW001WG99AW02	11/15/1999	1	1	5	0 5	1	1	1

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		1,1,1-Trichoroethane	1,1,2-Trichoroethane	1,2,4-Trichlorobenzene	Trichloroethene	Chloroform	1,2,3-Trichloropropane	1,2,4-Trimethylbenzene
Washington MCL[1]		**200**	**-**	**-**	**80**	**7,000**	**-**	**-**
Federal MCL[2]		**200**	**5**	**-**	**5**	**-**	**-**	**-**
MTCA[3]		**200,000**	**-**	**-**	**5,000**	**-**	**-**	**-**
Tap Water PRG[4]		**3,200,000**	**200**	**12,000**	**28**	**6,200**	**5.6**	**12,000**
99MLW001WG99AW03	11/15/1999	1	1	5	0 5	1	1	1
99MLW001WG99AW04	11/17/1999	1	1	5	0 5	1	1	1
99MLW001WG99AW05	11/17/1999	1	1	5	0 5	1	1	1
99MLW001WG99AW06	11/16/1999	1	1	5	0 5	1	1	1
99MLW001WG99AW07	11/18/1999	1	1	5	0 5	1	1	1
99MLW001WG99AW08	11/18/1999	1	1	5	0 5	1	1	1
99MLW001WG99AW09	11/16/1999	1	1	5	-	1	1	1
99MLW001WG99BW01	11/11/1999	1	1	5	-	1	1	1
99MLW001WG99BW02	11/19/1999	1	1	5	-	1	1	1
99MLW001WG99BW04	11/9/1999	1	1	5	0 5	1	1	1
99MLW001WG99BW05	11/9/1999	1	1	5	0 5	1	1	1
99MLW001WG99BW06	11/18/1999	1	1	5	0 5	1	1	1
99MLW001WG99BW08	11/15/1999	1	1	5	0 5	1	1	1
99MLW001WG99BW09	11/15/1999	1	1	5	0 5	1	1	1
99MLW001WG99BW10	11/15/1999	1	1	5	-	1	1	1
99MLW001WG99BW11	11/17/1999	1	1	5	0 5	1	1	1
99MLW001WG99BW12	11/17/1999	1	1	5	-	1	1	1
99MLW001WG99BW13	11/16/1999	1	1	5	0 5	1	1	1
99MLW001WG99BW14	11/18/1999	1	1	5	0 5	1	1	1
99MLW001WG99BW15	11/18/1999	1	1	5	-	1	1	1
99MLW001WG99BW16	11/19/1999	1	1	5	-	1	1	1
99MLW001WG99BW17	11/9/1999	1	1	5	0 5	1	1	1
99MLW001WG99BW18	11/16/1999	1	1	5	-	1	1	1
99MLW001WGBML04	11/9/1999	1	1	5	0 5	1	1	1
99MLW001WP13(1)	7/26/1999	1	1	5	0 5	1	1	1
99MLW001WP86	11/19/1999	1	1	5	-	1	1	1
99MLW001WS01	11/22/1999	1	1	5	0 5	1	1	1
99MLW002WP13	7/26/1999	1	1	5	0 5	1	1	1
99MLW003WP44(1)	7/26/1999	1	1	5	0 5	1	1	1
99MLW004WP21	7/26/1999	1	1	5	0 5	1	1	1
99MLW005WP60	7/26/1999	1	1	5	0 5	1	1	1
99MLW006WP61	7/26/1999	1	1	5	0 5	1	1	1
99MLW007WP42	7/26/1999	1	1	5	0 5	1	1	1
99MLW008WP42	7/26/1999	1	1	5	0 5	1	1	1
99MLW009WP22	7/27/1999	1	1	5	0 5	1	1	1
99MLW010WP46	7/27/1999	1	1	5	0 5	1	1	1
99MLW011WP63	7/27/1999	1	1	5	0 5	1	1	1
99MLW012WP64	7/27/1999	1	1	5	0 5	1	1	1
99MLW013WP04	7/27/1999	1	1	5	-	1	1	1
99MLW014WP44	7/27/1999	1	1	5	0 5	1	1	1
99MLW014WP65	7/28/1999	1	1	5	0 5	1	1	1
99MLW015WP66	7/28/1999	1	1	5	0 5	1	1	1

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		1,1,1-Trichoroethane	1,1,2-Trichoroethane	1,2,4-Trichlorobenzene	Trichloroethene	Chloroform	1,2,3-Trichloropropane	1,2,4-Trimethylbenzene
Washington MCL[1]		**200**	**-**	**-**	**80**	**7,000**	**-**	**-**
Federal MCL[2]		**200**	**5**	**-**	**5**	**-**	**-**	**-**
MTCA[3]		**200,000**	**-**	**-**	**5,000**	**-**	**-**	**-**
Tap Water PRG[4]		**3,200,000**	**200**	**12,000**	**28**	**6,200**	**5.6**	**12,000**
99MLW016WP67	7/28/1999	1	1	5	0 5	1	1	1
99MLW017WP68	7/28/1999	1	1	5	0 5	1	1	1
99MLW018WP69	7/28/1999	1	1	5	0 5	1	1	1
99MLW019WP70	7/28/1999	1	1	5	-	1	1	1
99MLW020WP71	7/28/1999	1	1	5	0 5	1	1	1
99MLW021WP10	7/28/1999	1	1	5	0 5	1	1	1
99MLW022WP03	7/28/1999	1	1	5	-	1	1	1
99MLW023WP01	7/29/1999	1	1	5	0 5	1	1	1
99MLW024WP72	7/29/1999	1	1	5	0 5	1	1	1
99MLW025WP73	7/29/1999	1	1	5	0 5	1	1	1
99MLW026WP74	7/29/1999	1	1	5	-	1	1	1
99MLW027WP27	7/29/1999	1	1	5	0 5	1	1	1
99MLW028WP28	7/29/1999	1	1	5	0 5	1	1	1
99MLW029WP24	7/29/1999	1	1	5	0 5	1	1	1
99MLW030WP75	7/29/1999	1	1	5	0 5	1	1	1
99MLW031WP76	7/29/1999	1	1	5	0 5	1	1	1
99MLW032WP32	7/29/1999	1	1	5	0 5	1	1	1
99MLW033WP77	7/29/1999	1	1	5	-	1	1	1
99MLW034WP41	7/30/1999	1	1	5	0 5	1	1	1
99MLW035WP78	7/30/1999	1	1	5	0 5	1	1	1
99MLW036WP79	7/30/1999	1	1	5	0 5	1	1	1
99MLW037WP80	7/30/1999	1	1	5	0 5	1	1	1
99MLW038WP81	7/30/1999	1	1	5	0 5	1	1	1
99MLW039WP50	7/30/1999	1	1	5	0 5	1	1	1
99MLW040WP82	7/30/1999	1	1	5	0 5	1	1	1
99MLW041WP83	7/30/1999	1	1	5	-	1	1	1
99MLW042WP84	7/30/1999	1	1	5	0 5	1	1	1
99MLW047WP38	7/31/1999	1	1	5	0 5	1	1	1
99MLW048WP85	7/31/1999	1	1	5	0 5	1	1	1

units are Micrograms per liter (µg/l)
Bold text indicates an exceedence of a regulato

[1] Source: Washington State Maximum Contam
[2] Source: National Drinking Water Regulation
[3] Source: Washington State Model Toxics Con
[4] Source: USEPA Region 9 Preliminary Reme

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		1,3,5-Trimethy benzene	Vinyl acetate	Vinyl chloride	m,p-Xylenes	o-Xylene
Washington MCL[1]		**-**	**-**	**20**	**-**	**-**
Federal MCL[2]		**-**	**-**	**2**	**-**	**-**
MTCA[3]		**-**	**-**	**200**	**-**	**-**
Tap Water PRG[4]		**12,000**	**410,000**	**20**	**210,000**	**210,000**
00MLW001WG91AW05	3/7/2000	1	10	0 5	1	1
00MLW001WG91AW10	3/13/2000	1	10	1	1	1
00MLW001WG91AW13	3/8/2000	1	10	1	1	1
00MLW001WG91AW14	3/8/2000	1	10	1	1	1
00MLW001WG91AW15	3/8/2000	1	10	1	1	1
00MLW001WG91AW16	3/7/2000	1	10	0 5	1	1
00MLW001WG91AW17	3/9/2000	1	10	1	1	1
00MLW001WG91AW18	3/9/2000	1	10	1	1	1
00MLW001WG91AW19	3/13/2000	1	10	1	1	1
00MLW001WG91BW02	3/7/2000	1	10	0 5	1	1
00MLW001WG91BW03	3/17/2000	1	10	1	1	1
00MLW001WG91BW04	3/13/2000	1	10	1	1	1
00MLW001WG92BW02	3/17/2000	1	10	1	1	1
00MLW001WG99AW01	3/14/2000	1	10	1	1	1
00MLW001WG99AW02	3/16/2000	1	10	1	1	1
00MLW001WG99AW03	3/10/2000	1	10	1	1	1
00MLW001WG99AW05	3/9/2000	1	10	1	1	1
00MLW001WG99AW06	3/13/2000	1	10	1	1	1
00MLW001WG99AW07	3/15/2000	1	10	1	1	1
00MLW001WG99AW08	3/15/2000	1	10	1	1	1
00MLW001WG99AW09	3/10/2000	1	10	1	1	1
00MLW001WG99AW10	3/14/2000	1	10	1	1	1
00MLW001WG99BW01	3/14/2000	1	10	1	1	1
00MLW001WG99BW04	3/16/2000	1	10	1	1	1
00MLW001WG99BW05	3/20/2000	1	10	1	1	1
00MLW001WG99BW06	3/16/2000	1	10	1	1	1
00MLW001WG99BW08	3/16/2000	1	10	1	1	1
00MLW001WG99BW09	3/10/2000	1	10	1	1	1
00MLW001WG99BW10	3/10/2000	1	10	1	1	1
00MLW001WG99BW11	3/14/2000	1	10	1	1	1
00MLW001WG99BW12	3/9/2000	1	10	1	1	1
00MLW001WG99BW13	3/13/2000	1	10	1	1	1
00MLW001WG99BW16	3/8/2000	1	10	1	1	1
00MLW001WG99BW17	3/20/2000	1	10	1	1	1
00MLW001WG99BW18	3/10/2000	1	10	1	1	1
00MLW001WP02	6/6/2000	1	10	0 5	1	1
00MLW001WP05	6/6/2000	1	10	0 5	1	1
00MLW001WP06	6/7/2000	1	10	0 5	1	1
00MLW001WP07	6/7/2000	1	10	0 5	1	1
00MLW001WP08	6/7/2000	1	10	0 5	1	1
00MLW001WP09	6/7/2000	1	10	0 5	1	1
00MLW001WP11	6/22/2000	1	10	0 5	1	1

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		1,3,5-Trimethy benzene	Vinyl acetate	Vinyl chloride	m,p-Xylenes	o-Xylene
Washington MCL[1]		**-**	**-**	**20**	**-**	**-**
Federal MCL[2]		**-**	**-**	**2**	**-**	**-**
MTCA[3]		**-**	**-**	**200**	**-**	**-**
Tap Water PRG[4]		**12,000**	**410,000**	**20**	**210,000**	**210,000**
00MLW001WP12	6/22/2000	1	10	0 5	1	1
00MLW001WP13E	6/6/2000	1	10	0 5	1	1
00MLW001WP13W	6/6/2000	1	10	0 5	1	1
00MLW001WP14	6/23/2000	1	10	0 5	1	1
00MLW001WP15W	6/23/2000	1	10	0 5	1	1
00MLW001WP16	6/23/2000	1	10	0 5	1	1
00MLW001WP17	6/23/2000	1	10	0 5	1	1
00MLW001WP18N	6/23/2000	1	10	0 5	1	1
00MLW001WP18S	6/23/2000	1	10	0 5	1	1
00MLW001WP19	6/26/2000	1	10	0 5	1	1
00MLW001WP20	6/26/2000	1	10	0 5	1	1
00MLW001WP70	6/22/2000	1	10	0 5	1	1
00MLW001WP71	6/22/2000	1	10	0 5	1	1
00MLW001WP82	6/7/2000	1	10	0 5	1	1
00MLW001WP83	6/7/2000	1	10	0 5	1	1
00MLW001WP86	6/6/2000	1	10	0 5	1	1
00MLW002WG91AW01	6/19/2000	1	10	0 5	1	1
00MLW002WG91AW02	6/19/2000	1	10	0 5	1	1
00MLW002WG91AW03	6/19/2000	1	10	0 5	1	1
00MLW002WG91AW05	6/8/2000	1	10	0 5	1	1
00MLW002WG91AW09	6/16/2000	1	10	0 5	1	1
00MLW002WG91AW10	6/8/2000	1	10	0 5	1	1
00MLW002WG91AW13	6/13/2000	1	10	0 5	1	1
00MLW002WG91AW14	6/15/2000	1	10	0 5	1	1
00MLW002WG91AW15	6/13/2000	-	10	0 5	1	1
00MLW002WG91AW16	6/21/2000	1	10	0 5	1	1
00MLW002WG91AW17	6/12/2000	1	10	0 5	1	1
00MLW002WG91AW18	6/12/2000	1	10	0 5	1	1
00MLW002WG91AW19	6/14/2000	1	10	0 5	1	1
00MLW002WG91BW01	6/19/2000	1	10	0 5	1	1
00MLW002WG91BW02	6/8/2000	1	10	0 5	1	1
00MLW002WG91BW03	6/16/2000	1	10	0 5	1	1
00MLW002WG91BW04	6/8/2000	1	10	0 5	1	1
00MLW002WG92BW01	6/20/2000	1	10	0 5	1	1
00MLW002WG92BW02	6/20/2000	1	10	0 5	1	1
00MLW002WG99AW01	6/16/2000	1	10	0 5	1	1
00MLW002WG99AW02	6/13/2000	1	10	0 5	1	1
00MLW002WG99AW03	6/14/2000	1	10	0 5	1	1
00MLW002WG99AW04	6/20/2000	1	10	0 5	1	1
00MLW002WG99AW05	6/12/2000	1	10	0 5	1	1
00MLW002WG99AW06	6/14/2000	1	10	0 5	1	1
00MLW002WG99AW07	6/15/2000	1	10	0 5	1	1

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		1,3,5-Trimethy benzene	Vinyl acetate	Vinyl chloride	m,p-Xylenes	o-Xylene
Washington MCL[1]		**-**	**-**	**20**	**-**	**-**
Federal MCL[2]		**-**	**-**	**2**	**-**	**-**
MTCA[3]		**-**	**-**	**200**	**-**	**-**
Tap Water PRG[4]		**12,000**	**410,000**	**20**	**210,000**	**210,000**
00MLW002WG99AW08	6/15/2000	1	10	0 5	1	1
00MLW002WG99AW09	6/13/2000	1	10	0 5	1	1
00MLW002WG99AW10	6/19/2000	1	10	0 5	1	1
00MLW002WG99BW01	6/16/2000	1	10	0 5	1	1
00MLW002WG99BW05	6/21/2000	1	10	0 5	1	1
00MLW002WG99BW09	6/13/2000	1	10	0 5	1	1
00MLW002WG99BW10	6/14/2000	1	10	0 5	1	1
00MLW002WG99BW11	6/20/2000	1	10	0 5	1	1
00MLW002WG99BW12	6/12/2000	1	10	0 5	1	1
00MLW002WG99BW13	6/14/2000	1	10	0 5	1	1
00MLW002WG99BW14	6/16/2000	1	10	0 5	1	1
00MLW002WG99BW15	6/15/2000	1	10	0 5	1	1
00MLW002WG99BW16	6/21/2000	1	10	0 5	1	1
00MLW002WG99BW18	6/13/2000	1	10	0 5	1	1
00MLW002WGBML04	6/21/2000	1	10	0 5	1	1
00MLW002WP15E	9/18/2000	1	10	0 5	1	1
00MLW002WP23	8/17/2000	1	10	0 5	1	1
00MLW002WP25E	8/17/2000	1	10	0 5	1	1
00MLW002WP25W	8/17/2000	1	10	0 5	1	1
00MLW002WP26	8/30/2000	1	10	0 5	1	1
00MLW002WP29	8/30/2000	1	10	0 5	1	1
00MLW003WG00AW03	9/25/2000	1	10	0 5	1	1
00MLW003WG00AW10	10/12/2000	1	10	0 5	1	1
00MLW003WG00AW11	10/9/2000	1	10	0 5	1	1
00MLW003WG00AW12	9/19/2000	1	10	0 5	1	1
00MLW003WG00AW13	10/30/2000	1	10	0 5	1	1
00MLW003WG00AW14	10/30/2000	1	10	0 5	1	1
00MLW003WG00BW01	10/6/2000	1	10	0 5	1	1
00MLW003WG00BW02	10/9/2000	1	10	0 5	1	1
00MLW003WG00BW03	9/25/2000	1	10	0 5	1	1
00MLW003WG00BW04	9/19/2000	1	10	0 5	1	1
00MLW003WG00BW05	9/18/2000	1	10	0 5	1	1
00MLW003WG00BW06	10/6/2000	1	10	0 5	1	1
00MLW003WG00BW07	9/19/2000	1	10	0 5	1	1
00MLW003WG00BW08	9/25/2000	1	10	0 5	1	1
00MLW003WG00BW09	9/18/2000	1	10	0 5	1	1
00MLW003WG00BW10	10/12/2000	1	10	0 5	1	1
00MLW003WG00BW11	10/6/2000	1	10	0 5	1	1
00MLW003WG00BW12	10/5/2000	1	10	0 5	1	1
00MLW003WG00BW13	10/5/2000	1	10	0 5	1	1
00MLW003WG00BW14	10/6/2000	1	10	0 5	1	1
00MLW003WG00BW15	9/19/2000	1	10	0 5	1	1

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		1,3,5-Trimethy benzene	Vinyl acetate	Vinyl chloride	m,p-Xylenes	o-Xylene
Washington MCL[1]		**-**	**-**	**20**	**-**	**-**
Federal MCL[2]		**-**	**-**	**2**	**-**	**-**
MTCA[3]		**-**	**-**	**200**	**-**	**-**
Tap Water PRG[4]		**12,000**	**410,000**	**20**	**210,000**	**210,000**
00MLW003WG00BW16	10/30/2000	1	10	0 5	1	1
00MLW003WG91AW01	9/28/2000	1	10	0 5	1	1
00MLW003WG91AW02	9/28/2000	1	10	0 5	1	1
00MLW003WG91AW03	9/28/2000	1	10	0 5	1	1
00MLW003WG91AW05	9/20/2000	1	10	0 5	1	1
00MLW003WG91AW09	9/21/2000	1	10	0 5	1	1
00MLW003WG91AW10	9/20/2000	1	10	0 5	1	1
00MLW003WG91AW13	9/21/2000	1	10	0 5	1	1
00MLW003WG91AW14	9/21/2000	1	10	0 5	1	1
00MLW003WG91AW15	9/21/2000	-	10	0 5	1	1
00MLW003WG91AW16	10/5/2000	1	10	0 5	1	1
00MLW003WG91AW17	9/22/2000	1	10	0 5	1	1
00MLW003WG91AW18	9/22/2000	1	10	0 5	1	1
00MLW003WG91AW19	10/5/2000	1	10	0 5	1	1
00MLW003WG91BW01	9/28/2000	1	10	0 5	1	1
00MLW003WG91BW02	9/20/2000	1	10	0 5	1	1
00MLW003WG91BW03	9/26/2000	1	10	0 5	1	1
00MLW003WG91BW04	9/20/2000	1	10	0 5	1	1
00MLW003WG92BW01	9/27/2000	1	10	0 5	1	1
00MLW003WG92BW02	9/27/2000	1	10	0 5	1	1
00MLW003WG99AW01	9/20/2000	1	10	0 5	1	1
00MLW003WG99AW02	9/26/2000	1	10	0 5	1	1
00MLW003WG99AW03	9/26/2000	1	10	0 5	1	1
00MLW003WG99AW04	9/27/2000	1	10	0 5	1	1
00MLW003WG99AW05	9/22/2000	1	10	0 5	1	1
00MLW003WG99AW06	10/3/2000	1	10	0 5	1	1
00MLW003WG99AW07	10/4/2000	1	10	0 5	1	1
00MLW003WG99AW08	10/4/2000	1	10	0 5	1	1
00MLW003WG99AW09	10/3/2000	1	10	0 5	1	1
00MLW003WG99AW10	10/4/2000	1	10	0 5	1	1
00MLW003WG99BW01	9/22/2000	1	10	0 5	1	1
00MLW003WG99BW05	10/9/2000	1	10	0 5	1	1
00MLW003WG99BW09	9/26/2000	1	10	0 5	1	1
00MLW003WG99BW10	9/26/2000	1	10	0 5	1	1
00MLW003WG99BW11	9/27/2000	1	10	0 5	1	1
00MLW003WG99BW12	9/22/2000	1	10	0 5	1	1
00MLW003WG99BW13	10/12/2000	1	10	0 5	1	1
00MLW003WG99BW14	10/4/2000	1	10	0 5	1	1
00MLW003WG99BW15	10/4/2000	1	10	0 5	1	1
00MLW003WG99BW16	9/21/2000	1	10	0 5	1	1
00MLW003WG99BW18	10/3/2000	1	10	0 5	1	1
00MLW003WGBML04	10/9/2000	1	10	0 5	1	1

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		1,3,5-Trimethy benzene	Vinyl acetate	Vinyl chloride	m,p-Xylenes	o-Xylene
Washington MCL[1]		**-**	**-**	**20**	**-**	**-**
Federal MCL[2]		**-**	**-**	**2**	**-**	**-**
MTCA[3]		**-**	**-**	**200**	**-**	**-**
Tap Water PRG[4]		**12,000**	**410,000**	**20**	**210,000**	**210,000**
00MLW003WGMW02	9/6/2000	1	10	0 5	1	1
00MLW003WGMW04	9/6/2000	1	10	0 5	1	1
01MLW001WG00AW03	2/2/2001	1	10	0 5	1	1
01MLW001WG00AW11	1/31/2001	1	10	0 5	1	1
01MLW001WG00AW12	1/31/2001	1	10	0 5	1	1
01MLW001WG00AW13	2/5/2001	1	10	0 5	1	1
01MLW001WG00AW14	1/23/2001	1	10	0 5	1	1
01MLW001WG00BW01	1/29/2001	1	10	0 5	1	1
01MLW001WG00BW02	1/30/2001	1	10	0 5	1	1
01MLW001WG00BW03	1/30/2001	1	10	0 5	1	1
01MLW001WG00BW04	1/29/2001	1	10	0 5	1	1
01MLW001WG00BW05	1/29/2001	1	10	0 5	1	1
01MLW001WG00BW06	1/25/2001	1	10	0 5	1	1
01MLW001WG00BW07	1/29/2001	1	10	0 5	1	1
01MLW001WG00BW08	1/19/2001	1	10	0 5	1	1
01MLW001WG00BW09	1/25/2001	1	10	0 5	1	1
01MLW001WG00BW10	2/5/2001	1	10	0 5	1	1
01MLW001WG00BW11	1/17/2001	1	10	0 5	1	1
01MLW001WG00BW12	1/30/2001	1	10	0 5	1	1
01MLW001WG00BW13	1/23/2001	1	10	0 5	1	1
01MLW001WG00BW14	1/29/2001	1	10	0 5	1	1
01MLW001WG00BW15	1/31/2001	1	10	0 5	1	1
01MLW001WG00BW16	2/1/2001	1	10	0 5	1	1
01MLW001WG91AW01	1/24/2001	1	10	0 5	1	1
01MLW001WG91AW02	1/24/2001	1	10	0 5	1	1
01MLW001WG91AW03	1/24/2001	1	10	0 5	1	1
01MLW001WG91AW05	1/19/2001	1	10	0 5	1	1
01MLW001WG91AW09	1/22/2001	1	10	0 5	1	1
01MLW001WG91AW10	1/23/2001	1	10	0 5	1	1
01MLW001WG91AW13	1/25/2001	1	10	0 5	1	1
01MLW001WG91AW14	1/19/2001	1	10	0 5	1	1
01MLW001WG91AW15	1/18/2001	-	10	0 5	1	1
01MLW001WG91AW16	1/30/2001	1	10	0 5	1	1
01MLW001WG91AW17	1/26/2001	1	10	0 5	1	1
01MLW001WG91AW18	1/26/2001	1	10	0 5	1	1
01MLW001WG91AW19	1/23/2001	1	10	0 5	1	1
01MLW001WG91BW01	1/24/2001	1	10	0 5	1	1
01MLW001WG91BW02	1/19/2001	1	10	0 5	1	1
01MLW001WG91BW03	2/2/2001	1	10	0 5	1	1
01MLW001WG91BW04	1/23/2001	1	10	0 5	1	1
01MLW001WG92BW01	1/31/2001	1	10	0 5	1	1
01MLW001WG92BW02	1/31/2001	1	10	0 5	1	1

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		1,3,5-Trimethy benzene	Vinyl acetate	Vinyl chloride	m,p-Xylenes	o-Xylene
Washington MCL[1]		**-**	**-**	**20**	**-**	**-**
Federal MCL[2]		**-**	**-**	**2**	**-**	**-**
MTCA[3]		**-**	**-**	**200**	**-**	**-**
Tap Water PRG[4]		**12,000**	**410,000**	**20**	**210,000**	**210,000**
01MLW001WG99AW01	1/24/2001	1	10	0 5	1	1
01MLW001WG99AW02	2/1/2001	1	10	0 5	1	1
01MLW001WG99AW03	2/1/2001	1	10	0 5	1	1
01MLW001WG99AW04	2/5/2001	1	10	0 5	1	1
01MLW001WG99AW05	1/26/2001	1	10	0 5	1	1
01MLW001WG99AW06	1/22/2001	1	10	0 5	1	1
01MLW001WG99AW07	1/18/2001	1	10	0 5	1	1
01MLW001WG99AW08	1/18/2001	1	10	0 5	1	1
01MLW001WG99AW09	1/22/2001	1	10	0 5	1	1
01MLW001WG99AW10	1/24/2001	1	10	0 5	1	1
01MLW001WG99BW01	1/25/2001	1	10	0 5	1	1
01MLW001WG99BW05	1/25/2001	1	10	0 5	1	1
01MLW001WG99BW09	2/1/2001	1	10	0 5	1	1
01MLW001WG99BW10	2/1/2001	1	10	0 5	1	1
01MLW001WG99BW11	2/5/2001	1	10	0 5	1	1
01MLW001WG99BW12	1/26/2001	1	10	0 5	1	1
01MLW001WG99BW13	1/22/2001	1	10	0 5	1	1
01MLW001WG99BW14	1/18/2001	1	10	0 5	1	1
01MLW001WG99BW15	1/18/2001	1	10	0 5	1	1
01MLW001WG99BW16	1/19/2001	1	10	0 5	1	1
01MLW001WG99BW18	1/22/2001	1	10	0 5	1	1
01MLW001WP30	1/30/2001	1	10	0 5	1	1
01MLW001WP31	1/31/2001	1	10	0 5	1	1
01MLW001WP33	1/31/2001	1	10	0 5	1	1
01MLW002WG01BW01	5/31/2001	1	10	0 5	1	1
99MLW001WG91AW05	11/10/1999	1	10	0 5	1	1
99MLW001WG91AW09	11/12/1999	1	10	0 5	1	1
99MLW001WG91AW10	11/12/1999	1	10	0 5	1	1
99MLW001WG91AW13	11/11/1999	1	10	0 5	1	1
99MLW001WG91AW14	11/19/1999	1	10	0 5	1	1
99MLW001WG91AW15	11/10/1999	-	10	0 5	1	1
99MLW001WG91AW16	11/10/1999	1	10	0 5	1	1
99MLW001WG91AW17	11/12/1999	1	10	0 5	1	1
99MLW001WG91AW18	11/11/1999	1	10	0 5	1	1
99MLW001WG91AW19	11/11/1999	1	10	0 5	1	1
99MLW001WG91BW02	11/10/1999	1	10	0 5	1	1
99MLW001WG91BW03	11/12/1999	1	10	0 5	1	1
99MLW001WG91BW04	11/12/1999	1	10	0 5	1	1
99MLW001WG92BW01	11/17/1999	1	10	0 5	1	1
99MLW001WG92BW02	11/16/1999	1	10	0 5	1	1
99MLW001WG99AW01	11/12/1999	1	10	0 5	1	1
99MLW001WG99AW02	11/15/1999	1	10	0 5	1	1

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		1,3,5-Trimethy benzene	Vinyl acetate	Vinyl chloride	m,p-Xylenes	o-Xylene
Washington MCL[1]		**-**	**-**	**20**	**-**	**-**
Federal MCL[2]		**-**	**-**	**2**	**-**	**-**
MTCA[3]		**-**	**-**	**200**	**-**	**-**
Tap Water PRG[4]		**12,000**	**410,000**	**20**	**210,000**	**210,000**
99MLW001WG99AW03	11/15/1999	1	10	0 5	1	1
99MLW001WG99AW04	11/17/1999	1	10	0 5	1	1
99MLW001WG99AW05	11/17/1999	1	10	0 5	1	1
99MLW001WG99AW06	11/16/1999	1	10	0 5	1	1
99MLW001WG99AW07	11/18/1999	1	10	0 5	1	1
99MLW001WG99AW08	11/18/1999	1	10	0 5	1	1
99MLW001WG99AW09	11/16/1999	1	10	0 5	1	1
99MLW001WG99BW01	11/11/1999	1	10	0 5	1	1
99MLW001WG99BW02	11/19/1999	1	10	0 5	1	1
99MLW001WG99BW04	11/9/1999	1	10	0 5	1	1
99MLW001WG99BW05	11/9/1999	1	10	0 5	1	1
99MLW001WG99BW06	11/18/1999	1	10	0 5	1	1
99MLW001WG99BW08	11/15/1999	1	10	0 5	1	1
99MLW001WG99BW09	11/15/1999	1	10	0 5	1	1
99MLW001WG99BW10	11/15/1999	1	10	0 5	1	1
99MLW001WG99BW11	11/17/1999	1	10	0 5	1	1
99MLW001WG99BW12	11/17/1999	1	10	0 5	1	1
99MLW001WG99BW13	11/16/1999	1	10	0 5	1	1
99MLW001WG99BW14	11/18/1999	1	10	0 5	1	1
99MLW001WG99BW15	11/18/1999	1	10	0 5	1	1
99MLW001WG99BW16	11/19/1999	1	10	0 5	1	1
99MLW001WG99BW17	11/9/1999	1	10	0 5	1	1
99MLW001WG99BW18	11/16/1999	1	10	0 5	1	1
99MLW001WGBML04	11/9/1999	1	10	0 5	1	1
99MLW001WP13(1)	7/26/1999	1	10	0 5	1	1
99MLW001WP86	11/19/1999	1	10	0 5	1	1
99MLW001WS01	11/22/1999	1	10	0 5	1	1
99MLW002WP13	7/26/1999	1	10	0 5	1	1
99MLW003WP44(1)	7/26/1999	1	10	0 5	1	1
99MLW004WP21	7/26/1999	1	10	0 5	1	1
99MLW005WP60	7/26/1999	1	10	0 5	1	1
99MLW006WP61	7/26/1999	1	10	0 5	1	1
99MLW007WP42	7/26/1999	1	10	0 5	1	1
99MLW008WP42	7/26/1999	1	10	0 5	1	1
99MLW009WP22	7/27/1999	1	10	0 5	1	1
99MLW010WP46	7/27/1999	1	10	0 5	1	1
99MLW011WP63	7/27/1999	1	10	0 5	1	1
99MLW012WP64	7/27/1999	1	10	0 5	1	1
99MLW013WP04	7/27/1999	1	10	0 5	1	1
99MLW014WP44	7/27/1999	1	10	0 5	1	1
99MLW014WP65	7/28/1999	1	10	0 5	1	1
99MLW015WP66	7/28/1999	1	10	0 5	1	1

TABLE 4-16

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - VOCs
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		1,3,5-Trimethy benzene	Vinyl acetate	Vinyl chloride	m,p-Xylenes	o-Xylene
Washington MCL[1]		**-**	**-**	**20**	**-**	**-**
Federal MCL[2]		**-**	**-**	**2**	**-**	**-**
MTCA[3]		**-**	**-**	**200**	**-**	**-**
Tap Water PRG[4]		**12,000**	**410,000**	**20**	**210,000**	**210,000**
99MLW016WP67	7/28/1999	1	10	0 5	1	1
99MLW017WP68	7/28/1999	1	10	0 5	1	1
99MLW018WP69	7/28/1999	1	10	0 5	1	1
99MLW019WP70	7/28/1999	1	10	0 5	1	1
99MLW020WP71	7/28/1999	1	10	0 5	1	1
99MLW021WP10	7/28/1999	1	10	0 5	1	1
99MLW022WP03	7/28/1999	1	10	0 5	1	1
99MLW023WP01	7/29/1999	1	10	0 5	1	1
99MLW024WP72	7/29/1999	1	10	0 5	1	1
99MLW025WP73	7/29/1999	1	10	0 5	1	1
99MLW026WP74	7/29/1999	1	10	0 5	1	1
99MLW027WP27	7/29/1999	1	10	0 5	1	1
99MLW028WP28	7/29/1999	1	10	0 5	1	1
99MLW029WP24	7/29/1999	1	10	0 5	1	1
99MLW030WP75	7/29/1999	1	10	0 5	1	1
99MLW031WP76	7/29/1999	1	10	0 5	1	1
99MLW032WP32	7/29/1999	1	10	0 5	1	1
99MLW033WP77	7/29/1999	1	10	0 5	1	1
99MLW034WP41	7/30/1999	1	10	0 5	1	1
99MLW035WP78	7/30/1999	1	10	0 5	1	1
99MLW036WP79	7/30/1999	1	10	0 5	1	1
99MLW037WP80	7/30/1999	1	10	0 5	1	1
99MLW038WP81	7/30/1999	1	10	0 5	1	1
99MLW039WP50	7/30/1999	1	10	0 5	1	1
99MLW040WP82	7/30/1999	1	10	0 5	1	1
99MLW041WP83	7/30/1999	1	10	0 5	1	1
99MLW042WP84	7/30/1999	1	10	0 5	1	1
99MLW047WP38	7/31/1999	1	10	0 5	1	1
99MLW048WP85	7/31/1999	1	10	0 5	1	1

units are Micrograms per liter (µg/l)
Bold text indicates an exceedence of a regulato

[1] Source: Washington State Maximum Contam
[2] Source: National Drinking Water Regulation
[3] Source: Washington State Model Toxics Con
[4] Source: USEPA Region 9 Preliminary Reme

TABLE 4-17

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - METALS
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Silver	Arsenic	Beryllium	Cadmium	Chromium	Coper	Iron	Mercury	Manganese	Nickel	Nitrite	Nitrate	Lead
Washington MCL[1]		**0.05**	**-**	**-**	**0.1**	**0.05**	**1.0[a]**	**0.30[a]**	**0.002**	**-**	**-**	**-**	**10**	**0.05**
Federal MCL[2]		**0.1[a]**	**0.01**	**0.004**	**0.005**	**0.1**	**1.3**	**0.3[a]**	**0.002**	**0.05[a]**	**-**	**-**	**1**	**0.015**
MTCA[3]		**-**	**0.005**	**-**	**0.005**	**0.05**	**-**	**-**	**0.002**	**-**	**-**	**-**	**-**	**0.015**
Tap Water PRG[4]		**0 18**	**-**	**0.073**	**0.018**	**5.5**	**1.5**	**11**	**-**	**0.88**	**0.73**	**1**	**10**	**-**
00MLW001WG91AW05	3/7/2000	-	-	-	-	-	-	**50**	-	-	-	-	-	-
00MLW001WG91AW09	3/17/2000	-	-	-	-	-	-	0 05	-	-	-	-	-	-
00MLW001WG91AW10	3/13/2000	-	-	-	-	-	-	0 05	-	-	-	-	-	-
00MLW001WG91AW13	3/8/2000	-	-	-	-	-	-	0 05	-	-	-	-	-	-
00MLW001WG91AW14	3/8/2000	-	-	-	-	-	-	0 05	-	-	-	-	-	-
00MLW001WG91AW15	3/8/2000	-	-	-	-	-	-	0 05	-	-	-	-	-	-
00MLW001WG91AW16	3/7/2000	-	-	-	-	-	-	**50**	-	-	-	-	-	-
00MLW001WG91AW17	3/9/2000	-	-	-	-	-	-	0 05	-	-	-	-	-	-
00MLW001WG91AW18	3/9/2000	-	-	-	-	-	-	0 05	-	-	-	-	-	-
00MLW001WG91AW19	3/13/2000	-	-	-	-	-	-	0 05	-	-	-	-	-	-
00MLW001WG91BW02	3/7/2000	-	-	-	-	-	-	**50**	-	-	-	-	-	-
00MLW001WG91BW03	3/17/2000	-	-	-	-	-	-	0 05	-	-	-	-	-	-
00MLW001WG91BW04	3/13/2000	-	-	-	-	-	-	0 05	-	-	-	-	-	-
00MLW001WG92BW01	3/17/2000	-	-	-	-	-	-	0 05	-	-	-	-	-	-
00MLW001WG92BW02	3/17/2000	-	-	-	-	-	-	0 05	-	-	-	-	-	-
00MLW001WG99AW01	3/14/2000	-	-	-	-	-	-	0 05	-	-	-	-	-	-
00MLW001WG99AW02	3/16/2000	-	-	-	-	-	-	0 05	-	-	-	-	-	-
00MLW001WG99AW03	3/10/2000	-	-	-	-	-	-	0 05	-	-	-	-	-	-
00MLW001WG99AW04	3/14/2000	-	-	-	-	-	-	0 05	-	-	-	-	-	-
00MLW001WG99AW05	3/9/2000	-	-	-	-	-	-	0 05	-	-	-	-	-	-
00MLW001WG99AW06	3/13/2000	-	-	-	-	-	-	0 05	-	-	-	-	-	-
00MLW001WG99AW07	3/15/2000	-	-	-	-	-	-	0 05	-	-	-	-	-	-
00MLW001WG99AW08	3/15/2000	-	-	-	-	-	-	0 05	-	-	-	-	-	-
00MLW001WG99AW09	3/10/2000	-	-	-	-	-	-	0 05	-	-	-	-	-	-
00MLW001WG99AW10	3/14/2000	-	-	-	-	-	-	0 05	-	-	-	-	-	-
00MLW001WG99BW01	3/14/2000	-	-	-	-	-	-	0 05	-	-	-	-	-	-
00MLW001WG99BW04	3/16/2000	-	-	-	-	-	-	0 05	-	-	-	-	-	-
00MLW001WG99BW06	3/16/2000	-	-	-	-	-	-	0 05	-	-	-	-	-	-
00MLW001WG99BW08	3/16/2000	-	-	-	-	-	-	0 05	-	-	-	-	-	-
00MLW001WG99BW09	3/10/2000	-	-	-	-	-	-	0 05	-	-	-	-	-	-
00MLW001WG99BW10	3/10/2000	-	-	-	-	-	-	0 05	-	-	-	-	-	-
00MLW001WG99BW11	3/14/2000	-	-	-	-	-	-	0 05	-	-	-	-	-	-
00MLW001WG99BW12	3/9/2000	-	-	-	-	-	-	0 05	-	-	-	-	-	-
00MLW001WG99BW13	3/13/2000	-	-	-	-	-	-	0 05	-	-	-	-	-	-
00MLW001WG99BW14	3/15/2000	-	-	-	-	-	-	0 05	-	-	-	-	-	-
00MLW001WG99BW15	3/15/2000	-	-	-	-	-	-	0 05	-	-	-	-	-	-
00MLW001WG99BW17	3/20/2000	-	-	-	-	-	-	0 05	-	-	-	-	-	-
00MLW001WG99BW18	3/10/2000	-	-	-	-	-	-	0 05	-	-	-	-	-	-
00MLW002WG91AW03	6/19/2000	0 01	-	**0.005**	0 005	0 01	0 01	0 05	0 0002	0 003	0 01	0 2	-	0 003
00MLW002WG91AW05	6/18/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW002WG91AW09	6/16/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-

TABLE 4-17

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - METALS
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Silver	Arsenic	Beryllium	Cadmium	Chromium	Coper	Iron	Mercury	Manganese	Nickel	Nitrite	Nitrate	Lead
Washington MCL[1]		**0.05**	**-**	**-**	**0.1**	**0.05**	**1.0[a]**	**0.30[a]**	**0.002**	**-**	**-**	**-**	**10**	**0.05**
Federal MCL[2]		**0.1[a]**	**0.01**	**0.004**	**0.005**	**0.1**	**1.3**	**0.3[a]**	**0.002**	**0.05[a]**	**-**	**-**	**1**	**0.015**
MTCA[3]		**-**	**0.005**	**-**	**0.005**	**0.05**	**-**	**-**	**0.002**	**-**	**-**	**-**	**-**	**0.015**
Tap Water PRG[4]		**0 18**	**-**	**0.073**	**0.018**	**5.5**	**1.5**	**11**	**-**	**0.88**	**0.73**	**1**	**10**	**-**
00MLW002WG91AW10	6/18/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW002WG91AW13	6/13/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW002WG91AW14	6/15/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW002WG91AW15	6/13/2000	-	-	-	-	-	-	-	-	-	-	0 2	-	-
00MLW002WG91AW16	6/21/2000	0 01	0 005	**0.005**	0 005	0 01	0 01	0 05	0 0002	0 003	0 01	2	-	0 003
00MLW002WG91AW17	6/12/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW002WG91AW18	6/12/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW002WG91AW19	6/14/2000	0 01	-	**0.005**	0 005	0 01	0 01	0 05	0 0002	0 003	0 01	0 2	-	0 003
00MLW002WG91BW01	6/19/2000	0 01	-	**0.005**	0 005	0 01	0 01	0 05	0 0002	0 003	0 01	0 2	-	0 003
00MLW002WG91BW02	6/18/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW002WG91BW03	6/16/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW002WG91BW04	6/18/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	2	-
00MLW002WG92BW01	6/20/2000	0 01	-	**0.005**	0 005	0 01	0 01	0 05	0 0002	0 003	0 01	0 2	-	0 003
00MLW002WG92BW02	6/20/2000	0 01	-	**0.005**	0 005	0 01	0 01	0 05	0 0002	0 003	0 01	2	-	0 003
00MLW002WG99AW01	6/16/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW002WG99AW02	6/9/2000	-	-	-	-	-	-	0 05	-	-	-	0 4	-	-
00MLW002WG99AW03	6/9/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW002WG99AW04	6/20/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW002WG99AW05	6/12/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW002WG99AW06	6/14/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW002WG99AW07	6/15/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW002WG99AW08	6/15/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW002WG99AW09	6/13/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	0 2	-
00MLW002WG99AW10	6/19/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW002WG99BW01	6/16/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW002WG99BW05	6/21/2000	0 01	0 005	**0.005**	0 005	0 01	0 01	0 05	0 0002	-	0 01	0 2	-	0 003
00MLW002WG99BW09	6/9/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW002WG99BW10	6/9/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW002WG99BW11	6/20/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW002WG99BW12	6/12/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW002WG99BW13	6/14/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW002WG99BW14	6/16/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW002WG99BW15	6/15/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW002WG99BW16	6/21/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW002WG99BW18	6/13/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW002WGBML04	6/21/2000	0 01	0 005	**0.005**	0 005	0 01	0 01	0 05	0 0002	0 003	0 01	0 2	-	0 003
00MLW003WG00AW03	9/25/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG00AW10	10/12/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG00AW11	10/9/2000	0 01	-	**0.005**	0 005	0 01	0 01	0 05	0 0002	-	0 01	0 2	-	0 003
00MLW003WG00AW12	9/19/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG00AW13	10/30/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-

TABLE 4-17

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - METALS
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Silver	Arsenic	Beryllium	Cadmium	Chromium	Coper	Iron	Mercury	Manganese	Nickel	Nitrite	Nitrate	Lead
Washington MCL[1]		**0.05**	**-**	**-**	**0.1**	**0.05**	**1.0[a]**	**0.30[a]**	**0.002**	**-**	**-**	**-**	**10**	**0.05**
Federal MCL[2]		**0.1[a]**	**0.01**	**0.004**	**0.005**	**0.1**	**1.3**	**0.3[a]**	**0.002**	**0.05[a]**	**-**	**-**	**1**	**0.015**
MTCA[3]		**-**	**0.005**	**-**	**0.005**	**0.05**	**-**	**-**	**0.002**	**-**	**-**	**-**	**-**	**0.015**
Tap Water PRG[4]		**0 18**	**-**	**0.073**	**0.018**	**5.5**	**1.5**	**11**	**-**	**0.88**	**0.73**	**1**	**10**	**-**
00MLW003WG00AW14	10/30/2000	0 01	0 005	**0.005**	0 005	0 01	0 01	0 05	0 0002	-	0 01	0 2	-	0 003
00MLW003WG00BW01	10/6/2000	0 01	0 005	**0.005**	0 005	0 01	0 01	0 05	0 0002	-	0 01	0 2	-	0 03
00MLW003WG00BW02	10/9/2000	0 01	0 005	**0.005**	0 005	0 01	0 01	-	0 0002	-	0 01	0 2	-	0 003
00MLW003WG00BW03	9/25/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG00BW04	9/19/2000	0 01	0 005	**0.005**	0 005	0 01	0 01	0 05	0 0002	0 003	0 01	0 2	-	0 003
00MLW003WG00BW05	9/18/2000	0 01	0 005	**0.005**	0 005	0 01	0 01	0 05	0 0002	-	0 01	0 2	-	0 003
00MLW003WG00BW06	10/6/2000	-	-	-	-	-	-	-	-	-	-	0 2	-	-
00MLW003WG00BW07	9/19/2000	0 01	0 005	**0.005**	0 005	0 01	0 01	0 05	0 0002	-	0 01	0 2	-	0 003
00MLW003WG00BW08	9/25/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG00BW09	9/18/2000	0 01	0 005	**0.005**	0 005	0 01	0 01	0 05	0 0002	0 003	0 01	0 2	-	0 003
00MLW003WG00BW10	10/12/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG00BW11	10/6/2000	-	-	-	-	-	-	-	-	-	-	0 2	-	-
00MLW003WG00BW12	10/5/2000	0 01	0 005	**0.005**	0 005	0 01	0 01	0 05	0 0002	-	0 01	0 2	-	0 003
00MLW003WG00BW13	10/5/2000	0 01	0 005	**0.005**	0 005	0 01	0 01	-	0 0002	-	0 01	0 2	-	0 003
00MLW003WG00BW14	10/6/2000	-	-	-	-	-	-	-	-	-	-	0 2	-	-
00MLW003WG00BW15	9/19/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG00BW16	10/30/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG91AW03	9/28/2000	0 01	-	**0.005**	0 005	0 01	0 01	0 05	0 0002	0 003	0 01	0 2	-	0 003
00MLW003WG91AW05	9/20/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG91AW09	9/21/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG91AW10	9/20/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG91AW13	9/21/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG91AW14	9/21/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG91AW15	9/21/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG91AW16	10/5/2000	0 01	0 005	**0.005**	0 005	0 01	0 01	0 05	0 0002	0 003	0 01	0 2	-	0 003
00MLW003WG91AW17	9/22/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG91AW18	9/22/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG91AW19	10/5/2000	0 01	0 005	**0.005**	0 005	0 01	0 01	0 05	0 0002	0 003	0 01	0 2	-	0 003
00MLW003WG91BW01	9/28/2000	0 01	-	**0.005**	0 005	0 01	0 01	0 05	0 0002	0 003	0 01	0 2	-	0 003
00MLW003WG91BW02	9/20/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG91BW03	9/26/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG91BW04	9/20/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG92BW01	9/27/2000	0 01	-	**0.005**	0 005	0 01	0 01	0 05	0 0002	0 003	0 01	0 2	-	0 003
00MLW003WG92BW02	9/27/2000	0 01	-	**0.005**	0 005	0 01	0 01	0 05	0 0002	0 003	0 01	0 2	-	0 003
00MLW003WG99AW01	9/20/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG99AW02	9/26/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG99AW03	9/26/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG99AW04	9/27/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG99AW05	9/22/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG99AW06	10/3/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG99AW07	10/4/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-

TABLE 4-17

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - METALS
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Silver	Arsenic	Beryllium	Cadmium	Chromium	Coper	Iron	Mercury	Manganese	Nickel	Nitrite	Nitrate	Lead
Washington MCL[1]		**0.05**	**-**	**-**	**0.1**	**0.05**	**1.0[a]**	**0.30[a]**	**0.002**	**-**	**-**	**-**	**10**	**0.05**
Federal MCL[2]		**0.1[a]**	**0.01**	**0.004**	**0.005**	**0.1**	**1.3**	**0.3[a]**	**0.002**	**0.05[a]**	**-**	**-**	**1**	**0.015**
MTCA[3]		**-**	**0.005**	**-**	**0.005**	**0.05**	**-**	**-**	**0.002**	**-**	**-**	**-**	**-**	**0.015**
Tap Water PRG[4]		**0 18**	**-**	**0.073**	**0.018**	**5.5**	**1.5**	**11**	**-**	**0.88**	**0.73**	**1**	**10**	**-**
00MLW003WG99AW08	10/4/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG99AW09	10/3/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG99AW10	10/4/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG99BW01	9/22/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG99BW05	10/9/2000	0 01	0 005	**0.005**	0 005	0 01	0 01	0 05	0 0002	-	0 01	0 2	-	0 003
00MLW003WG99BW09	9/26/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG99BW10	9/26/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG99BW11	9/27/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG99BW12	9/22/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG99BW13	10/12/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG99BW14	10/4/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG99BW15	10/4/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG99BW16	9/21/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WG99BW18	10/3/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WGBML04	10/9/2000	0 01	0 005	**0.005**	0 005	0 01	0 01	0 05	0 0002	0 003	0 01	0 2	-	0 003
00MLW003WGMW02	9/6/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW003WGMW04	9/6/2000	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
00MLW301WGSB	6/21/2000	-	0 005	-	-	-	-	-	0 0002	-	-	-	-	-
00MLW302WGSB	10/11/2000	-	0 005	-	-	-	-	-	0 0002	-	-	-	-	0 003
01MLW001WG00AW11	1/31/2001	0 01	-	**0.005**	0 005	0 01	0 01	0 05	0 0002	0 003	0 01	0 2	-	0 003
01MLW001WG00AW12	1/31/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG00AW13	2/5/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG00AW14	1/23/2001	0 01	0 005	**0.005**	0 005	0 01	0 01	0 05	0 0002	-	0 01	0 2	-	0 003
01MLW001WG00BW01	1/29/2001	0 01	0 005	**0.005**	0 005	0 01	0 01	0 05	0 0002	0 003	0 01	0 2	-	0 003
01MLW001WG00BW02	1/30/2001	0 01	0 005	**0.005**	0 005	0 01	0 01	0 05	0 0002	-	0 01	0 2	-	0 003
01MLW001WG00BW03	1/30/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG00BW04	1/29/2001	0 01	-	**0.005**	0 005	0 01	0 01	0 05	0 0002	0 003	0 01	0 2	-	0 003
01MLW001WG00BW05	1/29/2001	0 01	0 005	**0.005**	0 005	0 01	0 01	0 05	0 0002	0 003	0 01	0 2	-	0 003
01MLW001WG00BW06	1/25/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG00BW07	1/29/2001	0 01	0 005	**0.005**	0 005	0 01	0 01	0 05	0 0002	0 003	0 01	0 2	-	0 003
01MLW001WG00BW08	1/19/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG00BW09	1/25/2001	0 01	0 005	**0.005**	0 005	0 01	0 01	0 05	0 0002	0 003	0 01	0 2	-	0 003
01MLW001WG00BW10	2/5/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG00BW11	1/17/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG00BW12	1/30/2001	0 01	0 005	**0.005**	0 005	0 01	0 01	0 05	0 0002	-	0 01	0 2	-	0 003
01MLW001WG00BW13	1/23/2001	0 01	0 005	**0.005**	0 005	0 01	0 01	0 05	0 0002	-	0 01	0 2	-	0 003
01MLW001WG00BW14	1/29/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG00BW15	1/31/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG00BW16	2/1/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG91AW03	1/24/2001	0 01	-	0 005	0 005	0 01	0 01	0 05	0 0002	0 003	0 01	0 2	-	0 003
01MLW001WG91AW05	1/19/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-

TABLE 4-17

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - METALS
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Silver	Arsenic	Beryllium	Cadmium	Chromium	Coper	Iron	Mercury	Manganese	Nickel	Nitrite	Nitrate	Lead
Washington MCL[1]		**0.05**	**-**	**-**	**0.1**	**0.05**	**1.0[a]**	**0.30[a]**	**0.002**	**-**	**-**	**-**	**10**	**0.05**
Federal MCL[2]		**0.1[a]**	**0.01**	**0.004**	**0.005**	**0.1**	**1.3**	**0.3[a]**	**0.002**	**0.05[a]**	**-**	**-**	**1**	**0.015**
MTCA[3]		**-**	**0.005**	**-**	**0.005**	**0.05**	**-**	**-**	**0.002**	**-**	**-**	**-**	**-**	**0.015**
Tap Water PRG[4]		**0 18**	**-**	**0.073**	**0.018**	**5.5**	**1.5**	**11**	**-**	**0.88**	**0.73**	**1**	**10**	**-**
01MLW001WG91AW09	1/22/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG91AW10	1/23/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG91AW13	1/25/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG91AW14	1/19/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG91AW15	1/18/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG91AW16	1/30/2001	0 01	0 005	**0.005**	0 005	0 01	0 01	0 05	0 0002	0 003	0 01	0 2	-	0 003
01MLW001WG91AW17	1/26/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG91AW18	1/26/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG91AW19	1/23/2001	0 01	0 005	**0.005**	0 005	0 01	0 01	0 05	0 0002	0 003	0 01	0 2	-	0 003
01MLW001WG91BW01	1/24/2001	0 01	-	**0.005**	0 005	0 01	0 01	0 05	0 0002	0 003	0 01	0 2	-	0 003
01MLW001WG91BW02	1/19/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG91BW03	2/2/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG91BW04	1/23/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG92BW01	1/31/2001	0 01	-	**0.005**	0 005	0 01	0 01	0 05	0 0002	0 003	0 01	0 2	-	0 003
01MLW001WG92BW02	1/31/2001	0 01	-	**0.005**	0 005	0 01	0 01	0 05	0 0002	0 003	0 01	0 2	-	0 003
01MLW001WG99AW01	1/24/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG99AW02	2/1/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG99AW03	2/1/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG99AW04	2/5/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG99AW05	1/26/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG99AW06	1/22/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG99AW07	1/18/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG99AW08	1/18/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG99AW09	1/22/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG99AW10	1/24/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG99BW01	1/25/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG99BW05	1/25/2001	0 01	0 005	0 005	0 005	0 01	0 01	0 05	0 0002	0 003	0 01	0 2	-	0 003
01MLW001WG99BW09	2/1/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG99BW10	2/1/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG99BW11	2/5/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG99BW12	1/26/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG99BW13	1/22/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG99BW14	1/18/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG99BW15	1/18/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG99BW16	1/19/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WG99BW18	1/22/2001	-	-	-	-	-	-	0 05	-	-	-	0 2	-	-
01MLW001WGISI01	2/2/2001	-	-	-	-	-	-	-	-	-	-	-	-	-
01MLW001WGISI02	2/2/2001	-	-	-	-	-	-	-	-	-	-	-	-	-
01MLW001WGISI03	2/2/2001	-	-	-	-	-	-	-	-	-	-	-	-	-
01MLW002WG01BW01	5/31/2001	0 01	0 005	**0.005**	0 005	0 01	0 01	-	0 0002	-	0 01	-	-	0 003
01MLW201WG01BW01	5/31/2001	0 01	0 005	**0.005**	0 005	0 01	0 01	-	0 0002	-	0 01	-	-	0 003

TABLE 4-17

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - METALS
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Silver	Arsenic	Beryllium	Cadmium	Chromium	Coper	Iron	Mercury	Manganese	Nickel	Nitrite	Nitrate	Lead
Washington MCL[1]		**0.05**	**-**	**-**	**0.1**	**0.05**	**1.0[a]**	**0.30[a]**	**0.002**	**-**	**-**	**-**	**10**	**0.05**
Federal MCL[2]		**0.1[a]**	**0.01**	**0.004**	**0.005**	**0.1**	**1.3**	**0.3[a]**	**0.002**	**0.05[a]**	**-**	**-**	**1**	**0.015**
MTCA[3]		**-**	**0.005**	**-**	**0.005**	**0.05**	**-**	**-**	**0.002**	**-**	**-**	**-**	**-**	**0.015**
Tap Water PRG[4]		**0 18**	**-**	**0.073**	**0.018**	**5.5**	**1.5**	**11**	**-**	**0.88**	**0.73**	**1**	**10**	**-**
01MLW201WGISI02	2/2/2001	-	-	-	-	-	-	-	-	-	-	-	-	-
99MLW001SB	11/19/1999	**10**	0 005	**5**	**5**	**10**	**10**	**50**	-	**10**	**10**	-	-	0 003
99MLW001WC01	11/22/1999	-	-	-	-	-	-	**50**	-	-	-	-	-	-
99MLW001WC02	11/22/1999	-	-	-	-	-	-	**50**	-	-	-	-	-	-
99MLW001WC03	11/22/1999	-	-	-	-	-	-	**50**	-	-	-	-	-	-
99MLW001WC04	11/22/1999	-	-	-	-	-	-	**50**	-	-	-	-	-	-
99MLW001WG91AW01	11/8/1999	**10**	-	**5**	**5**	**10**	**10**	**50**	-	**10**	**10**	-	-	0 003
99MLW001WG91AW02	11/8/1999	**10**	-	**5**	**5**	**10**	**10**	**50**	-	**10**	**10**	-	-	0 003
99MLW001WG91AW03	11/8/1999	**10**	-	**5**	**5**	**10**	**10**	**50**	-	**10**	**10**	-	-	0 003
99MLW001WG91AW05	11/10/1999	-	-	-	-	-	-	**50**	-	-	-	**100**	-	-
99MLW001WG91AW13	11/11/1999	-	-	-	-	-	-	**50**	-	-	-	-	-	-
99MLW001WG91AW14	11/19/1999	**10**	-	**5**	**5**	**10**	**10**	**50**	-	**10**	**10**	-	-	-
99MLW001WG91AW15	11/10/1999	-	-	-	-	-	-	-	-	-	-	**100**	-	-
99MLW001WG91AW16	11/10/1999	-	-	-	-	-	-	**50**	-	-	-	**100**	-	-
99MLW001WG91AW17	11/12/1999	-	-	-	-	-	-	**50**	-	-	-	-	-	-
99MLW001WG91AW18	11/11/1999	-	-	-	-	-	-	**50**	-	-	-	-	-	-
99MLW001WG91AW19	11/11/1999	-	-	-	-	-	-	**50**	-	-	-	-	-	-
99MLW001WG91BW01	11/8/1999	**10**	-	**5**	**5**	**10**	**10**	-	-	**10**	**10**	-	-	0 003
99MLW001WG91BW02	11/10/1999	-	-	-	-	-	-	**50**	-	-	-	**100**	-	-
99MLW001WG91BW03	11/12/1999	-	-	-	-	-	-	**50**	-	-	-	-	-	-
99MLW001WG92BW01	11/17/1999	-	-	-	-	-	-	**50**	-	-	-	**200**	-	-
99MLW001WG92BW02	11/16/1999	-	-	-	-	-	-	**50**	-	-	-	-	-	-
99MLW001WG99AW01	11/12/1999	-	-	-	-	-	-	**50**	-	-	-	-	-	-
99MLW001WG99AW03	11/15/1999	-	-	-	-	-	-	**50**	-	-	-	-	-	-
99MLW001WG99AW04	11/17/1999	-	-	-	-	-	-	**50**	-	-	-	**100**	-	-
99MLW001WG99AW05	11/17/1999	-	-	-	-	-	-	**50**	-	-	-	**100**	-	-
99MLW001WG99AW06	11/16/1999	-	-	-	-	-	-	**50**	-	-	-	-	-	-
99MLW001WG99AW07	11/18/1999	-	-	-	-	-	-	**50**	-	-	-	-	-	-
99MLW001WG99AW08	11/18/1999	-	-	-	-	-	-	**50**	-	-	-	-	-	-
99MLW001WG99BW01	11/11/1999	-	-	-	-	-	-	**50**	-	-	-	-	-	-
99MLW001WG99BW02	11/19/1999	**10**	-	**5**	**5**	**10**	**10**	**50**	-	-	10	-	-	0 003
99MLW001WG99BW04	11/9/1999	**10**	-	**5**	**5**	**10**	**10**	**50**	-	-	10	**100**	-	0 003
99MLW001WG99BW05	11/9/1999	**10**	0 005	**5**	**5**	**10**	**10**	**50**	-	-	10	-	-	0 003
99MLW001WG99BW06	11/18/1999	-	-	-	-	-	-	**50**	-	-	-	-	-	-
99MLW001WG99BW08	11/15/1999	-	-	-	-	-	-	**50**	-	-	-	-	-	-
99MLW001WG99BW09	11/15/1999	-	-	-	-	-	-	**50**	-	-	-	-	-	-
99MLW001WG99BW10	11/15/1999	-	-	-	-	-	-	**50**	-	-	-	-	-	-
99MLW001WG99BW11	11/17/1999	-	-	-	-	-	-	-	-	-	-	**100**	-	-
99MLW001WG99BW12	11/17/1999	-	-	-	-	-	-	50	-	-	-	**100**	-	-
99MLW001WG99BW13	11/16/1999	-	-	-	-	-	-	50	-	-	-	-	-	-
99MLW001WG99BW14	11/18/1999	-	-	-	-	-	-	50	-	-	-	-	-	-

TABLE 4-17

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - METALS
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Silver	Arsenic	Beryllium	Cadmium	Chromium	Coper	Iron	Mercury	Manganese	Nickel	Nitrite	Nitrate	Lead
Washington MCL[1]		**0.05**	**-**	**-**	**0.1**	**0.05**	**1.0[a]**	**0.30[a]**	**0.002**	**-**	**-**	**-**	**10**	**0.05**
Federal MCL[2]		**0.1[a]**	**0.01**	**0.004**	**0.005**	**0.1**	**1.3**	**0.3[a]**	**0.002**	**0.05[a]**	**-**	**-**	**1**	**0.015**
MTCA[3]		**-**	**0.005**	**-**	**0.005**	**0.05**	**-**	**-**	**0.002**	**-**	**-**	**-**	**-**	**0.015**
Tap Water PRG[4]		**0 18**	**-**	**0.073**	**0.018**	**5.5**	**1.5**	**11**	**-**	**0.88**	**0.73**	**1**	**10**	**-**
99MLW001WG99BW16	11/19/1999	**10**	-	**5**	**5**	**10**	**10**	-	-	-	**10**	-	-	-
99MLW001WG99BW17	11/9/1999	**10**	0 005	**5**	**5**	**10**	**10**	**50**	-	**10**	**10**	**100**	-	0 003
99MLW001WG99BW18	11/16/1999	-	-	-	-	-	-	**50**	-	-	-	-	-	-
99MLW001WGBML04	11/9/1999	**10**	0 005	**5**	**5**	**10**	**10**	**50**	-	**10**	**10**	**100**	-	0 003
99MLW002SB	11/19/1999	**10**	0 005	**5**	**5**	**10**	**10**	**50**	-	**10**	**10**	-	-	0 003
Sample Identification	**Collection Date**													

units are Milligrams per liter (mg/l)
Bold text indicates an exceedence of a regulatory level
[a] - Secondary standard

[1] Source: Washington State Maximum Contaminant Levels, WAC 173-200
[2] Source: National Drinking Water Regulations Maximum Contaminant Levels (EPA 816-F-02-013 July 2002)
[3] Source: Washington State Model Toxics Control Act (MTCA) Method A Groundwater Cleanup Levels (WAC 173-340-900)
[4] Source: USEPA Region 9 Preliminary Remediation Goals (PRGs) 2002 (USEPA, 2002)

TABLE 4-17

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - METALS
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Perchlorate	Antimony	Selenium	Thallium	Zinc
Washington MCL[1]		**-**	**-**	**0.01**	**-**	**5.0[a]**
Federal MCL[2]		**-**	**0.006**	**0.05**	**0.002**	**5[a]**
MTCA[3]		**-**	**-**	**-**	**-**	**-**
Tap Water PRG[4]		**0.0036**	**-**	**0 18**	**0.0024**	**1 1**
00MLW001WG91AW05	3/7/2000	-	-	-	-	-
00MLW001WG91AW09	3/17/2000	-	-	-	-	-
00MLW001WG91AW10	3/13/2000	-	-	-	-	-
00MLW001WG91AW13	3/8/2000	-	-	-	-	-
00MLW001WG91AW14	3/8/2000	-	-	-	-	-
00MLW001WG91AW15	3/8/2000	-	-	-	-	-
00MLW001WG91AW16	3/7/2000	-	-	-	-	-
00MLW001WG91AW17	3/9/2000	-	-	-	-	-
00MLW001WG91AW18	3/9/2000	-	-	-	-	-
00MLW001WG91AW19	3/13/2000	-	-	-	-	-
00MLW001WG91BW02	3/7/2000	-	-	-	-	-
00MLW001WG91BW03	3/17/2000	-	-	-	-	-
00MLW001WG91BW04	3/13/2000	-	-	-	-	-
00MLW001WG92BW01	3/17/2000	-	-	-	-	-
00MLW001WG92BW02	3/17/2000	-	-	-	-	-
00MLW001WG99AW01	3/14/2000	-	-	-	-	-
00MLW001WG99AW02	3/16/2000	-	-	-	-	-
00MLW001WG99AW03	3/10/2000	-	-	-	-	-
00MLW001WG99AW04	3/14/2000	-	-	-	-	-
00MLW001WG99AW05	3/9/2000	-	-	-	-	-
00MLW001WG99AW06	3/13/2000	-	-	-	-	-
00MLW001WG99AW07	3/15/2000	-	-	-	-	-
00MLW001WG99AW08	3/15/2000	-	-	-	-	-
00MLW001WG99AW09	3/10/2000	-	-	-	-	-
00MLW001WG99AW10	3/14/2000	-	-	-	-	-
00MLW001WG99BW01	3/14/2000	-	-	-	-	-
00MLW001WG99BW04	3/16/2000	-	-	-	-	-
00MLW001WG99BW06	3/16/2000	-	-	-	-	-
00MLW001WG99BW08	3/16/2000	-	-	-	-	-
00MLW001WG99BW09	3/10/2000	-	-	-	-	-
00MLW001WG99BW10	3/10/2000	-	-	-	-	-
00MLW001WG99BW11	3/14/2000	-	-	-	-	-
00MLW001WG99BW12	3/9/2000	-	-	-	-	-
00MLW001WG99BW13	3/13/2000	-	-	-	-	-
00MLW001WG99BW14	3/15/2000	-	-	-	-	-
00MLW001WG99BW15	3/15/2000	-	-	-	-	-
00MLW001WG99BW17	3/20/2000	-	-	-	-	-
00MLW001WG99BW18	3/10/2000	-	-	-	-	-
00MLW002WG91AW03	6/19/2000	-	0 005	0 005	**0.005**	0 01
00MLW002WG91AW05	6/18/2000	-	-	-	-	-
00MLW002WG91AW09	6/16/2000	-	-	-	-	-

TABLE 4-17

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - METALS
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Perchlorate	Antimony	Selenium	Thallium	Zinc
Washington MCL[1]		**-**	**-**	**0.01**	**-**	**5.0[a]**
Federal MCL[2]		**-**	**0.006**	**0.05**	**0.002**	**5[a]**
MTCA[3]		**-**	**-**	**-**	**-**	**-**
Tap Water PRG[4]		**0.0036**	**-**	**0 18**	**0.0024**	**1 1**
00MLW002WG91AW10	6/18/2000	-	-	-	-	-
00MLW002WG91AW13	6/13/2000	-	-	-	-	-
00MLW002WG91AW14	6/15/2000	-	-	-	-	-
00MLW002WG91AW15	6/13/2000	-	-	-	-	-
00MLW002WG91AW16	6/21/2000	-	0 005	0 005	**0.005**	0 01
00MLW002WG91AW17	6/12/2000	-	-	-	-	-
00MLW002WG91AW18	6/12/2000	-	-	-	-	-
00MLW002WG91AW19	6/14/2000	-	0 005	0 005	**0.005**	0 01
00MLW002WG91BW01	6/19/2000	-	0 005	0 01	**0.005**	0 01
00MLW002WG91BW02	6/18/2000	-	-	-	-	-
00MLW002WG91BW03	6/16/2000	-	-	-	-	-
00MLW002WG91BW04	6/18/2000	-	-	-	-	-
00MLW002WG92BW01	6/20/2000	-	0 005	0 005	**0.005**	0 01
00MLW002WG92BW02	6/20/2000	-	0 005	0 005	**0.005**	0 01
00MLW002WG99AW01	6/16/2000	-	-	-	-	-
00MLW002WG99AW02	6/9/2000	-	-	-	-	-
00MLW002WG99AW03	6/9/2000	-	-	-	-	-
00MLW002WG99AW04	6/20/2000	-	-	-	-	-
00MLW002WG99AW05	6/12/2000	-	-	-	-	-
00MLW002WG99AW06	6/14/2000	-	-	-	-	-
00MLW002WG99AW07	6/15/2000	-	-	-	-	-
00MLW002WG99AW08	6/15/2000	-	-	-	-	-
00MLW002WG99AW09	6/13/2000	-	-	-	-	-
00MLW002WG99AW10	6/19/2000	-	-	-	-	-
00MLW002WG99BW01	6/16/2000	-	-	-	-	-
00MLW002WG99BW05	6/21/2000	-	0 005	0 005	**0.005**	-
00MLW002WG99BW09	6/9/2000	-	-	-	-	-
00MLW002WG99BW10	6/9/2000	-	-	-	-	-
00MLW002WG99BW11	6/20/2000	-	-	-	-	-
00MLW002WG99BW12	6/12/2000	-	-	-	-	-
00MLW002WG99BW13	6/14/2000	-	-	-	-	-
00MLW002WG99BW14	6/16/2000	-	-	-	-	-
00MLW002WG99BW15	6/15/2000	-	-	-	-	-
00MLW002WG99BW16	6/21/2000	-	-	-	-	-
00MLW002WG99BW18	6/13/2000	-	-	-	-	-
00MLW002WGBML04	6/21/2000	-	0 005	0 005	**0.005**	0 01
00MLW003WG00AW03	9/25/2000	-	-	-	-	-
00MLW003WG00AW10	10/12/2000	-	-	-	-	-
00MLW003WG00AW11	10/9/2000	-	0 005	0 005	**0.005**	0 01
00MLW003WG00AW12	9/19/2000	-	-	-	-	-
00MLW003WG00AW13	10/30/2000	-	-	-	-	-

TABLE 4-17

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - METALS
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Perchlorate	Antimony	Selenium	Thallium	Zinc
Washington MCL[1]		**-**	**-**	**0.01**	**-**	**5.0[a]**
Federal MCL[2]		**-**	**0.006**	**0.05**	**0.002**	**5[a]**
MTCA[3]		**-**	**-**	**-**	**-**	**-**
Tap Water PRG[4]		**0.0036**	**-**	**0 18**	**0.0024**	**1 1**
00MLW003WG00AW14	10/30/2000	-	0 005	0 005	**0.005**	0 01
00MLW003WG00BW01	10/6/2000	-	0 005	0 005	**0.005**	0 01
00MLW003WG00BW02	10/9/2000	-	0 005	0 005	**0.005**	-
00MLW003WG00BW03	9/25/2000	-	-	-	-	-
00MLW003WG00BW04	9/19/2000	-	0 005	0 005	**0.005**	0 01
00MLW003WG00BW05	9/18/2000	-	0 005	0 005	**0.005**	0 01
00MLW003WG00BW06	10/6/2000	-	-	-	-	-
00MLW003WG00BW07	9/19/2000	-	0 005	0 005	**0.005**	-
00MLW003WG00BW08	9/25/2000	-	-	-	-	-
00MLW003WG00BW09	9/18/2000	-	0 005	0 005	**0.005**	0 01
00MLW003WG00BW10	10/12/2000	-	-	-	-	-
00MLW003WG00BW11	10/6/2000	-	-	-	-	-
00MLW003WG00BW12	10/5/2000	-	0 005	0 005	**0.005**	-
00MLW003WG00BW13	10/5/2000	-	0 005	0 005	**0.005**	-
00MLW003WG00BW14	10/6/2000	-	-	-	-	-
00MLW003WG00BW15	9/19/2000	-	-	-	-	-
00MLW003WG00BW16	10/30/2000	-	-	-	-	-
00MLW003WG91AW03	9/28/2000	-	0 005	0 01	**0.005**	0 01
00MLW003WG91AW05	9/20/2000	-	-	-	-	-
00MLW003WG91AW09	9/21/2000	-	-	-	-	-
00MLW003WG91AW10	9/20/2000	-	-	-	-	-
00MLW003WG91AW13	9/21/2000	-	-	-	-	-
00MLW003WG91AW14	9/21/2000	-	-	-	-	-
00MLW003WG91AW15	9/21/2000	-	-	-	-	-
00MLW003WG91AW16	10/5/2000	-	0 005	0 005	**0.005**	0 01
00MLW003WG91AW17	9/22/2000	-	-	-	-	-
00MLW003WG91AW18	9/22/2000	-	-	-	-	-
00MLW003WG91AW19	10/5/2000	-	0 005	0 005	**0.005**	0 01
00MLW003WG91BW01	9/28/2000	-	0 005	0 005	**0.005**	0 01
00MLW003WG91BW02	9/20/2000	-	-	-	-	-
00MLW003WG91BW03	9/26/2000	-	-	-	-	-
00MLW003WG91BW04	9/20/2000	-	-	-	-	-
00MLW003WG92BW01	9/27/2000	-	0 005	0 005	**0.005**	0 01
00MLW003WG92BW02	9/27/2000	-	0 005	0 005	**0.005**	0 01
00MLW003WG99AW01	9/20/2000	-	-	-	-	-
00MLW003WG99AW02	9/26/2000	-	-	-	-	-
00MLW003WG99AW03	9/26/2000	-	-	-	-	-
00MLW003WG99AW04	9/27/2000	-	-	-	-	-
00MLW003WG99AW05	9/22/2000	-	-	-	-	-
00MLW003WG99AW06	10/3/2000	-	-	-	-	-
00MLW003WG99AW07	10/4/2000	-	-	-	-	-

TABLE 4-17

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - METALS
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Perchlorate	Antimony	Selenium	Thallium	Zinc
Washington MCL[1]		**-**	**-**	**0.01**	**-**	**5.0[a]**
Federal MCL[2]		**-**	**0.006**	**0.05**	**0.002**	**5[a]**
MTCA[3]		**-**	**-**	**-**	**-**	**-**
Tap Water PRG[4]		**0.0036**	**-**	**0 18**	**0.0024**	**1 1**
00MLW003WG99AW08	10/4/2000	-	-	-	-	-
00MLW003WG99AW09	10/3/2000	-	-	-	-	-
00MLW003WG99AW10	10/4/2000	-	-	-	-	-
00MLW003WG99BW01	9/22/2000	-	-	-	-	-
00MLW003WG99BW05	10/9/2000	-	0 005	0 005	**0.005**	-
00MLW003WG99BW09	9/26/2000	-	-	-	-	-
00MLW003WG99BW10	9/26/2000	-	-	-	-	-
00MLW003WG99BW11	9/27/2000	-	-	-	-	-
00MLW003WG99BW12	9/22/2000	-	-	-	-	-
00MLW003WG99BW13	10/12/2000	-	-	-	-	-
00MLW003WG99BW14	10/4/2000	-	-	-	-	-
00MLW003WG99BW15	10/4/2000	-	-	-	-	-
00MLW003WG99BW16	9/21/2000	-	-	-	-	-
00MLW003WG99BW18	10/3/2000	-	-	-	-	-
00MLW003WGBML04	10/9/2000	-	0 005	0 005	**0.005**	0 01
00MLW003WGMW02	9/6/2000	-	-	-	-	-
00MLW003WGMW04	9/6/2000	-	-	-	-	-
00MLW301WGSB	6/21/2000	-	-	-	-	-
00MLW302WGSB	10/11/2000	-	0 005	0 005	-	-
01MLW001WG00AW11	1/31/2001	-	0 005	0 005	**0.005**	0 01
01MLW001WG00AW12	1/31/2001	-	-	-	-	-
01MLW001WG00AW13	2/5/2001	-	-	-	-	-
01MLW001WG00AW14	1/23/2001	-	0 005	0 005	**0.005**	0 01
01MLW001WG00BW01	1/29/2001	-	0 005	0 005	**0.005**	0 01
01MLW001WG00BW02	1/30/2001	-	0 005	0 005	**0.005**	0 01
01MLW001WG00BW03	1/30/2001	-	-	-	-	-
01MLW001WG00BW04	1/29/2001	-	0 005	0 005	**0.005**	0 01
01MLW001WG00BW05	1/29/2001	-	0 005	0 005	**0.005**	0 01
01MLW001WG00BW06	1/25/2001	-	-	-	-	-
01MLW001WG00BW07	1/29/2001	-	0 005	0 005	**0.005**	0 01
01MLW001WG00BW08	1/19/2001	-	-	-	-	-
01MLW001WG00BW09	1/25/2001	-	0 005	0 005	**0.005**	0 01
01MLW001WG00BW10	2/5/2001	-	-	-	-	-
01MLW001WG00BW11	1/17/2001	-	-	-	-	-
01MLW001WG00BW12	1/30/2001	-	0 005	0 005	**0.005**	-
01MLW001WG00BW13	1/23/2001	-	0 005	0 005	**0.005**	-
01MLW001WG00BW14	1/29/2001	-	-	-	-	-
01MLW001WG00BW15	1/31/2001	-	-	-	-	-
01MLW001WG00BW16	2/1/2001	-	-	-	-	-
01MLW001WG91AW03	1/24/2001	-	0 005	0 005	**0.005**	0 01
01MLW001WG91AW05	1/19/2001	-	-	-	-	-

TABLE 4-17

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - METALS
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Perchlorate	Antimony	Selenium	Thallium	Zinc
Washington MCL[1]		**-**	**-**	**0.01**	**-**	**5.0[a]**
Federal MCL[2]		**-**	**0.006**	**0.05**	**0.002**	**5[a]**
MTCA[3]		**-**	**-**	**-**	**-**	**-**
Tap Water PRG[4]		**0.0036**	**-**	**0 18**	**0.0024**	**1 1**
01MLW001WG91AW09	1/22/2001	-	-	-	-	-
01MLW001WG91AW10	1/23/2001	-	-	-	-	-
01MLW001WG91AW13	1/25/2001	-	-	-	-	-
01MLW001WG91AW14	1/19/2001	-	-	-	-	-
01MLW001WG91AW15	1/18/2001	-	-	-	-	-
01MLW001WG91AW16	1/30/2001	-	0 005	0 005	**0.005**	0 01
01MLW001WG91AW17	1/26/2001	-	-	-	-	-
01MLW001WG91AW18	1/26/2001	-	-	-	-	-
01MLW001WG91AW19	1/23/2001	-	0 005	0 005	**0.005**	0 01
01MLW001WG91BW01	1/24/2001	-	0 005	0 01	**0.005**	0 01
01MLW001WG91BW02	1/19/2001	-	-	-	-	-
01MLW001WG91BW03	2/2/2001	-	-	-	-	-
01MLW001WG91BW04	1/23/2001	-	-	-	-	-
01MLW001WG92BW01	1/31/2001	-	0 005	0 01	**0.005**	0 01
01MLW001WG92BW02	1/31/2001	-	0 005	0 005	**0.005**	0 01
01MLW001WG99AW01	1/24/2001	-	-	-	-	-
01MLW001WG99AW02	2/1/2001	-	-	-	-	-
01MLW001WG99AW03	2/1/2001	-	-	-	-	-
01MLW001WG99AW04	2/5/2001	-	-	-	-	-
01MLW001WG99AW05	1/26/2001	-	-	-	-	-
01MLW001WG99AW06	1/22/2001	-	-	-	-	-
01MLW001WG99AW07	1/18/2001	-	-	-	-	-
01MLW001WG99AW08	1/18/2001	-	-	-	-	-
01MLW001WG99AW09	1/22/2001	-	-	-	-	-
01MLW001WG99AW10	1/24/2001	-	-	-	-	-
01MLW001WG99BW01	1/25/2001	-	-	-	-	-
01MLW001WG99BW05	1/25/2001	-	0 005	0 005	**0.005**	-
01MLW001WG99BW09	2/1/2001	-	-	-	-	-
01MLW001WG99BW10	2/1/2001	-	-	-	-	-
01MLW001WG99BW11	2/5/2001	-	-	-	-	-
01MLW001WG99BW12	1/26/2001	-	-	-	-	-
01MLW001WG99BW13	1/22/2001	-	-	-	-	-
01MLW001WG99BW14	1/18/2001	-	-	-	-	-
01MLW001WG99BW15	1/18/2001	-	-	-	-	-
01MLW001WG99BW16	1/19/2001	-	-	-	-	-
01MLW001WG99BW18	1/22/2001	-	-	-	-	-
01MLW001WGISI01	2/2/2001	**0.004**	-	-	-	-
01MLW001WGISI02	2/2/2001	**0.004**	-	-	-	-
01MLW001WGISI03	2/2/2001	**0.004**	-	-	-	-
01MLW002WG01BW01	5/31/2001	-	0 005	0 005	**0.005**	0 01
01MLW201WG01BW01	5/31/2001	-	0 005	0 005	**0.005**	0 01

TABLE 4-17

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - METALS
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Perchlorate	Antimony	Selenium	Thallium	Zinc
Washington MCL[1]		**-**	**-**	**0.01**	**-**	**5.0[a]**
Federal MCL[2]		**-**	**0.006**	**0.05**	**0.002**	**5[a]**
MTCA[3]		**-**	**-**	**-**	**-**	**-**
Tap Water PRG[4]		**0.0036**	**-**	**0 18**	**0.0024**	**1 1**
01MLW201WGISI02	2/2/2001	**0.004**	-	-	-	-
99MLW001SB	11/19/1999	-	50	0 005	**0.005**	**10**
99MLW001WC01	11/22/1999	-	-	-	-	-
99MLW001WC02	11/22/1999	-	-	-	-	-
99MLW001WC03	11/22/1999	-	-	-	-	-
99MLW001WC04	11/22/1999	-	-	-	-	-
99MLW001WG91AW01	11/8/1999	-	50	0 005	**0.005**	**10**
99MLW001WG91AW02	11/8/1999	-	50	0 005	**0.005**	**10**
99MLW001WG91AW03	11/8/1999	-	50	0 005	**0.005**	**10**
99MLW001WG91AW05	11/10/1999	-	-	-	-	-
99MLW001WG91AW13	11/11/1999	-	-	-	-	-
99MLW001WG91AW14	11/19/1999	-	50	-	-	**10**
99MLW001WG91AW15	11/10/1999	-	-	-	-	-
99MLW001WG91AW16	11/10/1999	-	-	-	-	-
99MLW001WG91AW17	11/12/1999	-	-	-	-	-
99MLW001WG91AW18	11/11/1999	-	-	-	-	-
99MLW001WG91AW19	11/11/1999	-	-	-	-	-
99MLW001WG91BW01	11/8/1999	-	50	0 005	**0.005**	**10**
99MLW001WG91BW02	11/10/1999	-	-	-	-	-
99MLW001WG91BW03	11/12/1999	-	-	-	-	-
99MLW001WG92BW01	11/17/1999	-	-	-	-	-
99MLW001WG92BW02	11/16/1999	-	-	-	-	-
99MLW001WG99AW01	11/12/1999	-	-	-	-	-
99MLW001WG99AW03	11/15/1999	-	-	-	-	-
99MLW001WG99AW04	11/17/1999	-	-	-	-	-
99MLW001WG99AW05	11/17/1999	-	-	-	-	-
99MLW001WG99AW06	11/16/1999	-	-	-	-	-
99MLW001WG99AW07	11/18/1999	-	-	-	-	-
99MLW001WG99AW08	11/18/1999	-	-	-	-	-
99MLW001WG99BW01	11/11/1999	-	-	-	-	-
99MLW001WG99BW02	11/19/1999	-	**50**	0 005	**0.005**	**10**
99MLW001WG99BW04	11/9/1999	-	**50**	-	**0.005**	**10**
99MLW001WG99BW05	11/9/1999	-	**50**	-	**0.005**	-
99MLW001WG99BW06	11/18/1999	-	-	-	-	-
99MLW001WG99BW08	11/15/1999	-	-	-	-	-
99MLW001WG99BW09	11/15/1999	-	-	-	-	-
99MLW001WG99BW10	11/15/1999	-	-	-	-	-
99MLW001WG99BW11	11/17/1999	-	-	-	-	-
99MLW001WG99BW12	11/17/1999	-	-	-	-	-
99MLW001WG99BW13	11/16/1999	-	-	-	-	-
99MLW001WG99BW14	11/18/1999	-	-	-	-	-

TABLE 4-17

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - METALS
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Perchlorate	Antimony	Selenium	Thallium	Zinc
Washington MCL[1]		**-**	**-**	**0.01**	**-**	**5.0[a]**
Federal MCL[2]		**-**	**0.006**	**0.05**	**0.002**	**5[a]**
MTCA[3]		**-**	**-**	**-**	**-**	**-**
Tap Water PRG[4]		**0.0036**	**-**	**0 18**	**0.0024**	**1 1**
99MLW001WG99BW16	11/19/1999	-	**50**	-	-	**10**
99MLW001WG99BW17	11/9/1999	-	**50**	-	**0.005**	-
99MLW001WG99BW18	11/16/1999	-	-	-	-	-
99MLW001WGBML04	11/9/1999	-	**50**	-	**0.005**	**10**
99MLW002SB	11/19/1999	-	**50**	0 005	**0.005**	**10**
Sample Identification	**Collection Date**					

units are Milligrams per liter (mg/l)
Bold text indicates an exceedence of a regulato
[a] - Secondary standard

[1] Source: Washington State Maximum Contan
[2] Source: National Drinking Water Regulation
[3] Source: Washington State Model Toxics Cor
[4] Source: USEPA Region 9 Preliminary Reme

TABLE 4-18

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - PESTICIDES
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND
(Page 1 of 2)

		Aldrin	alpha-BHC	beta-BHC	gamma-BHC	alpha Chlordane	gamma Chlordane	4,4-DDD	4,4-DDE	4,4-DDT
Washington MCL[1]		**0.005[c]**	**-**	**-**	**-**	**0.06[a,c]**	**0.06[a,c]**	**0.3[b,c]**	**0.3[b,c]**	**0.3[b,c]**
Federal MCL[2]		**-**	**-**	**-**	**0.2**	**2**	**-**	**-**	**-**	**-**
MTCA[3]		**-**	**-**	**-**	**0.2**	**-**	**-**	**-**	**-**	**0.3**
Tap Water PRG[4]		**0.0004**	**0.011**	**0.037**	**0.052**	**.00019[a]**	**.00019[a]**	**0.00028**	**0.0002**	**0.0002**
Sample Identification	**Collection Date**									
00MLW002WG91AW16	6/21/2000	**0.05**	0 05	0 05	0 05	**0.05**	**0.05**	**0.1**	**0.1**	**0.1**
00MLW002WG91AW19	6/14/2000	**0.05**	0 05	0 05	0 05	**0.05**	**0.05**	**0.1**	**0.1**	**0.1**
00MLW002WG92BW01	6/20/2000	**0.05**	0 05	0 05	0 05	**0.05**	**0.05**	**0.1**	**0.1**	**0.1**
00MLW002WG92BW02	6/20/2000	**0.05**	0 05	0 05	0 05	**0.05**	**0.05**	**0.1**	**0.1**	**0.1**
00MLW003WG00AW11	10/9/2000	-	0 05	0 05	0 05	**0.05**	**0.05**	**0.1**	**0.1**	**0.1**
00MLW003WG00AW14	10/30/2000	**0.05**	0 05	0 05	0 05	**0.05**	**0.05**	**0.1**	**0.1**	**0.1**
00MLW003WG00BW01	10/6/2000	-	0 05	0 05	0 05	**0.05**	**0.05**	**0.1**	**0.1**	**0.1**
00MLW003WG00BW02	10/9/2000	-	0 05	0 05	0 05	**0.05**	**0.05**	**0.1**	**0.1**	**0.1**
00MLW003WG00BW12	10/5/2000	-	0 05	0 05	0 05	**0.05**	**0.05**	**0.1**	**0.1**	**0.1**
00MLW003WG00BW13	10/5/2000	-	0 05	0 05	0 05	**0.05**	**0.05**	**0.1**	**0.1**	**0.1**
00MLW003WG91AW16	10/5/2000	-	0 05	0 05	0 05	**0.05**	**0.05**	**0.1**	**0.1**	**0.1**
00MLW003WG91AW19	10/5/2000	**0.05**	0 05	0 05	0 05	**0.05**	**0.05**	**0.1**	**0.1**	**0.1**
00MLW003WG92BW01	9/27/2000	**0.05**	0 05	0 05	0 05	**0.05**	**0.05**	**0.1**	**0.1**	**0.1**
00MLW003WG92BW02	9/27/2000	**0.05**	0 05	0 05	0 05	**0.05**	**0.05**	**0.1**	**0.1**	**0.1**
00MLW202WG91AW19	6/14/2000	**0.05**	0 05	0 05	0 05	**0.05**	**0.05**	**0.1**	**0.1**	**0.1**
00MLW203WG00BW02	10/9/2000	-	0 05	0 05	0 05	**0.05**	**0.05**	**0.1**	**0.1**	**0.1**
00MLW203WG91AW16	10/5/2000	-	0 05	0 05	0 05	**0.05**	**0.05**	**0.1**	**0.1**	**0.1**
00MLW203WG92BW02	9/27/2000	**0.05**	0 05	0 05	0 05	**0.05**	**0.05**	**0.1**	**0.1**	**0.1**

units are Micrograms per liter (µg/l)
Bold text indicates an exceedence of a regulatory level
[a] - Single standard, standards for isomers not listed
[b] - Standard is total for all detected isomers
[c] - Compounds have been listed as carcinogens by Washington State standard

[1] Source: Washington State Maximum Contaminant Levels, WAC 173-200
[2] Source: National Drinking Water Regulations Maximum Contaminant Levels (EPA 816-F-02-013 July 2002)
[3] Source: Washington State Model Toxics Control Act (MTCA) Method A Groundwater Cleanup Levels (WAC 173-340-900)
[4] Source: USEPA Region 9 Preliminary Remediation Goals (PRGs) 2002 (USEPA, 2002)

TABLE 4-18

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - PESTICIDES
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND
(Page 2 of 2)

		Dieldrin	Endosulfan A	Endosulfan B	Endrin	Heptachlor	Heptachlor epoxide	Methoxychlor	Toxaphene
Washington MCL[1]		**0.005[c]**	**-**	**-**	**0.2**	**0.02[c]**	**0.009[c]**	**100**	**0.008[c]**
Federal MCL[2]		**-**	**-**	**-**	**2**	**0.4**	**0.2**	**-**	**3**
MTCA[3]		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Tap Water PRG[4]		**0.0042**	**0.022[a]**	**0.022[a]**	**0.11**	**0.015**	**-**	**0.018**	**0.061**
Sample Identification	**Collection Date**								
00MLW002WG91AW16	6/21/2000	**0.1**	0 05	**0.1**	0 1	**0.05**	**0.05**	0 5	**5**
00MLW002WG91AW19	6/14/2000	**0.1**	0 05	**0.1**	0 1	**0.05**	**0.05**	0 5	**5**
00MLW002WG92BW01	6/20/2000	**0.1**	0 05	**0.1**	0 1	**0.05**	**0.05**	0 5	**5**
00MLW002WG92BW02	6/20/2000	**0.1**	0 05	**0.1**	0 1	**0.05**	**0.05**	0 5	**5**
00MLW003WG00AW11	10/9/2000	**0.1**	0 05	**0.1**	0 1	**0.05**	**0.05**	0 5	**5**
00MLW003WG00AW14	10/30/2000	**0.1**	0 05	**0.1**	0 1	**0.05**	**0.05**	0 5	**5**
00MLW003WG00BW01	10/6/2000	**0.1**	0 05	**0.1**	0 1	**0.05**	**0.05**	0 5	**5**
00MLW003WG00BW02	10/9/2000	**0.1**	0 05	**0.1**	0 1	**0.05**	**0.05**	0 5	**5**
00MLW003WG00BW12	10/5/2000	**0.1**	0 05	**0.1**	0 1	**0.05**	**0.05**	0 5	**5**
00MLW003WG00BW13	10/5/2000	**0.1**	0 05	**0.1**	0 1	**0.05**	**0.05**	0 5	**5**
00MLW003WG91AW16	10/5/2000	**0.1**	0 05	**0.1**	0 1	**0.05**	**0.05**	0 5	**5**
00MLW003WG91AW19	10/5/2000	**0.1**	0 05	**0.1**	0 1	**0.05**	**0.05**	0 5	**5**
00MLW003WG92BW01	9/27/2000	**0.1**	0 05	**0.1**	0 1	**0.05**	**0.05**	0 5	**5**
00MLW003WG92BW02	9/27/2000	**0.1**	0 05	**0.1**	0 1	**0.05**	**0.05**	0 5	**5**
00MLW202WG91AW19	6/14/2000	**0.1**	0 05	**0.1**	0 1	**0.05**	**0.05**	0 5	**5**
00MLW203WG00BW02	10/9/2000	**0.1**	0 05	**0.1**	0 1	**0.05**	**0.05**	0 5	**5**
00MLW203WG91AW16	10/5/2000	**0.1**	0 05	**0.1**	0 1	**0.05**	**0.05**	0 5	**5**
00MLW203WG92BW02	9/27/2000	**0.1**	0 05	**0.1**	0 1	**0.05**	**0.05**	0 5	**5**

units are Micrograms per liter (µg/l)
Bold text indicates an exceedence of a regulatc
[a] - Single standard, standards for isomers not li
[b] - Standard is total for all detected isomers
[c] - Compounds have been listed as carcinogens

[1] Source: Washington State Maximum Contar
[2] Source: National Drinking Water Regulation
[3] Source: Washington State Model Toxics Co
[4] Source: USEPA Region 9 Preliminary Reme

TABLE 4-19

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - SVOCS
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND
(Page 1 of 6)

		Acenaphthalene	Anthracene	Bis(2-Chloroethyl) ether	bis(2-Chloroethyl)ether	bis(2-Ethylhexyl) phthalate	Benzo(a)anthracene	Benzoic acid	Benzo(a)pyrene
Washington MCL[1]		**-**	**-**	**0.07[b]**	**-**	**6[b]**	**-**	**-**	**0.008[b]**
Federal MCL[2]		**-**	**-**	**-**	**-**	**6**	**-**	**-**	**0.2**
MTCA[3]		**0.1[c]**	**0.1[c]**	**-**	**-**	**-**	**0.1[c]**	**-**	**0.1[c]**
Tap Water PRG[4]		**370**	**1800**	**0.0098**	**0.75**	**4.8**	**0.092**	**150000**	**0.0092**
Sample Identificatio	**Collection Date**								
00MLW001TK01	9/27/2000	**10**	10	**10**	**10**	**10**	**10**	50	**10**
00MLW001TK02	10/11/2000	**10**	10	**10**	**10**	**10**	**10**	50	**10**
00MLW002WG91AW16	6/21/2000	**10**	10	**10**	**10**	**10**	**10**	50	**10**
00MLW002WG91AW19	6/14/2000	**10**	10	**10**	**10**	**10**	**10**	50	**10**
00MLW002WG92BW01	6/20/2000	**10**	10	**10**	**10**	**10**	**10**	50	**10**
00MLW002WG92BW02	6/20/2000	**10**	10	**10**	**10**	**10**	**10**	50	**10**
00MLW003WG00AW11	10/9/2000	**10**	10	**10**	**10**	**10**	**10**	50	**10**
00MLW003WG00AW14	10/30/2000	**10**	10	**10**	**10**	**10**	**10**	50	**10**
00MLW003WG00BW01	10/6/2000	**10**	10	**10**	**10**	**10**	**10**	50	**10**
00MLW003WG00BW02	10/9/2000	**10**	10	**10**	**10**	**10**	**10**	50	**10**
00MLW003WG00BW12	10/5/2000	**10**	10	**10**	**10**	**10**	**10**	50	**10**
00MLW003WG00BW13	10/5/2000	**10**	10	**10**	**10**	**10**	**10**	50	**10**
00MLW003WG91AW16	10/5/2000	**10**	10	**10**	**10**	**10**	**10**	50	**10**
00MLW003WG91AW19	10/5/2000	**10**	10	**10**	**10**	**10**	**10**	50	**10**
00MLW003WG92BW01	9/27/2000	**10**	10	**10**	**10**	**10**	**10**	50	**10**
00MLW003WG92BW02	9/27/2000	**10**	10	**10**	**10**	**10**	**10**	50	**10**
00MLW202WG91AW19	6/14/2000	**10**	10	**10**	**10**	**10**	**10**	50	**10**
00MLW203WG00BW02	10/9/2000	**10**	10	**10**	**10**	**10**	**10**	50	**10**
00MLW203WG91AW16	10/5/2000	**10**	10	**10**	**10**	**10**	**10**	50	**10**
00MLW203WG92BW02	9/27/2000	**10**	10	**10**	**10**	**10**	**10**	50	**10**

units are Micrograms per liter (µg/l)
Bold text indicates an exceedence of a regulatory level
[a] - Standard lists naphthalenes
[b] - Compounds have been listed as carcinogens by Washington State standard
[c] - Standard was developed August 2001, samples were collect prior to the publication of the standard

[1] Source: Washington State Maximum Contaminant Levels, WAC 173-200
[2] Source: National Drinking Water Regulations Maximum Contaminant Levels (EPA 816-F-02-013 July 2002)
[3] Source: Washington State Model Toxics Control Act (MTCA) Method A Groundwater Cleanup Levels (WAC 173-340-900)
[4] Source: USEPA Region 9 Preliminary Remediation Goals (PRGs) 2002 (USEPA, 2002)

TABLE 4-19

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - SVOCS
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzyl alcohol	Chrysene	4-Chloroaniline	2-Chlorophenol	2-Chloronaphthalene	Dibenzo(a,h)anthracene	Dibenzofuran
Washington MCL[1]		-	-	-	-	-	-	-	-	-
Federal MCL[2]		-	-	-	-	-	-	-	-	-
MTCA[3]		**0.1[c]**	**0.1[c]**	-	**0.1[c]**	-	-	-	**0.1[c]**	-
Tap Water PRG[4]		**0.092**	**0.92**	**11000**	**9.2**	**150**	**30**	**490**	**0.0092**	**24**
Sample Identificatior	**Collection Date**									
00MLW001TK01	9/27/2000	**10**	**10**	20	**10**	20	10	10	**10**	10
00MLW001TK02	10/11/2000	**10**	**10**	20	**10**	20	10	10	**10**	10
00MLW002WG91AW16	6/21/2000	**10**	**10**	20	**10**	20	10	10	**10**	10
00MLW002WG91AW19	6/14/2000	**10**	**10**	20	**10**	20	10	10	**10**	10
00MLW002WG92BW01	6/20/2000	**10**	**10**	20	**10**	20	10	10	**10**	10
00MLW002WG92BW02	6/20/2000	**10**	**10**	20	**10**	20	10	10	**10**	10
00MLW003WG00AW11	10/9/2000	**10**	**10**	20	**10**	20	10	10	**10**	10
00MLW003WG00AW14	10/30/2000	**10**	**10**	20	**10**	20	10	10	**10**	10
00MLW003WG00BW01	10/6/2000	**10**	**10**	20	**10**	20	10	10	**10**	10
00MLW003WG00BW02	10/9/2000	**10**	**10**	20	**10**	20	10	10	**10**	10
00MLW003WG00BW12	10/5/2000	**10**	**10**	20	**10**	20	10	10	**10**	10
00MLW003WG00BW13	10/5/2000	**10**	**10**	20	**10**	20	10	10	**10**	10
00MLW003WG91AW16	10/5/2000	**10**	**10**	20	**10**	20	10	10	**10**	10
00MLW003WG91AW19	10/5/2000	**10**	**10**	20	**10**	20	10	10	**10**	10
00MLW003WG92BW01	9/27/2000	**10**	**10**	20	**10**	20	10	10	**10**	10
00MLW003WG92BW02	9/27/2000	**10**	**10**	20	**10**	20	10	10	**10**	10
00MLW202WG91AW19	6/14/2000	**10**	**10**	20	**10**	20	10	10	**10**	10
00MLW203WG00BW02	10/9/2000	**10**	**10**	20	**10**	20	10	10	**10**	10
00MLW203WG91AW16	10/5/2000	**10**	**10**	20	**10**	20	10	10	**10**	10
00MLW203WG92BW02	9/27/2000	**10**	**10**	20	**10**	20	10	10	**10**	10

units are Micrograms per liter (µg/l)
Bold text indicates an exceedence of a regulatoı
[a] - Standard lists naphthalenes
[b] - Compounds have been listed as carcinogens
[c] - Standard was developed August 2001, sampl

[1] Source: Washington State Maximum Contam
[2] Source: National Drinking Water Regulation
[3] Source: Washington State Model Toxics Con
[4] Source: USEPA Region 9 Preliminary Reme

TABLE 4-19

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - SVOCS
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND
(Page 3 of 6)

		3,3-Dichlorobenzidine	2,4-Dichlorophenol	Diethyl phthalate	2,4-Dimethylphenol	Dimethylphthalate	Di-n-octyl phthalate	2,4-Dinitrophenol	2,4-Dintrotoluene
Washington MCL[1]		**0.2[b]**	-	-	-	-	-	-	**0.1[b]**
Federal MCL[2]		-	-	-	-	-	-	-	-
MTCA[3]		-	-	-	-	-	-	-	-
Tap Water PRG[4]		**0 15**	**110**	**29000**	**730**	**360000**	**1500**	**73**	**73**
Sample Identificatior	**Collection Date**								
00MLW001TK01	9/27/2000	**20**	10	10	10	10	10	50	**10**
00MLW001TK02	10/11/2000	**20**	10	10	10	10	10	50	**10**
00MLW002WG91AW16	6/21/2000	**20**	10	10	10	10	10	50	**10**
00MLW002WG91AW19	6/14/2000	**20**	10	10	10	10	10	50	**10**
00MLW002WG92BW01	6/20/2000	**20**	10	10	10	10	10	50	**10**
00MLW002WG92BW02	6/20/2000	**20**	10	10	10	10	10	50	**10**
00MLW003WG00AW11	10/9/2000	**20**	10	10	10	10	10	50	**10**
00MLW003WG00AW14	10/30/2000	**20**	10	10	10	10	10	50	**10**
00MLW003WG00BW01	10/6/2000	**20**	10	10	10	10	10	50	**10**
00MLW003WG00BW02	10/9/2000	**20**	10	10	10	10	10	50	**10**
00MLW003WG00BW12	10/5/2000	**20**	10	10	10	10	10	50	**10**
00MLW003WG00BW13	10/5/2000	**20**	10	10	10	10	10	50	**10**
00MLW003WG91AW16	10/5/2000	**20**	10	10	10	10	10	50	**10**
00MLW003WG91AW19	10/5/2000	**20**	10	10	10	10	10	50	**10**
00MLW003WG92BW01	9/27/2000	**20**	10	10	10	10	10	50	**10**
00MLW003WG92BW02	9/27/2000	**20**	10	10	10	10	10	50	**10**
00MLW202WG91AW19	6/14/2000	**20**	10	10	10	10	10	50	**10**
00MLW203WG00BW02	10/9/2000	**20**	10	10	10	10	10	50	**10**
00MLW203WG91AW16	10/5/2000	**20**	10	10	10	10	10	50	**10**
00MLW203WG92BW02	9/27/2000	**20**	10	10	10	10	10	50	**10**

units are Micrograms per liter (µg/l)
Bold text indicates an exceedence of a regulatoı
[a] - Standard lists naphthalenes
[b] - Compounds have been listed as carcinogens
[c] - Standard was developed August 2001, sampl

[1] Source: Washington State Maximum Contam
[2] Source: National Drinking Water Regulations
[3] Source: Washington State Model Toxics Con
[4] Source: USEPA Region 9 Preliminary Remec

TABLE 4-19

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - SVOCS
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND
(Page 4 of 6)

		2,6-Dintrotoluene	Fluorene	Fluoranthene	Hexachlorobutadiene	Hexachlorocyclopentadiene	Hexachlorobenzene	Hexachloroethane	Indeno(1,2,3-cd)pyrene	Isophorone
Washington MCL[1]		**0.1[b]**	**-**	**-**	**-**	**-**	**0.05[b]**	**-**	**-**	**-**
Federal MCL[2]		**-**	**-**	**-**	**-**	**50**	**1**	**-**	**-**	**-**
MTCA[3]		**-**	**0.1[c]**	**0 1[c]**	**-**	**-**	**-**	**-**	**-**	**-**
Tap Water PRG[4]		**36**	**240**	**1500**	**0.86**	**220**	**0.042**	**4.8**	**0.092**	**71**
Sample Identificatio	**Collection Date**									
00MLW001TK01	9/27/2000	**10**	10	10	**10**	10	**10**	**10**	**10**	10
00MLW001TK02	10/11/2000	**10**	10	10	**10**	10	**10**	**10**	**10**	10
00MLW002WG91AW16	6/21/2000	**10**	10	10	**10**	10	**10**	**10**	**10**	10
00MLW002WG91AW19	6/14/2000	**10**	10	10	**10**	10	**10**	**10**	**10**	10
00MLW002WG92BW01	6/20/2000	**10**	10	10	**10**	10	**10**	**10**	**10**	10
00MLW002WG92BW02	6/20/2000	**10**	10	10	**10**	10	**10**	**10**	**10**	10
00MLW003WG00AW11	10/9/2000	**10**	10	10	**10**	10	**10**	**10**	**10**	10
00MLW003WG00AW14	10/30/2000	**10**	10	10	**10**	10	**10**	**10**	**10**	10
00MLW003WG00BW01	10/6/2000	**10**	10	10	**10**	10	**10**	**10**	**10**	10
00MLW003WG00BW02	10/9/2000	**10**	10	10	**10**	10	**10**	**10**	**10**	10
00MLW003WG00BW12	10/5/2000	**10**	10	10	**10**	10	**10**	**10**	**10**	10
00MLW003WG00BW13	10/5/2000	**10**	10	10	**10**	10	**10**	**10**	**10**	10
00MLW003WG91AW16	10/5/2000	**10**	10	10	**10**	10	**10**	**10**	**10**	10
00MLW003WG91AW19	10/5/2000	**10**	10	10	**10**	10	**10**	**10**	**10**	10
00MLW003WG92BW01	9/27/2000	**10**	10	10	**10**	10	**10**	**10**	**10**	10
00MLW003WG92BW02	9/27/2000	**10**	10	10	**10**	10	**10**	**10**	**10**	10
00MLW202WG91AW19	6/14/2000	**10**	10	10	**10**	10	**10**	**10**	**10**	10
00MLW203WG00BW02	10/9/2000	**10**	10	10	**10**	10	**10**	**10**	**10**	10
00MLW203WG91AW16	10/5/2000	**10**	10	10	**10**	10	**10**	**10**	**10**	10
00MLW203WG92BW02	9/27/2000	**10**	10	10	**10**	10	**10**	**10**	**10**	10

units are Micrograms per liter (µg/l)
Bold text indicates an exceedence of a regulator

[a] - Standard lists naphthalenes

[b] - Compounds have been listed as carcinogens

[c] - Standard was developed August 2001, sampl

[1] Source: Washington State Maximum Contam

[2] Source: National Drinking Water Regulations

[3] Source: Washington State Model Toxics Con

[4] Source: USEPA Region 9 Preliminary Reme

TABLE 4-19

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - SVOCS
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND
(Page 5 of 6)

		2-Methylphenol	4-Methylphenol	Naphthalene	n-Nitrosodiphenylamine	n-Nitroso-di-n-proprylamine	2-Nitrolaniline	Nitrobenzene	Pentachlorophenol	Phenol	Pyrene
Washington MCL[1]		**-**	**-**	**-**	**17[b]**	**0.01[b]**	**-**	**-**	**-**	**-**	**-**
Federal MCL[2]		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**
MTCA[3]		**-**	**-**	**160[a,c]**	**-**	**-**	**-**	**-**	**-**	**-**	**0 1[c]**
Tap Water PRG[4]		**1800**	**180**	**6.2**	**14**	**-**	**1**	**3.4**	**0.56**	**22000**	**180**
Sample Identificatior	**Collection Date**										
00MLW001TK01	9/27/2000	10	10	**10**	10	**10**	**50**	**10**	**50**	10	10
00MLW001TK02	10/11/2000	10	10	**10**	10	**10**	**50**	**10**	**50**	10	10
00MLW002WG91AW16	6/21/2000	10	10	**10**	10	**10**	**50**	**10**	**50**	10	10
00MLW002WG91AW19	6/14/2000	10	10	**10**	10	**10**	**50**	**10**	**50**	10	10
00MLW002WG92BW01	6/20/2000	10	10	**10**	10	**10**	**50**	**10**	**50**	10	10
00MLW002WG92BW02	6/20/2000	10	10	**10**	10	**10**	**50**	**10**	**50**	10	10
00MLW003WG00AW11	10/9/2000	10	10	**10**	10	**10**	**50**	**10**	**50**	10	10
00MLW003WG00AW14	10/30/2000	10	10	**10**	10	**10**	**50**	**10**	**50**	10	10
00MLW003WG00BW01	10/6/2000	10	10	**10**	10	**10**	**50**	**10**	**50**	10	10
00MLW003WG00BW02	10/9/2000	10	10	**10**	10	**10**	**50**	**10**	**50**	10	10
00MLW003WG00BW12	10/5/2000	10	10	**10**	10	**10**	**50**	**10**	**50**	10	10
00MLW003WG00BW13	10/5/2000	10	10	**10**	10	**10**	**50**	**10**	**50**	10	10
00MLW003WG91AW16	10/5/2000	10	10	**10**	10	**10**	**50**	**10**	**50**	10	10
00MLW003WG91AW19	10/5/2000	10	10	**10**	10	**10**	**50**	**10**	**50**	10	10
00MLW003WG92BW01	9/27/2000	10	10	**10**	10	**10**	**50**	**10**	**50**	10	10
00MLW003WG92BW02	9/27/2000	10	10	**10**	10	**10**	**50**	**10**	**50**	10	10
00MLW202WG91AW19	6/14/2000	10	10	**10**	10	**10**	**50**	**10**	**50**	10	10
00MLW203WG00BW02	10/9/2000	10	10	**10**	10	**10**	**50**	**10**	**50**	10	10
00MLW203WG91AW16	10/5/2000	10	10	**10**	10	**10**	**50**	**10**	**50**	10	10
00MLW203WG92BW02	9/27/2000	10	10	**10**	10	**10**	**50**	**10**	**50**	10	10

units are Micrograms per liter (µg/l)
Bold text indicates an exceedence of a regulator

[a] - Standard lists naphthalenes

[b] - Compounds have been listed as carcinogens

[c] - Standard was developed August 2001, sampl

[1] Source: Washington State Maximum Contam

[2] Source: National Drinking Water Regulation

[3] Source: Washington State Model Toxics Con

[4] Source: USEPA Region 9 Preliminary Reme

TABLE 4-19

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - SVOCS
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND
(Page 6 of 6)

		1,2,4-Trichlorobenzene	2,4,5-Trichlorophenol	2,4,6-Trichlorophenol
Washington MCL[1]		**-**	**-**	**4[b]**
Federal MCL[2]		**-**	**-**	**-**
MTCA[3]		**-**	**-**	**-**
Tap Water PRG[4]		**190**	**3600**	**3.6**
Sample Identificatior	**Collection Date**			
00MLW001TK01	9/27/2000	10	10	**10**
00MLW001TK02	10/11/2000	10	10	**10**
00MLW002WG91AW16	6/21/2000	10	10	**10**
00MLW002WG91AW19	6/14/2000	10	10	**10**
00MLW002WG92BW01	6/20/2000	10	10	**10**
00MLW002WG92BW02	6/20/2000	10	10	**10**
00MLW003WG00AW11	10/9/2000	10	10	**10**
00MLW003WG00AW14	10/30/2000	10	10	**10**
00MLW003WG00BW01	10/6/2000	10	10	**10**
00MLW003WG00BW02	10/9/2000	10	10	**10**
00MLW003WG00BW12	10/5/2000	10	10	**10**
00MLW003WG00BW13	10/5/2000	10	10	**10**
00MLW003WG91AW16	10/5/2000	10	10	**10**
00MLW003WG91AW19	10/5/2000	10	10	**10**
00MLW003WG92BW01	9/27/2000	10	10	**10**
00MLW003WG92BW02	9/27/2000	10	10	**10**
00MLW202WG91AW19	6/14/2000	10	10	**10**
00MLW203WG00BW02	10/9/2000	10	10	**10**
00MLW203WG91AW16	10/5/2000	10	10	**10**
00MLW203WG92BW02	9/27/2000	10	10	**10**

units are Micrograms per liter (µg/l)
Bold text indicates an exceedence of a regulator

[a] - Standard lists naphthalenes

[b] - Compounds have been listed as carcinogens

[c] - Standard was developed August 2001, sampl

[1] Source: Washington State Maximum Contam

[2] Source: National Drinking Water Regulation

[3] Source: Washington State Model Toxics Con

[4] Source: USEPA Region 9 Preliminary Reme

TABLE 4-20

COMPARISON OF PRACTICAL QUANTITATION LIMITS TO REGULATORY CRITERIA FOR NON-DETECT SOIL DATA - TPH
SUPPLEMENTAL REMEDIAL INVESTIGATION
MOSES LAKE WELLFIELD SUPERFUND

		Diesel	Gasoline	Oil
Washington MCL[1]		**-**	**-**	**-**
Federal MCL[2]		**-**	**-**	**-**
MTCA[3]		**0.5**	**0.8**	**0.5**
Tap Water PRG[4]		**-**	**-**	**-**
Sample Identification	**Collection Date**			
00MLW002WG91AW14	6/15/2000	-	-	-
00MLW002WG91AW16	6/21/2000	0.5	0.25	0.5
00MLW002WG91AW19	6/14/2000	0.5	0.25	0.5
00MLW002WG92BW01	6/20/2000	0.5	0.25	0.5
00MLW002WG92BW02	6/20/2000	0.5	0.25	0.5
00MLW002WG99AW10	6/19/2000	0.5	0.25	0.5
00MLW002WG99BW16	6/21/2000	-	-	-
00MLW003WG00AW11	10/9/2000	0.5	0.25	0.5
00MLW003WG00AW14	10/30/2000	0.5	0.25	0.5
00MLW003WG00BW01	10/6/2000	0.5	0.25	0.5
00MLW003WG00BW02	10/9/2000	0.5	0.25	0.5
00MLW003WG00BW04	9/19/2000	0.5	0.25	0.5
00MLW003WG00BW05	9/18/2000	0.5	0.25	0.5
00MLW003WG00BW07	9/19/2000	0.5	0.25	0.5
00MLW003WG00BW09	9/18/2000	0.5	0.25	0.5
00MLW003WG00BW12	10/5/2000	0.5	0.25	0.5
00MLW003WG00BW13	10/5/2000	0.5	0.25	0.5
00MLW003WG91AW14	9/21/2000	-	-	-
00MLW003WG91AW16	10/5/2000	0.5	0.25	0.5
00MLW003WG91AW19	10/5/2000	0.5	0.25	0.5
00MLW003WG92BW01	9/27/2000	0.5	0.25	0.5
00MLW003WG92BW02	9/27/2000	0.5	0.25	0.5
00MLW003WG99AW10	10/4/2000	0.5	0.25	0.5
00MLW003WG99BW16	9/21/2000	-	-	-
00MLW202WG91AW14	6/15/2000	-	-	-
00MLW203WG99BW16	9/21/2000	-	-	-
01MLW002WG01BW01	5/31/2001	0.25	0.1	0.5
01MLW201WG01BW01	5/31/2001	0.25	0.1	0.5
01MLW301SOSB	4/17/2001	0.25	0.1	0.5

units are Milligrams per liter (mg/l)
Bold text indicates an exceedence of a regulatory level.

[1] Source: Washington State Maximum Contaminant Levels, WAC 173-200

[2] Source: National Drinking Water Regulations Maximum Contaminant Levels (EPA 816-F-02-013 July 2002)

[3] Source: Washington State Model Toxics Control Act (MTCA) Method A Groundwater Cleanup Levels (WAC 173-340-900)

[4] Source: USEPA Region 9 Preliminary Remediation Goals (PRGs) 2002 (USEPA, 2002)

TABLE 5.1 CONTAMINANT TRANSPORT MODEL ASSUMPTIONS	
Parameter	**Assumption**
Solution Technique	Third-Order TVD
Time Step	Controlled by the program (1.27×10^{-2} days)
Dispersion	Numeric dispersion only
Effective Porosity	0.1 (assumed value for all layers)
Sorption Coefficient	0 (no adsorption or retardation)
Initial Concentration	110 mg/L and 260 mg/L[1]
Duration of Pulse (non-continuous pulse only)	50 days
Duration of Simulation	10 and 50 years

Notes:

1. The 260 mg/L starting concentration was used at the LOX Plant, while the 110 mg/L starting concentration was used at all of the other sources.

Table 6.1
Summary Statistics for Measured Arsenic Concentrations in Soil
Moses Lake Wellfield Superfund Site
Moses Lake, Washington

Summary Statistical Parameters	Arsenic Concentrations in Soil (mg/kg) Original Results [a]	Censored Results [b]
Number of samples:	65	64
Number of detects:	62	61
Maximum detected concentration:	94	5.6
Minimum result:	<0.25	<0.25
Mean:	3.0	1.6
Standard Deviation:	11.5	1.1
95th Percentile:	4.4	3.7
95/95 BUTL:	8.1	5.4

Notes:

[a]Original results include all soil sampling results for arsenic, excluding duplicate samples.

[b]Censored results include all soil sampling results, excluding duplicate samples, with the exception of the maximum value detected (94 mg/kg) which was determined to be a statistical outlier. Arsenic results were censored according to methods described in EPA's *External Review Draft Guidance for Characterizing Background Chemicals in Soil at Superfund Sites* (EPA, 2001a).

BUTL - Background upper tolerance limit.
mg/kg - Milligrams per kilogram.

Table 6.2
Arsenic Concentrations Measured in Background Monitoring Wells
Moses Lake Wellfield Superfund Site
Moses Lake, Washington

Sample Location ID	Sample Date	Arsenic Concentration in Groundwater (ug/L)
Hanford/Ringold Member		
91AW01	Nov-99	8.9
91AW02	Nov-99	6
91AW03	Nov-99	8.5
91AW03	Jun-00	9
91AW03	Sep-00	10
91AW03	Jan-01	8
Number (N):		6
Maximum:		10
Minimum:		6
Mean:		8.4
Standard Deviation:		1.3
Roza Member		
91BW01	Nov-99	5.4
91BW01	Jun-00	6
91BW01	Sep-00	5
91BW01	Jan-01	6
99BW05	Nov-99	<5
99BW05	Jun-00	<5
99BW05	Oct-00	<5
99BW05	Jan-01	<5
99BW17	Nov-99	<5
Number (N):		4
Maximum:		6
Minimum:		5
Mean:		5.3
Standard Deviation:		0.4

Notes:
ug/L - Micrograms per liter.

Table 6.3
Selection of Human Health Benchmark Criteria
Soils
Moses Lake Wellfield Superfund Site

Constituent	EPA Region 9 Industrial Soil PRGs[a] (mg/kg)	MTCA-Method A Industrial Soil Cleanup Levels[b] (mg/kg)	Selected Soil Benchmark Criteria[c] (mg/kg)		Soil COPC Screening Level[d] (mg/kg)
Metals					
Antimony	409	na	409	nc	41
Arsenic	1 6	20	1 6	ca	1 6
Barium	66577	na	66577	nc	6658
Beryllium	1941	na	1941	ca	1941
Cadmium	451	2	451	nc	45
Chromium	448	19[e]	448	ca	448
Copper	40877	na	40877	nc	4088
Lead	750	1000	750	nc	750
Manganese	19458	na	19458	nc	1946
Mercury	307	2	307	nc	31
Nickel	20439	na	20439	nc	2044
Selenium	5110	na	5110	nc	511
Silver	5110	na	5110	nc	511
Thallium	67	na	67	nc	6 7
Zinc	100000	na	100000	ca	100000
VOCs					
Toluene	520	7	520	ca	520
Trichloroethene	0 11	0 03	0 11	ca	0 11
SVOCs					
Bis-(2-ethylhexyl)phthalate	123	na	123	ca	123
2,4-Dimethylphenol	12312	na	12312	nc	1231
Pentachlorophenol	9 0	na	9 0	ca	9 0
TPH					
Gro-Gx[f]	na	30	30	nc	30
Diesel-Dx[f]	na	2,000	2000	nc	2000
Oilm-Dx[f]	na	2,000	2000	nc	2000
PAHs					
Benzo(a)anthracene	2 1	na	2 1	ca	2 1
Benzo(a)pyrene	0 21	2 0	0 21	ca	0 21
Benzo(b)fluoranthene	2 1	na	2 1	ca	2 1
Benzo(ghi)perylene	na	na	na	na	na
Benzo(k)fluoranthene	21	na	21	ca	21
Chrysene	211	na	211	ca	211
Dibenzo(ah)anthracene	0 21	na	0 21	ca	0 21
Fluoranthene	22000	na	22000	nc	2200
Indeno(123-cd)pyrene	2 1	na	2 1	ca	2 1
Pyrene	29126	na	29126	nc	2913

Table 6.3
Selection of Human Health Benchmark Criteria
Soils
Moses Lake Wellfield Superfund Site

Constituent	EPA Region 9 Industrial Soil PRGs[a] (mg/kg)	MTCA-Method A Industrial Soil Cleanup Levels[b] (mg/kg)	Selected Soil Benchmark Criteria[c] (mg/kg)		Soil COPC Screening Level[d] (mg/kg)
PCBs					
PCB1016	21	na	21	ca	21
PCB1221	0 74	na	0 74	ca	0 74
PCB1232	0 74	na	0 74	ca	0 74
PCB1242	0 74	na	0 74	ca	0 74
PCB1248	0 74	na	0 74	ca	0 74
PCB1254	0 74	na	0 74	ca	0 74
PCB1260	0 74	na	0 74	ca	0 74

Notes:
[a]Source: Region 9 PRGs Table 2000 Update (EPA, 2002)
[b]Washington State Department of Ecology Chapter 173-340 WAC, MTCA Method A Industrial Soil Cleanup Levels from Table 745-1 (2001)
[c]Benchmark Criterion is equal to, in order of priority, (1) the EPA Region 9 Industrial Soil PRGs,
or, (2) the MTCA Method A Industrial Soil Cleanup Levels, Table 745-1
[d]Soil Screening level is equal to the selected soil benchmark for carcinogenic chemicals, or one-tenth the selected soil
benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with the EPA
Region 10 risk assessment guidance
[e]Criterion for Chromium is based upon MTCA cleanup levels for Chromium VI, in lieu of having criterion for total Chromium
[e]Criterion for TPH is based on impacts to goroundwater, rather than human exposures to soil
Therefore, the Screening Level is equal to the selected soil benchmark criteria rather than 1/10 this criteria

ca - Carcinogen
COPC - Chemical of Potential Concern
mg/kg - Milligrams per kilogram
MTCA - Model Toxics Control Act
na - Not available
nc - Noncarcinogen

Table 6.4
Selection of Human Health Benchmark Criteria
Soil Gas
Moses Lake Wellfield Superfund Site

Constituents	EPA Region 9 PRG[a] ($\mu g/m^3$)		Screening Benchmark[b] ($\mu g/m^3$)
1,1,1-Trichloroethane	2,300	nc	230
1,1,2-Trichloro-1,2,2-trifluoroethane	na		na
1,1,2-Trichloroethane	0.12	ca	0.12
1,2,4-Trimethylbenzene	6.2	nc	0.62
1,3,5-Trimethylbenzene	6.2	nc	0.62
1,2-Dichlorobenzene	209	nc	21
1,2-Dichloroethane	0.074	nc	0.0074
1,3-Butadiene	0.0069	ca	0.0069
1,4-Dichlorobenzene	0.31	ca	0.31
1,4-Dioxane	0.61	ca	0.61
2-Butanone	1,043	nc	104
2-Butanone (MEK)	1,043	nc	104
2-Hexanone[c]	83	nc	8.3
2-Propanol	na		na
4-Ethyltoluene	na	nc	na
4-Methyl-2-pentanone (MIBK)	83	nc	8.3
Acetone	365	nc	37
Benzene	0.23	ca	0.23
Bromodichloromethane	0.11	ca	0.11
Bromomethane	5.2	nc	0.52
Carbon disulfide	730	nc	73
Carbon tetrachloride	0.13	ca	0.13
Chloroform	3.1	nc	0.31
Chloromethane	1.1	ca	1.1
cis-1,2-Dichloroethene	37	nc	3.7
cis-1,3-Dichloropropene	0.48	ca	0.48
Cyclohexane	20805	nc	2081
Dichlorodifluoromethane	209	nc	21
Ethanol[d]	1,825	nc	183
Ethylbenzene	1.7	ca	1.7

Table 6.4
Selection of Human Health Benchmark Criteria
Soil Gas
Moses Lake Wellfield Superfund Site

Constituents	EPA Region 9 PRG[a] ($\mu g/m^3$)		Screening Benchmark[b] ($\mu g/m^3$)
Heptane	na	nc	na
Hexane	209	nc	21
m,p-Xylene	106	nc	11
Methylene chloride	4.1	ca	4.1
o-Xylene	106	nc	11
Propene	na	nc	na
Propylene	3.1	nc	0.31
Pyrene	110	nc	11
Styrene	1,059	nc	106
Tetrachloroethene	0.67	ca	0.67
Toluene	402	nc	40
trans-1,3-Dichloropropene	0.48	ca	0.48
Trichloroethene	0.017	ca	0.017
Trichlorofluoromethane	730	nc	73
Vinyl chloride	0.11	ca	0.11

Notes:

[a]Source: Region 9 PRGs Table 2002 Update (EPA, 2002).

[b]Soil Screening level is equal to the selected ambient air benchmark for carcinogenic chemicals, or one-tenth the selected ambient air benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with the USEPA Region 10 risk assessment guidance.

[c]Criterion for 2-hexanone is derived from methyl isobutyl ketone as a surrogate constituent.

[d]Criterion for ethanol is derived from methanol as a surrogate constituent.

Table 6.5
Selection of Human Health Benchmark Criteria
Groundwater
Moses Lake Wellfield Superfund Site

Constituent	EPA Region 9 Tap Water PRG[a] (mg/L)	MTCA-Method A Industrial GroundwaterCleanup Levels[b] (mg/L)	Selected Groundwater Benchmark Criteria[c] (mg/L)		Groundwater COPC Screening Level[d] (mg/L)
Metals					
Arsenic	0.000045	0.0050	0.000045	ca	0.000045
Manganese	0.88	na	0.88	nc	0.088
Mercury	0.011	0.0020	0.011	nc	0.0011
Zinc	11	na	11	nc	1.1
VOCs					
1,2-Dibromo-3-chloropropane	0.000048	na	0.000048	ca	0.000048
1,2,4-Trimethylbenzene	0.012	na	0.012	nc	0.0012
1,3,5-Trimethylbenzene	0.012	na	0.012	nc	0.0012
2-Butanone (MEK)	1.9	na	1.9	nc	0.19
2-Hexanone [e]	0.16	na	0.16	nc	0.016
4-Methyl-2-pentanone (MIBK)	0.16	na	0.16	nc	0.016
Acetone	0.61	na	0.61	nc	0.061
Benzene	0.00034	0.0050	0.00034	ca	0.00034
Bromodichloromethane	0.00018	na	0.00018	ca	0.00018
Bromoform	0.0085	na	0.0085	ca	0.0085
Bromomethane	0.0087	na	0.0087	nc	0.00087
Carbon disulfide	1.0	na	1.0	nc	0.10
Chloroethane	0.0046	na	0.0046	ca	0.0046
Chloroform	0.0062	na	0.0062	ca	0.0062
Chloromethane	0.0015	na	0.0015	ca	0.0015
cis-1,2-Dichloroethene	0.061	na	0.061	nc	0.0061
Dibromochloromethane	0.00013	na	0.00013	ca	0.00013
Dichlorodifluoromethane	0.39	na	0.39	nc	0.039
Ethene[f]	73	na	73	nc	7.3
Isopropylbenzene	0.66	na	0.66	nc	0.066
Methane	na	na	na		na
Methylene chloride	0.0043	0.0050	0.0043	ca	0.0043
n-Butylbenzene	0.24	na	0.24	nc	0.024
Naphthalene	0.0062	0.16	0.0062	nc	0.00062

Table 6.5
Selection of Human Health Benchmark Criteria
Groundwater
Moses Lake Wellfield Superfund Site

Constituent	EPA Region 9 Tap Water PRG[a] (mg/L)	MTCA-Method A Industrial GroundwaterCleanup Levels[b] (mg/L)	Selected Groundwater Benchmark Criteria[c] (mg/L)		Groundwater COPC Screening Level[d] (mg/L)
sec-Butylbenzene	0.24	na	0.24	nc	0.024
tert-Butylbenzene	0.24	na	0.24	nc	0.024
Toluene	0.72	1.0	0.72	nc	0.072
Tert-butyl methyl ether (MTBE)	0.013	0.020	0.013	ca	0.013
Tetrachloroethene	0.66	0.0050	0.66	ca	0.66
Trichloroethene[g]	na	0.0050	0.0050	ca	0.0050
Trichlorofluoromethane	1.3	na	1.3	nc	0.13

Notes:

[a]Source: EPA Region 9 Tap Water Preliminary Remediation Goals (PRGs) EPA 20002.

[b]Source: Washington State Department of Ecology Chapter 173-340 WAC, MTCA Method A Cleanup Levels for Ground Water from Table 720-1.

[c]Benchmark Criterion is equal to, in order of priority, (1) the EPA Region 9 Tap Water PRGs, or, (2) the MTCA Method A Cleanup Levels for Ground Water, Table 720-1.

[d]Selected groundwater screening level is equal to one-tenth the selected groundwater benchmark criteria for noncarcinogenic chemicals, or the selected groundwater benchmark critieria for carcinogenic chemicals, to account for potential cumulative effects, consistent with the EPA Region 10 risk assessment guidance.

[e]Methyl isobutyl ketone was used as a surrogate for 2-hexanone (methyl butyl ketone).

[f]Ethylene glycol used as a surrogate for ethene.

[g]In concurrence with EPA, the current federal primary drinking water standard and MTCA-A Groundwater Clean-up level of 5 ug/L (0.005 mg/L) was selected as the screening level for TCE in groundwater.

ca - Carcinogen.
COPC - Chemical of potential concern.
mg/L - Milligrams per liter.
na - Not available.
nc - Noncarcinogen.

Table 6.6
Human Health COPC Screening Summary-Soils
Sites 6a and 6b (Base Closure Landfill)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/kg)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/kg)	Soil COPC Screening Level[a] (mg/kg)	COPC (Yes/No?)
Metals							
Antimony	19	8	1	13%	na	41	No
Arsenic	94	8	8	100%	5.4[b]	1.6	Yes
Beryllium	0.28	8	4	50%	na	1941	No
Cadmium	5.4	8	8	100%	na	45	No
Chromium	280	8	8	100%	na	448	No
Copper	2400	8	8	100%	na	4088	No
Lead	1900	8	8	100%	na	750	Yes
Mercury	1.3	8	2	25%	na	31	No
Nickel	9900	8	8	100%	na	2044	Yes
Silver	0.76	8	1	13%	na	511	No
Thallium	0.6	8	1	13%	na	6.7	No
Zinc	1800	8	8	100%	na	100000	No

Notes:

[a]Soil screening level is equal to the selected soil benchmark for carcinogenic chemicals, or one-tenth the selected soil benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with EPA Region 10 risk assessment guidance.

[b]Refer to Section 6.2.2.4.1 for derivation of a background upper tolerance limit (BUTL) for arsenic.

COPC-Chemical of potential concern.

mg/kg-Milligrams per kilogram.

na-Not available.

Table 6.7
Human Health COPC Screening Summary-Soils
Site 8 (Randolph Road Base Dump)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/kg)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/kg)	Soil COPC Screening Level[a] (mg/kg)	COPC (Yes/No?)
Metals							
Arsenic	2.1	8	6	75%	5.4[b]	1.6	No
Beryllium	0.36	8	8	100%	na	1941	No
Cadmium	0.73	8	5	63%	na	45	No
Chromium	10	8	8	100%	na	448	No
Copper	22	8	8	100%	na	4088	No
Lead	450	8	8	100%	na	750	No
Mercury	0.94	8	3	38%	na	31	No
Nickel	14	8	8	100%	na	2044	No
Thallium	0.3	8	3	38%	na	6.7	No
Zinc	550	8	8	100%	na	100000	No

Notes:

[a]Soil screening level is equal to the selected soil benchmark for carcinogenic chemicals, or one-tenth the selected soil benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with EPA Region 10 risk assessment guidance.

[b]Refer to Section 6.2.2.4.1 for derivation of a background upper tolerance limit (BUTL) for arsenic.

COPC-Chemical of potential concern.

mg/kg-Milligrams per kilogram.

na-Not available.

Table 6.8
Human Health COPC Screening Summary-Soils
Site 11 (Fire Training Area - Burn Pit B)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/kg)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/kg)	Soil COPC Screening Level[a] (mg/kg)	COPC (Yes/No?)
PAHs							
Benzo(a)anthracene	0.068	3	2	67%	na	2.1	No
Benzo(a)pyrene	0.063	3	2	67%	na	0.21	No
Benzo(b)fluoranthene	0.072	3	2	67%	na	2.1	No
Benzo(ghi)perylene	0.068	3	2	67%	na	na	Yes
Benzo(k)fluoranthene	0.077	3	2	67%	na	21.1	No
Chrysene	0.0985	3	2	67%	na	211	No
Dibenz(ah)anthracene	0.075	3	2	67%	na	0.21	No
Fluoranthene	0.063	3	2	67%	na	2200	No
Indeno(123-cd)pyrene	0.07	3	2	67%	na	2.1	No
Pyrene	0.1005	3	2	67%	na	2913	No
TPH							
Diesel-Dx	1600	3	3	100%	na	2000	No
Oilm-Dx	14000	3	3	100%	na	2000	Yes

Notes:

[a]Soil screening level is equal to the selected soil benchmark for carcinogenic chemicals, or one-tenth the selected soil benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with EPA Region 10 risk assessment guidance.
COPC-Chemical of potential concern.
mg/kg-Milligrams per kilogram.
na-Not available.

Table 6.9
Human Health COPC Screening Summary-Soils
Site 12 (Motor Pool Drain Areas)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/kg)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/kg)	Soil COPC Screening Level[a] (mg/kg)	COPC (Yes/No?)
Metals							
Arsenic	1.15	3	3	100%	5.4[b]	1.6	No
Beryllium	0.41	3	3	100%	na	1941	No
Cadmium	1.3	3	3	100%	na	45	No
Chromium	9.6	3	3	100%	na	448	No
Copper	21	3	3	100%	na	4088	No
Lead	92	3	3	100%	na	750	No
Nickel	10	3	3	100%	na	2044	No
Silver	0.65	3	1	33%	na	511	No
Zinc	170	3	3	100%	na	100000	No
PAHs							
Benzo(a)pyrene	0.25	1	1	100%	na	0.21	Yes
Benzo(b)fluoranthene	0.17	1	1	100%	na	2.1	No
Benzo(k)fluoranthene	0.16	1	1	100%	na	21	No
Fluoranthene	0.042	1	1	100%	na	2200	No
Pyrene	0.019	1	1	100%	na	2913	No

Table 6.9
Human Health COPC Screening Summary-Soils
Site 12 (Motor Pool Drain Areas)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/kg)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/kg)	Soil COPC Screening Level[a] (mg/kg)	COPC (Yes/No?)
TPH							
Gro-Gx	27	1	1	100%	na	30	No
Diesel-Dx	4600	3	2	67%	na	2000	Yes
Oilm-Dx	18000	3	2	67%	na	2000	Yes

Notes:

[a]Soil screening level is equal to the selected soil benchmark for carcinogenic chemicals, or one-tenth the selected soil benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with EPA Region 10 risk assessment guidance.

[b]Refer to Section 6.2.2.4.1 for derivation of a background upper tolerance limit (BUTL) for arsenic.

COPC-Chemical of potential concern.

mg/kg-Milligrams per kilogram.

na-Not available.

PAH - Polynuclear aromatic hydrocarbons.

TPH - Total petroleum hydrocarbons.

Table 6.10
Human Health COPC Screening Summary-Soils
Site 14 (8-Place Hangar)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/kg)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/kg)	Soil COPC Screening Level[a] (mg/kg)	COPC (Yes/No?)
Metals							
Arsenic	1.6	4	4	100%	5.4[b]	1.6	No
Beryllium	0.50	4	4	100%	na	1941	No
Cadmium	0.30	4	4	100%	na	45	No
Chromium	7.7	4	4	100%	na	448	No
Copper	12	4	4	100%	na	4088	No
Lead	41	4	4	100%	na	750	No
Nickel	7.5	4	4	100%	na	2044	No
Zinc	61.9	4	4	100%	na	100000	No
TPH							
Diesel-Dx	180	2	2	100%	na	2000	No
Oilm-Dx	1300	2	2	100%	na	2000	No

Notes:

[a]Soil screening level is equal to the selected soil benchmark for carcinogenic chemicals, or one-tenth the selected soil benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with EPA Region 10 risk assessment guidance.

[b]Refer to Section 6.2.2.4.1 for derivation of a background upper tolerance limit (BUTL) for arsenic.

COPC-Chemical of potential concern.

mg/kg-Milligrams per kilogram.

na-Not available.

Table 6.11
Human Health COPC Screening Summary-Soils
Site 15 (8-Place Hangar Ditch)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/kg)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/kg)	Soil COPC Screening Level[a] (mg/kg)	COPC (Yes/No?)
Metals							
Arsenic	5.1	4	4	100%	5.4[b]	1.6	No
Beryllium	0.30	4	3	75%	na	1,941	No
Cadmium	4.6	4	4	100%	na	45	No
Chromium	53	4	4	100%	na	448	No
Copper	55	4	4	100%	na	4,088	No
Lead	49	4	4	100%	na	750	No
Mercury	0.27	4	2	50%	na	31	No
Nickel	23	4	4	100%	na	2,044	No
Zinc	286	4	4	100%	na	100,000	No

Notes:

[a]Soil screening level is equal to the selected soil benchmark for carcinogenic chemicals, or one-tenth the selected soil benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with EPA Region 10 risk assessment guidance.

[b]Refer to Section 6.2.2.4.1 for derivation of a background upper tolerance limit (BUTL) for arsenic.

COPC-Chemical of potential concern.

mg/kg-Milligrams per kilogram.

na-Not available.

Table 6.12
Human Health COPC Screening Summary-Soils
Site 17 (3-Place Hangar-Bldg 5801)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/kg)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/kg)	Soil COPC Screening Level[a] (mg/kg)	COPC (Yes/No?)
Metals							
Arsenic	5.6	4	4	100%	5.4[b]	1.6	Yes
Beryllium	0.47	4	4	100%	na	1,941	No
Cadmium	4.9	4	2	50%	na	45	No
Chromium	31	4	4	100%	na	448	No
Copper	35	4	4	100%	na	4,088	No
Lead	290	4	4	100%	na	750	No
Mercury	0.28	4	1	25%	na	31	No
Nickel	14	4	4	100%	na	2,044	No
Silver	0.56	4	4	100%	na	511	No
Thallium	0.44	4	4	100%	na	7	No
Zinc	510	4	4	100%	na	100,000	No
PAHs							
Benzo(a)anthracene	2	1	1	100%	na	2.1	No
Benzo(a)pyrene	2.5	1	1	100%	na	0.21	Yes
Benzo(b)fluoranthene	2.2	1	1	100%	na	2.1	Yes
Benzo(ghi)perylene	2.1	1	1	100%	na	na	Yes
Benzo(k)fluoranthene	2.2	1	1	100%	na	21	No
Chrysene	2.2	1	1	100%	na	211	No
Fluoranthene	3.9	1	1	100%	na	2,200	No
Indeno(123-cd)pyrene	2	1	1	100%	na	2.1	No
Pyrene	3.4	1	1	100%	na	2,913	No

Table 6.12
Human Health COPC Screening Summary-Soils
Site 17 (3-Place Hangar-Bldg 5801)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/kg)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/kg)	Soil COPC Screening Level[a] (mg/kg)	COPC (Yes/No?)
PCBs							
PCB 1254	0.31	4	2	50%	na	0.74	No
PCB 1260	0.26	4	2	50%	na	0.74	No
TPH							
Diesel-Dx	260	1	1	100%	na	2,000	No
Oilm-Dx	440	1	1	100%	na	2,000	No

Notes:

[a]Soil screening level is equal to the selected soil benchmark for carcinogenic chemicals, or one-tenth the selected soil benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with EPA Region 10 risk assessment guidance.

[b]Refer to Section 6.2.2.4.1 for derivation of a background upper tolerance limit (BUTL) for arsenic.

COPC-Chemical of potential concern.
mg/kg-Milligrams per kilogram.
na-Not available.
PAH-Polynuclear aromatic hydrocarbons.
PCB-Polychlorinated biphenyls.
TPH-Total petroleum hydrocarbons.

Table 6.13
Human Health COPC Screening Summary-Soils
Site 18 (Paint Hangar-Bldg 5825)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/kg)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/kg)	Soil COPC Screening Level[a] (mg/kg)	COPC (Yes/No?)
Metals							
Arsenic	1.4	3	3	100%	5.4[b]	1.6	No
Beryllium	0.34	3	3	100%	na	1941	No
Cadmium	2.3	3	3	100%	na	45	No
Chromium	26.5	3	3	100%	na	448	No
Copper	44	3	3	100%	na	4088	No
Lead	555	3	3	100%	na	750	No
Mercury	26.5	3	2	67%	na	31	No
Nickel	11	3	3	100%	na	2044	No
Zinc	300	3	3	100%	na	100000	No
PCBs							
PCB 1254	0.86	3	2	67%	na	0.74	Yes
PCB 1260	2.1	3	1	33%	na	0.74	Yes

Notes:

[a]Soil screening level is equal to the selected soil benchmark for carcinogenic chemicals, or one-tenth the selected soil benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with EPA Region 10 risk assessment guidance.

[b]Refer to Section 6.2.2.4.1 for derivation of a background upper tolerance limit (BUTL) for arsenic.

COPC-Chemical of potential concern.

mg/kg-Milligrams per kilogram.

na-Not available.

PCB-Polychlorinated biphenyls.

Table 6.14
Human Health COPC Screening Summary-Soils
Site 19 (Liquid Oxygen Generating Plant-Bldg 5102)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/kg)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/kg)	Soil COPC Screening Level[a] (mg/kg)	COPC (Yes/No?)
Metals							
Arsenic	0.92	8	8	100%	5.4[b]	1.6	No
Beryllium	0.27	8	1	13%	na	1,941	No
Cadmium	0.67	8	3	38%	na	45	No
Chromium	4.7	8	8	100%	na	448	No
Copper	29	8	8	100%	na	4,088	No
Lead	5.6	8	8	100%	na	750	No
Manganese	380	8	8	100%	na	1,946	No
Nickel	8.1	8	8	100%	na	2,044	No
Zinc	69	8	8	100%	na	100,000	No
VOCs							
Toluene	0.040	8	1	13%	na	520	No
Trichloroethene	0.082	8	2	25%	na	0.11	No
SVOCs							
Bis-(2-ethylhexyl)phthalate	2.5	8	1	13%	na	123	No
2,4-Dimethylphenol	1.3	8	2	25%	na	1,231	No
PAHs							
Benzo(a)anthracene	0.013	6	4	67%	na	2.1	No
Benzo(a)pyrene	0.0086	6	1	17%	na	0.21	No
Benzo(b)fluoranthene	0.012	6	2	33%	na	2.1	No
Benzo(ghi)perylene	0.011	6	2	33%	na	na	Yes
Benzo(k)fluoranthene	0.0074	6	1	17%	na	21	No
Chrysene	0.012	6	3	50%	na	211	No
Fluoranthene	0.018	6	4	67%	na	2,200	No
Indeno(123-cd)pyrene	0.011	6	3	50%	na	2.1	No

Table 6.14
Human Health COPC Screening Summary-Soils
Site 19 (Liquid Oxygen Generating Plant-Bldg 5102)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/kg)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/kg)	Soil COPC Screening Level[a] (mg/kg)	COPC (Yes/No?)
Pyrene	0.019	6	4	67%	na	2,913	No
TPH							
Diesel-Dx	150	6	4	67%	na	2,000	No
Oilm-Dx	890	6	6	100%	na	2,000	No

Notes:

[a]Soil screening level is equal to the selected soil benchmark for carcinogenic chemicals, or one-tenth the selected soil benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with EPA Region 10 risk assessment guidance.

[b]Refer to Section 6.2.2.4.1 for derivation of a background upper tolerance limit (BUTL) for arsenic.

Concentrations based upon samples collected from 0-10 ft. bgs.

COPC-Chemical of potential concern.

mg/kg-Milligrams per kilogram.

na-Not available.

PAH-Polynuclear aromatic hydrocarbons.

SVOC-Semivolatile organic compounds.

TPH-Total petroleum hydrocarbons.

VOC-Volatile organic compounds.

Table 6.15
Human Health COPC Screening Summary-Soils
Site 20 (South Base Dump)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/kg)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/kg)	Soil COPC Screening Level[a] (mg/kg)	COPC (Yes/No?)
Metals							
Arsenic	1.9	8	8	100%	5.4[b]	1.6	No
Beryllium	0.39	8	8	100%	na	1,941	No
Cadmium	16	8	7	88%	na	45	No
Chromium	67	8	8	100%	na	448	No
Copper	70	8	8	100%	na	4088	No
Lead	5700	8	8	100%	na	750	Yes
Mercury	0.17	8	2	25%	na	31	No
Nickel	15	8	8	100%	na	2,044	No
Silver	6.3	8	5	63%	na	511	No
Zinc	330	8	8	100%	na	100,000	No

Notes:

[a]Soil screening level is equal to the selected soil benchmark for carcinogenic chemicals, or one-tenth the selected soil benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with EPA Region 10 risk assessment guidance.

[b]Refer to Section 6.2.2.4.1 for derivation of a background upper tolerance limit (BUTL) for arsenic.

COPC-Chemical of potential concern.

mg/kg-Milligrams per kilogram.

na-Not available.

Table 6.16
Human Health COPC Screening Summary-Soils
Site 22 (Paint Hangar Leach Pit)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/kg)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/kg)	Soil COPC Screening Level[a] (mg/kg)	COPC (Yes/No?)
Metals							
Arsenic	3.8	3	3	100%	5.4[b]	1.6	No
Cadmium	16	3	3	100%	na	45	No
Chromium	425	3	3	100%	na	448	No
Copper	120	3	3	100%	na	4088	No
Lead	1200	3	3	100%	na	750	Yes
Mercury	0.92	3	2	67%	na	31	No
Nickel	27	3	3	100%	na	2,044	No
Zinc	680	3	3	100%	na	100,000	No
PAHs							
Benzo(a)anthracene	0.13	1	1	100%	na	2.1	No
Benzo(a)pyrene	0.29	1	1	100%	na	0.21	Yes
Benzo(b)fluoranthene	0.48	1	1	100%	na	2.1	No
Benzo(ghi)perylene	0.42	1	1	100%	na	na	Yes
Benzo(k)fluoranthene	0.43	1	1	100%	na	21	No
Chrysene	0.28	1	1	100%	na	211	No
Dibenz(ah)anthracene	0.10	1	1	100%	na	0.21	No
Fluoranthene	0.21	1	1	100%	na	2,200	No
Indeno(123-cd)pyrene	0.5	1	1	100%	na	2.1	No
Pyrene	0.31	1	1	100%	na	2,913	No

Table 6.16
Human Health COPC Screening Summary-Soils
Site 22 (Paint Hangar Leach Pit)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/kg)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/kg)	Soil COPC Screening Level[a] (mg/kg)	COPC (Yes/No?)
PCBs							
PCB 1254	8.1	3	3	100%	na	0.74	Yes
PCB 1260	0.0063	3	1	33%	na	0.74	No
TPH							
Gro-Gx	150	1	1	100%	na	30	Yes
Diesel-Dx	320	3	3	100%	na	2,000	No
Oilm-Dx	190	3	3	100%	na	2,000	No

Notes:

[a]Soil screening level is equal to the selected soil benchmark for carcinogenic chemicals, or one-tenth the selected soil benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with EPA Region 10 risk assessment guidance.

[b]Refer to Section 6.2.2.4.1 for derivation of a background upper tolerance limit (BUTL) for arsenic.

COPC-Chemical of potential concern.

mg/kg-Milligrams per kilogram.

Table 6.17
Human Health COPC Screening Summary-Soils
Site 31 (19th Avenue Base Dump)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/kg)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/kg)	Soil COPC Screening Level[a] (mg/kg)	COPC (Yes/No?)
Metals							
Arsenic	2.3	8	8	100%	5.4[b]	1.6	No
Beryllium	0.35	8	6	75%	na	1,941	No
Cadmium	6.3	8	7	88%	na	45	No
Chromium	210	8	8	100%	na	448	No
Copper	46	8	8	100%	na	4,088	No
Lead	670	8	8	100%	na	750	No
Mercury	0.21	8	1	13%	na	31	No
Nickel	23	8	8	100%	na	2,044	No
Silver	1.9	8	2	25%	na	511	No
Zinc	960	8	8	100%	na	100,000	No

Notes:

[a]Soil screening level is equal to the selected soil benchmark for carcinogenic chemicals, or one-tenth the selected soil benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with EPA Region 10 risk assessment guidance.

[b]Refer to Section 6.2.2.4.1 for derivation of a background upper tolerance limit (BUTL) for arsenic.

COPC-Chemical of potential concern.

mg/kg-Milligrams per kilogram.

na-Not available.

Table 6.18
Human Health COPC Screening Summary-Soils
Site 33 (End of Runway 32 Dump)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/kg)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/kg)	Soil COPC Screening Level[a] (mg/kg)	COPC (Yes/No?)
Metals							
Barium	67	1	1	100%	na	6,658	No
Chromium	4.0	1	1	100%	na	448	No
Lead	16	1	1	100%	na	750	No
SVOCs							
Pentachlorophenol	6.4	1	1	100%	na	9.0	No
TPH							
TPH-Dx[b]	1300	9	8	89%	na	2,000	No

Notes:

[a]Soil screening level is equal to the selected soil benchmark for carcinogenic chemicals, or one-tenth the selected soil benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with EPA Region 10 risk assessment guidance.

[b]Analyte range was extended to include motor oil range compounds; modified method 8015.

COPC-Chemical of potential concern.
mg/kg-Milligrams per kilogram.
na-Not available.
SVOC-Semivolatile organic compounds.
TPH-Total petroleum hydrocarbons.

Table 6.19
Human Health COPC Screening Summary-Soils
Site 35 (Stained Soil)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/kg)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/kg)	Soil COPC Screening Level[a] (mg/kg)	COPC (Yes/No?)
Metals							
Arsenic	1.9	3	3	100%	5.4[b]	1.6	No
Beryllium	0.29	3	1	33%	na	1,941	No
Cadmium	3.3	3	2	67%	na	45	No
Chromium	38	3	3	100%	na	448	No
Copper	69	3	3	100%	na	4,088	No
Lead	210	3	3	100%	na	750	No
Nickel	14	3	3	100%	na	2,044	No
Zinc	250	3	3	100%	na	100,000	No
PAHs							
Benzo(b)fluoranthene	0.069	1	1	100%	na	2.1	No
Fluoranthene	0.055	1	1	100%	na	2,200	No
Pyrene	0.13	1	1	100%	na	2,913	No

Table 6.19
Human Health COPC Screening Summary-Soils
Site 35 (Stained Soil)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/kg)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/kg)	Soil COPC Screening Level[a] (mg/kg)	COPC (Yes/No?)
TPH							
Gro-Gx	110	2	1	50%	na	30	Yes
Diesel-Dx	16000	3	3	100%	na	2,000	Yes
Oilm-Dx	31500	3	3	100%	na	2,000	Yes

Notes:

[a]Soil screening level is equal to the selected soil benchmark for carcinogenic chemicals, or one-tenth the selected soil benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with EPA Region 10 risk assessment guidance.

[b]Refer to Section 6.2.2.4.1 for derivation of a background upper tolerance limit (BUTL) for arsenic.

COPC-Chemical of potential concern.
mg/kg-Milligrams per kilogram.
na-Not available.
PAH-Polynuclear aromatic hydrocarbons.
TPH-Total petroleum hydrocarbons.

Table 6.20
Summary of Soil COPCs for Individual Sites
Moses Lake Wellfield Superfund Site

Site	Soil COPC's
6a and 6b-Base Closure Landfill	Arsenic, lead, nickel
8-Randolph Road Base Dump	None[a]
11-Fire Training Area - Burn Pit B	Benzo(ghi)perylene, oilm-Dx
12-Motor Pool Drain Areas	Benzo(a)pyrene, diesel-Dx, oilm-Dx
14-8-Place Hangar	None[a]
15-8-Place Hangar Ditch	None[a]
17-3-Place Hangar-Bldg. 5801	Arsenic, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene
18-Paint Hangar-Bldg. 5825	Aroclor 1254, Aroclor 1260
19-Liquid Oxygen Generating Plant-Bldg. 5102	Benzo(ghi)perylene
20-South Base Dump	Lead
22-Paint Hangar Leach Pit	Lead, benzo(a)pyrene, benzo(ghi)perylene, Aroclor 1254, Gro-Gx
31-19th Avenue Base Dump	None[a]
33-End of Runway 32 Dump	None[a]
35-Stained Soil	Gro-Gx, diesel-Dx, oilm-Dx

Notes:

[a]No COPCs were identified for this site; all analyte concentrations were below screening criteria.
COPC-Chemical of potential concern.

Table 6.21
Human Health COPC Screening Summary-Soil Gas
Site 2 (Big Bend Community College Hangar)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituents	Maximum Concentration[a] (ppbv)	Maximum Concentration[b] (µg/m^3)	Sample Depth fbgs	Number of Samples	Number of Detects	Detection Frequency	Screening Benchmark[c] (µg/m^3)	COPC (Yes/No)
1,3-Butadiene	5.7	13	6	3	1	33%	0.0069	Yes
1,4-Dioxane	6.0	22	6	3	1	33%	0.61	Yes
2-Butanone (MEK)	3.3	10	6	3	2	67%	104	No
Acetone	20	48	6	3	3	100%	37	Yes
Benzene	1.8	5.7	6	3	1	33%	0.23	Yes
Carbon disulfide	6.25	19	6	3	1	33%	73	No
Dichlorodifluoromethane	1.5	7.4	6	3	2	67%	21	No
Ethanol	15	28	6	3	3	100%	183	No
m,p-Xylene	1.04	5	6	3	1	33%	11	No
Toluene	1.8	6.8	6	3	3	100%	40	No
Trichloroethene	1.74	9.3	6	3	1	33%	0.017	Yes
Trichlorofluoromethane	4.4	25	6	3	2	67%	73	No

Notes:

[a]Maximum concentration in soil gas samples collected from less than or equal to 15 ft. bgs.

[b]Maximum concetration converted to units of µg/m^3.

[c]Soil gas screening benchmark is equal to the selected soil gas benchmark for carcinogenic chemicals, or one-tenth the selected soil gas benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with the USEPA Region 10 risk assessment guidance. Source: Region 9 PRGs Table 2000 Update (EPA, 2000a).

COPC-Chemical of potential concern.

ppbv-Parts per billion volume.

µg/m^3-Micrograms per cubic meter.

Table 6.22
Human Health COPC Screening Summary-Soil Gas
Site 3a (Aircraft Wash Rack & Discharge Areas)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituents	Maximum Concentration[a] (ppbv)	Maximum Concentration[b] (µg/m^3)	Sample Depth fbgs	Number of Samples	Number of Detects	Detection Frequency	Screening Benchmark[c] (µg/m^3)	COPC (Yes/No)
1,2,4-Trimethylbenzene	52	256	8	5	4	80%	0.62	Yes
1,3,5-Trimethylbenzene	10	49	8	5	2	40%	0.62	Yes
1,3-Butadiene	27	60	6	5	1	20%	0.0069	Yes
2-Butanone (MEK)	36	106	8	5	3	60%	104	Yes
4-Ethyltoluene	31	152	8	5	2	40%	na	Yes
Acetone	180	428	8	5	5	100%	37	Yes
Benzene	23	73	6	5	2	40%	0.23	Yes
Carbon disulfide	88	274	6	5	4	80%	73	Yes
Chloromethane	1.7	3.5	8	5	1	20%	1.1	Yes
Ethanol	19	36	6	5	3	60%	183	No
Ethylbenzene	13	56	8	5	2	40%	1.7	Yes
Ethylbenzene	4.1	18	6	5	2	40%	1.7	Yes
Heptane	8.8	36	6	5	1	20%	na	Yes
Hexane	16	56	6	5	1	20%	21	Yes
m,p-Xylene	45	195	8	5	3	60%	11	Yes
o-Xylene	23	100	8	5	2	40%	11	Yes
Propene	320	551	6	5	1	20%	na	Yes
Styrene	2.9	12	6	5	1	20%	106	No
Toluene	24	90	6	5	3	60%	40	Yes
Trichloroethene	2.6	14	6	5	1	20%	0.017	Yes

Notes:

Table 6.22
Human Health COPC Screening Summary-Soil Gas
Site 3a (Aircraft Wash Rack & Discharge Areas)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituents	Maximum Concentration[a] (ppbv)	Maximum Concentration[b] ($\mu g/m^3$)	Sample Depth fbgs	Number of Samples	Number of Detects	Detection Frequency	Screening Benchmark[c] ($\mu g/m^3$)	COPC (Yes/No)

[a]Maximum concentration in soil gas samples collected from less than or equal to 15 ft. bgs.

[b]Maximum concetration converted to units of $\mu g/m^3$.

[c]Soil gas screening benchmark is equal to the selected soil gas benchmark for carcinogenic chemicals, or one-tenth the selected soil gas benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with the USEPA Region 10 risk assessment guidance. Source: Region 9 PRGs Table 2000 Update (EPA, 2000a).

COPC-Chemical of potential concern.

na-Not available.

ppbv-Parts per billion volume.

$\mu g/m^3$-Micrograms per cubic meter.

Table 6.23
Human Health COPC Screening Summary-Soil Gas
Site 3b (Aircraft Wash Rack & Discharge Areas)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituents	Maximum Concentration[a] (ppbv)	Maximum Concentration[b] (µg/m^3)	Sample Depth fbgs	Number of Samples	Number of Detects	Detection Frequency	Screening Benchmark[c] (µg/m^3)	COPC (Yes/No)
1,2,4-Trimethylbenzene	5.0	25	6	3	2	67%	0.62	Yes
1,3-Butadiene	110	243	6	3	2	67%	0.0069	Yes
1,4-Dioxane	6.5	23	6	3	1	33%	0.61	Yes
2-Butanone (MEK)	8.1	24	6	3	2	67%	104	No
Acetone	37	88	6	3	3	100%	37	Yes
Benzene	21	67	6	3	2	67%	0.23	Yes
Carbon disulfide	9.0	28	6	3	2	67%	73	No
Chloroform	2.8	14	12	3	2	67%	0.31	Yes
Chloromethane	1.6	3.3	6	3	1	33%	1.1	Yes
Ethylbenzene	2.1	9.1	6	3	1	33%	1.7	Yes
Heptane	10	41	6	3	1	33%	na	Yes
Hexane	14	49	6	3	1	33%	21	Yes
m,p-Xylene	5.4	23	6	3	1	33%	11	Yes
o-Xylene	2.3	10	6	3	1	33%	11	No
Styrene	1.9	8.1	6	3	1	33%	106	No
Toluene	18	68	6	3	3	100%	40	Yes
Trichloroethene	23	125	12	3	1	33%	0.017	Yes

Notes:

[a]Maximum concentration in soil gas samples collected from less than or equal to 15 ft. bgs.

[b]Maximum concetration converted to units of µg/m^3.

[c]Soil gas screening benchmark is equal to the selected soil gas benchmark for carcinogenic chemicals, or one-tenth the selected soil gas benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with the USEPA Region 10 risk assessment guidance. Source: Region 9 PRGs Table 2000 Update (EPA, 2000a).

COPC-Chemical of potential concern.

na-Not available.

Table 6.24
Human Health COPC Screening Summary-Soil Gas
Site 3c (Aircraft Wash Rack & Discharge Areas)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituents	Maximum Concentration[a] (ppbv)	Maximum Concentration[b] (µg/m^3)	Sample Depth fbgs	Number of Samples	Number of Detects	Detection Frequency	Screening Benchmark[c] (µg/m^3)	COPC (Yes/No)
1,2,4-Trimethylbenzene	4.4	22	6	3	2	67%	0.62	Yes
1,3-Butadiene	20	44	2	3	1	33%	0.0069	Yes
1,4-Dioxane	11	40	2	3	1	33%	0.61	Yes
2-Butanone (MEK)	11	32	2	3	1	33%	104	No
Acetone	53	126	2	3	3	100%	37	Yes
Benzene	8.1	26	2	3	3	100%	0.23	Yes
Carbon disulfide	26	81	6	3	3	100%	73	Yes
Chloromethane	2.3	5	2	3	1	33%	1.1	Yes
Ethanol	17	32	2	3	1	33%	183	No
m,p-Xylene	2.7	12	6	3	2	67%	11	Yes
Toluene	9.5	36	2	3	3	100%	40	No

Notes:

[a]Maximum concentration in soil gas samples collected from less than or equal to 15 ft. bgs.

[b]Maximum concetration converted to units of µg/m^3.

[c]Soil gas screening benchmark is equal to the selected soil gas benchmark for carcinogenic chemicals, or one-tenth the selected soil gas benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with the USEPA Region 10 risk assessment guidance. Source: Region 9 PRGs Table 2000 Update (EPA, 2000a).
COPC-Chemical of potential concern.

Table 6.25
Human Health COPC Screening Summary-Soil Gas
Site 4a (Tarmac Areas)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituents	Maximum Concentration[a] (ppbv)	Maximum Concentration[b] (µg/m^3)	Sample Depth fbgs	Number of Samples	Number of Detects	Detection Frequency	Screening Benchmark[c] (µg/m^3)	COPC (Yes/No)
1,2,4-Trimethylbenzene	15	74	6	9	5	56%	0.62	Yes
1,3,5-Trimethylbenzene	5.5	27	6	9	1	11%	0.62	Yes
1,3-Butadiene	11	23	6	9	2	22%	0.0069	Yes
2-Butanone (MEK)	35	103	6	9	3	33%	104	No
4-Ethyltoluene	13	64	6	9	1	11%	na	Yes
Acetone	44	105	6	9	8	89%	37	Yes
Benzene	5.7	18	6	9	3	33%	0.23	Yes
Carbon disulfide	17	53	6	9	5	56%	73	No
Chloromethane	1.7	3.5	6	9	1	11%	1.1	Yes
Ethanol	18	34	6	9	5	56%	183	No
Hexane	4.7	16	6	9	1	11%	21	No
m,p-Xylene	5.9	26	6	9	3	33%	11	Yes
o-Xylene	2.3	10	6	9	1	11%	11	No
Styrene	1.6	6.8	6	9	1	11%	106	No
Tetrachloroethene	3.2	22	6	9	1	11%	0.67	Yes
Toluene	9.7	36	6	9	3	33%	40	No
Trichloroethene	2.0	11	6	9	1	11%	0.017	Yes

Notes:

[a]Maximum concentration in soil gas samples collected from less than or equal to 15 ft. bgs.

[b]Maximum concetration converted to units of µg/m^3.

[c]Soil gas screening benchmark is equal to the selected soil gas benchmark for carcinogenic chemicals, or one-tenth the selected soil gas benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with the USEPA Region 10 risk assessment guidance. Source: Region 9 PRGs Table 2000 Update (EPA, 2000a).

COPC-Chemical of potential concern.

na-Not available.

ppbv-Parts per billion volume.

µg/m^3-Micrograms per cubic meter.

Table 6.26
Human Health COPC Screening Summary-Soil Gas
Site 4b (Tarmac Areas)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituents	Maximum Concentration[a] (ppbv)	Maximum Concentration[b] (µg/m^3)	Sample Depth fbgs	Number of Samples	Number of Detects	Detection Frequency	Screening Benchmark[c] (µg/m^3)	COPC (Yes/No)
1,2,4-Trimethylbenzene	1.9	9.3	6	4	1	25%	0.62	Yes
Acetone	20	48	6	4	4	100%	37	Yes
Ethanol	30	57	6	4	3	75%	183	No
m,p-Xylene	2.4	10	6	4	1	25%	11	No
Toluene	2.4	9.0	6	4	1	25%	40	No
Trichloroethene	2.0	11	8	4	1	25%	0.017	Yes

Notes:

[a]Maximum concentration in soil gas samples collected from less than or equal to 15 ft. bgs.

[b]Maximum concetration converted to units of µg/m^3.

[c]Soil gas screening benchmark is equal to the selected soil gas benchmark for carcinogenic chemicals, or one-tenth the selected soil gas benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with the USEPA Region 10 risk assessment guidance. Source: Region 9 PRGs Table 2000 Update (EPA, 2000a).

COPC-Chemical of potential concern.

ppbv-Parts per billion volume.

µg/m^3-Micrograms per cubic meter.

Table 6.27
Human Health COPC Screening Summary-Soil Gas
Site 5 (JAL Hangar Area & Tarmac)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituents	Maximum Concentration[a] (ppbv)	Maximum Concentration[b] ($\mu g/m^3$)	Sample Depth fbgs	Number of Samples	Number of Detects	Detection Frequency	Screening Benchmark[c] ($\mu g/m^3$)	COPC (Yes/No)
1,2,4-Trimethylbenzene	1.6	7.9	6	3	2	67%	0.62	Yes
Acetone	26	62	6	3	3	100%	37	Yes
Carbon disulfide	11	34	6	3	1	33%	73	No
Chloroform	3.3	16	6	3	1	33%	0.31	Yes
Ethanol	7.9	15	6	3	1	33%	183	No
Propene	6.1	11	6	3	1	33%	na	Yes
Tetrachloroethene	5.5	37	6	3	1	33%	0.67	Yes
Toluene	1.9	7.1	6	3	3	100%	40	No
Trichloroethene	7.2	39	6	3	1	33%	0.017	Yes

Notes:

[a]Maximum concentration in soil gas samples collected from less than or equal to 15 ft. bgs.

[b]Maximum concetration converted to units of $\mu g/m^3$.

[c]Soil gas screening benchmark is equal to the selected soil gas benchmark for carcinogenic chemicals, or one-tenth the selected soil gas benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with the USEPA Region 10 risk assessment guidance. Source: Region 9 PRGs Table 2000 Update (EPA, 2000a).

COPC-Chemical of potential concern.

na-Not available.

ppbv-Parts per billion volume.

$\mu g/m^3$-Micrograms per cubic meter.

Table 6.28
Human Health COPC Screening Summary-Soil Gas
Site 9 (Gravel Pit)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituents	Maximum Concentration[a] (ppbv)	Maximum Concentration[b] (µg/m^3)	Sample Depth fbgs	Number of Samples	Number of Detects	Detection Frequency	Screening Benchmark[c] (µg/m^3)	COPC (Yes/No)
1,2,4-Trimethylbenzene	2.2	11	6	6	3	50%	0.62	Yes
1,3-Butadiene	51	113	6	6	1	17%	0.0069	Yes
2-Butanone (MEK)	17	50	6	6	3	50%	104	No
Acetone	56	133	6	6	6	100%	37	Yes
Benzene	4.5	14	6	6	2	33%	0.23	Yes
Carbon disulfide	15	47	6	6	3	50%	73	No
Chloromethane	1.3	2.7	6	6	2	33%	1.1	Yes
Dichlorodifluoromethane	0.80	4.0	6	6	1	17%	21	No
Ethanol	7.1	13	6	6	4	67%	183	No
m,p-Xylene	1.8	7.8	6	6	4	67%	11	No
o-Xylene	1.7	7.4	6	6	1	17%	11	No
Toluene	5.3	20	6	6	6	100%	40	No
Trichloroethene	3.6	19	6	6	3	50%	0.017	Yes
Trichlorofluoromethane	2.3	13	6	6	2	33%	73	No

Notes:

[a]Maximum concentration in soil gas samples collected from less than or equal to 15 ft. bgs.

[b]Maximum concetration converted to units of µg/m^3.

[c]Soil gas screening benchmark is equal to the selected soil gas benchmark for carcinogenic chemicals, or one-tenth the selected soil gas benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with the USEPA Region 10 risk assessment guidance. Source: Region 9 PRGs Table 2000 Update (EPA, 2000a).

COPC-Chemical of potential concern.

ppbv-Parts per billion volume.

µg/m^3-Micrograms per cubic meter.

Table 6.29
Human Health COPC Screening Summary-Soil Gas
Site 11 (Fire Training Area Burn Pit B)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituents	Maximum Concentration[a] (ppbv)	Maximum Concentration[b] (µg/m^3)	Sample Depth fbgs	Number of Samples	Number of Detects	Detection Frequency	Screening Benchmark[c] (µg/m^3)	COPC (Yes/No)
1,2,4-Trimethylbenzene	2.8	14	6	3	3	100%	0.62	Yes
1,3,5-Trimethylbenzene	0.94	4.6	6	3	1	33%	0.62	Yes
1,4-Dioxane	4.4	16	6	3	1	33%	0.61	Yes
2-Butanone (MEK)	3.7	11	6	3	1	33%	104	No
Acetone	19	45	6	3	3	100%	37	Yes
Benzene	0.91	2.9	6	3	1	33%	0.23	Yes
Chloroform	4.2	21	6	3	1	33%	0.31	Yes
Chloromethane	0.80	1.7	6	3	1	33%	1.1	Yes
Ethanol	11	21	6	3	1	33%	183	No
m,p-Xylene	1.4	6.1	6	3	3	100%	11	No
Toluene	2.5	9.4	6	3	3	100%	40	No
Trichloroethene	31	166	6	3	1	33%	0.017	Yes

Notes:

[a]Maximum concentration in soil gas samples collected from less than or equal to 15 ft. bgs.

[b]Maximum concetration converted to units of µg/m^3.

[c]Soil gas screening benchmark is equal to the selected soil gas benchmark for carcinogenic chemicals, or one-tenth the selected soil gas benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with the USEPA Region 10 risk assessment guidance. Source: Region 9 PRGs Table 2000 Update (EPA, 2000a).

COPC-Chemical of potential concern.

ppbv-Parts per billion volume.

µg/m^3-Micrograms per cubic meter.

Table 6.30
Human Health COPC Screening Summary-Soil Gas
Site 12 (Motor Pool Drain)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituents	Maximum Concentration[a] (ppbv)	Maximum Concentration[b] (µg/m^3)	Sample Depth fbgs	Number of Samples	Number of Detects	Detection Frequency	Screening Benchmark[c] (µg/m^3)	COPC (Yes/No)
1,1,1-Trichloroethane	6.2	34	6	5	1	20%	230	No
1,2,4-Trimethylbenzene	16	79	6	5	5	100%	0.62	Yes
1,3,5-Trimethylbenzene	6.2	30	6	5	1	20%	0.62	Yes
1,3-Butadiene	22	49	6	5	3	60%	0.0069	Yes
2-Butanone (MEK)	150	442	6	5	2	40%	104	Yes
2-Hexanone	13	53	6	5	1	20%	8.3	Yes
4-Ethyltoluene	14	69	6	5	1	20%	na	Yes
Acetone	66	157	8	5	5	100%	37	Yes
Benzene	17	54	8	5	4	80%	0.23	Yes
Carbon disulfide	50	156	6	5	4	80%	73	Yes
Chloromethane	2.2	4.5	8	5	1	20%	1.1	Yes
Ethanol	33	62	6	5	4	80%	183	No
Ethylbenzene	2.6	11	8	5	2	40%	1.7	Yes
Hexane	8.1	29	8	5	2	40%	21	Yes
m,p-Xylene	6.1	26	6	5	4	80%	11	Yes
o-Xylene	2.6	11	6	5	2	40%	11	Yes
Propene	160	275	6	5	2	40%	na	Yes
Styrene	3.3	14	8	5	1	20%	106	No
Toluene	16	60	8	5	4	80%	40	Yes
Trichloroethene	5.4	29	6	5	1	20%	0.017	Yes

Notes:

[a]Maximum concentration in soil gas samples collected from less than or equal to 15 ft. bgs.

[b]Maximum concetration converted to units of µg/m^3.

[c]Soil gas screening benchmark is equal to the selected soil gas benchmark for carcinogenic chemicals, or one-tenth the selected soil gas benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with the USEPA Region 10 risk assessment guidance. Source: Region 9 PRGs Table 2000 Update (EPA, 2000a).

COPC-Chemical of potential concern.

na-Not available.

ppbv-Parts per billion volume.

µg/m^3-Micrograms per cubic meter.

Table 6.31
Human Health COPC Screening Summary-Soil Gas
Site 14 (8-Place Hangar)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituents	Maximum Concentration[a] (ppbv)	Maximum Concentration[b] (µg/m^3)	Sample Depth fbgs	Number of Samples	Number of Detects	Detection Frequency	Screening Benchmark[c] (µg/m^3)	COPC (Yes/No)
1,2,4-Trimethylbenzene	2.4	12	5.7	25	4	16%	0.62	Yes
1,2-Dichlorobenzene	1.1	6.6	5.7	25	1	4%	21	No
1,2-Dichloroethane	5.4	22	5.7	25	1	4%	0.0074	Yes
1,3-Butadiene	19	42	5.7	25	15	60%	0.0069	Yes
1,4-Dichlorobenzene	1.7	10	5.7	25	1	4%	0.31	Yes
1,4-Dioxane	290	1045	5.7	25	4	16%	0.61	Yes
2-Butanone (MEK)	12	35	5.7	25	5	20%	104	No
Acetone	46	109	5.7	25	23	92%	37	Yes
Benzene	5.1	16	5.7	25	14	56%	0.23	Yes
Bromomethane	2.5	10	5.7	25	1	4%	0.52	Yes
Carbon disulfide	39	121	5.7	25	13	52%	73	Yes
Carbon tetrachloride	1.1	6.9	5.7	25	1	4%	0.13	Yes
Chloroform	1.8	8.8	5.7	25	5	20%	0.31	Yes
Chloromethane	2.4	5.0	5.7	25	15	60%	1.1	Yes
cis-1,2-Dichloroethene	4.9	19	5.7	25	8	32%	3.7	Yes
Dichlorodifluoromethane	0.76	3.8	5.7	25	1	4%	21	No
Ethanol	22	41	5.7	25	8	32%	183	No
Ethylbenzene	1.1	4.8	5.7	25	3	12%	1.7	Yes
Heptane	3.9	16	5.7	25	1	4%	na	Yes
Hexane	4.6	16	5.7	25	2	8%	21	No
m,p-Xylene	3.4	15	5.7	25	14	56%	11	Yes

Table 6.31
Human Health COPC Screening Summary-Soil Gas
Site 14 (8-Place Hangar)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituents	Maximum Concentration[a] (ppbv)	Maximum Concentration[b] (µg/m^3)	Sample Depth fbgs	Number of Samples	Number of Detects	Detection Frequency	Screening Benchmark[c] (µg/m^3)	COPC (Yes/No)
o-Xylene	2.0	8.7	5.7	25	6	24%	11	No
Methylene chloride	2.1	7.3	5.7	25	6	24%	4.1	Yes
Toluene	8.1	30	5.7	25	18	72%	40	No
Trichloroethene	42	225	5.7	25	17	68%	0.017	Yes

Notes:

[a]Maximum concentration in soil gas samples collected from less than or equal to 15 ft. bgs.

[b]Maximum concetration converted to units of µg/m^3.

[c]Soil gas screening benchmark is equal to the selected soil gas benchmark for carcinogenic chemicals, or one-tenth the selected soil gas benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with the USEPA Region 10 risk assessment guidance. Source: Region 9 PRGs Table 2000 Update (EPA, 2000a).

COPC-Chemical of potential concern.

na-Not available.

ppbv-Parts per billion volume.

µg/m^3-Micrograms per cubic meter.

Table 6.32
Human Health COPC Screening Summary-Soil Gas
Site 15 (8-Place Hangar Ditch)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituents	Maximum Concentration[a] (ppbv)	Maximum Concentration[b] (µg/m^3)	Sample Depth fbgs	Number of Samples	Number of Detects	Detection Frequency	Screening Benchmark[c] (µg/m^3)	COPC (Yes/No)
2-Butanone (MEK)	3.1	9.1	13	7	1	14%	104	No
Acetone	21	50	13	7	7	100%	37	Yes
Carbon disulfide	9.5	30	14	7	2	29%	73	No
Chloromethane	1.7	3.5	13	7	2	29%	1.1	Yes
cis-1,2-Dichloroethene	2.5	10	13	7	2	29%	3.7	Yes
Ethanol	13	24	14	7	1	14%	183	No
Methylene chloride	2.5	8.7	13	7	3	43%	4.1	Yes
Toluene	1.4	5.3	14	7	1	14%	40	No
Trichloroethene	28	150	13	7	3	43%	0.017	Yes

Notes:

[a]Maximum concentration in soil gas samples collected from less than or equal to 15 ft. bgs.

[b]Maximum concetration converted to units of µg/m^3.

[c]Soil gas screening benchmark is equal to the selected soil gas benchmark for carcinogenic chemicals, or one-tenth the selected soil gas benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with the USEPA Region 10 risk assessment guidance. Source: Region 9 PRGs Table 2000 Update (EPA, 2000a).

[d]Criterion for ethanol is derived from methanol as a surrogate constituent.

COPC-Chemical of potential concern.

na-Not available.

ppbv-Parts per billion volume.

µg/m^3-Micrograms per cubic meter.

Table 6.33
Human Health COPC Screening Summary-Soil Gas
Site 16 (Engine Rebuilding Facility-Bldg. 2203)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituents	Maximum Concentration[a] (ppbv)	Maximum Concentration[b] ($\mu g/m^3$)	Sample Depth fbgs	Number of Samples	Number of Detects	Detection Frequency	Screening Benchmark[c] ($\mu g/m^3$)	COPC (Yes/No)
1,3-Butadiene	9.2	20	6	3	1	33%	0.0069	Yes
2-Butanone (MEK)	8.2	24	6	3	1	33%	104	No
Acetone	36	86	6	3	3	100%	37	Yes
Benzene	4.7	15	6	3	2	67%	0.23	Yes
Chloroform	1.7	8.3	6	3	1	33%	0.31	Yes
Ethanol	7.1	13	6	3	1	33%	183	No
Propene	24	41	6	3	1	33%	na	Yes
Tetrachloroethene	4.1	28	6	3	1	33%	0.67	Yes
Toluene	4.7	18	6	3	2	67%	40	No
Trichloroethene	10	54	8	3	3	100%	0.017	Yes

Notes:

[a]Maximum concentration in soil gas samples collected from less than or equal to 15 ft. bgs.

[b]Maximum concetration converted to units of $\mu g/m^3$.

[c]Soil gas screening benchmark is equal to the selected soil gas benchmark for carcinogenic chemicals, or one-tenth the selected soil gas benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with the USEPA Region 10 risk assessment guidance. Source: Region 9 PRGs Table 2000 Update (EPA, 2000a).

COPC-Chemical of potential concern.

na-Not available.

ppbv-Parts per billion volume.

Table 6.34
Human Health COPC Screening Summary-Soil Gas
Site 17 (3-Place Hangar-Bldg. 5801)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituents	Maximum Concentration[a] (ppbv)	Maximum Concentration[b] (µg/m^3)	Sample Depth fbgs	Number of Samples	Number of Detects	Detection Frequency	Screening Benchmark[c] (µg/m^3)	COPC (Yes/No)
1,2,4-Trimethylbenzene	0.93	4.6	6	5	1	20%	0.62	Yes
1,4-Dioxane	17	61	14	5	2	40%	0.61	Yes
2-Butanone (MEK)	4.4	13	14	5	2	40%	104	No
Acetone	21	50	6	5	5	100%	37	Yes
Benzene	0.56	1.8	6	5	1	20%	0.23	Yes
Carbon disulfide	26	81	6	5	1	20%	73	Yes
Chloromethane	1.3	2.7	14	5	4	80%	1.1	Yes
Dichlorodifluoromethane	0.77	3.8	14	5	2	40%	21	No
Ethanol	3.3	6.2	6	5	1	20%	183	No
Methylene chloride	3.8	13	14	5	5	100%	4.1	Yes
Toluene	0.65	2.4	6	5	1	20%	40	No
Trichloroethene	2.0	11	14	5	1	20%	0.017	Yes

Notes:

[a]Maximum concentration in soil gas samples collected from less than or equal to 15 ft. bgs.

[b]Maximum concetration converted to units of µg/m^3.

[c]Soil gas screening benchmark is equal to the selected soil gas benchmark for carcinogenic chemicals, or one-tenth the selected soil gas benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with the USEPA Region 10 risk assessment guidance. Source: Region 9 PRGs Table 2000 Update (EPA, 2000a).

COPC-Chemical of potential concern.

ppbv-Parts per billion volume.

µg/m^3-Micrograms per cubic meter.

Table 6.35
Human Health COPC Screening Summary-Soil Gas
Site 18 (Paint Hangar-Bldg. 5825)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituents	Maximum Concentration[a] (ppbv)	Maximum Concentration[b] (µg/m^3)	Sample Depth fbgs	Number of Samples	Number of Detects	Detection Frequency	Screening Benchmark[c] (µg/m^3)	COPC (Yes/No)
1,2,4-Trimethylbenzene	2.1	10	10	4	2	50%	0.62	Yes
1,3-Butadiene	6.6	14	5	4	1	25%	0.0069	Yes
Acetone	22	52	10	4	4	100%	37	Yes
Benzene	2.6	8.1	5	4	1	25%	0.23	Yes
Carbon disulfide	21	64	5	4	1	25%	73	No
Chloromethane	1.4	2.9	5	4	1	25%	1.1	Yes
Ethanol	13	24	5	4	2	50%	183	No
Ethylbenzene	5.4	23	5	4	1	25%	1.7	Yes
m,p-Xylene	24	104	5	4	2	50%	11	Yes
o-Xylene	12	52	5	4	1	25%	11	Yes
Propene	17	29	5	4	1	25%	na	Yes
Toluene	8.2	31	5	4	2	50%	40	No
Trichloroethene	2.7	14	10	4	1	25%	0.017	Yes

Notes:

[a]Maximum concentration in soil gas samples collected from less than or equal to 15 ft. bgs.

[b]Maximum concetration converted to units of µg/m^3.

[c]Soil gas screening benchmark is equal to the selected soil gas benchmark for carcinogenic chemicals, or one-tenth the selected soil gas benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with the USEPA Region 10 risk assessment guidance. Source: Region 9 PRGs Table 2000 Update (EPA, 2000a).

COPC-Chemical of potential concern.

na-Not available.

ppbv-Parts per billion volume.

µg/m^3-Micrograms per cubic meter.

Table 6.36
Human Health COPC Screening Summary-Soil Gas
Site 19 (Liquid Oxygen Generating Plant-Bldg. 5102)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituents	Maximum Concentration[a] (ppbv)	Maximum Concentration[b] (µg/m^3)	Sample Depth fbgs	Number of Samples	Number of Detects	Detection Frequency	Screening Benchmark[c] (µg/m^3)	COPC (Yes/No)
1,2,4-Trimethylbenzene	0.92	4.5	10	27	13	48%	0.62	Yes
1,3,5-Trimethylbenzene	0.20	0.98	15	27	4	15%	0.62	Yes
1,3-Butadiene	18	40	5	27	16	59%	0.0069	Yes
2-Butanone (MEK)	5.8	17	5	27	15	56%	104	No
2-Hexanone	0.41	1.7	10	27	4	15%	8.3	No
2-Propanol	1.1	2.7	10	27	14	52%	na	Yes
4-Ethyltoluene	1.1	5.4	10	27	13	48%	na	Yes
Acetone	22	52	5	27	22	81%	37	Yes
Benzene	10	32	5	27	16	59%	0.23	Yes
Bromomethane	0.21	0.82	5	27	1	4%	0.52	Yes
Carbon disulfide	4.6	14	10	27	12	44%	73	No
Carbon Tetrachloride	0.071	0.45	10	27	9	33%	0.13	Yes
Chloroform	0.25	1.2	10	27	7	26%	0.31	Yes
Chloromethane	0.49	1.0	5	27	9	33%	1.1	No
cis-1,2-Dichloroethene	14	56	10	27	13	48%	3.7	Yes
cis-1,3-Dichloropropene	2.2	10	10	27	5	19%	0.48	Yes
Cyclohexane	0.65	14	10	27	6	22%	2081	No
Dichlorodifluoromethane	0.53	2.6	10	27	14	52%	21	No
Ethanol	4.0	7.5	10	27	11	41%	183	No
Ethylbenzene	1.9	8.3	10	27	9	33%	1.7	Yes
Heptane	9.4	39	10	27	12	44%	na	Yes
Hexane	10	35	10	27	13	48%	21	Yes
m,p-Xylene	5.3	23	10	27	14	52%	11	Yes
o-Xylene	1.3	5.6	10	27	13	48%	11	No
Propylene	82	141	10	27	23	85%	0.31	Yes
Styrene	2.9	12	10	27	8	30%	106	No

Table 6.36
Human Health COPC Screening Summary-Soil Gas
Site 19 (Liquid Oxygen Generating Plant-Bldg. 5102)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituents	Maximum Concentration[a] (ppbv)	Maximum Concentration[b] (µg/m^3)	Sample Depth fbgs	Number of Samples	Number of Detects	Detection Frequency	Screening Benchmark[c] (µg/m^3)	COPC (Yes/No)
Tetrachloroethene	8.3	56	10	27	14	52%	0.67	Yes
Toluene	8.0	30	10	27	17	63%	40	No
trans-1,3-Dichloropropen	1.4	6.4	10	27	4	15%	0.48	Yes
Trichloroethene	2200	11787	10	27	27	100%	0.017	Yes
Trichlorofluoromethane	0.23	1.3	10	27	8	30%	73	No

Notes:

[a]Maximum concentration in soil gas samples collected from less than or equal to 15 ft. bgs.

[b]Maximum concentration converted to units of µg/m^3.

[c]Soil gas screening benchmark is equal to the selected soil gas benchmark for carcinogenic chemicals, or one-tenth the selected soil gas benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with the USEPA Region 10 risk assessment guidance. Source: Region 9 PRGs Table 2000 Update (EPA, 2000a).

COPC-Chemical of potential concern.

ppbv-Parts per billion volume.

µg/m^3-Micrograms per cubic meter.

Table 6.37
Human Health COPC Screening Summary-Soil Gas
Site 19b (Liquid Oxygen Generating Plant Site)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituents	Maximum Concentration[a] (ppbv)	Maximum Concentration[b] (µg/m^3)	Sample Depth fbgs	Number of Samples	Number of Detects	Detection Frequency	Screening Benchmark[c] (µg/m^3)	COPC (Yes/No)
1,1,2-Trichloro-1,2,2-trifluoroethane	0.074	0.57	10	20	8	40%	na	Yes
1,1,2-Trichloroethane	0.24	1.3	10	20	1	5%	0.12	Yes
1,2,4-Trimethylbenzene	1.2	5.9	9	20	20	100%	0.62	Yes
1,3,5-Trimethylbenzene	0.80	3.9	10	20	14	70%	0.62	Yes
1,3-Butadiene	16	35	9	20	20	100%	0.0069	Yes
1,4-Dichlorobenzene	0.11	0.66	10	20	1	5%	0.31	Yes
1,4-Dioxane	0.13	0.47	10	20	1	5%	0.61	No
2-Butanone (MEK)	18	53	10	20	20	100%	104	No
2-Hexanone	0.84	3.4	9	20	11	55%	8.3	No
2-Propanol	4.1	10	9	20	17	85%	na	Yes
4-Ethyltoluene	1.3	6.4	9	20	20	100%	na	Yes
4-Methyl-2-pentanone (MIBK)	2.3	9.4	9	20	9	45%	8.3	Yes
Acetone	84	200	10	20	20	100%	37	Yes
Benzene	13	42	9	20	20	100%	0.23	Yes
Bromomethane	0.094	0.36	9.5	20	1	5%	0.52	No
Carbon disulfide	5.4	17	10	20	18	90%	73	No
Carbon tetrachloride	0.061	0.38	9	20	20	100%	0.13	Yes
Chloroform	0.35	1.7	10	20	16	80%	0.31	Yes
Chloromethane	3.8	7.8	10	20	18	90%	1.1	Yes
Cyclohexane	1.5	31	10	20	15	75%	2081	No
Dichlorodifluoromethane	0.47	2.3	10	20	20	100%	21	No
Ethanol	17	32	9	20	19	95%	183	No
Ethylbenzene	4.7	20	10	20	19	95%	1.7	Yes
Heptane	7.4	30	9	20	18	90%	na	Yes
Hexane	13	46	10	20	19	95%	21	Yes
Methylene chloride	0.10	0.35	9	20	1	5%	4.1	No
m,p-Xylene	4.5	20	9	20	19	95%	11	Yes
o-Xylene	1.9	8.2	9	20	20	100%	11	No

Table 6.37
Human Health COPC Screening Summary-Soil Gas
Site 19b (Liquid Oxygen Generating Plant Site)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituents	Maximum Concentration[a] (ppbv)	Maximum Concentration[b] ($\mu g/m^3$)	Sample Depth fbgs	Number of Samples	Number of Detects	Detection Frequency	Screening Benchmark[c] ($\mu g/m^3$)	COPC (Yes/No)
Propylene	150	258	10	20	20	100%	0.31	Yes
Styrene	1.5	6.4	9	20	19	95%	106	No
Toluene	13	49	9	20	20	100%	40	Yes
Trichloroethene	0.084	0.45	10	20	1	5%	0.017	Yes
Trichlorofluoromethane	0.23	1.3	10	20	8	40%	73	No
Vinyl chloride	0.24	0.62	10	20	2	10%	0.11	Yes

Notes:

[a]Maximum concentration in soil gas samples collected from less than or equal to 15 ft. bgs.

[b]Maximum concentration converted to units of $\mu g/m^3$.

[c]Soil gas screening benchmark is equal to the selected soil gas benchmark for carcinogenic chemicals, or one-tenth the selected soil gas benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with the USEPA Region 10 risk assessment guidance. Source: Region 9 PRGs Table 2000 Update (EPA, 2000a).

COPC-Chemical of potential concern.

ppbv-Parts per billion volume.

$\mu g/m^3$-Micrograms per cubic meter.

Table 6.38
Human Health COPC Screening Summary-Soil Gas
Site 22 (Paint Hangar Leach Pit)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituents	Maximum Concentration[a] (ppbv)	Maximum Concentration[b] ($\mu g/m^3$)	Sample Depth fbgs	Number of Samples	Number of Detects	Detection Frequency	Screening Benchmark[c] ($\mu g/m^3$)	COPC (Yes/No)
Acetone	27	64	15	5	5	100%	37	Yes
Benzene	1.6	5.1	15	5	1	20%	0.23	Yes
Chloromethane	1.8	3.7	15	5	2	40%	1.1	Yes
Ethanol	7.0	13	15	5	1	20%	183	No
Toluene	1.8	6.8	15	5	1	20%	40	No

Notes:

[a]Maximum concentration in soil gas samples collected from less than or equal to 15 ft. bgs.

[b]Maximum concetration converted to units of $\mu g/m^3$.

[c]Soil gas screening benchmark is equal to the selected soil gas benchmark for carcinogenic chemicals, or one-tenth the selected soil gas benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with the USEPA Region 10 risk assessment guidance. Source: Region 9 PRGs Table 2000 Update (EPA, 2000a).

COPC-Chemical of potential concern.

ppbv-Parts per billion volume.

$\mu g/m^3$-Micrograms per cubic meter.

Table 6.39
Human Health COPC Screening Summary-Soil Gas
Site 23 (Engine Buildup Facility-Bldg. 2113)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituents	Maximum Concentration[a] (ppbv)	Maximum Concentration[b] (µg/m^3)	Sample Depth fbgs	Number of Samples	Number of Detects	Detection Frequency	Screening Benchmark[c] (µg/m^3)	COPC (Yes/No)
1,1,1-Trichloroethane	4.2	23	5	2	1	50%	230	No
1,2,4-Trimethylbenzene	1.8	8.8	6	2	1	50%	0.62	Yes
2-Butanone (MEK)	6.5	19	5	2	1	50%	104	No
Acetone	30	71	5	2	2	100%	37	Yes
Benzene	1.8	5.7	5	2	1	50%	0.23	Yes
Bromodichloromethane	12	80	5	2	1	50%	0.11	Yes
Carbon disulfide	12	37	6	2	1	50%	73	No
Chloroform	16	78	5	2	1	50%	0.31	Yes
Dichlorodifluoromethane	1.2	5.9	5	2	1	50%	21	No
Ethanol	6.8	13	6	2	1	50%	183	No
Propene	9.5	16	6	2	1	50%	na	Yes
Toluene	2.4	9.0	5	2	1	50%	40	No
Trichloroethene	1.1	5.9	5	2	1	50%	0.017	Yes

Notes:

[a]Maximum concentration in soil gas samples collected from less than or equal to 15 ft. bgs.

[b]Maximum concetration converted to units of µg/m^3.

[c]Soil gas screening benchmark is equal to the selected soil gas benchmark for carcinogenic chemicals, or one-tenth the selected soil gas benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with the USEPA Region 10 risk assessment guidance. Source: Region 9 PRGs Table 2000 Update (EPA, 2000a).

COPC-Chemical of potential concern.

na-Not available.

ppbv-Parts per billion volume.

µg/m^3-Micrograms per cubic meter.

Table 6.40
Human Health COPC Screening Summary-Soil Gas
Site 25 (Bldg. 408)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituents	Maximum Concentration[a] (ppbv)	Maximum Concentration[b] (µg/m^3)	Sample Depth fbgs	Number of Samples	Number of Detects	Detection Frequency	Screening Benchmark[c] (µg/m^3)	COPC (Yes/No)
1,2,4-Trimethylbenzene	3.6	18	8	3	2	67%	0.62	Yes
2-Butanone (MEK)	8.6	25	6	3	1	33%	104	No
Acetone	49	116	6	3	3	100%	37	Yes
Benzene	8.6	27	6	3	1	33%	0.23	Yes
Carbon disulfide	35	109	6	3	2	67%	73	Yes
Ethanol	17	32	8	3	2	67%	183	No
Heptane	7.6	31	6	3	1	33%	na	Yes
Hexane	19	67	6	3	1	33%	21	Yes
m,p-Xylene	4.5	20	6	3	2	67%	11	Yes
o-Xylene	2.6	11	8	3	2	67%	11	Yes
Styrene	2.9	12	8	3	1	33%	106	No
Toluene	20	75	6	3	2	67%	40	Yes
Trichloroethene	3.2	17	6	3	1	33%	0.017	Yes
Trichlorofluoromethane	2.0	11	8	3	1	33%	73	No

Notes:

[a]Maximum concentration in soil gas samples collected from less than or equal to 15 ft. bgs.

[b]Maximum concetration converted to units of µg/m^3.

[c]Soil gas screening benchmark is equal to the selected soil gas benchmark for carcinogenic chemicals, or one-tenth the selected soil gas benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with the USEPA Region 10 risk assessment guidance. Source: Region 9 PRGs Table 2000 Update (EPA, 2000a).

COPC-Chemical of potential concern.

na-Not available.

ppbv-Parts per billion volume.

µg/m^3-Micrograms per cubic meter.

Table 6.41
Human Health COPC Screening Summary-Soil Gas
Site 33 (Landfill at the end of Runway 32)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituents	Maximum Concentration[a] (ppbv)	Maximum Concentration[b] ($\mu g/m^3$)	Sample Depth fbgs	Number of Samples	Number of Detects	Detection Frequency	Screening Benchmark[c] ($\mu g/m^3$)	COPC (Yes/No)
2-Butanone (MEK)	10	29	6	2	1	50%	104	No
Acetone	52	124	6	2	2	100%	37	Yes
Benzene	2.2	7.0	8	2	1	50%	0.23	Yes
Carbon disulfide	29	90	6	2	2	100%	73	Yes
Chloromethane	4.3	8.9	6	2	1	50%	1.1	Yes
Toluene	2.4	9.0	8	2	1	50%	40	No
Trichloroethene	2.8	15	6	2	1	50%	0.017	Yes

Notes:

[a]Maximum concentration in soil gas samples collected from less than or equal to 15 ft. bgs.

[b]Maximum concetration converted to units of $\mu g/m^3$.

[c]Soil gas screening benchmark is equal to the selected soil gas benchmark for carcinogenic chemicals, or one-tenth the selected soil gas benchmark criteria for noncarcinogenic chemicals to account for potential cumulative effects, consistent with the USEPA Region 10 risk assessment guidance. Source: Region 9 PRGs Table 2000 Update (EPA, 2000a).

COPC-Chemical of potential concern.

ppbv-Parts per billion volume.

$\mu g/m^3$-Micrograms per cubic meter.

Table 6.42
Summary of Soil Gas COPCs for Individual Sites
Moses Lake Wellfield Superfund Site
(Page 1 of 2)

Site	Soil Gas COPC's
2-Big Bend Community College Hangar	1,3-Butadiene, 1,4-dioxane, acetone, benzene, trichloroethene
3a-Aircraft Wash Rack & Discharge Areas	1,2,4-Trimethylbenzene, 1,3,5-Trimethylbenzene, 1,3-butadiene, 2-butanone, 4-ethyltoluene, acetone, benzene, carbon disulfide, chloromethane, ethylbenzene, heptane, hexane, m,p-xylene, o-xylene, propene, toluene, trichloroethene
3b-Aircraft Wash Rack & Discharge Areas	1,2,4-Trimethylbenzene, 1,3-butadiene, 1,4-dioxane, acetone, benzene, chloroform, chloromethane, ethylbenzene, heptane, hexane, m,p-xylene, toluene, trichloroethene
3c-Aircraft Wash Rack & Discharge Areas	1,2,4-Trimethylbenzene, 1,3-butadiene, 1,4-dioxane, acetone, benzene, carbon disulfide, chloromethane, m,p-xylene
4a-Tarmac Areas	1,2,4-Trimethylbenzene, 1,3,5-Trimethylbenzene, 1,3-butadiene, 4-ethyltoluene, acetone, benzene, chloromethane, m,p-xylene, tetrachloroethene, trichloroethene
4b-Tarmac Areas	1,2,4-Trimethylbenzene, acetone, trichloroethene
5-JAL Hangar Area & Tarmac	1,2,4-Trimethylbenzene, acetone, chloroform, propene, tetrachloroethene, trichloroethene
9-Gravel Pit	1,2,4-Trimethylbenzene, 1,3-butadiene, acetone, benzene, chloromethane, trichloroethene
11-Fire Training Area - Burn Pit B	1,2,4-Trimethylbenzene, 1,3,5-Trimethylbenzene, 1,4-dioxane, acetone, benzene, chloroform, chloromethane, trichloroethene
12-Motor Pool Drain Areas	1,2,4-Trimethylbenzene, 1,3,5-Trimethylbenzene, 1,3-butadiene, 2-butanone, 2-hexanone, 4-ethyltoluene, acetone, benzene, carbon disulfide, chloromethane, ethylbenzene, hexane, m,p-xylene, o-xylene, propene, toluene, trichloroethene
14-8-Place Hangar	1,2,4-Trimethylbenzene, 1,2-dichloroethane, 1,3-butadiene, 1,4-dichlorobenzene, 1,4-dioxane, acetone, benzene, bromomethane, carbon disulfide, carbon tetrachloride, chloroform, chloromethane, cis-1,2-dichlororethene, ethylbenzene, heptane, m,p-xylene, methylene chloride, trichloroethene
15-8-Place Hangar Ditch	Acetone, chloromethane, cis-1,2-dichloroethene, methylene chloride, trichloroethene
16-Engine Rebuilding Facility-Bldg. 2203	1,3-Butadiene, acetone, benzene, chloroform, propene, tetrachloroethene, trichloroethene

Table 6.42
Summary of Soil Gas COPCs for Individual Sites
Moses Lake Wellfield Superfund Site
(Page 2 of 2)

Site	Soil Gas COPC's
17-3-Place Hangar-Bldg. 5801	1,2,4-Trimethylbenzene, 1,4-dioxane, acetone, benzene, carbon disulfide, chloromethane, methylene chloride, trichloroethene
18-Paint Hangar-Bldg. 5825	1,2,4-Trimethylbenzene, 1,3-butadiene, acetone, benzene, chloromethane, ethylbenzene, m,p-xylene, o-xylene, propene, trichloroethene
19-Liquid Oxygen Generating Plant-Bldg. 5102	1,2,4-Trimethylbenzene, 1,3,5-trimethylbenzene, 1,3-butadiene, 2-propanol, 4-ethyltoluene, acetone, benzene, bromomethane, carbon tetrachloride, chloroform, cis-1,2-dichloroethene, cis-1,3-dichloropropene, ethylbenzene, heptane, hexane, m,p-xylene, propylene, tetrachloroethene, trans-1,3-dichloropropene, trichloroethene
19b-Alternate Liquid Oxygen Generating Plant Sit	1,1,2-Trichloro-1,2,2-trifluoroethane, 1,1,2-trichloroethane, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, 1,3-butadiene, 1,4-dichlorobenzene,2-propanol, 4-ethyltoluene, 4-methyl-2-pentanone, acetone, benzene, carbon tetrachloride, chloroform, chloromethane, ethylbenzene, heptane, hexane, m,p-xylene, propylene, toluene, trichloroethene, vinyl chloride
22-Paint Hangar Leach Pit	Acetone, benzene, chloromethane
23-Engine Buildup Facility-Bldg. 2113	1,2,4-Trimethylbenzene, acetone, benzene, bromodichloromethane, chloroform, propene, trichloroethene
25-Bldg. 408	1,2,4-Trimethylbenzene, acetone, benzene, carbon disulfide, heptane, hexane, m,p-xylene, o-xylente, toluene, trichloroethene
33-End of Runway 32 Dump	Acetone, benzene, carbon disulfide, chloromethane, trichloroethene

Notes:

[a]Human Health COPCs were identified based on comparisons against EPA Region 9 PRGs for ambient air.
COPC-Chemical of potential concern.

Table 6.43
Human Health COPC Screening Summary
Hanford/Ringold Formation
Mose Lake Wellfield Superfund Site

Constituent	Maximum Concentration (mg/L)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/L)	Groundwater COPC Screening Level[a] (mg/L)	COPC (Yes/No?)
Metals							
Arsenic	0.010	17	10	59%	na	0.000045	No[b]
Manganese	0.076	18	4	22%	na	0.088	No
VOCs							
1,2,4-Trimethylbenzene	0.0035	132	5	4%	na	0.0012	Yes
1,3,5-Trimethylbenzene	0.0069	132	6	5%	na	0.0012	Yes
Acetone	0.0028	111	1	1%	na	0.061	No
Benzene	0.00028	132	1	1%	na	0.00034	No
Bromodichloromethane	0.00061	132	1	1%	na	0.00018	Yes
Bromomethane	0.00063	132	1	1%	na	0.00087	No
Chloroethane	0.00036	132	1	1%	na	0.0046	No
Chloroform	0.00030	132	1	1%	na	0.0062	No
Chloromethane	0.00026	132	3	2%	na	0.0015	No
Dibromochloromethane	0.00037	132	1	1%	na	0.00013	Yes
Isopropylbenzene	0.0025	132	3	2%	na	0.066	No
Methylene chloride	0.00018	132	1	1%	na	0.0043	No
n-Butylbenzene	0.0033	132	4	3%	na	0.024	No
sec-Butylbenzene	0.013	132	6	5%	na	0.024	No
tert-Butylbenzene	0.00048	132	1	1%	na	0.024	No
Toluene	0.0013	132	3	2%	na	0.072	No
Tert-butyl methyl ether (MTBE)	0.0081	93	1	1%	na	0.0133	No
Trichloroethene	0.0051	132	36	27%	na	0.0050	Yes
Trichlorofluoromethane	0.0014	132	3	2%	na	0.13	No

Notes:

[a]Selected groundwater screening level is equal to the selected groundwater benchmark criteria for carcinogenic chemicals, or one-tenth the selected groundwater benchmark critieria for noncarcinogenic chemicals, to account for potential cumulative effects, consistent with the EPA Region 10 risk assessment guidance.

[b]Arsenic concentrations detected in groundwater wells associated with Moses Lake Wellfield Superfund Site are within the range of regional arsenic levels and are in compliance with current and potential future drinking water standards. Consequently, potential risks associated with arsenic in groundwater are not quantified in the HHRA. Please see Section 6.2.2.4.

COPC-Chemical of potential concern.

mg/L-Milligrams per liter.

na-Not available.

Table 6.44
Human Health COPC Screening Summary
Priest Rapids Member
Mose Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/L)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/L)	Groundwater COPC Screening Level[a] (mg/L)	COPC (Yes/No?)
Metals							
Manganese	0.18	14	8	57%	na	0.088	Yes
Zinc	0.42	15	6	40%	na	1.1	No
VOCs							
Benzene	0.00043	80	1	1%	na	0.00034	Yes
Carbon disulfide	0.00033	80	1	1%	na	0.10	No
Chloromethane	0.00027	80	2	3%	na	0.0015	No
cis-1,2-Dichloroethene	0.0037	80	5	6%	na	0.0061	No
Methylene chloride	0.00018	80	3	4%	na	0.0043	No
sec-Butylbenzene	0.0084	80	3	4%	na	0.024	No
tert-Butylbenzene	0.00050	80	1	1%	na	0.024	No
Tert-butyl methyl ether (MTBE)	0.016	66	1	2%	na	0.0133	Yes
Trichloroethene	0.037	80	34	43%	na	0.0050	Yes
Trichlorofluoromethane	0.0022	80	1	1%	na	0.13	No

Notes:

[a]Selected groundwater screening level is equal to the selected groundwater benchmark criteria for carcinogenic chemicals, or one-tenth the selected groundwater benchmark critieria for noncarcinogenic chemicals, to account for potential cumulative effects, consistent with the EPA Region 10 risk assessment guidance.

COPC-Chemical of potential concern.

mg/L-Milligrams per liter.

na-Not available.

Table 6.45
Human Health COPC Screening Summary
Roza Member
Mose Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/L)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/L)	Groundwater COPC Screening Level[a] (mg/L)	COPC (Yes/No?)
Metals							
Manganese	0.022	18	5	28%	na	0.088	No
Zinc	0.36	18	5	28%	na	1.1	No
VOCs							
2-Butanone (MEK)	0.0014	79	3	4%	na	0.19	No
2-Hexanone	0.00046	77	2	3%	na	0.016	No
4-Methyl-2-pentanone (MIBK)	0.00052	78	2	3%	na	0.016	No
Acetone	19	65	3	5%	na	0.061	Yes
Bromomethane	0.00058	78	3	4%	na	0.00087	No
Chloroform	0.00115	79	4	5%	na	0.0062	No
Chloromethane	0.00036	78	3	4%	na	0.0015	No
cis-1,2-Dichloroethene	0.0037	77	6	8%	na	0.0061	No
Ethene	0.00091	61	1	2%	na	7.3	No
Methane	0.00053	61	1	2%	na	na	No[b]
Methylene chloride	0.00041	78	4	5%	na	0.0043	No
Naphthalene	0.00020	77	1	1%	na	0.00062	No
Toluene	0.00037	77	2	3%	na	0.072	No
Tert-butyl methyl ether (MTBE)	0.040	51	1	2%	na	0.013	Yes
Trichloroethene	0.060	79	43	54%	na	0.0050	Yes
Trichlorofluoromethane	0.0019	77	2	3%	na	0.13	No

Notes:

[a]Selected groundwater screening level is equal to the selected groundwater benchmark criteria for carcinogenic chemicals, or one-tenth the selected groundwater benchmark critieria for noncarcinogenic chemicals, to account for potential cumulative effects, consistent with the EPA Region 10 risk assessment guidance.

[b]Methane is not analyzed as a COPC due to the current unavailability of screening values and toxicity values.

COPC-Chemical of potential concern.

mg/L-Milligrams per liter.

na-Not available.

Table 6.46
Human Health COPC Screening Summary
Priest Rapids/Roza Members
Mose Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/L)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/L)	Groundwater COPC Screening Level[a] (mg/L)	COPC (Yes/No?)
Metals							
Manganese	0.175	32	13	41%	na	0.088	Yes
Zinc	0.42	33	11	33%	na	1.1	No
VOCs							
2-Butanone (MEK)	0.0014	153	3	2%	na	0.19	No
2-Hexanone	0.00046	151	2	1%	na	0.016	No
4-Methyl-2-pentanone (MIBK)	0.00052	152	2	1%	na	0.016	No
Acetone	19	120	3	3%	na	0.061	Yes
Benzene	0.00043	151	1	1%	na	0.00034	Yes
Bromomethane	0.00058	152	3	2%	na	0.00087	No
Carbon disulfide	0.00033	150	1	1%	na	0.10	No
Chloroform	0.00115	153	4	3%	na	0.0062	No
Chloromethane	0.00036	152	5	3%	na	0.0015	No
cis-1,2-Dichloroethene	0.0037	151	6	4%	na	0.0061	No
Ethene	0.00091	118	1	1%	na	7.3	No
Methane	0.000525	118	1	1%	na	na	No[b]
Methylene chloride	0.00041	152	7	5%	na	0.0043	No
Naphthalene	0.00020	151	1	1%	na	0.00062	No
sec-Butylbenzene	0.0084	151	3	2%	na	0.024	No
tert-Butylbenzene	0.00050	151	1	1%	na	0.024	No
Toluene	0.00037	151	2	1%	na	0.072	No
Tert-butyl methyl ether (MTBE)	0.040	113	2	2%	na	0.013314	Yes
Trichloroethene	0.060	153	72	47%	na	0.0050	Yes
Trichlorofluoromethane	0.0022	151	3	2%	na	0.13	No

Notes:

[a]Selected groundwater screening level is equal to the selected groundwater benchmark criteria for carcinogenic chemicals, or one-tenth the selected groundwater benchmark critieria for noncarcinogenic chemicals, to account for potential cumulative effects, consistent with the EPA Region 10 risk assessment guidance.

[b]Methane is not analyzed as a COPC due to the current unavailability of screening values and toxicity values.

COPC-Chemical of potential concern.

mg/L-Milligrams per liter.

na-Not available.

Table 6.47
Human Health COPC Screening Summary
Drinking Water Wells
Mose Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/L)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/L)	Groundwater COPC Screening Level[a] (mg/L)	COPC (Yes/No?)
VOCs							
2-Butanone (MEK)	0.0012	107	1	1%	na	0.19	No
2-Hexanone	0.00061	107	1	1%	na	0.016	No
4-Methyl-2-pentanone (MIBK)	0.0086	107	3	3%	na	0.016	No
Acetone	0.010	102	2	2%	na	0.061	No
Bromodichloromethane	0.00038	107	1	1%	na	0.00018	Yes
Bromoform	0.00047	107	1	1%	na	0.0085	No
Chloroform	0.00019	107	1	1%	na	0.0062	No
Chloromethane	0.00024	107	3	3%	na	0.0015	No
cis-1,2-Dichloroethene	0.0022	107	3	3%	na	0.0061	No
Dibromochloromethane	0.00052	107	1	1%	na	0.00013	Yes
Dichlorodifluoromethane	0.00037	107	1	1%	na	0.039	No
Methylene chloride	0.0013	107	7	7%	na	0.0043	No
Tetrachloroethene	0.00038	107	1	1%	na	0.66	No
Toluene	0.00020	107	13	12%	na	0.072	No
Trichloroethene	0.028	107	28	26%	na	0.0050	Yes
Trichlorofluoromethane	0.0021	107	2	2%	na	0.13	No

Notes:

[a]Selected groundwater screening level is equal to the selected groundwater benchmark criteria for carcinogenic chemicals, or one-tenth the selected groundwater benchmark critieria for noncarcinogenic chemicals, to account for potential cumulative effects, consistent with the EPA Region 10 risk assessment guidance.

COPC-Chemical of potential concern.

mg/L-Milligrams per liter.

na-Not available.

Table 6.48
Summary of COPCs for Groundwater
Moses Lake Wellfield Superfund Site

Groundwater Type	Groundwater COPC's
Hanford/Ringold Formation	1,2,4-Trimethylbenzene, 1,3,5-Trimethylbenzene, Bromodichloromethane, Dibromochloromethane, Trichloroethene
Priest Rapids Member	Manganese, Benzene, Tert-buty methyl ether (MTBE), Trichloroethene
Roza Member	Acetone, Tert-butyl methyl ether (MTBE), Trichloroethene
Priest Rapids/Roza Members	Acetone, Manganese, Benzene, Tert-butyl methyl ether (MTBE), Trichloroethene
Drinking Water Wells	Bromodichloromethane, Dibromochloromethane, Trichloroethene

Notes:
COPC-Chemical of potential concern.

Table 6.49

Derivation of Exposure Point Concentrations for Soil COPCs [a]
Moses Lake Wellfield Superfund Site

Location/Constituent	Maximum Concentration (mg/kg)	95% UCL Concentration (mg/kg)	Exposure Point Concentration [b] (mg/kg)
Sites 6a and 6b (Base Closure Landfill)			
Arsenic	94	121	94
Lead	1,900	3,454	1,900
Nickel	9,900	415,323	9,900
Site 11 (Fire Training Area - Burn Pit B)			
Benzo(ghi)perylene	0.068	na	0.068
Oilm-Dx	14000	na	14000
Site 12 (Motor Pool Drain Areas)			
Benzo(a)pyrene	0.25	na	0.25
Diesel-Dx	4600	na	4600
Oilm-Dx	18000	na	18000
Site 17 (3-Place Hangar-Bldg 5801)			
Arsenic	5.6	na	5.6
Benzo(a)pyrene	2.5	na	2.5
Benzo(b)fluoranthene	2.2	na	2.2
Benzo(ghi)perylene	2.1	na	2.1
Site 18 (Paint Hangar-Bldg 5825)			
PCB 1254	0.86	na	0.86
PCB 1260	2.1	na	2.1
Site 19 (Liquid Oxygen Generating Plant-Bldg 5102)			
Benzo(ghi)perylene	11	8.5	8.5
Site 20 (South Base Dump)			
Lead	5,700	107,568	5,700
Site 22 (Paint Hangar Leach Pit)			
Lead	1200	na	1200
Benzo(a)pyrene	0.29	na	0.29
Benzo(ghi)perylene	0.42	na	0.42
PCB 1254	8.1	na	8.1
Gro-Gx	150	na	150
Site 35 (Stained Soil)			
Gro-Gx	110	na	110
Diesel-Dx	16000	na	16000
Oilm-Dx	31500	na	31500

Notes:

[a] 95% Upper confidence limit on the mean (95% UCL) concentrations were only calculated for COPCs with 5 or greater results. For all remaining COPCs, maximum concentrations were assumed as the exposure point concentration.

[b]Exposure point concentration represents the maximum concentration or the 95% UCL concentration, whichever value is lower, as per EPA (1989).

COPC-Chemical of potential concern.

mg/kg-Milligrams per kilogram.

UCL-Upper confidence limit on the mean.

Table 6.50

Derivation of Exposure Point Concentrations for Trichloroethene in Groundwater [a]
Moses Lake Wellfield Superfund Site

Member/Cluster ID [a]	Maximum Concentration (ug/L)	95% UCL Concentration (ug/L)	Exposure Point Concentration [b] (ug/L)
Hanford/Ringold Formation			
Well - 00AW11	5.1	na	5.1
Priest Rapids Member			
PR Cluster #1 - 99BW18, 99BW10	37	25	25
Well - 00BW12	28	na	28
Well - 99BW15	14	13	13
Roza Member			
Roza Cluster #1a - 91BW03, 92BW01, 99BW01	60	46	46
Roza Cluster #1b - 99BW15,	13.5	12	12
Well - 02BW01	19	na	19
Well - 99BW16	5.6	5.2	5.2
Priest Rapids/Roza Members Combined			
PR/R Cluster #1a - 91BW03, 92BW01, 99BW01	60	46	46
PR/R Cluster #1b - 99BW15,	13.5	12	12
PR/R Cluster #2 - 02BW01, 99BW18, 99BW10	37	25	25
Well - 00BW12	28	na	28
Well - 99BW16	5.6	5.2	5.2
Drinking Water Wells			
DW Cluster #1 - WP-15E, WP-15W	28	na	28
Well - WP-14	7.8	na	7.8

Notes:

[a] All wells were segregated by hydrostratigraphic formation and then clustered spatially/laterally.

[b]Exposure point concentration represents the maximum concentration or the 95% UCL concentration, whichever value is lower, as per EPA (1989).

mg/kg-Milligrams per kilogram.

UCL-Upper confidence limit on the mean.

TABLE 6.51

EXPOSURE PARAMETERS FOR HUMAN HEALTH RECEPTORS
MOSES LAKE WELLFIELD SUPERFUND SITE
(Page 1 of 2)

Exposure Parameter	Units	Adult Resident RME	Child Resident RME	Industrial Worker RME	Construction Worker RME	Trespassers RME
General						
Soil Concentration - C_S	mg/kg	CS	CS	CS	CS	CS
Exposure Frequency - EF	day/yr	350	350	250	250	100
Body Weight - BW	kg	70	15	70	70	70
Averaging Time - AT	days					
Carcinogens	years	70	70	70	70	70
Noncarcinogens	years	24	6	25	1	30
Ingestion of Soil/Dust						
Soil Ingestion Rate - IR	mg/day	100	200	50	300	100
Exposure Duration - ED	yr	24	6	25	1	30
Dermal Contact with Soil[a]						
Dermal Surface Area - SA	cm^2/event	5,700	2,800	3,300	3,300	3,300
Skin Adherence Factor - AF	mg/cm^2	0.07	0.2	0.2	0.2	0.2
Skin Absorption Factor - ABS	unitless	CS	CS	CS	CS	CS
Inhalation of Volatile Organics and Dust						
Inhalation Rate - InhR	m^3/day	20	15	20	20	20
Dust Concentration - DC						
Particulate Emission Factor -PEF	m^3/kg	1.30E+09	1.30E+09	1.30E+09	1.30E+09	1.30E+09
Ingestion of Groundwater						
Groundwater Ingestion Rate - IR	L/day	2	1	2	na	na
Exposure Duration - ED	yr	24	6	25	na	na
Inhalation of Consituents Volatilizing from Groundwater						
Inhalation Rate - InhR	m^3/day	20	15	20	na	na
Exposure Time - ET	hr/day	0.25	0.25	0.25	na	na

TABLE 6.51

EXPOSURE PARAMETERS FOR HUMAN HEALTH RECEPTORS
MOSES LAKE WELLFIELD SUPERFUND SITE
(Page 2 of 2)

Exposure Parameter	Units	Adult Resident RME	Child Resident RME	Industrial Worker RME	Construction Worker RME	Trespassers RME
Dermal Contact with Groundwater						
Contact Rate	hr	0.25	0.25	0.25	na	na
Dermal Surface Area - SA	cm^2/event	18,000	6,500	18,000	na	na
Dermal Permeability Constant - PC		CS	CS	CS	na	na
Exposure Time - ET	hr/day	0.25	0.25	0.25	na	na
Volatility Factor - VF	m^3/kg	CS	CS	CS	na	na

Sources:
Unless otherwise noted, parameter values are from EPA (1998a, 1998b, 1997c, 1991a).
[a] Source: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites - Peer Review Draft (USEPA, 2001)

Notes:
RME - Reasonable Maximum Exposure
na - not applicable
CS - Chemical Specific
SS - Site Specific

TABLE 6.52

Summary of Input Parameters and Assumptions for Johnson -Ettinger Vapor Intrusion Modeling
Moses Lake Wellfield Superfund Site

Parameter	Units	J-E Model Assumptions	
		Lower Bound	Upper Bound
Depth below grade to bottom of enclosed floor space:	cm	15	15
Soil gas sampling depth below grade:	cm	Site and Chemical Specific	
Average soil temperature:	^{o}C	13.6[a]	25
Upper Soil Layer (Stratum A)			
Thickness:	cm	40	40
User-defined soil type:	-	LS	LS
User-defined soil effective vapor permeability:	cm^2	na [b]	na [b]
Soil dry bulk density:	g/cm^3	1.5 [c]	1.62 [d]
Soil total porosity:	cm^3/cm^3	0.43 [e]	0.39 [f]
Soil water-filled porosity:	cm^3/cm^3	0.10 [g]	0.049 [h]
Lower Soil Layer (Stratum B)			
Thickness:		Site and Chemical Specific [i]	
Soil dry bulk density:	g/cm^3	1.86 [j]	1.66 [k]
Soil total porosity:	cm^3/cm^3	0.3	0.375 [l]
Soil water-filled porosity:	cm^3/cm^3	0.055	0.053 [m]
Indoor air exchange rate	1/hour	0.6	0.45 [n]
Averaging time for carcinogens:	years	70	70
Averaging time for noncarcinogens:	years	30	30
Exposure duration:	years	25	25
Exposure frequency:	days/year	250	250

Notes:
LS - Loamy sand.
na - Not applicable.
S - Sand.

[a] Average soil temperature is equal to mean groundwater temperature measured at Moses Lake.

[b] Not applicable; soil effective vapor permeability is calculated by the J-E model based on the specified soil

[c] Default value for soil dry bulk density cited in *User's Guide for the Johnson and Ettinger (1991) Model for Subsurface Vapor Intrusion Into Buildings - Revised (USEPA, 2000); the range of soil dry bulk density values cited is 1.25 - 1.75 g/cm3 (USEPA, 2000).*

[d] The Soil dry bulk density was calculated from Soil total porosity as follows, Soil dry bulk density = $(1 - 0.39\ cm^3/cm^3) \times 2.65\ g/cm^3 = 1.62\ g/cm^3$.

TABLE 6.52

Summary of Input Parameters and Assumptions for Johnson -Ettinger Vapor Intrusion Modeling
Moses Lake Wellfield Superfund Site

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[e] Default value for soil total porosity for all soil types that is cited in USEPA (2000). The range of soil total porosity values cited in USEPA (2000) and USEPA's Draft RCRA EI Guidance (2002) is 0.375 - 0.489 cm3/cm3; the value 0.43 cm3/cm3 is the average of this range.

[f] Value represents the default Soil total porosity value cited in USEPA (2000, 2002).

[g] The upper end of the range of Soil water-filled porosity values that is cited in USEPA (2000, 2002) for loamy sand (i.e., 0.049 - 0.1 cm^3/cm^3).

[h] Value represents the low end of the range of soil water-filled porosity values for loamy sand that is cited in USEPA (2000, 2002); the range of values cited for loamy sand is 0.049 - 0.1 cm3/cm3 (USEPA, 2000; 2002).

[i] The thickness of soil layer B = soil sampling depth - thickness of soil layer A

[j] Value for soil dry bulk density for sand presented in Marcia Bailey's December 27, 2002 e-mail comments on the December 20, 2002 teleconference. Soil dry bulk density for sand was changed from 1.5 g/cm3 to 1.86 g/cm3 because of a change to soil total porosity; teleconference. Soil dry bulk density for sand was changed from 1.5 g/cm3 to 1.86 g/cm3 because of a change to soil total porosity;

Soil total porosity = 1 - (Soil dry bulk density/Soil particle density). Solving for 'soil dry bulk density'

Soil dry bulk density = (1 - Soil total porosity) x Soil particle density. USEPA (2000) assumes a 'typical' soil particle density is 2.65 g/cm^3. Therefore, Soil dry bulk density = (1 - 0.3 cm3/cm3) x 2.65 g/cm3 = 1.86 g/cm3.

[k] Soil dry bulk density = (1 - Soil total porosity) x Soil particle density. USEPA (2000) assumes a 'typical' soil particle density is 2.65 g/cm^3. Based on the low end of the range of soil total porosity equal to 0.375 - 0.489 (USEPA, 2002), Soil dry bulk density = (1 - 0.375 cm3/cm3) x 2.65 g/cm3 = 1.66 g/cm3.

[l] Based on the low end of the range of soil total porosity values (0.375 - 0.489 cm3/cm3) cited in USEPA

[m] A proposed soil water-filled porosity value for sand. The range of soil water-filled porosity values for sand that is cited in USEPA (2000, 2002) is 0.053 - 0.055 cm3/cm3. The low end of the range, and default value, for sand that is cited in USEPA (2000, 2002) is 0.053 cm3/cm3.

[n] The default air exchange rate in USEPA (2002).

TABLE 6.53

TOXICITY VALUES USED IN THE BASELINE HUMAN HEALTH RISK ASSESSMENT
MOSES LAKE WELLFIELD SUPERFUND SITE

COPC	Carcinogen Weight of Evidence		Cancer Slope Factor - CSF (mg/kg-d)$^{-1}$				Reference Dose - RfD (mg/kg-d)			
			Oral		Inhalation		Oral		Inhalation	
Inorganics										
Arsenic	A	I	1.5E+00	I	5.0E+01	H	3.0E-04	I	3.0E-04	R
Lead	B2	I	na [a]		na [a]		na [a]		na [a]	
Nickel (Soluble Salts)			na		na		2.0E-02	I	2.0E-02	R
Manganese	D	I	na		na		1.4E-01	I	1.4E-05	I
VOCs										
1,2-Dibromo-3-chloropropane			1.4E+00	H	1.4E+00	R	5.7E-05	R	5.7E-05	I
2-Hexanone			na		na		8.0E-02 [e]	H	2.3E-02 [e]	H
Acetone	D	I	na		na		1.0E-01	I	1.0E-01	R
Benzene			5.5E-02	I	2.9E-02	I	3.0E-03	N	1.7E-03	N
Bromodichloromethane	B2	I	6.2E-02	I	6.2E-02	R	2.0E-02	I	2.0E-02	R
Dibromochloromethane	C	I	8.4E-02	I	8.4E-02	R	2.0E-02	I	2.0E-02	R
Tert-butyl methyl ether (MTBE)			na		na		8.6E-01	R	8.6E-01	I
SVOCs										
Aroclor 1254	B2	I	2.0E+00 [b]	I	4.0E-01 [b]	I	2.0E-05	I	2.0E-05	R
Aroclor 1260	B2		2.0E+00 [b]	I	4.0E-01 [b]	I	2.0E-05 [b]	I	2.0E-05 [b]	R
Benzo(a)pyrene	B2	I	7.3E+00	H	3.1E+00	N	na		na	
Benzo(b)fluoranthene	B2	I	7.3E-01	N	7.3E-01	R	na		na	
Benzo(ghi)perylene	D	I	na		na		2.0E-02 [c]	I	8.6E-04 [c]	I
Benzo(k)fluoranthene	B2	I	7.3E-02	N	7.3E-02	R	na		na	
Sec-butylbenzene			na		na		1.0E-02	T	1.0E-02	R
Trichloroethylene	B2		1.1E-02 [d]	N	6.0E-03 [d]	N	6.0E-03 [d]	N	6.0E-03 [d]	N
1,2,4-trimethylbenzene			na		na		5.0E-02	T	5.0E-02	R
1,3,5-trimethylbenzene			na		na		5.0E-02	T	5.0E-02	R
HDGs										
Methane	na		na		na		na		na	
Total Petroleum Hydrocarbons (TPH)										
Gro-Gx			na		na		5.7E-01	S	5.7E-01	R
Diesel-Dx			na		na		1.6E-01	S	1.6E-01	R
Oilm-Dx			na		na		4.4E+00	S	4.4E+00	R

TABLE 6.53

TOXICITY VALUES USED IN THE BASELINE HUMAN HEALTH RISK ASSESSMENT
MOSES LAKE WELLFIELD SUPERFUND SITE

Notes:

CSF - Cancer Slope factor

mg/kg-d - Milligram per kilogram per day.

GRO - Gasoline Range Organics

na - Not available

RfD - Reference Dose

tbd - To be determined.

Carcinogen Weight of Evidence:

A Human Carcinogen

B2 Probable Human Carcinogen

C Possible Human Carcinogen

D Not classifiable as to human carcinogenicity

Source Data:

I IRIS Database (EPA, 2003)

H HEAST (EPA, 1995a)

N National Center for Environmental Assessment (NCEA)

S Staats et al. (1997)

T Total Petroleum Hydrocarbon Work Group (TPHCWG, 1997)

R Route extrapolation

[a] Consistent with EPA policy, toxicy values are not currently available for lead. Please refer to Section 6.4.3.1.

[b] Please refer to Section 6.4.3.4

[c] Toxicity values of naphthalene were used as a surrogate for benzo(ghi)perylene due to the unavailability of specific toxicity values for this chemical.

[d] Please refer to Section 6.4.3.2

[e] Hexanone used as a surrogate.

TABLE 6.54

SUMMARY OF HUMAN HEALTH RISK ASSESSMENT RESULTS
SOIL SOURCE AREAS
MOSES LAKE WELLFIELD SUPERFUND SITE

	Cancer Risk and Noncancer Hazard Estimate					
	Commercial/ Industrial Worker		Construction Worker		Trespasser	
Site/Constituent	**ILCR**	**HI**	**ILCR**	**HI**	**ILCR**	**HI**
6a and 6b (Base Closure Landfill)						
General COPCs	na[a]	na[a]	na[a]	na[a]	2.8E-05	0.4
Lead [b]	na[a]	na[a]	na[a]	na[a]	<10 ug/dl	
8 (Randolph Road Base Dump)	na[c]	na[c]	na[c]	na[c]	na[c]	na[c]
11 (Fire Training Area - Burn Pit B)						
General COPCs	na[d]	0.000005	na[d]	0.00001	na[a]	na[a]
TPH (Oilm-Dx)	na[d]	0.004	na[d]	0.01	na[a]	na[a]
12 (Motor Pool Drain Areas)						
General COPCs	9.5E-07	na[e]	1.0E-07	na[e]	na[a]	na[a]
TPH (Diesel-Dx, Oilm-Dx)	na[d]	0.03	na[a]	0.1	na[a]	na[a]
14 (8-Place Hangar)	na[c]	na[c]	na[c]	na[c]	na[c]	na[c]
15 (8-Place Hangar Ditch)	na[c]	na[c]	na[c]	na[c]	na[c]	na[c]
17 (3-Place Hangar-Bldg 5801)						
General COPCs	na[f]	na[f]	1.5E-06	0.06	na[a]	na[a]
18 (Paint Hangar-Bldg 5825)						
General COPCs	3.1E-06	0.2	3.3E-07	0.6	na[a]	na[a]
19 (Liquid Oxygen Generating Plant-Bldg 5102)						
General COPCs	na[d]	na[f]	na[d]	0.000002	na[a]	na[a]
20 (South Base Dump)						
Lead [b]	na[a]	na[a]	na[a]	na[a]	<10 ug/dl	
22 (Paint Hangar Leach Pit)						
General COPCs	9.5E-06	0.6	1.0E-06	2	na[a]	na[a]
TPH (Gro-Gx)	na[d]	0.0003	na[d]	0.0009	na[a]	na[a]

Lead [b]	<10 ug/dl		>10 ug/dl		na[a]	na[a]
31 (19th Avenue Base Dump)	na[c]	na[c]	na[c]	na[c]	na[c]	na[c]
33 (End of Runway 32 Dump)	na[c]	na[c]	na[c]	na[c]	na[c]	na[c]
35 (Stained Soil)						
TPH	na[d]	0.20	na[d]	0.38	na[a]	na[a]

Notes:

[a] The indicated receptor is not anticipated to be exposed to soils associated with this source area, consistent with the human health conceptual site model.

[b] As per EPA guidance (EPA, 1991b; 1998a), lead is not included in the cumulative risk or noncancer hazard estimate. Instead, the lead evaluation results in a blood-lead concentration that is a blood-lead concentration that is compared to an acceptable screening criterion of 10 ug/dl (please refer to Section 6.4.3.1).

[c] All analytes detected in soils associated with this source area were present at concentrations below COPC screening criteria.

[d] No carcinogenic COPCs were identified for this source area.

[e] No non-carcinogenic general COPCs were identified for this source area.

[f] The 'Commercial Industrial Worker' scenario is only complete for inhalation of VOCs, however none of the COPCs at this site are volatile so there is no risk/hazard under this scenario.

COPC - Chemical of potential concern.
HI - Hazard index.
ILCR - Incremental lifetime cancer risk.
na - Not applicable.
ug/dl - Micrograms per deciliter.

TABLE 6.55

SUMMARY OF HUMAN HEALTH RISK ASSESSMENT RESULTS
SOIL GAS MEASUREMENTS
MOSES LAKE WELLFIELD SUPERFUND SITE

	Cancer Risk and Noncancer Hazard Estimate			
	Lower Bound Assumptions [a]		Upper Bound Assumptions [b]	
	Commercial/ Industrial Worker		Commercial/ Industrial Worker	
Site/Constituent	**ILCR**	**HI**	**ILCR**	**HI**
2 (Big Bend Community College Hangar)	1 1E-08	0 00001	1.8E-08	0.00002
3a (Aircraft Wash Rack & Discharge Areas)	6 5E-08	0 0002	1.0E-07	0.0003
3b (Aircraft Wash Rack & Discharge Areas)	2 1E-07	0 00004	3.4E-07	0.00006
3c (Aircraft Wash Rack & Discharge Areas)	5 0E-08	0 00005	7.5E-08	0.00007
4a (Tarmac Areas)	2 3E-08	0 00003	3.7E-08	0.00004
4b (Tarmac Areas)	6 0E-10	0 00001	9.6E-10	0.00002
5 (JAL Hangar Area & Tarmac)	1 7E-08	0 00002	2.7E-08	0.00002
9 (Gravel Pit)	8 7E-08	0 00003	1.4E-07	0.00005
11 (Fire Training Area - Burn Pit B)	2 9E-08	0 00001	4.5E-08	0.00002
12 (Motor Pool Drain Areas)	5 1E-08	0 00007	8.1E-08	0.0001
14 (8-Place Hangar)	8 3E-08	0 0003	1.3E-07	0.0004
15 (8-Place Hangar Ditch)	7 1E-09	0 00003	1.2E-08	0.00005
16 (Engine Rebuilding Facility - Bldg 2203)	3 0E-08	0 00002	4.7E-08	0.00003
17 (3-Place Hangar - Bldg 5801)	1 2E-09	0 00002	2.0E-09	0.00004
18 (Paint Hangar - Bldg 5825)	1 4E-08	0 00002	2.2E-08	0.00003
19 (Liquid Oxygen Generating Plant - Bldg 5102)	6 5E-07	0 0002	1.1E-06	0.0003
19b (Liquid Oxygen Generating Plant Site)	3 5E-08	0 00006	5.7E-08	0.00009
22 (Paint Hangar Leach Pit)	1 1E-09	0 00001	1.9E-09	0.00002
23 (Engine Rebuilding Facility - Bldg 2113)	1 1E-07	0 00002	1.8E-07	0.00003
25 (Bldg 408)	8 9E-09	0 00006	1.4E-08	0.00009

TABLE 6.55

SUMMARY OF HUMAN HEALTH RISK ASSESSMENT RESULTS
SOIL GAS MEASUREMENTS
MOSES LAKE WELLFIELD SUPERFUND SITE

	Cancer Risk and Noncancer Hazard Estimate			
	Lower Bound Assumptions [a]		Upper Bound Assumptions [b]	
	Commercial/ Industrial Worker		Commercial/ Industrial Worker	
Site/Constituent	**ILCR**	**HI**	**ILCR**	**HI**
33 (Landfill at End of Runway 32)	2 9E-09	0 00004	4.6E-09	0.00007

Notes:

[a] 'Lower Bound Assumption' risk estimates are based on less protective vapor intrusion modeling assumptions than 'Upper Bound Assumption' risk estimates, as described in Section 6 3 5 1

[b] 'Upper Bound Assumption' risk estimates are based on more protective vapor intrusion modeling assumptions than 'Lower Bound Assumption' risk estimates, as described in Section 6 3 5 1

HI-Hazard index
ILCR-Incremental lifetime cancer risk

TABLE 6.56

SUMMARY OF HUMAN HEALTH RISK ASSESSMENT RESULTS
GROUNDWATER MODEL #1- PRIEST RAPIDS AND ROZA MEMBERS SEPARATE
MOSES LAKE WELLFIELD SUPERFUND SITE

Member	Cluster ID/Well	Groundwater Exposure Point Concentration (mg/L)	Future Resident Risk ILCR	Future Resident Risk HI	Future Commercial/ Industrial Worker ILCR	Future Commercial/ Industrial Worker HI	Hypothetical Unrestricted Drinking Water Scenario ILCR	Hypothetical Unrestricted Drinking Water Scenario HI
Hanford Ringold (HR)								
	Well - 00AW11		na[a]	na[a]	5.0E-07	0.025	1.1E-06	0.090
	Trichloroethene	0.0051						
	Well - 91AW14		na[a]	na[a]	5.2E-07	0.00030	1.1E-06	0.0013
	Bromodichloromethane	0.00061						
	Dibromochloromethane	0.00037						
	Well - 91AW15		na[a]	na[a]	na[b]	0.0065	na[b]	0.025
	1,2,4-Trimethylbenzene	0.0035						
	1,3,5-Trimethylbenzne	0.0069						
Priest Rapids (PR)								
	PR Cluster #1 - 99BW18, 99BW10		5.4E-06	0.44	2.5E-06	0.12	5.4E-06	0.44
	Trichloroethene	0.025						
	Well - 00BW02		na[a]	na[a]	na[b]	0.017	na[b]	0.078
	Manganese	0.122						
	Well - 00BW11		na[a]	na[a]	2.0E-07	0.0031	4.2E-07	0.013
	Benzene	0.00043						
	Well - 00BW12		na[a]	na[a]	2.8E-06	0.16	6.1E-06	0.60
	Trichloroethene	0.028						
	Manganese	0.16						
	Well - 00BW13		na[a]	na[a]	na[b]	0.025	na[b]	0.12
	Manganese	0.18						
	Well - 00BW18		na[a]	na[a]	na[b]	0.00038	na[b]	0.0017
	Tert-butyl methyl ether (MTBE)	0.016						
	Well - 99BW15		2.82E-06	0.23	1.3E-06	0.063	2.8E-06	0.23
	Trichloroethene	0.013						
Roza								
	Roza Cluster #1a - 91BW03, 92BW01, 99BW01		1.0E-05	0.81	4.5E-06	0.22	1.0E-05	0.81
	Trichloroethene	0.046						
	Roza Cluster #1b - 99BW15, 02BW02		2.6E-06	**18**	1.2E-06	**3.8**	2.6E-06	**18**
	Trichloroethene	0.012						
	Acetone	**19**						
	Well - 02BW01		na[a]	na[a]	1.9E-06	0.093	4.1E-06	0.34
	Trichloroethene	0.019						
	Well - 92BW02		na[a]	na[a]	na[b]	0.00094	na[b]	0.0043
	Tert-butyl methyl ether (MTBE)	0.040						

TABLE 6.56

SUMMARY OF HUMAN HEALTH RISK ASSESSMENT RESULTS
GROUNDWATER MODEL #1- PRIEST RAPIDS AND ROZA MEMBERS SEPARATE
MOSES LAKE WELLFIELD SUPERFUND SITE

Member	Cluster ID/Well	Groundwater Exposure Point Concentration (mg/L)	Future Resident Risk ILCR	Future Resident Risk HI	Future Commercial/ Industrial Worker ILCR	Future Commercial/ Industrial Worker HI	Hypothetical Unrestricted Drinking Water Scenario ILCR	Hypothetical Unrestricted Drinking Water Scenario HI
	Well - 99BW16		na[a]	na[a]	8.6E-06	0.298	6.9E-07	0.035
	Trichloroethene	0.0054						
Drinking Water Wells (DW)								
	DW Cluster #1 - WP-15E, WP-15W		6.1E-06[c]	0.50[c]	2.8E-06[c]	0.14[c]	6.1E-06[c]	0.50[c]
	Trichloroethene	0.028						
	Well WP-13E		1.0E-06	0.0011	4.9E-07	0.00025	1.0E-06	0.0011
	Bromodichloromethane	0.00038						
	Dibromochloromethane	0.00052						
	Well - WP-14		1.7E-06	0.14	7.7E-07	0.038	1.7E-06	0.14
	Trichloroethene	0.0078						

Notes:

[a] Future residential risk estimates were not calculated for this well cluster or minotoring well because it is located within a non-residential land use area, as per the Grant County Master Plan.

[b] No carcinogenic COPCs were identified for this monitoring well.

[c]The indicated risks for WP-15E (Skyline Well #2) are based on RI data collected prior to replacement of this well. Current and anticipated future risks for well WP-15E are lower than estmates shown.

Bold text indicates exceedance of MTCA target risk level.

mg/L - Milligrams per liter.
HI - Hazard index.
ILCR - Incremental lifetime cancer risk.
na - Not applicable.

TABLE 6.57

SUMMARY OF HUMAN HEALTH RISK ASSESSMENT RESULTS
GROUNDWATER MODEL #2 - PRIEST RAPIDS AND ROZA MEMBERS COMBINED
MOSES LAKE WELLFIELD SUPERFUND SITE

Member	Cluster ID/Well	Groundwater Exposure Point Concentration (mg/L)	Future Resident Risk ILCR	Future Resident Risk HI	Future Commercial/ Industrial Worker ILCR	Future Commercial/ Industrial Worker HI	Hypothetical Unrestricted Drinking Water Scenario ILCR	Hypothetical Unrestricted Drinking Water Scenario HI
Hanford Ringold (HR)								
	Well - 00AW11		na[a]	na[a]	5.0E-07	0.025	1.1E-06	0.090
	Trichloroethene	0.0051						
	Well - 91AW14		na[a]	na[a]	5.2E-07	0.00030	1.1E-06	0.0013
	Bromodichloromethane	0.00061						
	Dibromochloromethane	0.00037						
	Well - 91AW15		na[a]	na[a]	na[b]	0.0065	na[b]	0.025
	1,2,4-Trimethylbenzene	0.0035						
	1,3,5-Trimethylbenzne	0.0069						
Priest Rapids/Roza Combined (PR/R)								
	PR/R Cluster #1a - 91BW03, 92BW01, 99BW01		1.0E-05	0.81	4.5E-06	0.22	1.0E-05	0.81
	Trichloroethene	0.046						
	PR/R Cluster #1b - 99BW15, 02BW02		2.6E-06	**18**	1.2E-06	**3.8**	2.6E-06	**18**
	Trichloroethene	0.012						
	Acetone	**19**						
	PR/R Cluster #2 - 02BW01, 99BW18, 99BW10		5.4E-06	0.44	2.5E-06	0.12	5.4E-06	0.44
	Trichloroethene	0.025						
	Well - 00BW02		na[a]	na[a]	na[b]	0.017	na[b]	0.078
	Manganese	0.122						
	Well - 00BW11		na[a]	na[a]	2.0E-07	0.0031	4.2E-07	0.013
	Benzene	0.00043						
	Well - 00BW12		na[a]	na[a]	2.8E-06	0.16	6.1E-06	0.60
	Trichloroethene	0.028						
	Manganese	0.16						
	Well - 00BW13		na[a]	na[a]	na[b]	0.025	na[b]	0.12
	Manganese	0.18						
	Well - 00BW18		na[a]	na[a]	na[b]	0.00038	na[b]	0.0017
	Tert-butyl methyl ether (MTBE)	0.016						
	Well - 92BW02		na[a]	na[a]	na[b]	0.00094	na[b]	0.0043
	Tert-butyl methyl ether (MTBE)	0.040						
	Well - 99BW16		na[a]	na[a]	8.6E-06	0.298	6.9E-07	0.035
	Trichloroethene	0.0054						
Drinking Water Wells (DW)								

TABLE 6.57

SUMMARY OF HUMAN HEALTH RISK ASSESSMENT RESULTS
GROUNDWATER MODEL #2 - PRIEST RAPIDS AND ROZA MEMBERS COMBINED
MOSES LAKE WELLFIELD SUPERFUND SITE

Member	Cluster ID/Well	Groundwater Exposure Point Concentration (mg/L)	Future Resident Risk ILCR	Future Resident Risk HI	Future Commercial/ Industrial Worker ILCR	Future Commercial/ Industrial Worker HI	Hypothetical Unrestricted Drinking Water Scenario ILCR	Hypothetical Unrestricted Drinking Water Scenario HI
DW Cluster #1 - WP-15E, WP-15W			6.1E-06[c]	0.50[c]	2.8E-06[c]	0.14[c]	6.1E-06[c]	0.50[c]
	Trichloroethene	0.028						
Well - WP-13E			1.0E-06	0.0011	4.9E-07	0.00025	1.0E-06	0.0011
	Bromodichloromethane	0.00038						
	Dibromochloromethane	0.00052						
Well - WP-14			1.7E-06	0.14	7.7E-07	0.038	1.7E-06	0.14
	Trichloroethene	0.0078						

Notes:

[a] Future residential risk estimates were not calculated for this well cluster or minotoring well because it is located within a non-residential land use area, as per the Grant County Master Plan.

[b] No carcinogenic COPCs were identified for this monitoring well.

[c]The indicated risks for WP-15E (Skyline Well #2) are based on RI data collected prior to replacement of this well. Current and anticipated future risks for well WP-15E are lower than estmates shown.

Bold text indicates exceedance of MTCA target risk level.

mg/L - Milligrams per liter.
HI - Hazard index.
ILCR - Incremental lifetime cancer risk.
na - Not applicable.

TABLE 7.1 KNOWN HIGH-QUALITY PLANT COMMUNITIES AND WETLAND ECOSYSTEMS OF GRANT COUNTY GRANT COUNTY, WASHINGTON		
Common Name	**Scientific Name**	**Community Type**
Stiff Sagebrush/	*Artemisia rigida*	Dwarf-shrub
Sandberg's Bluegrass	*Poa secunda*	Herbaceous Vegetation
Big Sagebrush/	*Artemisia tridentata*	Shrub
Idaho Fescue	*Festuca idahoensis*	Herbaceous Vegetation
Big Sagebrush	*Artemisia tridentata*	Cover Type Shrubland
Wyoming Big Sagebrush/	*Artemisia tridentata ssp. Wyomingensis*	Shrub
Bluebunch Wheatgrass	*Pseudoroegneria spicata*	Herbaceous
Wyoming Big Sagebrush/	*Artemisia tridentata ssp. Wyomingensis*	Shrubland
Needle-and –thread	*Stipa comata*	Shrubland
Threetip Sagebrush/	*Artemisia tripartita*	Shrub
Idaoho Fescue	*Festuca idahoensis*	Herbaceous Vegetation
Threetip Sagebrush/	*Artemisia Tripartita*	Shrub
Bluebunch Wheatgrass	*Pseudoroegneria Spicata*	Herbaceous Vegetation
Water Birch	*Betula occidentalis*	Shrubland
Red-Osier Dogwood	*Cornus sericea*	Shrubland
Saltgrass	*Distichlis spicata*	Herbaceous Vegetation
Creeping Spikerush	*Eleocharis palustris*	Intermittently flooded herbaceous vegetation
Streamside Wildrye/	*Elyumus lanceolatus*	Herbaceous Vegetation
Needle-and-Thread	*Stipa Comata*	Herbaceous Vegetation
Thyme Buchwheat/	*Erigonum thymoides*	Dwarf-shrub
Sandberg's Bluegrass	*Poa secunda*	Herbaceous Vegetation
Spiny Hopsage/	*Grayia spinosa*	Shrubland
Sandberg's Bluegrass	*Poa secunda*	Shrubland
Mock Orange	*Philadelphus lewisii*	Intermittently Flooded Shrubland
Ponderosa Pine/	*Pinus ponderosa*	Forest Cover Type
Douglas-Fir Forest	*Pseudotsuga menziesii*	Forest Cover Type
Ponderosa Pine/	*Pinus ponderosa*	Temporarily Flooded Woodland
Common Snowberry	*Symphoricarps albus*	Temporarily Flooded Woodland
Bluebunch Wheatgrass/	*Pseudoroegneria spicata*	Canyon Herbaceous Vegetation
Idaho Fescue Canyon	*Festuca idahoensis*	Canyon Herbaceous Vegetation
Bitterbrush/	*Purshia tridentata*	Shrubland
Indian Ricegrass	*Oryzopsis hymenoides*	Shrubland

TABLE 7.1 KNOWN HIGH-QUALITY PLANT COMMUNITIES AND WETLAND ECOSYSTEMS OF GRANT COUNTY GRANT COUNTY, WASHINGTON		
Common Name	**Scientific Name**	**Community Type**
Bitterbrush/	*Purshia tridentata*	Herbaceous Vegetation
Needle-and-Thread	*Stipa comata*	Herbaceous Vegetation
Greasewood/	*Sarcobatus vermiculatus*	Shrubland
Saltgrass	*Distichlis spicata*	Shrubland
Sand Dropseed/	*Sporobolus cryptandrus*	Herbaceous Vegetation
Sandberg's Bluegrass	*Poa secunda*	Herbaceous Vegetation
Needle-and-Thread	*Stipa comata*	Grassland Cover Type
Vernal Pond CB	*Vernal Pond CB*	
Source: (WNHP, 2000)		

TABLE 7.2 PLANT SPECIES KNOWN TO OCCUR IN GRANT COUNTY GRANT COUNTY, WASHINGTON				
Common Name	**Scientific Name**		**Rare**	**Source**
	Genus	**Species**		
(not available)	*Artemisia*	*campestris spp. borealis var. wormskioldii*	X	2
(not available)	*Polygonum*	*austiniae*	X	2
(not available)	*Teucrium*	*canadense spp. viscidum*	X	2
Absinth wormwood	*Artemisia*	*absinthium*		1
African rue	*Peganum*	*harmala*		1
Alkali bulrush	*Scirpus*	*maritimus*		1
Alkali sandspurry	*Spergularia*	*diandra*		1
Annual buckwheat	*Eriogonum*	*annuum*		1
Annual bursage	*Ambrosia*	*acanthicarpa*		1
Annual fleabane	*Erigeron*	*annuus*		1
Annual polemonium	*Polemonium*	*micranthum*		1
Annual sowthistle	*Sonchus*	*oleraceus*		1
Arrowleaf balsamroot	*Balsamorhiza*	*sagittata*		1
Aster	*Aster*	*spp.*		1
Awned flatsedge	*Cyperus*	*aristatus*		1
Barestem lomatium	*Lomatium*	*nudicaule*		1
Beaked spikerush	*Eleocharis*	*rostellata*	X	2
Bermudagrass	*Cynodon*	*dactylon*		1
Big sagebrush	*Artemisia*	*tridentata*		1
Bittersweet nightshade	*Solanum*	*dulcamara*		1
Black nightshade	*Solanum*	*nigrum*		1
Blazing star mentzelia	*Mentzelia*	*laevicaulis*		1
Blue elderberry	*Sambucus*	*cerulea*		1
Blue mustard	*Chorispora*	*tenella*		1
Bluebunch wheatgrass	*Agropyron*	*spicatum*		1
Bottlebrush sedge	*Carex*	*hystericina*	X	2
Bouncingbet	*Saponaria*	*officinalis*		1
Box elder	*Acer*	*negundo*		1
Brook cinquefoil	*Potentilla*	*rivalis*		1
Broom snakeweed	*Gutierrezia*	*sarothrae*		1
Buffalobur	*Solanum*	*rostratum*		1
Bulbous bluegrass	*Poa*	*bulbosa*		1
Bull thistle	*Cirsium*	*vulgare*		1
Bur buttercup	*Ranunculus*	*testiculatus*		1
Bushy cinquefoil	*Potentilla*	*paradoxa*		1
Canada thistle	*Cirsium*	*arvense*		1
Carrot	*Daucus*	*spp.*		1
Catchweed bedstraw	*Galium*	*aparine*		1
Catnip	*Nepeta*	*cataria*		1
Chick pea milk vetch	*Astragalus*	*cicer*		1
Chickweed	*Cerastium*	*spp.*		1
Chicory	*Cichorium*	*intybus*		1
Columbia River gumweed	*Grindelia*	*columbiana*		1
Columbian yellowcress	*Rorippa*	*columbiae*	X	2
Common burdock	*Arctium*	*minus*		1
Common cocklebur	*Xanthium*	*strumarium*		1

TABLE 7.2 PLANT SPECIES KNOWN TO OCCUR IN GRANT COUNTY GRANT COUNTY, WASHINGTON				
Common Name	**Scientific Name**		**Rare**	**Source**
	Genus	**Species**		
Common elodea	*Elodea*	*canadensis*		1
Common eriophyllum	*Eriophyllum*	*lanatum*		1
Common evening primrose	*Oenothera*	*biennis*		1
Common groundsel	*Senecio*	*vulgaris*		1
Common monkey flower	*Mimulus*	*guttatus*		1
Common purslane	*Portulaca*	*oleracea*		1
Common ragweed	*Ambrosia*	*artemisiifolia*		1
Common reed	*Phragmites*	*australis*		1
Common sage	*Salvia*	*officinalis*		1
Common sunflower	*Helianthus*	*annuus*		1
Common teasel	*Dipsacus*	*fullonum*		1
Common threesquare	*Scirpus*	*americanus*		1
Common willow herb	*Epilobium*	*ciliatum*		1
Cone catchfly	*Silene*	*conoidea*		1
Corn spurry	*Spergula*	*arvensis*		1
Coyote tobacco	*Nicotiana*	*attenuata*	X	2
Creeping bellflower	*Campanula*	*rapunculoides*		1
Creeping bentgrass	*Agrostis*	*stolonifera*		1
Creeping woodsorrel	*Oxalis*	*corniculata*		1
Crested wheatgrass	*Agropyron*	*cristatum*		1
Curly dock	*Rumex*	*crispus*		1
Daisy	*Erigeron*	*spp.*		1
Dalmatian toadflax	*Linaria*	*dalmatica*		1
Devils beggarticks	*Bidens*	*frondosa*		1
Diffuse knapweed	*Centaurea*	*diffusa*		1
Douglas' knotweed	*Polygonum*	*douglasii*		1
Downy brome	*Bromus*	*tectorum*		1
Dwarf mallow	*Malva*	*neglecta*		1
Dwarf suncup	*Camissonia*	*pygmaea*	X	2
English daisy	*Bellis*	*perennis*		1
Eurasian watermilfoil	*Myriophyllum*	*spicatum*		1
Fescue	*Festuca*	*spp.*		1
Field bindweed	*Convolvulus*	*arvensis*		1
Field horsetail	*Equisetum*	*arvense*		1
Field locoweed	*Oxytropis*	*campestris var. wanapum*	X	2
Fivehook bassia	*Bassia*	*hyssopifolia*		1
Fringed quickweed	*Galinsoga*	*quadriradiata*		1
Geyer's milkvetch	*Astragalus*	*geyeri*	X	2
Giant hellebore	*Epipactis*	*gigantea*	X	2
Giant ragweed	*Ambrosia*	*trifida*		1
Goldenrod	*Solidago*	*spp.*		1
Grand Coulee onion	*Allium*	*constrictum*	X	2
Gray cryptantha	*Cryptantha*	*leucophaea*	X	2
Greater celandine	*Chelidonium*	*majus*		1
Hairy whitetop	*Cardaria*	*pubescens*		1
Hedge bindweed	*Calystegia*	*sepium*		1
Helleborus	*Helleborus*	*spp.*		1

TABLE 7.2 PLANT SPECIES KNOWN TO OCCUR IN GRANT COUNTY GRANT COUNTY, WASHINGTON				
Common Name	**Scientific Name**		**Rare**	**Source**
	Genus	**Species**		
Hoary aster	*Machaeranthera*	*canescens*		1
Hoary cress	*Cardaria*	*draba*		1
Honesty	*Lunaria*	*annua*		1
Hoover's desertparsley	*Lomatium*	*tuberosum*	X	2
Indian-paintbrush	*Castilleja*	*spp.*		1
Italian ryegrass	*Lolium*	*multiflorum*		1
Japanese knotweed	*Polygonum*	*cuspidatum*		1
Jerusalem oak goosefoot	*Chenopodium*	*botrys*		1
Jimsonweed	*Datura*	*stramonium*		1
Johnsongrass	*Sorghum*	*halepense*		1
Kentucky bluegrass	*Poa*	*pratensis*		1
Ladysthumb	*Polygonum*	*persicaria*		1
Larkspur	*Delphinium*	*spp.*		1
Lemon scurfpea	*Psoralea*	*lanceolata*		1
Love in a mist	*Nigella*	*damascena*		1
Low pussy toes	*Antennaria*	*dimorpha*		1
Lowl cudweed	*Gnaphalium*	*palustre*		1
Lyall's milk-vetch	*Astragalus*	*lyallii*		1
Marchantia	*Marchantia*	*spp.*		1
Marshelder	*Iva*	*xanthifolia*		1
Marshpepper smartweed	*Polygonum*	*hydropiper*		1
Matrimonyvine	*Lycium*	*halimifolium*		1
Mayweed chamomile	*Anthemis*	*cotula*		1
Myrtle spurge	*Euphorbia*	*myrsinites*		1
Narrowleaf goldenrod	*Solidago*	*graminifolia*		1
Orange arnica	*Arnica*	*fulgens*		1
Orchardgrass	*Dactylis*	*glomerata*		1
Orcutt's lovegrass	*Eragrostis*	*orcuttiana*		1
Pale bulrush	*Scirpus*	*pallidus*		1
Pale evening primrose	*Oenothera*	*pallida*		1
Pale smartweed	*Polygonum*	*lapathifolium*		1
Palouse milkvetch	*Astragalus*	*arrectus*	X	2
Panicle willowweed	*Epilobium*	*paniculatum*		1
Peach leaf willow	*Salix*	*amygdaloides*		1
Pearly everlasting	*Anaphalis*	*margaritacea*		1
Pennsylvania pellitory	*Parietaria*	*pensylvanica*		1
Perennial ryegrass	*Lolium*	*perenne*		1
Piper's fleabane	*Erigeron*	*piperianus*	X	2
Plains coreopsis	*Coreopsis*	*tinctoria*		1
Prickly lettuce	*Lactuca*	*serriola*		1
Prostrate pigweed	*Amaranthus*	*graecizans*		1
Prostrate vervain	*Verbena*	*bracteata*		1
Purple loosestrife	*Lythrum*	*salicaria*		1
Rabbitfoot polypogon	*Polypogon*	*monspeliensis*		1
Ridgeseed spurge	*Euphorbia*	*glyptosperma*		1
River bulrush	*Scirpus*	*fluviatilis*		1
Rough stickseed	*Hackelia*	*hispida var. disjuncta*	X	2

TABLE 7.2 PLANT SPECIES KNOWN TO OCCUR IN GRANT COUNTY GRANT COUNTY, WASHINGTON				
Common Name	**Scientific Name**		**Rare**	**Source**
	Genus	**Species**		
Rush skeletonweed	*Chondrilla*	*juncea*		1
Russian knapweed	*Centaurea*	*repens*		1
Russian thistle	*Salsola*	*iberica*		1
Safflower	*Carthamus*	*tinctorius*		1
Saltgrass	*Distichlis*	*spicata*		1
Sandwort	*Arenaria*	*spp.*		1
Scarlet gilia	*Gilia*	*aggregata*		1
Scentless chamomile	*Matricaria*	*maritima*		1
Scotch thistle	*Onopordum*	*acanthium*		1
Sharp leaved penstemon	*Penstemon*	*acuminatus*		1
Shepherd's purse	*Capsella*	*bursa-pastoris*		1
Sicklepod rockcress	*Arabis*	*sparsiflora*		1
Silverweed cinquefoil	*Potentilla*	*anserina*		1
Slender cudweed	*Gnaphalium*	*microcephalum*		1
Slender flatsedge	*Cyperus*	*bipartitus*	X	2
Small flowered bulrush	*Scirpus*	*microcarpus*		1
Small flowered gilia	*Ipomopsis*	*minutiflora*		1
Snake River cryptantha	*Cryptantha*	*spiculifera*	X	2
Spiny cocklebur	*Xanthium*	*spinosum*		1
Spotted knapweed	*Centaurea*	*maculosa*		1
Spring whitlowgrass	*Draba*	*verna*		1
Suksdorf's monkeyflower	*Mimulus*	*suksdorfii*	X	2
Sulfur cinquefoil	*Potentilla*	*recta*		1
Swainsonpea	*Sphaerophysa*	*salsula*		1
Syrian beancaper	*Zygophyllum*	*fabago*		1
Syrian mustard	*Euclidium*	*syriacum*		1
Tall fescue	*Festuca*	*arundinacea*		1
Tall hedge mustard	*Sisymbrium*	*loeselii*		1
Tall oatgrass	*Arrhenatherum*	*elatius*		1
Tall tumblemustard	*Sisymbrium*	*altissimum*		1
Tarragon	*Artemisia*	*dracunculus*		1
Thickleaved thelypody	*Thelypodium*	*laciniatum*		1
Tufted eveningprimrose	*Oenothera*	*cespitosa spp. cespitosa*	X	2
Tufted lovegrass	*Eragrostis*	*pectinacea*		1
Umbrella spurry	*Holosteum*	*umbellatum*		1
Veiny dock	*Rumex*	*venosus*		1
Velvetleaf	*Abutilon*	*theophrasti*		1
Violet	*Viola*	*spp.*		1
Water speedwell	*Veronica*	*anagallis-aquatica*		1
Watercress	*Nasturtium*	*officinale*		1
Wavyleaf thistle	*Cirsium*	*undulatum*		1
Western salsify	*Tragopogon*	*dubius*		1
Western serviceberry	*Amelanchier*	*alnifolia*		1
Western sticktight	*Lappula*	*redowskii*		1
Western wallflower	*Erysimum*	*asperum*		1
Western waterhemlock	*Cicuta*	*douglasii*		1
Wheatgrass	*Agropyron*	*spp.*		1

TABLE 7.2
PLANT SPECIES KNOWN TO OCCUR IN GRANT COUNTY
GRANT COUNTY, WASHINGTON

Common Name	Scientific Name		Rare	Source
	Genus	Species		
White abronia	*Abronia*	*mellifera*		1
White catchfly	*Silene*	*latifolia*		1
White false tickhead	*Eatonella*	*nivea*	X	2
White stemmed globemallow	*Sphaeralcea*	*munroana*		1
White sweetclover	*Melilotus*	*albus*		1
Whitestem stickleaf	*Mentzelia*	*albicaulis*		1
Wild garlic	*Allium*	*vineale*		1
Wild licorice	*Glycyrrhiza*	*lepidota*		1
Wild oat	*Avena*	*fatua*		1
Woolly plantain	*Plantago*	*patagonica*		1
Yellow bedstraw	*Galium*	*verum*		1
Yellow bee plant	*Cleome*	*lutea*		1
Yellow foxtail	*Setaria*	*glauca*		1
Yellow sweetclover	*Melilotus*	*officinalis*		1
Yellowcress	*Rorippa*	*spp.*		1
Yellowflag iris	*Iris*	*pseudacorus*		1

Sources:
1 UMT, 2001
This query includes all species of Grant County from 1940 to 2001
2 WNHP, 1999

TABLE 7.3
MAMMALS KNOWN TO OCCUR OR POTENTIALLY OCCUR AT MOSES LAKE WELLFIELD SUPERFUND SITE
MOSES LAKE, WASHINGTON

Common Name	Scientific Name	Habitats in core zones	Habitats in peripheral zones	Township/Range with a record	State Status	Federal Status	Source
Badger	*Taxidea taxus*	X		X			1
Beaver	*Castor canadensis*	X		X			1
Big Brown Bat	*Eptesicus fuscus*	X		X	P		1,4
Black-tailed Jack Rabbit	*Lepus californicus*	X			C,P		1,3,4
Bobcat	*Lynx rufus*	X					1
Bushy-tailed Woodrat	*Neotoma cinerea*	X		X			1
California Myotis	*Myotis californicus*		X				1
Coyote	*Canis latrans*	X					1
Deer Mouse	*Peromyscus maniculatus*	X		X			1
Fringed Myotis	*Myotis thysanodes*	X					1
Great Basin Pocket Mouse	*Perognathus parvus*	X		X			1
Hoary Bat	*Lasiurus cinereus*	X		X			1
House Mouse	*Mus musculus*	X		X			1
Least Chipmunk	*Tamias minimus*	X					1
Little Brown Myotis	*Myotis lucifugus*		X				1
Long-eared Myotis	*Myotis evotis*	X					1
Long-legged Myotis	*Myotis volans*		X				1
Long-tailed Weasel	*Mustela frenata*	X		X			1
Meadow Vole	*Microtus pennsylvanicus*	X		X			1
Merriam's Shrew	*Sorex merriami*	X			C,P		1,3,4
Mink	*Mustela vison*		X		P		1,4
Montane Vole	*Microtus montanus*	X		X			1
Mule Deer	*Odocoileus hemionus*	X					1
Muskrat	*Ondatra zibethicus*	X		X			1
Northern Grasshopper Mouse	*Onychomys leucogaster*	X		X			1
Northern Pocket Gopher	*Thomomys talpoides*	X		X			1
Norway Rat	*Rattus norvegicus*	X					1
Nuttall's Cottontail	*Sylvilagus nuttallii*	X		X			1
Pallid Bat	*Antrozous pallidus*	X		X	P		1,4
Porcupine	*Erethizon dorsatum*	X					1
Raccoon	*Procyon lotor*	X					1
Sagebrush Vole	*Lemmiscus curtatus*	X					1
Silver-haired Bat	*Lasionycteris noctivagans*		X				1
Small-footed Myotis	*Myotis cilliolabrum*	X		X			1
Striped Skunk	*Mephitis mephitis*	X					1
Townsend's Big-eared Bat	*Plecotus townsendii*	X			C,P	SC	1,3,4
Vagrant Shrew	*Sorex vagrans*	X		X			1
Washington Ground Squirrel	*Spermophilus washingtoni*	X		X	C,P	C	1,3,4
Western Harvest Mouse	*Reithrodontomys megalotis*	X		X			1
White-tailed Deer	*Odocoileus virginianus*		X				1
White-tailed Jack Rabbit	*Lepus townsendii*		X		C		1,3
Yellow-bellied Marmot	*Marmota flaviventris*	X					1
Yuma Myotis	*Myotis ymanensis*	X		X		SC	1,3

State Status
E = Endangered
T = Threatened
S = Sensitive
C = Candidate
P= Priorities for conservation and management in some portion of species range

Federal Status
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T = Threatened
C = Candidate
SC = Species of Concern
PT = Proposed Threatened
PE = Proposed Endangered

Sources:
1 WAGAP 1998
2 WDFW 1999
3 WDFW, 2000a
4 WDFW, 2000c

TABLE 7.4
BIRDS KNOWN TO OCCUR OR POTENTIALLY OCCUR AT MOSES LAKE WELLFIELD SUPERFUND SITE

		Occurrence						
Common Name	**Scientific Name**	**Confirmed**	**Probable Breeding**	**Possible Breeding**	**Core Habitat only**	**State Status**	**Federal Status**	**Source**
American Avocet	*Recurvivostra americana*	X						1,2
American Bittern	*Botaurus lentiginosus*		X					1,2
American Coot	*Cinclus mexicanus*	X						1,2
American Crow	*Corvus brachyrhynchos*			X				1
American Goldfinch	*Carduelis tristis*			X				1,2
American Kestrel	*Setophaga ruticilla*	X						1,2
American Robin	*Turdus migratorius*	X						1,2
American Wigeon	*Anas americana*			X				1,2
American/Northwestern Crow	*Calypte anna*			X				2
Ash-throated Flycatcher	*Columba fasciata*			X				1,2
Bank Swallow	*Riparia riparia*	X						1,2
Barn Owl	*Tyto alba*	X						1,2
Barn Swallow	*Bucephala islandica*	X						1,2
Belted Kingfisher	*Ceryle alcyon*			X				1,2
Bewick`s Wren	*Cypseloides niger*			X				1,2
Black Tern	*Picoides arcticus*	X						1,2
Black-billed Magpie	*Archilochus alexandri*	X						1,2
Black-crowned Night-Heron	*Nycticorax nycticorax*	X				P		1,2,4
Black-headed Grosbeak	*Pheucticus melanocephalus*		X					1,2
Black-necked Stilt	*Dendragapus obscurus*	X						1,2
Blue-winged Teal	*Phalacrocorax penicillatu*	X						1,2
Brewer`s Blackbird	*Euphagus cyanocephalus*	X						1,2
Brewer`s Sparrow	*Certhia americana*		X					1,2
Brown-headed Cowbird	*Molothrus ater*	X						1,2
Bullock`s Oriole	*Icterus bullockii*	X						2
Burrowing Owl	*Psaltriparus minimus*	X				C,P	SC	1,2,3,4
California Gull	*Larus californicus*	X						1,2
California Quail	*Stellula calliope*	X						1,2
Canada Goose	*Branta canadensis*	X						1,2
Canvasback	*Aythya valisineria*	X						1,2
Canyon Wren	*Catherpes mexicanus*		X					1,2
Caspian Tern	*Sterna caspia*	X						1,2
Cedar Waxwing	*Spizella passerina*			X				1,2
Chukar	*Alectoris chukar*			X		P		1,2,4
Cinnamon Teal	*Anas cyanoptera*	X						1,2
Clark`s Grebe	*Nucifraga columbiana*	X						1,2
Cliff Swallow	*Gavia immer*	X						1,2
Common Merganser	*Uria aalge*			X				1,2
Common Nighthawk	*Phalaenoptilus nuttallii*		X					1,2
Common Raven	*Corvus corax*	X						1,2
Common Snipe	*Gallinago gallinago*		X					1,2
Common Yellowthroat	*Junco hyemalis*			X				2
Double-crested Cormorant	*Phalacrocorax auritus*	X						1,2
Downy Woodpecker	*Empidonax oberholseri*	X						1,2

TABLE 7.4
BIRDS KNOWN TO OCCUR OR POTENTIALLY OCCUR AT MOSES LAKE WELLFIELD SUPERFUND SITE

		Occurrence						
Common Name	**Scientific Name**	**Confirmed**	**Probable Breeding**	**Possible Breeding**	**Core Habitat only**	**State Status**	**Federal Status**	**Source**
Eared Grebe	*Podiceps nigricollis*			X				1,2
Eastern Kingbird	*Tyrannus tyrannus*	X						1,2
European Starling	*Coccothraustes vespertinu*	X						1,2
Ferruginous Hawk	*Oceanodroma furcata*			X		T,P	SC	2,3,4,
Forster`s Tern	*Passerella iliaca*	X						1,2
Gadwall	*Regulus satrapa*	X						1,2
Grasshopper Sparrow	*Leucosticte tephrocotis*		X					1,2
Great Blue Heron	*Ardea herodias*	X						1,2
Great Egret	*Strix nebulosa*	X						1,2
Great Horned Owl	*Pipilo chlorurus*	X						1,2
Green-winged Teal	*Lophodytes cucullatus*		X					1,2
Horned Lark	*Eremophila alpestris*			X				1,2
House Finch	*Carpodacus mexicanus*			X				1,2
House Sparrow	*Passer domesticus*	X						1,2
House Wren	*Vireo huttoni*			X				1,2
Killdeer	*Charadrius vociferus*	X						1,2
Lark Sparrow	*Chondestes grammacus*	X						1,2
Lazuli Bunting	*Carduelis psaltria*	X						1,2
Lesser Scaup	*Melospiza lincolnii*		X					1,2
Loggerhead Shrike	*Lanius ludovicianus*		X			C,P	SC	1,2,3,4
Long-billed Curlew	*Numenius americanus*	X						1,2
Long-eared Owl	*Oporornis tolmiei*	X						1,2
Mallard	*Brachyramphus marmoratus*	X						1,2
Marsh Wren	*Oreortyx pictus*	X						1,2
Mourning Dove	*Colinus virginianus*	X						1,2
Northern Flicker	*Accipiter gentilis*	X						2
Northern Harrier	*Circus cyaneus*	X						1,2
Northern Mockingbird	*Mimus polyglottos*	X						1
Northern Oriole	*Icterus galbula*	X						1
Northern Pintail	*Glaucidium gnoma*	X						1,2
Northern Rough-winged Swallow	*Falco peregrinus*	X						1,2
Northern Shoveler	*Anas clypeata*	X						1,2
Pied-billed Grebe	*Carduelis pinus*	X						1,2
Prairie Falcon	*Podiceps grisegena*			X		P		2,4
Red-breasted Sapsucker	*Sphyrapicus ruber*							1
Redhead	*Cerorhinca monocerata*	X						1,2
Red-tailed Hawk	*Buteo jamaicensis*	X						1,2
Red-winged Blackbird	*Agelaius phoeniceus*	X						1,2
Ring-billed Gull	*Larus delawarensis*	X						1,2
Ring-necked Duck	*Aythya collaris*		X					1,2
Ring-necked Pheasant	*Phasianus colchicus*	X				P		1,2,4
Rock Dove	*Columba livia*	X						1,2
Rock Wren	*Regulus calendula*	X						1,2
Ruddy Duck	*Centrocercus urophasianus*	X						1,2

TABLE 7.4
BIRDS KNOWN TO OCCUR OR POTENTIALLY OCCUR AT MOSES LAKE WELLFIELD SUPERFUND SITE

		Occurrence						
Common Name	**Scientific Name**	**Confirmed**	**Probable Breeding**	**Possible Breeding**	**Core Habitat only**	**State Status**	**Federal Status**	**Source**
Sage Sparrow	*Amphispiza belli*		X			C,P		1,2,4
Sage Thrasher	*Grus canadensis*		X			C,P		1,2,4
Savannah Sparrow	*Passerculus sandwichensis*		X					1,2
Say`s Phoebe	*Tympanuchus phasianellus*	X						1,2
Semipalmated Plover	*charadrius semipalmatus*							1
Short-eared Owl	*Vireo solitarius*	X						1,2
Song Sparrow	*Melospiza melodia*	X						1,2
Sora	*Strix occidentalis*		X					1,2
Spotted Sandpiper	*Cyanocitta stelleri*	X						1,2
Swainson`s Hawk	*Catharus fuscescens*	X						1,2
Vesper Sparrow	*Pooecetes gramineus*		X					1,2
Violet-green Swallow	*Tachycineta thalassina*		X					1,2
Virginia Rail	*Sialia mexicana*	X						1,2
Western Grebe	*Larus occidentalis*	X						1,2
Western Kingbird	*Tyrannus verticalis*	X						1,2
Western Meadowlark	*Empidonax traillii*	X						1,2
White-throated Swift	*Aeronautes saxatalis*				X			1
Wilson`s Phalarope	*Troglodytes troglodytes*			X				1,2
Wood Duck	*Aix sponsa*		X					1,2
Yellow Warbler	*Dendroica petechia*			X				1,2
Yellow-breasted Chat	*Icteria virens*		X					1,2
Yellow-headed Blackbird	*Dendroica coronata*	X						1,2

State Status
E = Endangered
T = Threatened
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P = Priorities for conservation and management in some portion of species range

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Sources:
1 WAGAP. 1998
2 WDFW. 1999
3 WDFW, 2000a
4. WDFW, 2000c

TABLE 7.5
REPTILES AND AMPHIBIANS KNOWN TO OCCUR OR POTENTIALLY OCCUR AT MOSES LAKE WELLFIELD SUPERFUND SITE

		Occurrence					
Common Name	**Scientific Name**	**Habitats in core zones**	**Habitats in peripheral zones**	**Township/Range with a record**	**State Status**	**Federal Status**	**Source**
Bullfrog	*Rana catesbeiana*	X					1,2
Columbia Spotted Frog	*Rana luteiventris*		X	X	C,P	SC	1,2,3,4
Common Garter Snake	*Thamnophis sirtalis*	X					1,2
Gopher Snake	*Pituophis catenifer*	X		X			1,2
Great Basin Spadefoot	*Scaphiopus intermontanus*	X		X			2
Long-toed Salamander	*Ambystoma macrodactylum*		X	X			1,2
Night Snake	*Hypsiglena torquata*	X		X			1,2
Northern Leopard Frog	*Rana pipiens*	X		X	E,P		1,2,3,4
Pacific Treefrog	*Hyla regilla*	X		X			1,2
Painted Turtle	*Chrysemys picta*	X		X			1,2
Racer	*Coluber constrictor*	X		X			1,2
Rubber Boa	*Charina bottae*	X		X			1,2
Sagebrush Lizard	*Sceloporus graciosus*	X		X		SC	1,2,3
Short-horned Lizard	*Phrynosoma douglassii*	X		X			1,2
Side-blotched Lizard	*Uta stansburiana*	X		X			1,2
Spadefoot toad	*Pelodytidae*	X		X			1
Striped Whipsnake	*Masticophis taeniatus*	X			C,P		1,2,3,4
Tiger Salamander	*Ambystoma tigrinum*	X		X			1,2
Western Rattlesnake	*Crotalus viridis*	X		X			1,2
Western Skink	*Eumeces skiltonianus*	X					1,2
Western Terrestrial Garter Snake	*Thamnophis elegans*	X					1,2

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Federal Status
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Sources:
1 WAGAP. 1998
2 WDFW. 1999
3 WDFW, 2000a
4 WDFW, 2000c

Table 7.6
Selection of Ecological Benchmark Criteria
Soils
Moses Lake Wellfield Superfund Site

Constituent	MTCA-Method A Soil Cleanup Levels Plants[a] (mg/kg)	MTCA-Method A Soil Cleanup Levels Soil Biota[b] (mg/kg)	MTCA-Method A Soil Cleanup Levels Wildlife[c] (mg/kg)	Selected Soil Benchmark Criteria[d] (mg/kg)	Soil COPEC Screening Level[e] (mg/kg)
Metals					
Antimony	5	na	na	5	0.5
Arsenic	na	na	7	7	0.7
Barium	500	na	102	102	10.2
Beryllium	10	na	na	10	1
Cadmium	4	20	14	4	0.4
Chromium	42	42	67	42	4.2
Copper	100	50	217	50	5
Lead	50	500	118	50	5
Manganese	1100	na	1500	1100	110
Mercury	0.3	0.1	5.5	0.1	0.01
Nickel	30	200	980	30	3
Selenium	1	70	0.3	0.3	0.03
Silver	2	na	na	2	0.2
Thallium	1	na	na	1	0.1
Zinc	86	200	360	86	8.6
VOCs					
Toluene	200	na	na	200	20
Trichloroethene	na	na	na	na	na
SVOCs					
Bis-(2-ethylhexyl)phthalate	na	na	na	na	na
2,4-Dimethylphenol	na	na	na	na	na
Pentachlorophenol	3	6	4.5	3	0.3

Table 7.6
Selection of Ecological Benchmark Criteria
Soils
Moses Lake Wellfield Superfund Site

Constituent	MTCA-Method A Soil Cleanup Levels Plants[a] (mg/kg)	MTCA-Method A Soil Cleanup Levels Soil Biota[b] (mg/kg)	MTCA-Method A Soil Cleanup Levels Wildlife[c] (mg/kg)	Selected Soil Benchmark Criteria[d] (mg/kg)	Soil COPEC Screening Level[e] (mg/kg)
PAHs					
Benzo(a)anthracene	na	na	na	na	na
Benzo(a)pyrene	na	na	12	12	1.2
Benzo(b)flouranthene	na	na	na	na	na
Benzo(ghi)perylene	na	na	na	na	na
Benzo(k)fluoranthene	na	na	na	na	na
Chrysene	na	na	na	na	na
Dibenzo(ah)anthracene	na	na	na	na	na
Fluoranthene	na	na	na	na	na
Indeno(123-cd)pyrene	na	na	na	na	na
Pyrene	na	na	na	na	na
PCBs					
PCB1016	na	na	na	na	na
PCB1221	na	na	na	na	na
PCB1232	na	na	na	na	na
PCB1242	na	na	na	na	na
PCB1248	na	na	na	na	na
PCB1254	na	na	na	na	na
PCB1260	na	na	na	na	na
PCB Mixtures (Total)[f]	40	na	0.65	0.65	0.065
TPHs					
Diesel Range Organics	na	200	6000	200	20
Gasoline Range Organics	na	100	5000	100	10
Residual Range Organics	na	na	na	na	na
Total Petroleum Hydrocarbons	na	na	na	na	na

Table 7.6
Selection of Ecological Benchmark Criteria
Soils
Moses Lake Wellfield Superfund Site

Constituent	MTCA-Method A Soil Cleanup Levels Plants[a] (mg/kg)	MTCA-Method A Soil Cleanup Levels Soil Biota[b] (mg/kg)	MTCA-Method A Soil Cleanup Levels Wildlife[c] (mg/kg)	Selected Soil Benchmark Criteria[d] (mg/kg)	Soil COPEC Screening Level[e] (mg/kg)

Notes:

[a]Source: Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1997 Revision, Oak Ridge National Laboratory, 1997.

[b]Source: Toxicological Benchmarks for Potential Contaminants of Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process, Oak Ridge National Laboratory, 1997.

[c]Derived from calculated exposure models provided in Tables 749-4 and 749-5 from Washington State Department of Ecology Chapter 173-340 WAC.

[d]Selected Soil Benchmark Criteria is based upon the lowest value from the plant, soil biota, and wildlife criterion.

[e]Soil Screening level is equal to one-tenth the selected soil benchmark criteria to account for potential cumulative effects, consistent with the USEPA Region 10 risk assessment guidance.

[f]Criterion for PCB Mixtures (Total) assumed as the Soil COPEC Screening Level for ecological soil screening, since criterion for specific PCB constituents are not available.

COPEC-Chemical of Potential Ecological Concern

mg/kg-Milligrams per kilogram

Table 7.7
Ecological COPEC Screening Summary-Soils
Sites 6a and 6b (Base Closure Landfill)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/kg)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/kg)	Soil COPEC Screening Level[a] (mg/kg)	COPEC (Yes/No?)
Metals							
Antimony	19	8	1	13%	na	0.50	Yes
Arsenic	94	8	8	100%	5.4[b]	0.70	Yes
Beryllium	0.28	8	4	50%	na	1.0	No
Cadmium	5.4	8	8	100%	na	0.40	Yes
Chromium	280	8	8	100%	na	4.2	Yes
Copper	2400	8	8	100%	na	5.0	Yes
Lead	1900	8	8	100%	na	5.0	Yes
Mercury	1.3	8	2	25%	na	0.010	Yes
Nickel	9900	8	8	100%	na	3.0	Yes
Silver	0.76	8	1	13%	na	0.20	Yes
Thallium	0.60	8	1	13%	na	0.10	Yes
Zinc	1800	8	8	100%	na	8.6	Yes

Notes:

[a]Soil screening level is equal to one-tenth the MTCA Method A Soil Cleanup Level for Plants, Soil Biota, and Wildlife (173-340-740 WAC).

[b]Refer to Section 6.2.2.4.1 for derivation of a background upper tolerance limit (BUTL) for arsenic.

COPEC-Chemical of potential ecological concern

mg/kg-Milligrams per kilogram

na-Not available

Table 7.8
Ecological COPEC Screening Summary-Soils
Site 8 (Randolph Road Base Dump)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/kg)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/kg)	Soil COPEC Screening Level[a] (mg/kg)	COPEC (Yes/No?)
Metals							
Arsenic	2.1	8	6	75%	5.4[b]	0.70	No
Beryllium	0.36	8	8	100%	na	1.0	No
Cadmium	0.73	8	5	63%	na	0.40	Yes
Chromium	10	8	8	100%	na	4.2	Yes
Copper	22	8	8	100%	na	5.0	Yes
Lead	450	8	8	100%	na	5.0	Yes
Mercury	0.94	8	3	38%	na	0.010	Yes
Nickel	14	8	8	100%	na	3.0	Yes
Thallium	0.30	8	3	38%	na	0.10	Yes
Zinc	550	8	8	100%	na	8.6	Yes

Notes:

[a]Soil screening level is equal to one-tenth the MTCA Method A Soil Cleanup Level for Plants, Soil Biota, and Wildlife (173-340-740 WAC).

[b]Refer to Section 6.2.2.4.1 for derivation of a background upper tolerance limit (BUTL) for arsenic.

COPEC-Chemical of potential ecological concern
mg/kg-Milligrams per kilogram
na-Not available

Table 7.9
Ecological COPEC Screening Summary-Soils
Site 11 (Fire Training Area - Burn Pit B)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/kg)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/kg)	Soil COPEC Screening Level[a] (mg/kg)	COPEC (Yes/No?)
PAHs [b]							
Benzo(a)anthracene	0.068	3	2	67%	na	1.2	No
Benzo(a)pyrene	0.063	3	2	67%	na	1.2	No
Benzo(b)fluoranthene	0.072	3	2	67%	na	1.2	No
Benzo(ghi)perylene	0.068	3	2	67%	na	1.2	No
Benzo(k)fluoranthene	0.077	3	2	67%	na	1.2	No
Chrysene	0.099	3	2	67%	na	1.2	No
Dibenz(ah)anthracene	0.075	3	2	67%	na	1.2	No
Fluoranthene	0.063	3	2	67%	na	1.2	No
Indeno(123-cd)pyrene	0.070	3	2	67%	na	1.2	No
Pyrene	0.10	3	2	67%	na	1.2	No
TPH							
Diesel-Dx	1600	3	3	100%	na	20	Yes
Oilm-Dx	14000	3	3	100%	na	na	Yes

Notes:

[a]Soil screening level is equal to one-tenth the MTCA Method A Soil Cleanup Level for Plants, Soil Biota, and Wildlife (173-340-740 WAC).

[b]Ecological benchmark is based on the use of benzo(a)pyrene as a surrogate.

COPEC-Chemical of potential ecological concern

mg/kg-Milligrams per kilogram

na-Not available

Table 7.10
Ecological COPEC Screening Summary-Soils
Site 15 (8-Place Hangar Ditch)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/kg)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/kg)	Soil COPEC Screening Level[a] (mg/kg)	COPEC (Yes/No?)
Metals							
Arsenic	5.1	4	4	100%	5.4[b]	0.70	No
Beryllium	0.30	4	3	75%	na	1.0	No
Cadmium	4.6	4	4	100%	na	0.40	Yes
Chromium	53	4	4	100%	na	4.2	Yes
Copper	55	4	4	100%	na	5.0	Yes
Lead	49	4	4	100%	na	5.0	Yes
Mercury	0.27	4	2	50%	na	0.010	Yes
Nickel	23	4	4	100%	na	3.0	Yes
Zinc	286	4	4	100%	na	8.6	Yes

Notes:

[a]Soil screening level is equal to one-tenth the MTCA Method A Soil Cleanup Level for Plants, Soil Biota, and Wildlife (173-340-740 WAC).

[b]Refer to Section 6.2.2.4.1 for derivation of a background upper tolerance limit (BUTL) for arsenic.

COPEC-Chemical of potential ecological concern
mg/kg-Milligrams per kilogram
na-Not available

Table 7.11
Ecological COPEC Screening Summary-Soils
Site 17 (3-Place Hangar-Bldg 5801)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/kg)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/kg)	Soil COPEC Screening Level[a] (mg/kg)	COPEC (Yes/No?)
Metals							
Arsenic	5.6	4	4	100%	5.4[b]	0.70	Yes
Beryllium	0.47	4	4	100%	na	1.0	No
Cadmium	4.9	4	2	50%	na	0.40	Yes
Chromium	31	4	4	100%	na	4.2	Yes
Copper	35	4	4	100%	na	5.0	Yes
Lead	290	4	4	100%	na	5.0	Yes
Mercury	0.28	4	1	25%	na	0.010	Yes
Nickel	14	4	4	100%	na	3.0	Yes
Silver	0.56	4	4	100%	na	0.20	Yes
Thallium	0.44	4	4	100%	na	0.10	Yes
Zinc	510	4	4	100%	na	8.6	Yes
PAHs [c]							
Benzo(a)anthracene	2.0	1	1	100%	na	1.2	Yes
Benzo(a)pyrene	2.5	1	1	100%	na	1.2	Yes
Benzo(b)fluoranthene	2.2	1	1	100%	na	1.2	Yes
Benzo(ghi)perylene	2.1	1	1	100%	na	1.2	Yes
Benzo(k)fluoranthene	2.2	1	1	100%	na	1.2	Yes
Chrysene	2.2	1	1	100%	na	1.2	Yes
Fluoranthene	3.9	1	1	100%	na	1.2	Yes
Indeno(123-cd)pyrene	2.0	1	1	100%	na	1.2	Yes
Pyrene	3.4	1	1	100%	na	1.2	Yes
PCBs[d]							
PCB 1254	0.31	4	2	50%	na	0.065	Yes

Table 7.11
Ecological COPEC Screening Summary-Soils
Site 17 (3-Place Hangar-Bldg 5801)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/kg)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/kg)	Soil COPEC Screening Level[a] (mg/kg)	COPEC (Yes/No?)
PCB 1260	0.26	4	2	50%	na	0.065	Yes
TPHs							
Diesel-Dx	260	1	1	100%	na	20	Yes
Oilm-Dx	440	1	1	100%	na	na	Yes

Notes:

[a]Soil screening level is equal to one-tenth the MTCA Method A Soil Cleanup Level for Plants, Soil Biota, and Wildlife (173-340-740 WAC).

[b]Refer to Section 6.2.2.4.1 for derivation of a background upper tolerance limit (BUTL) for arsenic.

[c]Ecological benchmark is based on the use of benzo(a)pyrene as a surrogate.

[d]PCB criterion is based upon PCB Mixture (Total), Table 749-3 from Washington State Department of Ecology, Chapter 173-340 WAC.

COPEC-Chemical of potential ecological concern
mg/kg-Milligrams per kilogram
na-Not available

Table 7.12
Ecological COPEC Screening Summary-Soils
Site 19 (Liquid Oxygen Generating Plant-Bldg 5102)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/kg)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/kg)	Soil COPEC Screening Level[a] (mg/kg)	COPEC (Yes/No?)
Metals							
Arsenic	0.92	8	8	100%	5.4[b]	0.70	No
Beryllium	0.27	8	1	13%	na	1.0	No
Cadmium	0.67	8	3	38%	na	0.40	Yes
Chromium	4.7	8	8	100%	na	4.2	Yes
Copper	29	8	8	100%	na	5.0	Yes
Lead	5.6	8	8	100%	na	5.0	Yes
Manganese	380	8	8	100%	na	110	Yes
Nickel	8.1	8	8	100%	na	3.0	Yes
Zinc	69	8	8	100%	na	8.6	Yes
VOCs							
Toluene	0.040	8	1	13%	na	20	No
Trichloroethene	0.082	8	2	25%	na	na	Yes
SVOCs							
Bis-(2-ethylhexyl)phthalate (	2.5	8	1	13%	na	na	Yes
2,4-Dimethylphenol	1.3	8	2	25%	na	na	Yes

Table 7.12
Ecological COPEC Screening Summary-Soils
Site 19 (Liquid Oxygen Generating Plant-Bldg 5102)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/kg)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/kg)	Soil COPEC Screening Level[a] (mg/kg)	COPEC (Yes/No?)
PAHs							
Benzo(a)anthracene	0.013	6	4	67%	na	1.2	No
Benzo(a)pyrene	0.0086	6	1	17%	na	1.2	No
Benzo(b)fluoranthene	0.012	6	2	33%	na	1.2	No
Benzo(ghi)perylene	0.011	6	2	33%	na	1.2	No
Benzo(k)fluoranthene	0.0074	6	1	17%	na	1.2	No
Chrysene	0.012	6	3	50%	na	1.2	No
Fluoranthene	0.018	6	4	67%	na	1.2	No
Indeno(123-cd)pyrene	0.011	6	3	50%	na	1.2	No
Pyrene	0.019	6	4	67%	na	1.2	No
TPH							
Diesel-Dx	150	6	4	67%	na	20	Yes
Oilm-Dx	890	6	6	100%	na	na	Yes

Notes:

[a]Soil screening level is equal to one-tenth the MTCA Method A Soil Cleanup Level for Plants, Soil Biota, and Wildlife (173-340-740 WAC).

[b]Refer to Section 6.2.2.4.1 for derivation of a background upper tolerance limit (BUTL) for arsenic.

[c]Ecological benchmark is based on the use of benzo(a)pyrene as a surrogate.

COPEC-Chemical of potential ecological concern

Table 7.13
Ecological COPEC Screening Summary-Soils
Site 20 (South Base Dump)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/kg)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/kg)	Soil COPEC Screening Level[a] (mg/kg)	COPEC (Yes/No?)
Metals							
Arsenic	1.9	8	8	100%	5.4[b]	0.70	No
Beryllium	0.39	8	8	100%	na	1.0	No
Cadmium	16	8	7	88%	na	0.40	Yes
Chromium	67	8	8	100%	na	4.2	Yes
Copper	70	8	8	100%	na	5.0	Yes
Lead	5700	8	8	100%	na	5.0	Yes
Mercury	0.17	8	2	25%	na	0.010	Yes
Nickel	15	8	8	100%	na	3.0	Yes
Silver	6.3	8	5	63%	na	0.20	Yes
Zinc	330	8	8	100%	na	8.6	Yes

Notes:

[a]Soil screening level is equal to one-tenth the MTCA Method A Soil Cleanup Level for Plants, Soil Biota, and Wildlife (173-340-740 WAC).

[b]Refer to Section 6.2.2.4.1 for derivation of a background upper tolerance limit (BUTL) for arsenic.

COPEC-Chemical of potential ecological concern

mg/kg-Milligrams per kilogram

na-Not available

Table 7.14
Ecological COPEC Screening Summary-Soils
Site 22 (Paint Hangar Leach Pit)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/kg)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/kg)	Soil COPEC Screening Level[a] (mg/kg)	COPEC (Yes/No?)
Metals							
Arsenic	3.8	3	3	100%	5.4[b]	0.70	No
Cadmium	16	3	3	100%	na	0.40	Yes
Chromium	425	3	3	100%	na	4.2	Yes
Copper	120	3	3	100%	na	5.0	Yes
Lead	1200	3	3	100%	na	5.0	Yes
Mercury	0.92	3	2	67%	na	0.010	Yes
Nickel	27	3	3	100%	na	3.0	Yes
Zinc	680	3	3	100%	na	8.6	Yes
PAHs							
Benzo(a)anthracene	0.13	1	1	100%	na	1.2	No
Benzo(a)pyrene	0.29	1	1	100%	na	1.2	No
Benzo(b)fluoranthene	0.48	1	1	100%	na	1.2	No
Benzo(ghi)perylene	0.42	1	1	100%	na	1.2	No
Benzo(k)fluoranthene	0.43	1	1	100%	na	1.2	No
Chrysene	0.28	1	1	100%	na	1.2	No
Dibenz(ah)anthracene	0.10	1	1	100%	na	1.2	No
Fluoranthene	0.21	1	1	100%	na	1.2	No
Indeno(123-cd)pyrene	0.5	1	1	100%	na	1.2	No
Pyrene	0.31	1	1	100%	na	1.2	No

Table 7.14
Ecological COPEC Screening Summary-Soils
Site 22 (Paint Hangar Leach Pit)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/kg)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/kg)	Soil COPEC Screening Level[a] (mg/kg)	COPEC (Yes/No?)
PCBs							
PCB 1254	8.1	3	3	100%	na	0.065	Yes
PCB 1260	0.0063	3	1	33%	na	0.065	No
TPH							
Gro-Gx	150	1	1	100%	na	10	Yes
Diesel-Dx	320	3	3	100%	na	20	Yes
Oilm-Dx	190	3	3	100%	na	na	Yes

Notes:

[a]Soil screening level is equal to one-tenth the MTCA Method A Soil Cleanup Level for Plants, Soil Biota, and Wildlife (173-340-740 WAC).

[b]Refer to Section 6.2.2.4.1 for derivation of a background upper tolerance limit (BUTL) for arsenic.

[c]Ecological benchmark is based on the use of benzo(a)pyrene as a surrogate.

[d]PCB criterion is based upon PCB Mixture (Total), Table 749-3 from Washington State Department of Ecology, Chapter 173-340 WAC.

COPEC-Chemical of potential ecological concern
mg/kg-Milligrams per kilogram
na-Not available

Table 7.15
Ecological COPEC Screening Summary-Soils
Site 31 (19th Avenue Base Dump)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/kg)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/kg)	Soil COPEC Screening Level[a] (mg/kg)	COPEC (Yes/No?)
Metals							
Arsenic	2.3	8	8	100%	5.4[b]	0.70	No
Beryllium	0.35	8	6	75%	na	1.0	No
Cadmium	6.3	8	7	88%	na	0.40	Yes
Chromium	210	8	8	100%	na	4.2	Yes
Copper	46	8	8	100%	na	5.0	Yes
Lead	670	8	8	100%	na	5.0	Yes
Mercury	0.21	8	1	13%	na	0.010	Yes
Nickel	23	8	8	100%	na	3.0	Yes
Silver	1.9	8	2	25%	na	0.20	Yes
Zinc	960	8	8	100%	na	8.6	Yes

Notes:

[a]Soil screening level is equal to one-tenth the MTCA Method A Soil Cleanup Level for Plants, Soil Biota, and Wildlife (173-340-740 WAC).

[b]Refer to Section 6.2.2.4.1 for derivation of a background upper tolerance limit (BUTL) for arsenic.

COPEC-Chemical of potential ecological concern

mg/kg-Milligrams per kilogram

na-Not available

Table 7.16
Ecological COPEC Screening Summary-Soils
Site 33 (End of Runway 32 Dump)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/kg)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/kg)	Soil COPEC Screening Level[a] (mg/kg)	COPEC (Yes/No?)
Metals							
Barium	67	1	1	100%	na	10.2	Yes
Chromium	4.0	1	1	100%	na	4.2	No
Lead	16	1	1	100%	na	5.0	Yes
SVOCs							
Pentachlorophenol	6.4	1	1	100%	na	0.30	Yes
TPH							
TPH-Dx[b]	1300	9	8	89%	na	na	Yes

Notes:

[a]Soil screening level is equal to one-tenth the MTCA Method A Soil Cleanup Level for Plants, Soil Biota, and Wildlife (173-340-740 WAC).

[b]Analyte range was extended to include motor oil range compounds; modified method 8015.

COPEC-Chemical of potential ecological concern

mg/kg-Milligrams per kilogram

na-Not available

Table 7.17
Ecological COPEC Screening Summary-Soils
Site 35 (Stained Soil)
Moses Lake Wellfield Superfund Site
Detected Compounds Only

Constituent	Maximum Concentration (mg/kg)	Number of Samples	Number of Detections	Detection Frequency	Background Concentration (mg/kg)	Soil COPEC Screening Level[a] (mg/kg)	COPEC (Yes/No?)
Metals							
Arsenic	1.9	3	3	100%	5.4[b]	0.70	No
Beryllium	0.29	3	1	33%	na	1.0	No
Cadmium	3.3	3	2	67%	na	0.40	Yes
Chromium	38	3	3	100%	na	4.2	Yes
Copper	69	3	3	100%	na	5.0	Yes
Lead	210	3	3	100%	na	5.0	Yes
Nickel	14	3	3	100%	na	3.0	Yes
Zinc	250	3	3	100%	na	8.6	Yes
PAHs							
Benzo(b)fluoranthene	0.069	1	1	100%	na	1.2	No
Fluoranthene	0.055	1	1	100%	na	1.2	No
Pyrene	0.13	1	1	100%	na	1.2	No
TPH							
Gro-Gx	110	2	1	50%	na	10	Yes
Diesel-Dx	16000	3	3	100%	na	20	Yes
Oilm-Dx	31500	3	3	100%	na	na	Yes

Notes:

[a]Soil screening level is equal to one-tenth the MTCA Method A Soil Cleanup Level for Plants, Soil Biota, and Wildlife (173-340-740 WAC).

[b]Refer to Section 6.2.2.4.1 for derivation of a background upper tolerance limit (BUTL) for arsenic.

[c]Ecological benchmark is based on the use of benzo(a)pyrene as a surrogate.

COPEC-Chemical of potential ecological concern

mg/kg-Milligrams per kilogram

na-Not available

Table 7.18

Ecological Soil COPEC Exposure Point Concentrations
Moses Lake Wellfield

Location/Constituent	Maximum Concentration (mg/kg)	95% UCL Concentration (mg/kg)	Exposure Point Concentration (mg/kg)
Sites 6a and 6b (Base Closure Landfill)			
Metals			
Antimony	19	na	19
Arsenic	94	121	94
Cadmium	5.4	19	5.4
Chromium	280	299	280
Copper	2400	4730	2400
Lead	1900	3454	1900
Mercury	1.3	5.6	1.3
Nickel	9900	415323	9900
Silver	0.76	2.3	0.76
Thallium	0.60	0.37	0.37
Zinc	1800	3677	1800
Site 8 (Randolph Road Base Dump)			
Metals			
Cadmium	0.73	0.50	0.50
Chromium	10	9.4	9.4
Copper	22	21	21
Lead	450	7404	450
Mercury	0.94	0.56	0.56
Nickel	14	12	12
Thallium	0.30	0.23	0.23
Zinc	550	270	270
Site 11 (Fire Training Area - Burn Pit B)			
TPH			
Diesel-Dx	1600	na	1600
Oilm-Dx	14000	na	14000
Site 15 (8-Place Hangar Ditch)			
Metals			
Cadmium	4.6	na	4.6
Chromium	53	na	53
Copper	55	na	55
Lead	49	na	49
Mercury	0.27	na	0.27
Nickel	23	na	23
Zinc	286	na	286
Site 17 (3-Place Hangar-Bldg 5801)			

Table 7.18

Ecological Soil COPEC Exposure Point Concentrations
Moses Lake Wellfield

Location/Constituent	Maximum Concentration (mg/kg)	95% UCL Concentration (mg/kg)	Exposure Point Concentration (mg/kg)
Metals			
Arsenic	5.6	na	5.6
Cadmium	4.9	na	4.9
Chromium	31	na	31
Copper	35	na	35
Lead	290	na	290
Mercury	0.28	na	0.28
Nickel	14	na	14
Silver	0.56	na	0.56
Thallium	0.44	na	0.44
Zinc	510	na	510
PAHs			
Benzo(a)anthracene	2.0	na	2.0
Benzo(a)pyrene	2.5	na	2.5
Benzo(b)fluoranthene	2.2	na	2.2
Benzo(ghi)perylene	2.1	na	2.1
Benzo(k)fluoranthene	2.2	na	2.2
Chrysene	2.2	na	2.2
Fluoranthene	3.9	na	3.9
Indeno(123-cd)pyrene	2.0	na	2.0
Pyrene	3.4	na	3.4
PCBs			
PCB 1254	0.31	na	0.31
PCB 1260	0.26	na	0.26
TPHs			
Diesel-Dx	260	na	260
Oilm-Dx	440	na	440
Site 19 (Liquid Oxygen Generating Plant-Bldg 5102)			
Metals			
Cadmium	0.67	0.44	0.44
Chromium	4.7	4.1	4.1
Copper	29	25	25
Lead	5.6	4.3	4.3
Manganese	380	357	357
Nickel	8.05	7.4	7.4
Zinc	69	60	60
VOCs			

Table 7.18

Ecological Soil COPEC Exposure Point Concentrations
Moses Lake Wellfield

Location/Constituent	Maximum Concentration (mg/kg)	95% UCL Concentration (mg/kg)	Exposure Point Concentration (mg/kg)
Trichloroethene	0.082	0.056	0.056
SVOCs			
Bis-(2-ethylhexyl)phthala	2.5	1.2	1.2
2,4-Dimethylphenol	1.3	0.86	0.86
TPH			
Diesel-Dx	150	1772	150
Oilm-Dx	890	1078	890
Site 20 (South Base Dump)			
Metals			
Cadmium	16	21	16
Chromium	67	33	33
Copper	70	48	48
Lead	5700	107568	5700
Mercury	0.17	0.11	0.11
Nickel	15	12	12
Silver	6.3	10	6.3
Zinc	330	176	176
Site 22 (Paint Hangar Leach Pit)			
Metals			
Cadmium	16	na	16
Chromium	425	na	425
Copper	120	na	120
Lead	1200	na	1200
Mercury	0.92	na	0.92
Nickel	27	na	27
Zinc	680	na	680
PCBs			
PCB 1254	8.1	na	8.1
TPH			
Gro-Gx	150	na	150
Diesel-Dx	320	na	320
Oilm-Dx	190	na	190
Site 31 (19th Avenue Base Dump)			
Metals			
Cadmium	6.25	10	6.3

Table 7.18

Ecological Soil COPEC Exposure Point Concentrations
Moses Lake Wellfield

Location/Constituent	Maximum Concentration (mg/kg)	95% UCL Concentration (mg/kg)	Exposure Point Concentration (mg/kg)
Chromium	210	316	210
Copper	46	39	39
Lead	670	493	493
Mercury	0.205	0.11	0.11
Nickel	22.5	21	21
Silver	1.85	3813	1.9
Zinc	960	738	738
Site 33 (End of Runway 32 Dump)			
Metals			
Barium	67	na	67
Lead	16	na	16
SVOCs			
Pentachlorophenol	6.4	na	6.4
TPH			
TPH-Dxb	1300	3813	1300
Site 35 (Stained Soil)			
Metals			
Cadmium	3.3	na	3.3
Chromium	38	na	38
Copper	69	na	69
Lead	210	na	210
Nickel	14	na	14
Zinc	250	na	250
TPH			
Gro-Gx	110	na	110
Diesel-Dx	16000	na	16000
Oilm-Dx	31500	na	31500

Notes:

[a]Exposure point concentration represents the lesser value between maximum concentration and the 95% UCL concentration.
mg/kg-Milligrams per kilogram

TABLE 7.19

PHYSICAL/CHEMICAL DATA FOR ECOLOGICAL EXPOSURE DOSE CALCULATIONS
MOSES LAKE WELLFIELD SUPERFUND SITE

COPEC	Chemical Information					
	log (Kow)	Source	Kow	Source	Koc	Source
Antimony (Sb)	na		na		na	
Aroclor1254	6.21	[a]	1.61E+06	[b]	9.83E+04	[b]
Aroclor1260	6.21	[b,c]	1.61E+06	[a]	9.83E+04	[c]
Arsenic (As)	na		na		na	
Benzo(a)anthracene	5.68	[a]	4.77E+05	[b]	2.60E+05	[b]
Benzo(a)pyrene	6.13	[a]	1.35E+06	[b]	9.69E+05	[b]
Benzo(b)fluoranthene	6.20	[a]	1.59E+06	[b]	8.36E+05	[b]
Benzo(ghi)perylene	6.70	[d]	5.01E+06	[a]	3.86E+06	[d]
Benzo(k)fluoranthene	6.19	[a]	1.56E+06	[b]	8.32E+05	[b]
Bis-(2-ethylhexyl)phthalate	5.30	[d]	2.00E+05	[a]	1.51E+07	[d]
Cadmium (Cd)	na		na		na	
Chromium (Cr)	na		na		na	
Chrysene	5.74	[a]	5.48E+05	[b]	2.97E+05	[b]
Copper (Cu)	na		na		na	
2,4-dimethylphenol	2.36	[a]	2.29E+02	[b]	pH vary	[b]
Fluoranthene	5.08	[a]	1.21E+05	[b]	4.91E+04	[b]
Indeno(123-cd)pyrene	6.91	[a]	8.22E+06	[b]	4.11E+06	[b]
Lead (Pb)	na		na		na	
Manganese (Mn)	na		na		na	
Mercury (Hg)	na		na		na	
Nickel (Ni)	na		na		na	
Pentachlorophenol	5.08	[a]	1.20E+05	[b]	pH vary	[b]
Pyrene	5.00	[a]	1.00E+05	[b]	6.80E+04	[b]
Silver (Ag)	na		na		na	
Thallium (Tl)	na		na		na	
Trichloroethene	2.43	[a]	2.71E+02	[b]	9.40E+01	
Zinc (Zn)	na		na		na	

Notes:

[a]Calculated from Log (Kow) or Kow

[b]USEPA, 1999

[c]Based on Arclor 1254

[d]RAIS, 2001

na - not applicable

TABLE 7.20

BIOACCUMULATION INFORMATION FOR ECOLOGICAL EXPOSURE DOSE CALCULATIONS
MOSES LAKE WELLFIELD SUPERFUND SITE

COPEC	FCM			$BMF_{TLx/TLy}$					
	FCM_{TL2}	FCM_{TL3}	FCM_{TL4}	$BMF_{TL4/TL3}$	Source	$BMF_{TL4/TL2}$	Source	$BMF_{TL3/TL2}$	Source
				kg plant tissue/kg tissue		kg plant tissue/kg tissue		kg plant tissue/kg tissue	
Antimony (Sb)	1	1	1	1.00E+00	a	1.00E+00	a	1.00E+00	a
Aroclor1254	1	12	20	1.67E+00	a	2.00E+01	a	1.20E+01	a
Aroclor1260	1	12	20	1.67E+00	a	2.00E+01	a	1.20E+01	a
Arsenic (As)	1	1	1	1.00E+00	a	1.00E+00	a	1.00E+00	a
Benzo(a)anthracene	1	8	10	1.25E+00	a	1.00E+01	a	8.00E+00	a
Benzo(a)pyrene	1	11	18	1.64E+00	a	1.80E+01	a	1.10E+01	a
Benzo(b)fluoranthene	1	12	20	1.67E+00	a	2.00E+01	a	1.20E+01	a
Benzo(ghi)perylene	1	14	26	1.86E+00	a	2.60E+01	a	1.40E+01	a
Benzo(k)fluoranthene	1	12	20	1.67E+00	a	2.00E+01	a	1.20E+01	a
Bis-(2-ethylhexyl)phthalate	1	4.8	4.7	9.79E-01	a	4.70E+00	a	4.80E+00	a
Cadmium (Cd)	1	1	1	1.00E+00	a	1.00E+00	a	1.00E+00	a
Chromium (Cr)	1	1	1	1.00E+00	a	1.00E+00	a	1.00E+00	a
Chrysene	1	8	10	1.25E+00	a	1.00E+01	a	8.00E+00	a
Copper (Cu)	1	1	1	1.00E+00	a	1.00E+00	a	1.00E+00	a
2,4-dimethylphenol	1	1	1	1.00E+00	a	1.00E+00	a	1.00E+00	a
Fluoranthene	1	3.6	3.2	8.89E-01	a	3.20E+00	a	3.60E+00	a
Indeno(123-cd)pyrene	1	14	27	1.93E+00	a	2.70E+01	a	1.40E+01	a
Lead (Pb)	1	1	1	1.00E+00	a	1.00E+00	a	1.00E+00	a
Manganese (Mn)	1	1	1	1.00E+00	a	1.00E+00	a	1.00E+00	a
Mercury (Hg)	1	1	1	1.00E+00	a	1.00E+00	a	1.00E+00	a
Nickel (Ni)	1	1	1	1.00E+00	a	1.00E+00	a	1.00E+00	a
Pentachlorophenol	1	3.6	3.2	8.89E-01	a	3.20E+00	a	3.60E+00	a
Pyrene	1	3.2	2.6	8.13E-01	a	2.60E+00	a	3.20E+00	a
Silver (Ag)	1	1	1	1.00E+00	a	1.00E+00	a	1.00E+00	a
Thallium (Tl)	1	1	1	1.00E+00	a	1.00E+00	a	1.00E+00	a
Trichloroethene	1	1	1	1.00E+00	a	1.00E+00	a	1.00E+00	a
Zinc (Zn)	1	1	1	1.00E+00	a	1.00E+00	a	1.00E+00	a

Notes:
Source USEPA, 1999
a Calculated using equations for C_{CARN} #4

TABLE 7.21

EQUATIONS FOR ESTIMATING COPEC CONCENTRATIONS IN INDICATOR RECEPTORS MOSES LAKE WELLFIELD SUPERFUND SITE

Equations for C_{PLANTS}

1 $C_{PLANTS} = 0.12 * Pr$

2 $Pr = C_{SOIL} * BCF_{S-P}$

3 BCF_{S-P} = for organics = 10^(1.588-0.578 * log Kow)
for metals = from EPA (1999)

Equations for C_{TI}

1 $C_{TI} = C_{SOIL} * BCF_{S-TI}$

Where literature values for BCF_{S-TI} were not available in EPA (1999), BCFs for organic COPCs were estimated from the water to aquatic invertebrate BCF using the equilibrium partitioning method. See below.

2 $C_{TI} = C_{IW} * BCF_{IW-I}$

3 $C_{IW} = \frac{C_{SOIL}}{f_{oc} * K_{oc}}$

4 $BCF_{S-TI} = \frac{BCF_{IW-I}}{f_{oc} * K_{oc}}$

5 $BCF_{IW-I} = 10 \wedge (0.819 * \log K_{OW} - 1.146)$

Equations for C_{HERB}

1 $C_{HERB} = C_{PLANT} * BCF_{TL2/TL1} + C_{SOIL/SED} * BCF_{S-H}$

2 BCF_{M-W} = a) Inorganics = Taken from Baes et al.
b) Organics = Ba * IR

3 Ba
Mammal = 10 ^ (-7.6 + log Kow)
Bird = 0.8 * 10 ^ (-7.6 + log Kow)

Equations for C_{OMN}

1 $C_{OMN} = \frac{BMF_{TL3/TL2} * ? C_{TL2,i} + BCF_{TL3/TL1} * ? C_{TL1,i}}{F} + BCF_{S-O} * C_{SOIL/SED}$

2 BCF_{M-W} = a) Inorganics = Taken from Baes et al.
b) Organics = Ba * IR

3 Ba
Mammal = 10 ^ (-7.6 + log Kow)
Bird = 0.8 * 10 ^ (-7.6 + log Kow)

4 $BMF_{TL3/TL2} = FCM_{TL3} / FCM_{TL2}$

Equations for C_{CARN}

1 $C_{CARN} = \frac{BMF_{TL4/TL3} * ? C_{TL3,i} + BMF_{TL4/TL2} * ? C_{TL2,i}}{F} + BCF_{S-C} * C_{SOIL/SED}$

2 BCF_{M-W} = a) Inorganics = Taken from Baes et al.
b) Organics = Ba * IR

3 Ba
Mammal = 10 ^ (-7.6 + log Kow)
Bird = 0.8 * 10 ^ (-7.6 + log Kow)

4 $BMF_{TLx/TLy} = FCM_{TLx} / FCM_{TLy}$

TABLE 7.22

EXPOSURE PARAMETERS FOR ECOLOGICAL INDICATOR RECEPTORS
MOSES LAKE WELLFIELD SUPERFUND SITE

	Exposure Value				
Exposure Parameter	**Washington Ground Squirrel** *Spermophilus washingtoni*	**Great Basin Pocket Mouse** *Perognathus parvus*	**Sage Sparrow** *Amphispiza belli*	**Ferruginous Hawk** *Oceanodroma furcata*	**Coyote** *Canis latrans*
Body Mass average (g)[a]	215	24	19.3	1510	15,000
Male range[b]	150-280	16.5-31		980-2041	10,000-21,000
Female range	150-280	16.5-31		980-2041	10,000-21,000
Diet Composition (%)[c]					
Plant Matter	100	100 winer/fall	majority winter/fall	0	some winter/fall
Animal Matter	0	more spring/summer	100 spring/summer	100	100 spring/summer
Food Ingestion Rate (g/d)[d]		3.7	4.9		637
Plant Matter	29			0	
Animal Matter	0			76	
Soil Ingestion Rate					
(%)[e]	2.4	<2	2	<2	2.8
(g/d)[f]	0.69	0.074	0.10	1.5	18
Skin Surface Area (cm^2)					
Total[g]	404	96.4	72	1325	6373
Exposed[h]	16	3.9	5.8	106	255
Home Range ($acre^2$)[i]	5.75[j]	0.52	8.3[k]	4,200-28,900	2,000-20,000
Exosure Area (acres)[l]					
Source Area 6	90	90	90	90	90
Source Area 8	166	166	166	166	166
Source Area 11	10	10	10	10	10
Source Area 15	3.6	3.6	3.6	3.6	3.6
Source Area 17	341	341	341	341	341
Source Area 19	5.0	5.0	5.0	5.0	5.0
Source Area 20	30	30	30	30	30
Source Area 22	0.79	0.79	0.79	0.79	0.79
Source Area 31-8	138	138	138	138	138
Source Area 33	8.3	8.3	8.3	8.3	8.3
Source Area 35	18	18	18	18	18
Site utilization Factor (unitless)[m]					
Source Area 6	1.0	1.0	1.0	0.0054	0.0082
Source Area 8	1.0	1.0	1.0	0.010	0.015
Source Area 11	1.0	1.0	1.0	0.00062	0.00094
Source Area 15	0.63	1.0	0.43	0.00022	0.00033
Source Area 17	1.0	1.0	1.0	0.021	0.031
Source Area 19	0.87	1.0	0.60	0.00030	0.00046
Source Area 20	1.0	1.0	1.0	0.0018	0.0027
Source Area 22	0.14	1.0	0.095	4.8E-05	7.2E-05
Source Area 31-8	1.0	1.0	1.0	0.0084	0.013
Source Area 33	1.0	1.0	1.0	0.00050	0.00076
Source Area 35	1.0	1.0	1.0	0.0011	0.0016
Exposure Duration (% year)[n]	0.42	0.6	0.5	0.5	1

TABLE 7.22

EXPOSURE PARAMETERS FOR ECOLOGICAL INDICATOR RECEPTORS
MOSES LAKE WELLFIELD SUPERFUND SITE

[a] Average body weight for males and females combined.

[b] Range of body weights for males and females

[c] Sage sparrow and Great Basin Pocket Mouse diet composition varies seasonally

[d] Calculated using Equations 3-3 (Ferruginous Hawk), 3-4 (Sage Sparrow), 3-8 (Great Basin Pocket Mouse), 3-7 (Coycote), and 3-9 (Washington Ground Squirrel in USEPA (1993).

[e] Soil ingestion rates were derived from USEPA (1993);
Washington Ground Squirrel based on Meadow Vole soil ingestion rate
Sage Sparrow derived by Beyer et al. (1994) based on observations of omnivorous birds
Ferruginous Hawk based on passerines soil ingestion rate
Coyote based on Red Fox soil ingestion rate
Great Basin Pocket Mouse based on White-footed mouse soil ingestion rate

[f] Calculated as percent soil ingestion rates derived from USEPA (1993) multiplied by the food ingestion rate (g/d).

[g] Total skin surface area was calculated using Equation 3-22 (mammals) and 3-21 (birds) in USEAP (1993)

[h] Exposed skin surface area was calculated assuming the area of the feet (4% of total skin surface area) for the Great Basin Pocket Mouse, Coyote, and Washington Ground Squirrel and the beak and legs (8% of total surface area) for the Ferruginous Hawk and Sage Sparrow.

[I] Home range is equal to the area necessary to support the dietary and reproductive needs of each animal.

[j] Home range for Washington Ground Squirrel calculated by averaging the home ranges of similar species: Franklin's Ground Squirrel, Mexican Ground Squirrel and Thirteen-Lined Ground Squirrel

[k] Home range for Sage Sparrow calculated by averaging the home ranges of similar species: Song sparrow, Lark Sparrow, White-crowned sparrow, Rufous-crowned sparrow, savannah sparrow, and Golden-crowned sparrow.

[l] Exposure area based on the total area of each site

[m] Site utilization factors are calculated as the exposure area divided by the home range. When a range of values are reported for the home range, their average value was used in this calculation. Instances where the home range > exposure area are reported as 1.

[n] Exposure duration (I.e. precent of year exposed) for species based on the following facts:
Washington Ground Squirrel = 0.42- spends 7 months of the year dormant
Sage Sparrow = 0.5 - migrates to southeastern deserts to winter
Ferruginous Hawk = 0.5 - migrates to California to winter
Great Basin Pocket Mouse = 0.6 - no above-ground activity from November to March or April
Coyote = 1.0 - does not migrate and is active yearlong.

The information presented above was derived from the following sources:

BLM, 2001	USGS, 2000a
Burke Museum, 2000	USGS, 2000b
Dunning, 1993	USEPA, 1993
Enature	Zeiner, et al., 1990
UM, 2000	

TABLE 7.23

ECOLOGICAL TOXICITY REFERENCE VALUES FOR MAMMALIAN INDICATOR RECEPTORS
MOSES LAKE WELLFIELD SUPERFUND SITE

COPEC	Benchmark Concentrations (mg/kg-day)	Benchmark Species		Benchmark Species Body Weight (kg)		Allometric TRV (mg/kg-day) Washington Ground Squirrel *Spermophilus washingtoni*	Great Basin Pocket Mouse *Perognathus parvus*	Coyote *Canis latrans*
Antimony (Sb)	4.40E+00	MH - vole	a	0.044	c	2.96E+00	5.13E+00	1.02E+00
Aroclor 1254	1.40E-01	Mink	e,f	1	e	2.06E-01	3.57E-01	7.11E-02
Aroclor 1260	1.40E-01	Mink	e,f	1	e	2.06E-01	3.57E-01	7.11E-02
Arsenic (As)	1.25E+00	Dog	b, d	12.7	c	3.47E+00	6.01E+00	1.20E+00
Barium (Ba)	5.10E-01	Rat	b, d	0.35	c	5.76E-01	9.99E-01	1.99E-01
Benzo(a)anthracene [i]	1.00E+00	Mouse	c, d	0.03	c	6.11E-01	1.06E+00	2.11E-01
Benzo(a)pyrene	1.00E+00	Mouse	c, d	0.03	c	6.11E-01	1.06E+00	2.11E-01
Benzo(b)fluoranthene [i]	1.00E+00	Mouse	c, d	0.03	c	6.11E-01	1.06E+00	2.11E-01
Benzo(ghi)perylene [i]	1.00E+00	Mouse	c, d	0.03	c	6.11E-01	1.06E+00	2.11E-01
Benzo(k)fluoranthene [i]	1.00E+00	Mouse	c, d	0.03	c	6.11E-01	1.06E+00	2.11E-01
Bis-(2-ethylhexyl)phthalate	6.00E+01	Rat	b, d	0.35	c	6.78E+01	1.18E+02	2.35E+01
Cadmium (Cd)	1.00E+00	Rat	c, d	0.35	c	1.13E+00	1.96E+00	3.91E-01
Chromium (Cr)	3.50E+00	Rat	b, d	0.35	c	3.95E+00	6.86E+00	1.37E+00
Chrysene [i]	1.00E+00	Mouse	c, d	0.03	c	6.11E-01	1.06E+00	2.11E-01
Copper (Cu)	1.20E+01	Mink	b, d	1	c	1.76E+01	3.06E+01	6.10E+00
2,4-Dimethylphenol	na	na		na		na	na	na
Fluoranthene [i]	1.00E+00	Mouse	c, d	0.03	c	6.11E-01	1.06E+00	2.11E-01
Indeno(123-cd)pyrene [i]	1.00E+00	Mouse	c, d	0.03	c	6.11E-01	1.06E+00	2.11E-01
Lead (Pb)	8.00E+00	Rat	c, d	0.35	c	9.04E+00	1.57E+01	3.13E+00
Manganese (Mn)	8.80E+01	Rat	c	0.35	c	9.94E+01	1.72E+02	3.44E+01
Mercury (Hg)	1.00E+00	Mink	e	1	e	1.47E+00	2.55E+00	5.08E-01
Nickel (Ni)	5.00E+01	Rat	b, d	0.35	c	5.65E+01	9.80E+01	1.95E+01

TABLE 7.23

ECOLOGICAL TOXICITY REFERENCE VALUES FOR MAMMALIAN INDICATOR RECEPTORS
MOSES LAKE WELLFIELD SUPERFUND SITE

COPEC	Benchmark Concentrations (mg/kg-day)	Benchmark Species		Benchmark Species Body Weight (kg)		Allometric TRV (mg/kg-day) Washington Ground Squirrel *Spermophilus washingtoni*	Great Basin Pocket Mouse *Perognathus parvus*	Coyote *Canis latrans*
Pentachlorophenol	3.00E-01	Rat	b, d	0.35	c	3.39E-01	5.88E-01	1.17E-01
Pyrene [i]	1.00E+00	Mouse	c, d	0.03	c	6.11E-01	1.06E+00	2.11E-01
Silver (Ag)	3.75E-01	Mouse	b, d	0.03	c	2.29E-01	3.98E-01	7.93E-02
Thallium (Tl)	1.31E-02	Rat	b, d	0.35	c	1.48E-02	2.57E-02	5.12E-03
Trichloroethene	7.00E-01	Mouse	c	0.03	c	4.28E-01	7.42E-01	1.48E-01
Zinc (Zn)	1.04E+01	Mouse	b, d	0.03	c	6.36E+00	1.10E+01	2.20E+00

Notes:

Receptor-specific toxicity reference values are derived from body weight based allometric conversion of the toxicity benchmark value.
Reference: Toxicological Benchmarks for Wildlife: 1996 Revision, US Department of Energy

Please refer to Section 3.1 for Allometric TRV equation

na - not applicable

[a] Eco-SSL

[b] USEPA, 1999

[c] ORNL, 1996 Toxicological Benchmarks for Wildlife

[d] Mammal toxicity reference value

[e] Bird toxicity reference value

[f] USEPA, 2000b

[g] Based on total PCBs

[h] Body weight derived from a similar species body weight (ORNL, 1996)

[i] Benzo(a)pyrene is used as a surrogate for all PAHs

TABLE 7.24

ECOLOGICAL TOXICITY REFERENCE VALUES FOR AVIAN INDICATOR RECEPTORS
MOSES LAKE WELLFIELD SUPERFUND SITE

COPEC	Benchmark Concentrations (mg/kg-day)	Benchmark Species		Benchmark Species Body Weight (kg)		Allometric TRV (mg/kg-day) Sage Sparrow *Amphispiza belli*	Allometric TRV (mg/kg-day) Ferruginous Hawk *Oceanodroma furcata*
Antimony (Sb)	na	na		na		na	na
Aroclor 1254	7.20E-02	Ringed Dove	b, e	0.155	c	1.21E-01	4.08E-02
Aroclor 1260	4.20E-01	Screech Owl	e,f	0.2	e	7.54E-01	2.53E-01
Arsenic (As)	2.46E+00	Brown-headed cowbird	b, e	0.049	c	3.11E+00	1.04E+00
Barium	2.08E+01	1-day old chicks	b, e	0.121	c	3.29E+01	1.11E+01
Benzo(a)anthracene [i]	1.00E-01	Chicken	j, e	1.6	c	3.02E-01	1.01E-01
Benzo(a)pyrene	1.00E-01	Chicken	j, e	1.6	c	3.02E-01	1.01E-01
Benzo(b)fluoranthene [i]	1.00E-01	Chicken	j, e	1.6	c	3.02E-01	1.01E-01
Benzo(ghi)perylene [i]	1.00E-01	Chicken	j, e	1.6	c	3.02E-01	1.01E-01
Benzo(k)fluoranthene [i]	1.00E-01	Chicken	j, e	1.6	c	3.02E-01	1.01E-01
Bis-(2-ethylhexyl)phthalate	1.11E-01	Ringed Dove	b, e	0.155	c	1.87E-01	6.28E-02
Cadmium (Cd)	1.45E+00	Mallard duck	b, e	1	c	3.89E+00	1.31E+00
Chromium (Cr)	1.00E+00	Black duck	b, e	1.25	c	2.84E+00	9.54E-01
Chrysene [i]	1.00E-01	Chicken	j, e	1.6	c	3.02E-01	1.01E-01
Copper (Cu)	4.70E+01	1-day old chicks	b, e	0.121	c	7.43E+01	2.50E+01
2,4-Dimethylphenol	na	na		na		na	na
Fluoranthene [i]	1.00E-01	Chicken	j, e	1.6	c	3.02E-01	1.01E-01
Indeno(123-cd)pyrene [i]	1.00E-01	Chicken	j, e	1.6	c	3.02E-01	1.01E-01
Lead (Pb)	3.85E+00	American Kestrel	c	0.13	c	6.20E+00	2.09E+00
Manganese (Mn)	9.97E+02	Japanese Quail	c	0.15	c	1.66E+03	5.60E+02
Mercury (Hg)	4.50E-01	Japanese Quail	e	0.15	e	7.51E-01	2.53E-01
Nickel (Ni)	7.74E+01	Mallard	c	1	c	2.08E+02	6.98E+01
Pentachlorophenol	4.03E+00	Quail	b, e	0.15	h	6.73E+00	2.26E+00

TABLE 7.24

ECOLOGICAL TOXICITY REFERENCE VALUES FOR AVIAN INDICATOR RECEPTORS
MOSES LAKE WELLFIELD SUPERFUND SITE

COPEC	Benchmark Concentrations (mg/kg-day)	Benchmark Species		Benchmark Species Body Weight (kg)		Allometric TRV (mg/kg-day) Sage Sparrow *Amphispiza belli*	Allometric TRV (mg/kg-day) Ferruginous Hawk *Oceanodroma furcata*
Pyrene [i]	1.00E-01	Chicken	[j, e]	1.6	[c]	3.02E-01	1.01E-01
Silver (Ag)	1.78E+02	Mallard	[b, e]	1	[c]	4.78E+02	1.61E+02
Thallium (Tl)	3.50E-01	Starling	[b, e]	0.077	[h]	4.95E-01	1.66E-01
Trichloroethene	na	na		na		na	na
Zinc (Zn)	1.31E+02	Leghorn hen and New Hampshire rooster	[b, e]	1.85	[c]	4.10E+02	1.38E+02

Notes:

Receptor-specific toxicity reference values are derived from body weight based allometric conversion of the toxicity benchmark value. Reference: Toxicological Benchmarks for Wildlife: 1996 Revision, US Department of Energy

Please refer to Section 3.1 for Allometric TRV equation

na - not applicable

[a] Eco-SSL (USEPA, 2000a)

[b] USEPA, 1999

[c] ORNL, 1996 Toxicological Benchmarks for Wildlife

[d] Mammal toxicity reference value

[e] Bird toxicity reference value

[f] USEPA, 2000b

[g] Based on total PCBs

[h] Body weight derived from a similar species body weight (ORNL, 1996)

[i] Benzo(a)pyrene used as a surrogate for all PAHs.

[j] Bond et al., 1981.

TABLE 7-25

SUMMARY OF ECOLOGICAL HAZARD ESTIMATES
MOSES LAKE WELLFIELD SUPERFUND SITE

		Ecological Hazard Estimate				
Site/Constituent	**Exposure Point Concentration (mg/kg)**	**Washington Ground Squirrel** *Spermophilus washingtoni* HQ	**Great Basin Pocket Mouse** *Perognathus parvus* HQ	**Sage Sparrow** *Amphispiza belli* HQ	**Ferruginous Hawk** *Oceanodroma furcata* HQ	**Coyote** *Canis latrans* HQ
6a and 6b (Base Closure Landfill)						
Antimony	19	0.0172	0.049	0.34	0.00020	0.00054
Arsenic	94	0.043	0.11	0.30	0.00061	0.0016
Cadmium	5.4	0.018	0.13	0.092	0.00015	0.00129
Chromium	280	0.099	0.076	0.25	0.0011	0.0020
Copper	2400	0.55	0.47	0.27	0.00053	0.0066
Lead	1900	0.035	0.045	0.16	0.00036	0.00078
Mercury	1.3	0.0014	0.00095	0.0044	0.00020	0.000025
Nickel	9900	0.27	0.19	0.12	0.00062	0.0049
Silver	0.76	0.013	0.0036	0.0000041	0.000000051	0.000093
Thallium	0.37	0.034	0.027	0.0019	0.000033	0.00070
Zinc	1800	0.057	0.68	0.025	0.000069	0.011
TOTAL HI		**1.1**	**1.8**	**1.6**	**0.0039**	**0.030**
8 (Randolph Road Base Dump)						
Cadmium	0.50	0.0017	0.012	0.0086	0.000025	0.00022
Chromium	9.4	0.0033	0.0026	0.0085	0.000069	0.00012
Copper	21	0.0048	0.0041	0.0023	0.0000086	0.00011
Lead	450	0.0082	0.011	0.037	0.00016	0.00034
Mercury	0.56	0.0006	0.00041	0.0019	0.00016	0.000020
Nickel	12	0.00033	0.00023	0.00015	0.0000014	0.000011
Thallium	0.23	0.021	0.017	0.0012	0.000038	0.00080
Zinc	270	0.0086	0.10	0.0037	0.000019	0.0031
TOTAL HI		**0.049**	**0.15**	**0.063**	**0.00048**	**0.0048**
11 (Fire Training Area - Burn Pit B)		na[a]	na[a]	na[a]	na[a]	na[a]
15 (8-Place Hangar Ditch)						
Arsenic	5.1	0.0015	0.0061	0.0070	0.0000013	0.0000034
Cadmium	4.6	0.0097	0.11	0.034	0.0000050	0.000044
Chromium	53	0.012	0.014	0.021	0.0000085	0.000015
Copper	55	0.0079	0.011	0.0026	0.00000049	0.0000061
Lead	49	0.00056	0.0012	0.0017	0.00000037	0.00000080
Mercury	0.27	0.00018	0.00020	0.00040	0.0000016	0.00000021
Nickel	23	0.00040	0.00044	0.00012	0.000000058	0.00000046
Zinc	286	0.0057	0.11	0.0017	0.00000044	0.000072
TOTAL HI		**0.038**	**0.26**	**0.069**	**0.000018**	**0.00014**
17 (3-Place Hangar-Bldg 5801) [b]						
PCB1254	0.31	2.1E-03	1.6E-03	6.5E-03	1.0E-01	1.6E-04
PCB1260	0.26	1.8E-03	1.4E-03	8.8E-04	1.4E-02	1.3E-04
Arsenic	5.6	2.6E-03	6.7E-03	1.8E-02	1.4E-04	3.5E-04
Benzo(a)anthracene	2.0	7.3E-04	9.6E-04	4.6E-03	1.2E-04	1.6E-04
Benzo(a)pyrene	2.5	8.7E-04	1.8E-03	8.8E-03	4.1E-04	5.2E-04
Benzo(b)fluoranthene	2.2	7.6E-04	1.6E-03	7.8E-03	3.9E-04	4.9E-04
Benzo(ghi)perylene	2.1	4.8E-03	3.7E-03	1.8E-02	2.2E-04	3.7E-04
Benzo(k)fluoranthene	2.2	5.1E-03	3.9E-03	1.9E-02	2.9E-03	3.8E-04
Cadmium	4.9	1.6E-02	1.2E-01	8.4E-02	5.1E-04	4.4E-03
Chromium	31	1.1E-02	8.5E-03	2.8E-02	4.7E-04	8.4E-04
Chrysene	2.2	5.3E-03	3.9E-03	1.9E-02	1.2E-03	3.8E-04

TABLE 7-25

SUMMARY OF ECOLOGICAL HAZARD ESTIMATES
MOSES LAKE WELLFIELD SUPERFUND SITE

		Ecological Hazard Estimate				
Site/Constituent	**Exposure Point Concentration (mg/kg)**	**Washington Ground Squirrel** *Spermophilus washingtoni* HQ	**Great Basin Pocket Mouse** *Perognathus parvus* HQ	**Sage Sparrow** *Amphispiza belli* HQ	**Ferruginous Hawk** *Oceanodroma furcata* HQ	**Coyote** *Canis latrans* HQ
Copper	35	8.0E-03	6.9E-03	3.9E-03	3.0E-05	3.7E-04
Fluoranthene	3.9	1.0E-02	6.9E-03	3.3E-02	3.9E-02	6.8E-04
Indeno(123-cd)pyrene	2.0	4.5E-03	3.5E-03	1.7E-02	2.9E-03	3.5E-04
Lead	290	5.3E-03	6.9E-03	2.4E-02	2.1E-04	4.5E-04
Mercury	0.28	3.0E-04	2.1E-04	9.5E-04	1.6E-04	2.0E-05
Nickel	14	3.9E-04	2.7E-04	1.7E-04	3.3E-06	2.6E-05
Pyrene	3.4	9.3E-03	6.0E-03	2.9E-02	1.9E-02	5.9E-04
Silver	0.56	9.8E-03	2.6E-03	3.0E-06	1.4E-07	2.6E-04
Thallium	0.44	4.1E-02	3.2E-02	2.3E-03	1.5E-04	3.2E-03
Zinc	510	1.6E-02	1.9E-01	7.0E-03	7.4E-05	1.2E-02
TOTAL HI		**0.16**	**0.41**	**0.33**	**0.19**	**0.026**
19 (Liquid Oxygen Generating Plant-Bldg 5102) [c]						
Bis-(2-ethylhexyl)phthalate	1.2	0.000025	0.000019	0.010	0.0000029	0.000000028
Cadmium	0.44	0.0013	0.011	0.005	0.00000067	0.0000059
Chromium	4.1	0.0013	0.0011	0.002	0.00000091	0.0000016
Copper	25	0.0050	0.0049	0.0017	0.00000031	0.0000039
2,4-Dimethylphenol	0.86	na	na	na	na	na
Lead	4.3	0.000068	0.00010	0.00021	0.000000045	0.000000098
Manganese	357	0.0095	0.0039	0.00033	0.00000034	0.0000056
Nickel	7.4	0.00018	0.00014	0.000055	0.000000026	0.00000021
Trichloroethene	0.056	0.0013	0.00014	na	na	0.00000021
Zinc	60	0.0017	0.023	0.00050	0.00000013	0.000021
TOTAL HI		**0.020**	**0.044**	**0.019**	**0.0000054**	**0.000039**
20 (South Base Dump)						
Cadmium	16	0.054	0.40	0.27	0.00015	0.0013
Chromium	33	0.012	0.0090	0.030	0.000044	0.000078
Copper	48	0.0110	0.0095	0.0053	0.0000036	0.000044
Lead	5,700	0.10	0.13	0.47	0.00036	0.00078
Mercury	0.11	0.00012	0.000081	0.00037	0.0000056	0.00000070
Nickel	12	0.00033	0.00023	0.00015	0.00000025	0.0000020
Silver	6.3	0.11	0.030	0.000034	0.00000014	0.00026
Zinc	176	0.0056	0.066	0.0024	0.0000023	0.00037
TOTAL HI		**0.30**	**0.65**	**0.78**	**0.00056**	**0.0028**
22 (Paint Hangar Leach Pit) [d]						
Cadmium	16	0.0074	0.398	0.026	0.0000038	0.000034
Chromium	425	0.0206	0.12	0.036	0.000015	0.000027
Copper	120	0.0038	0.024	0.0013	0.00000023	0.0000029
Lead	1,200	0.0030	0.028	0.0093	0.0000020	0.0000043
Mercury	0.92	0.0001	0.001	0.00030	0.0000012	0.00000015
Nickel	27	0.00010	0.00052	0.000032	0.000000015	0.00000012
Zinc	680	0.00296	0.25510	0.00089	0.00000023	0.000038
PCB1254	8.1	0.0076	0.042	0.016	0.0063	0.000010
TOTAL HI		**0.046**	**0.87**	**0.091**	**0.0063**	**0.00011**
31 (19th Avenue Base Dump)						
Cadmium	6.3	0.021	0.16	0.11	0.00026	0.0023
Chromium	210	0.074	0.057	0.19	0.0013	0.0023

TABLE 7-25

SUMMARY OF ECOLOGICAL HAZARD ESTIMATES
MOSES LAKE WELLFIELD SUPERFUND SITE

		Ecological Hazard Estimate				
Site/Constituent	**Exposure Point Concentration (mg/kg)**	**Washington Ground Squirrel** *Spermophilus washingtoni* HQ	**Great Basin Pocket Mouse** *Perognathus parvus* HQ	**Sage Sparrow** *Amphispiza belli* HQ	**Ferruginous Hawk** *Oceanodroma furcata* HQ	**Coyote** *Canis latrans* HQ
Copper	39	0.0089	0.0077	0.00	0.000013	0.00017
Lead	493	0.0090	0.012	0.040	0.00014	0.00031
Mercury	0.11	0.00012	0.000081	0.00037	0.000026	0.0000032
Nickel	21	0.00058	0.00040	0.00026	0.0000020	0.000016
Silver	1.9	0.033	0.0089	0.000010	0.00000019	0.00036
Zinc	738	0.023	0.28	0.010	0.000044	0.0071
TOTAL HI		**0.17**	**0.52**	**0.35**	**0.0018**	**0.013**
33 (End of Runway 32 Dump) [e]						
Barium	67	0.11	0.87	0.036	0.0000059	0.00092
Lead	16	0.00012	0.00038	0.0013	0.00000028	0.00000061
Pentachlorophenol	6.4	0.013	0.020	0.0024	0.033	0.000049
TOTAL HI		**0.13**	**0.89**	**0.040**	**0.033**	**0.00097**
35 (Stained Soil) [f]						
Cadmium	3.3	0.011	0.082	0.057	0.000018	0.00016
Chromium	38	0.013	0.010	0.034	0.000030	0.000054
Copper	69	0.016	0.014	0.0076	0.0000031	0.000038
Lead	210	0.0038	0.0050	0.017	0.0000079	0.000017
Nickel	14	0.00039	0.00027	0.00017	0.00000018	0.0000014
Zinc	250	0.0079	0.094	0.0034	0.0000019	0.00031
TOTAL HI		**0.052**	**0.21**	**0.12**	**0.000061**	**0.00058**

Notes:

na - not available

[a] Although analyte concentrations measured at this source area were below COPEC screening criteria, ecological screening criteria were not available for Diesel-Dx or Oilm-Dx. Concentrations of Diesel-Dx up to 1,600 mg/kg and Oilm-Dx up to 14,000 mg/kg were detected in soil at this source area, and the site shows obvious signs of stressed vegetation. Therefore, this source area is proposed for further evaluation in regard to Oilm-Dx concentration.

[b] In addition to the analytes indicated, Diesel-Dx up top 260 mg/kg and Oilm-Dx up to 440 mg/kg were detected at source area 17. Ecological screening criteria were not available.

[c] In addition to the analytes indicated, Diesel-Dx up top 150 mg/kg and Oilm-Dx up to 890 mg/kg were detected at source area 19. Ecological screening criteria were not available.

[d] In addition to the analytes indicated, Diesel-Dx up top 320 mg/kg, Gro-Gx up to 150 mg/kg and Oilm-Dx up to 190 mg/kg were detected at source area 22. Ecological screening criteria were not available.

[e] In addition to the analytes indicated, TPH-Dx up to 1300 mg/kg was detected at source area 33. Ecological screening criteria were not available.

[f] In addition to the analytes indicated, Diesel-Dx up top 16000 mg/kg, Gro-Gx up to 110 mg/kg and Oilm-Dx up to 31500 mg/kg were detected at source area 35. Ecological screening criteria were not available.

Table 8.1
OBJECTIVES OF REMEDIAL INVESTIGATIONS AND FEASIBILITY STUDY

Objectives	Objective Met	Explanation
Interagency Agreement (February 1999)		
Identify the nature and extent of the plume	Yes	With some uncertainties.
Inventory and sample locate domestic wells	Yes	
Determine future movement of the plume and if other domestic water wells may be affected	Yes	Future movement of the plume(s) can be determined from water level maps generated for each of the applicable hydrogeologic units.
Identify safe domestic water alternatives for identified contaminated wells	Yes	Temporary measures include whole-house filters or bottled water. Long-term solutions will be addressed in the Feasibility Study.
Identify alternatives for addressing the plume	No	Feasibility Study task.
Identify surface exposures of contamination	Yes	
Locate potential source(s) of TCE contamination	Yes	LOX Plant
U.S. Army Corps of Engineer's Scope of Work (March 1999)		
Determine who is (and who will be) exposed to TCE in GW above acceptable risk	Yes	
Determine how to prevent current (and future) exposure to TCE above acceptable risk	Yes	Temporary measures include whole-house filters or bottled water. Long-term solutions will be addressed in the Feasibility Study.
Determine how to prevent or minimize migration of the TCE plume	No	Feasibility Study task.
Determine how to prevent or minimize the migration of TCE from DNAPL sources	Yes	DNAPL sources have not been identified.
Determine how to return groundwater to beneficial use if practicable	No	Feasibility Study task.
Determine whether current (or potentially future) exposures to radionuclide contamination exists in site soil, groundwater or air	Yes	
Determine how to prevent current (and future) exposure to radionuclides above acceptable risk levels	Yes	Sources of radionuclides have not been identified.
Determine whether current (or potentially future) exposures to tetraethyl lead (TEL) contamination exist in site soil, groundwater or air	Yes	Sources of tetraethyl lead (TEL) have not been identified.
Determine how to prevent current (and future) exposure to TEL above acceptable risk levels	Yes	Sources of tetraethyl lead (TEL) have not been identified.
Determine whether current (or potentially future) exposures to common USAF installation contaminants (e.g., heavy metals and chlorinated pesticides at landfills) exist in site soil, groundwater, or air	Yes	
Determine how to prevent current (and future) exposure to common USAF installation contaminants above acceptable risk levels	Yes	Not a risk.
Management Plan (September 1999)		
Characterize the vertical and lateral extent of the existing TCE plume	Yes	With uncertainties (e.g., Roza, "c-basalt"). The c-basalt was not part of the RIs although the IAG objectives don't seem to limit us to the "a-basalt".
Characterize geologic and hydrogeologic conditions within the study area to support development of the conceptual and numeric hydrogeologic models	Yes	
Identify potential contaminant pathways	Yes	
Measure the concentrations of TCE, if present, within domestic wells.	Yes	
Determine current and future land use	Yes	

Table 8.1
OBJECTIVES OF REMEDIAL INVESTIGATIONS AND FEASIBILITY STUDY

Objectives	Objective Met	Explanation
Determine the presence or absence of radiological anomalies at the Low Level Radioactive Waste Disposal Site.	Yes	
Characterize concentrations of TCE in springs and seeps along Moses Lake	Yes	
Management Plan (September 1999)[1]		
Fill in any remaining data gaps with respect to the TCE plume or hydrogeologic characterizations.	Yes	With some uncertainties.
Determine the presence or absence of potential TCE sources.	Yes	
Characterize potential sources associated with other (non-TCE) contaminants of concern	Yes	
Continue quarterly monitoring well sampling	Yes	Quarterly monitoring was conducted between November 1999 and February 2001.
Management Plan Addendum (April 2000)		
Determine the presence or absence of potential TCE sources.	Yes	
Characterize potential sources associated with non-TCE chemicals of potential concern (COPC)	Yes	
Address data gaps with respect to the TCE plume or hydrogeologic characterization	Yes	This one says "address" as opposed to "fill in".
Continue the quarterly well monitoring initiated in the fall of 1999	Yes	Quarterly monitoring was conducted between November 1999 and February 2001.
Measure the concentrations of TCE, if present, within additional domestic and public water supply well samples for TCE.	Yes	
Supplemental Management Plan (January 2003)		
Confirm specific conclusions made during execution of the 1999 and 2000 RIs.	Yes	
Evaluate whether certain sites not previously investigated are current or historical sources of TCE.	Yes	
Determine the exact nature of representative geophysical anomalies at the landfills.	Yes	
Conduct well maintenance/conversion	Yes	

Notes:
1. These objectives are listed in the Management Plan, but are relative to the 2000 RI.

TABLE 8.2

RISK ASSESSMENT SUMMARY FOR SOURCE AREAS
MOSES LAKE WELLFIELD SUPERFUND SITE

	Human Health Risk Summary				Ecological Risk Summary	Maximum	
	Soil Sampling		Soil Gas		Soil Sampling	Detected Soil	Remedial
	Maximum		Maximum		Maximum	Concentration	Investigation (RI)
Site/COPCs	**ILCR**	**HI**	**ILCR**	**HI**	**HI**	**(mg/kg)**	**Recommendation**
2 (Big Bend Community College Hangar)	**na [a]**	**na [a]**	**1.8E-08 [b]**	**0.000019 [b]**	**na [c]**	**na**	**NFC**
3a (Aircraft Wash Rack & Discharge Areas)	**na [a]**	**na [a]**	**1.0E-07 [b]**	**0.00026 [b]**	**na [c]**	**na**	**NFC**
3b (Aircraft Wash Rack and Dishcharge Areas)	**na [a]**	**na [a]**	**3.4E-07 [b]**	**0.000059 [b]**	**na [c]**	**na**	**NFA**
3c (Aircraft Wash Rack & Discharge Areas)	**na [a]**	**na [a]**	**7.5E-08 [b]**	**0.000071 [b]**	**na [c]**	**na**	**NFC**
4a (Tarmac Areas)	**na [a]**	**na [a]**	**3.7E-08 [b]**	**0.000042 [b]**	**na [c]**	**na**	**NFC**
4b (Tarmac Areas)	**na [a]**	**na [a]**	**9.6E-10 [b]**	**0.000019 [b]**	**na [c]**	**na**	**NFC**
5 (JAL Hangar Area & Tarmac)	**na [a]**	**na [a]**	**2.7E-08 [b]**	**0.000025 [b]**	**na [c]**	**na**	**NFC**
6a and 6b (Base Closure Landfill)	**2.8E-05 [d]**	**0.35 [d]**	**na [e]**	**na [e]**	**1.8 [f]**	**na**	**Further Evaluation**
Arsenic:	2.8E-05 [d]	na	na	na	0.11 [f]	94	
Cadmium:	na	na	na	na	0.13 [f]	5.4	
Copper:	na	na	na	na	0.47 [f]	2,400	
Nickel:	na	na	na	na	0.19 [f]	9,900	
Zinc:	na	na	na	na	0.68 [f]	1,800	
8 (Randolph Road Base Dump)	**na [g]**	**na [h]**	**na [e]**	**na [e]**	**0.15 [f]**	**na**	**NFC**
9 (Gravel Pit)	**na [a]**	**na [a]**	**1.4E-07 [b]**	**0.000053 [b]**	**na [c]**	**na**	**NFC**
11 (Fire Training Area - Burn Pit B)	**na [g]**	**0.011 [i]**	**4.5E-08 [b]**	**0.000018 [b]**	**na [j]**	**na**	**Further Evaluation**
Oilm-Dx						14,000	
12 (Motor Pool Drain Areas)	**9.5E-07 [b]**	**0.10 [i]**	**8.1E-08 [b]**	**0.00011 [b]**	**na [c]**	**na**	**NFC**
14 (8-Place Hangar)	**na [g]**	**na [h]**	**1.3E-07 [b]**	**0.00040 [b]**	**na [c]**	**na**	**NFC**
15 (8-Place Hangar Ditch)	**na [g]**	**na [h]**	**1.2E-08 [b]**	**0.000047 [b]**	**0.26 [f]**	**na**	**NFC**

TABLE 8.2

RISK ASSESSMENT SUMMARY FOR SOURCE AREAS
MOSES LAKE WELLFIELD SUPERFUND SITE

	Human Health Risk Summary				Ecological Risk Summary	Maximum	
	Soil Sampling		Soil Gas		Soil Sampling	Detected Soil	Remedial
	Maximum		Maximum		Maximum	Concentration	Investigation (RI)
Site/COPCs	**ILCR**	**HI**	**ILCR**	**HI**	**HI**	**(mg/kg)**	**Recommendation**
16 (Engine Rebuilding Facility - Bldg 2203)	**na [a]**	**na [a]**	**4.7E-08 [b]**	**0.000034 [b]**	**na [c]**	**na**	**NFC**
17 (3-Place Hangar - Bldg 5801)	**1.5E-06 [i]**	**0.059 [i]**	**2.0E-09 [b]**	**0.000036 [b]**	**0.41 [f,k]**	**na**	**NFC**
Arsenic	3.8E-07 [i]	na	na	na	na	5.6	
Benzo(a)pyrene	1.0E-06 [i]	na	na	na	na	2.5	
Benzo(b)fluoranthene	9.0E-08 [i]	na	na	na	na	2.2	
18 (Paint Hangar - Bldg 5825)	**3.1E-06 [b]**	**0.58 [i]**	**2.2E-08 [b]**	**0.000025 [b]**	**na [c]**	**na**	**NFC**
Aroclor 1260	2.2E-06 [b]	na	na	na	na	2.1	
19 (Liquid Oxygen Generating Plant - Bldg 51020)	**na [g]**	**0.0000017 [i]**	**1.1E-06 [b]**	**0.00031 [b]**	**0.044 [f,l]**	**na**	**NFC**
Trichloroethene	na	na	9.9E-07 [b]	na	na	2,200 ppbv	
19b (Liquid Oxygen Generating Plant)	**na [a]**	**na [a]**	**5.7E-08 [b]**	**0.000092 [b]**	**na [a]**	**na**	**Further Evaluation**
20 (South Base Dump)	**na [g]**	**na [m]**	**na [e]**	**na [e]**	**0.78 [n]**	**na**	**NFC**
22 (Paint Hangar Leach Pit)	**9.5E-06 [b]**	**1.6 [i]**	**1.9E-09 [b]**	**0.000021 [b]**	**0.87 [f,o]**	**na**	**Further Evaluation**
Aroclor 1254	8.4E-06 [b]	1.6 [i]	na	na	na	8.1	
Benzo(a)pyrene	1.1E-06 [b]	na	na	na	na	0 29	
Lead	>10 ug/dl [i]		na	na	na	1,200	
23 (Engine Rebuilding Facility - Bldg 2113)	**na [a]**	**na [a]**	**1.8E-07 [b]**	**0.000029 [b]**	**na [c]**	**na**	**NFC**
25 (Bldg 408)	**na [a]**	**na [a]**	**1.4E-08 [b]**	**0.000093 [b]**	**na [c]**	**na**	**NFC**
31 (19th Avenue Base Dump)	**na [g]**	**na [h]**	**na [e]**	**na [e]**	**0.52 [f]**	**na**	**NFC**
33 (Landfill at End of Runway 32)	**na [g]**	**na [h]**	**4.6E-09 [b]**	**0.000067 [b]**	**0.89 [f,p]**	**na**	**NFC**
35 (Stained Soil)	**na [g]**	**0.38 [i]**	**na [q]**	**na [q]**	**0.21 [f,r]**	**na**	**Further Evaluation**

TABLE 8.2

RISK ASSESSMENT SUMMARY FOR SOURCE AREAS
MOSES LAKE WELLFIELD SUPERFUND SITE

	Human Health Risk Summary				Ecological Risk Summary	Maximum	
	Soil Sampling		Soil Gas		Soil Sampling	Detected Soil	Remedial
	Maximum		Maximum		Maximum	Concentration	Investigation (RI)
Site/COPCs	**ILCR**	**HI**	**ILCR**	**HI**	**HI**	**(mg/kg)**	**Recommendation**

Notes:
ILCR - Incremental lifetime cancer risk.
HI - Hazard index.
na - Not applicable.
NFC - No further characterization.
mg/kg - Milligrams per kilogram.

[a] Soil samples were not collected at this site.
[b] Maximum ILCR/HQ estimated for a commercial/industrial worker.
[c] This site contains no suitable habitat for ecological receptors; therefore, this site was not evaluated in the predictive ERA.
[d] Maximum ILCR/HI estimated for a trespasser.
[e] Soil gas samples were collected at this site but were used for source delineation only.
[f] Maximum HQ estimated for the Great Basin Pocket Mouse.
[g] No carcinogenic COPCs were identified for this site.
[h] No noncarcinogenic COPCs were identified for this site.
[i] Maximum ILCR/HI estimated for a construction worker.
[j] Although analyte concentrations measured at this site were below COPEC screening criteria, an ecological screening criteria was not available for Diesel-Dx or Oilm-Dx. Concentrations of Diesel-Dx up to 1,600 mg/kg and Oilm-Dx up to 14,000 mg/kg were detected in soil at this site, and the site shows obvious signs of stressed vegetation. Therefore, this site was proposed for further evaluation in the FS.
[k] In addition to the analytes indicated, Diesel-Dx up top 260 mg/kg and Oilm-Dx up to 440 mg/kg were detected at Site 17. Ecological screening criteria were not available for these constituents. However, these concentrations are below the MTCA-A Cleanup Level for Soil - Protection of Drinking Water criteria of 2,000 mg/kg (Diesel-Dx) and 2,000 mg/kg (Oilm-Dx).
[l] In addition to the analytes indicated, Diesel-Dx up top 150 mg/kg and Oilm-Dx up to 890 mg/kg were detected at Site 19. Ecological screening criteria were not available for these constituents. However, these concentrations are below the MTCA-A Cleanup Level for Soil - Protection of Drinking Water criteria of 2,000 mg/kg (Diesel-Dx) and 2,000 mg/kg (Oilm-Dx).
[m] Soil analytes other than lead were below COPC screening criteria, and lead resulted in a blood lead concentration less than 10 ug/dl in the baseline HHRA.
[n] Maximum HQ estimated for the sage sparrow.
[o] In addition to the analytes indicated, Diesel-Dx up top 320 mg/kg, Gro-Gx up to 150 mg/kg and Oilm-Dx up to 190 mg/kg were detected at Site 22. Ecological screening criteria were not available for these constituents. However, these concentrations are below the MTCA-A Cleanup Level for Soil - Protection of Drinking Water criteria of 2,000 mg/kg (Diesel-Dx) and 2,000 mg/kg (Oilm-Dx). The maximum Gro-Gx concentration slightly exceeded the MTCA-A Cleanup Level for Gro-Gx of 100 mg/kg.

TABLE 8.2

RISK ASSESSMENT SUMMARY FOR SOURCE AREAS
MOSES LAKE WELLFIELD SUPERFUND SITE

	Human Health Risk Summary				Ecological Risk Summary	Maximum	
	Soil Sampling		Soil Gas		Soil Sampling	Detected Soil	Remedial
	Maximum		Maximum		Maximum	Concentration	Investigation (RI)
Site/COPCs	ILCR	HI	ILCR	HI	HI	(mg/kg)	Recommendation

[p] In addition to the analytes indicated, TPH-Dx up to 1300 mg/kg was detected at Site 33. Ecological screening criterion was not available for this constituent. However, this concentration is below the MTCA-A Cleanup Level for Soil - Protection of Drinking Water criterion of 2,000 (Diesel-Dx).

[q] Soil gas samples were not collected at this site.

[r] In addition to the analytes indicated, Diesel-Dx up top 16000 mg/kg, Gro-Gx up to 110 mg/kg and Oilm-Dx up to 31500 mg/kg were detected at Site 35. Ecological screening criteria were not available. Maximum concentrations of Diesel-Dx, Gro-Gx and Oilm-Dx exceeded their respective MTCA-A Cleanup Level for Soil - Protection of Drinking Water criterion.

TABLE 8.3

SUMMARY OF HUMAN HEALTH RISK ASSESSMENT RESULTS
GROUNDWATER
MOSES LAKE WELLFIELD SUPERFUND SITE

Cluster ID/Well	Groundwater Exposure Point Concentration (mg/L)	Human Health Risk Summary - Groundwater Maximum [a] ILCR	HI	Remedial Investigation (RI) Recommendation
Hanford Ringold (HR) Formation				
Well - 00AW11		1.1E-06	0.090	Further Evaluation
Trichloroethene	0.0051			
Well - 91AW14		1.1E-06	0.0013	NFA
Bromodichloromethane	0.00061			
Dibromochloromethane	0.00037			
Well - 91AW15		na [b]	0.025	NFA
1,2,4-Trimethylbenzene	0.0035			
1,3,5-Trimethylbenzne	0.0069			
Priest Rapids (PR) Member				
PR Cluster #1 - 99BW18, 99BW10		5.4E-06	0.44	Further Evaluation
Trichloroethene	0.025			
Well - 00BW02		na [b]	0.078	NFA
Manganese	0.122			
Well - 00BW11		4.2E-07	0.013	NFA
Benzene	0.00043			
Well - 00BW12		6.1E-06	0.60	Further Evaluation
Trichloroethene	0.028			
Manganese	0.16			
Well - 00BW13		na [b]	0.12	NFA
Manganese	0.18			
Well - 00BW18		na [b]	0.0017	NFA
Tert-butyl methyl ether (MTBE)	0.016			
Well - 99BW15		2.8E-06	0.23	Further Evaluation
Trichloroethene	0.013			
Roza (R) Member				
Roza Cluster #1a - 91BW03, 92BW01, 99BW01		1.0E-05	0.81	Further Evaluation
Trichloroethene	0.046			

TABLE 8.3

SUMMARY OF HUMAN HEALTH RISK ASSESSMENT RESULTS
GROUNDWATER
MOSES LAKE WELLFIELD SUPERFUND SITE

Cluster ID/Well	Groundwater Exposure Point Concentration (mg/L)	Human Health Risk Summary - Groundwater Maximum [a] ILCR	HI	Remedial Investigation (RI) Recommendation
Roza Cluster #1b - 99BW15, 02BW02		2.6E-06	**18**	Further Evaluation
Trichloroethene	0.012			
Acetone	**19**			
Well - 02BW01		4.1E-06	0.34	Further Evaluation
Trichloroethene	0.019			
Well - 92BW02		na [b]	0.0043	NFA
Tert-butyl methyl ether (MTBE)	0.040			
Well - 99BW16		8.6E-06	0.298	Further Evaluation
Trichloroethene	0.0054			
Priest Rapids/Roza Combined (PR/R) Members				
PR/R Cluster #1a - 91BW03, 92BW01, 99BW01		1.0E-05	0.81	Further Evaluation
Trichloroethene	0.046			
PR/R Cluster #1b - 99BW15, 02BW02		2.6E-06	**18**	Further Evaluation
Trichloroethene	0.012			
Acetone	**19**			
PR/R Cluster #2 - 02BW01, 99BW18, 99BW10		5.4E-06	0.44	Further Evaluation
Trichloroethene	0.025			
Well - 00BW02		na [b]	0.078	NFA
Manganese	0.122			
Well - 00BW11		4.2E-07	0.013	NFA
Benzene	0.00043			
Well - 00BW12		6.1E-06	0.60	Further Evaluation
Trichloroethene	0.028			
Manganese	0.16			
Well - 00BW13		na [b]	0.12	NFA
Manganese	0.18			
Well - 00BW18		na [b]	0.0017	NFA
Tert-butyl methyl ether (MTBE)	0.016			

TABLE 8.3

SUMMARY OF HUMAN HEALTH RISK ASSESSMENT RESULTS
GROUNDWATER
MOSES LAKE WELLFIELD SUPERFUND SITE

Cluster ID/Well	Groundwater Exposure Point Concentration (mg/L)	Human Health Risk Summary - Groundwater Maximum [a] ILCR	HI	Remedial Investigation (RI) Recommendation
Well - 92BW02		na [b]	0.0043	NFA
Tert-butyl methyl ether (MTBE)	0.040			
Well - 99BW16		8.6E-06	0.298	Further Evaluation
Trichloroethene	0.0054			
Drinking Water Wells (DW)				
DW Cluster #1 - WP-15E, WP-15W		6.1E-06	0.50	Further Evaluation
Trichloroethene	0.028			
Well WP-13E		1.0E-06	0.0011	NFA
Bromodichloromethane	0.00038			
Dibromochloromethane	0.00052			
Well - WP-14		1.7E-06	0.14	Further Evaluation
Trichloroethene	0.0078			

Notes:
[a] Maximum ILCR and HI estimates were calculated for the hypothetical unrestricted drinking water scenario.
[b] No carcinogenic COPCs were identified for this monitoring well.
Bold text indicates exceedance of MTCA target risk level.
mg/L - Milligrams per liter.
HI - Hazard index.
ILCR - Incremental lifetime cancer risk.
na - Not applicable.