APPENDIX B

RISK ASSESSMENT SCENARIOS: RURAL RESIDENTIAL, INTRUDER, AND TRIBAL LAND-USE EXPOSURE SCENARIOS

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TERMS

bgs	Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
CLARC	Cleanup Levels and Risk Calculations
COC	Contaminants of Concern
COPC	Contaminants of Potential Concern
COPEC	Contaminants of Potential Environmental Concern
CSM	Conceptual Site Model
CUL	Cleanup Levels
DOE	U.S. Department of Energy
DOE/RL	U.S. Department of Energy Richland Operations Office
Ecology	Washington State Department of Ecology
ELCR	Excess Lifetime Cancer Risk
EPA	U.S. Environmental Protection Agency
EPC	Exposure Point Concentrations
FR	Federal Register
FS	Feasibility Study
ft	feet
g	grams
mrem	millirem (rem = Roentgen Equivalent Man)
MTCA	Model Toxics Control Act
OU	Operable Unit
PAH	Polycyclic Aromatic Hydrocarbons
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
Tri Parties	U.S. Department of Energy Richland Operations Office, U.S. Environmental Protection Agency, and Washington State Department of Ecology
WAC	Washington Administrative Code
y	Year

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APPENDIX B

RISK ASSESSMENT SCENARIOS: RURAL RESIDENTIAL, INTRUDER, AND TRIBAL LAND-USE EXPOSURE SCENARIOS

This appendix presents the results of the human health risk assessments completed for a rural residential land-use scenario, a Tribal use scenario, and three intruder scenarios at the 216-A-29 Ditch, the 216-B-63 Trench, the 216-S-10 Ditch and the 216-S-10 Pond in the 200-CS-1 Operable Unit (OU). These scenarios are included in this Feasibility Study (FS) to provide information on additional risk scenarios and to be consistent with the framework documented in the External Letter, "Consensus Advice #132: Exposure Scenarios Task Force on the 200 Area," (Klein et al. 2002). In addition to the risk assessment described in Chapter 3.0, two additional unrestricted land-use and three intruder scenarios are evaluated in this appendix to provide decision makers with information on potential human health risks associated with a variety of potential future land-uses.

B1.0 HUMAN HEALTH RISK ASSESSMENTS

B1.1 OVERVIEW

This section presents human health risk assessments performed under two unrestricted land-use scenarios (e.g., a rural residential land-use scenario and a Tribal use scenario) and three intruder scenarios (e.g., a future construction trench worker, a future well driller, and a future residential intruder scenario) for the 200-CS-1 OU waste sites. The human health risk assessment presented in Chapter 3.0 was performed under an industrial land-use scenario, consistent with WAC 173-340-745, "Soil Cleanup Standards for Industrial Properties" and the Environmental Protection Agency's (EPA) EPA/540/1-89/002, *Risk Assessment Guidance for Superfund (RAGS), Volume 1-Human Health Evaluation Manual (Part A) (Interim Final)*. For the industrial land-use scenario, the direct soil contact exposure pathway was evaluated to support decisions regarding remedial alternatives at the waste sites. Direct soil contact exposure pathways are considered for the unrestricted and intruder scenarios as well.

The analysis of the rural residential scenario and the Confederated Tribes of the Umatilla Indian Reservation Traditional Subsistence Lifeways scenario are included to inform and support risk management decisions. The inadvertent intruder scenarios consider the possibility an individual unwittingly (through human error or loss of knowledge concerning the location of contaminants) engages in an activity that results in contact with wastes remaining in place (10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Waste").

The reasonably anticipated future land-use for the 200 Areas is continued industrial activities based on DOE/EIS-0222-F, *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement* and the associated record of decision 64 FR 61615, "Record of Decision: Hanford Comprehensive Land-Use Plan Environmental Impact Statement (HCP EIS)". For locations in the industrial area, such as the waste sites within the 200-CS-1 O U, the

U.S. Department of Energy (DOE) dose rate limits for the protection of workers and the affected public will be in effect for as long as facility management operations continue. After a period of 50 years, it is assumed that all operations will have ceased and public entry to the area will be restricted for an additional 100 years by enforcement of institutional controls.

These other land-use scenarios may occur at a time well into the future when institutional controls may lapse and individuals have access to the waste sites. In this manner, humans could be exposed to residual soil constituents. Regulatory agencies and the DOE assume that DOE will maintain control of the Hanford Site for as long as hazards exist. However, for the purpose of performing these risks assessments, the proposed DOE Richland Operations Office (DOE/RL) position establishes that after 50 years all operations at the site will have ceased and public entry to the area will be restricted for an additional 100 years by enforcement of institutional controls. After 150 years, active institutional controls will cease and only passive institutional controls will be in place. Passive institutional controls at the Hanford Site will be maintained for 500 years (2550). However, at 2150, potential exposure in the following scenarios may possibly occur.

After the cessation of operations, protection of human receptors would be based on EPA guidance for protection of individuals receiving a reasonable maximum exposure. The goal is to achieve a 1×10^{-4} to 1×10^{-6} risk range using a direct exposure dose rate of 15 mrem/y above background as an operational guideline to achieve this goal.

For the purposes of this risk assessment, the radiation dose limit for the rural residential and Confederated Tribes of the Umatilla Indian Reservation exposure scenarios is 15 mrem/y (10 CFR 835, "Occupational Radiation Protection"). This dose limit is developed for members of the public who are unknowingly exposed to radiation and is approximately equivalent to an excess lifetime cancer risk (ELCR) of 1×10^{-4}. The EPA generally considers action to be warranted at a site when cancer risks exceed 1×10^{-4} based on a reasonable maximum exposure scenario. Action generally is not required for risks falling within 1×10^{-4} to 1×10^{-6}; however, this is evaluated on a case-by-case basis. Risks less than 1×10^{-6} generally are not of concern to regulatory agencies (*Risk Assessment Guidance for Superfund Volume 1: Human Health Evaluation Manual Supplemental Guidance, "Standard Default Exposure Factors" (Interim Final)* [EPA 1991]).

B1.1.1 Scope and Objectives of the Unrestricted and Intruder Risk Assessments

This risk assessment was conducted to determine whether a potential for risk to human health and the environment exists under current and reasonably anticipated future site use conditions at the 200-CS-1 OU. The results, in part, provide decision makers with information on potential human health risks associated with a variety of potential future uses.

The results of the unrestricted and intruder land-use scenarios described in this appendix are not intended as the primary drivers for risk management decisions at the 200-CS-1 OU, but are presented to support risk management decisions developed for industrial (exclusive) land-uses. The analysis of the rural residential scenario and the Tribal use scenario are included for the purpose of making informed risk management decisions. The analysis of the inadvertent

intruder scenarios is based on the possibility that an individual unwittingly (through human error or loss of knowledge concerning the location of contaminants) engages in an activity that results in contact with waste left in place (10 CFR 61).

The scope of the unrestricted and intruder evaluations follow *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) and Washington Administrative Code (WAC) guidance and conducts risk assessments for each of the four representative sites in the 200-CS-1 OU. The exposure area (or exposure unit) evaluated in these risk assessments is the ditch, trench, or pond itself. Radiological and nonradiological constituents measured in shallow-zone soils (i.e., 0 to 4.6 m [0 to 15 ft] below ground surface) are evaluated for potential human health impacts for the unrestricted scenarios.

As identified by DOE, groundwater use by humans is precluded for the foreseeable future. As a result, the use of groundwater by human receptors is not evaluated as a potential exposure pathway for these waste sites. Remediation of contaminated groundwater beneath the Central Plateau is the subject of the Remedial Investigation/Feasibility Study (RI/FS) activities underway for the 200-BP-5, 200-PO-1, 200-UP-1, and 200-ZP-1 Groundwater OUs.

The main objectives of the risk assessments presented in this appendix are the same as those outlined in Chapter 3.0 and are listed below. These objectives are to:

- Logically present the methodology used and the results of the various steps of each assessment
- Identify nonradionuclide and radionuclide contaminants of concern (COC) based on their potential for presenting unacceptable health and environmental risks
- Clearly present the inherent uncertainties associated with the available data; assumptions and parameters used for exposure, toxicity, and fate and transport modeling; and the resulting risk outcome.

The following subsections provide a brief overview of the land-use scenarios.

B1.1.2 Unrestricted Land-Use Scenarios

In the rural residential scenario, site restrictions have lapsed and the site has been developed for residential purposes. The rural residential scenario assumes that current (pre-Record of Decision) conditions exist at the site and that contamination existing within the 0 to 4.6 m (0 to 15 ft) is the principal source of contamination for all pathways (WAC 173-340-740[6][d], "Unrestricted Land Use Soil Cleanup Standards,"). The rural residential exposure scenario represents an individual exposed to radiological contaminants from soil and through the food chain. The potential exposure pathways for the rural residential scenario includes direct contact with soil (external radiation, incidental ingestion, and dermal contact); inhalation of fugitive dust; and food chain exposure from ingestion of garden produce, meat, and milk. Exposure to groundwater beneath this operable unit will be evaluated during the groundwater RI/FS process.

In the Tribal use scenario, site restrictions have lapsed and the site has been developed for residential purposes. The Tribal use scenario assumes that current (pre-Record of Decision) conditions exist at the site and that contamination existing within the 0 to 4.6 m (0 to 15 ft) is the principal source of contamination for all pathways. This point of compliance is chosen in accordance with WAC 173-340-740(6)(d) for the purpose of making direct comparisons to the rural residential and industrial (exclusive) land-use scenarios. The Tribal use scenario represents an individual that is exposed to radiological contaminants from soil and through the food chain. This scenario assumes that native and natural habitat will be present, including native wildlife species and soil biota and that deep-zone groundwater is not accessible to Tribal members. Tribal members access the site and use it for hunting, fishing, and gathering activities typical of a subsistence lifestyle. The potential exposure pathways for this scenario include direct contact with soil (external radiation, incidental ingestion, and dermal contact); inhalation of fugitive dust; and food chain exposure from consumption of garden produce, fruits, berries, wild plants, poultry, livestock, game birds, and wild game. Ingestion of fish is not considered in this evaluation as it is being addressed in the River Corridor Baseline Risk Assessment. Similar to the rural residential scenario, exposure to groundwater beneath this operable unit will be evaluated during the groundwater RI/FS process.

B1.1.3 Intruder Scenarios

The intruder scenario assumes that post-remediation conditions exist at the site and that contamination remaining in soils from 0 m to groundwater is the principal source of contamination for all pathways. For purposes of evaluating risk, it is assumed that an intruder could obtain access to the area after 150 years, although passive institutional controls would remain in place. Three intruder scenarios are considered for evaluation:

1. Future Construction Trench Worker Intruder Scenario
2. Future Well Driller Intruder Scenario
3. Future Residential Intruder Scenario.

Of the three intruder scenarios, the third is considered the worst case scenario because it would have the longest exposure time. In this scenario, an intruder drills a well and incorporates contaminated soil from the well boring (0 m to groundwater) into a pasture and garden area. The intruder pastures a cow and maintains a vegetable garden at the site, and uses groundwater for drinking water and irrigation. This exposure scenario assumes that local groundwater has been restored to the highest beneficial use (i.e., drinking water purposes) and is not impacted by site contaminants.

B1.2 CONCEPTUAL MODEL

According to WAC 173-340-200, “Definitions’” a Conceptual Site Model (CSM) is a conceptual understanding of a site that identifies potential or suspected sources of hazardous substances, types and concentrations of hazardous substances, potentially contaminated media, and actual and potential exposure pathways and receptors. Site history, physical setting and current and future land and groundwater use are important factors used to develop

the conceptual model. The CSM described in Section 3.2 has been modified to show the potentially complete human exposure pathways for each scenario. Figures B-1 through B-2 show the CSMs and complete exposure pathways considered for the unrestricted and intruder scenarios for the human health risk assessments.

B1.2.1 Land-Use

As described in Chapter 3.0, the most probable future land-use in the 200-CS-1 OU area is continued industrial activities based on DOE/EIS-0222-F, *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement* and the associated record of decision (64 FR 61615). After a period of 50 years, it is assumed that all operations will have ceased and public entry to the area will be restricted for an additional 100 years by enforcement of institutional controls. Passive institutional controls of the Hanford Site will be maintained for 500 years. However, long-term future land-use at the Hanford Site is uncertain and it has been regarded as possible, though not likely, that a variety of exposure scenarios, including the rural residential land-use, Tribal use, and intruder scenarios, could occur. For the purposes of evaluating these scenarios it has been assumed that after 150 years when active institutional controls have lapsed, an individual could obtain access to the area. The land-use would be considered unrestricted at that time and is considered as such for all scenarios evaluated in this appendix.

B1.2.2 Groundwater Use

Local groundwater is not a current source of drinking water at the 200-CS-1 OU waste sites and, regardless of the land-use designation for soil, groundwater beneath the waste sites is not anticipated to become a future source of drinking water until groundwater cleanup criteria are met and groundwater is restored to the highest beneficial use (i.e., drinking water purposes).

Direct exposure to groundwater by terrestrial receptors is considered an incomplete exposure pathway because no groundwater connection to the surface is available. In addition, the aquifer is too deep for plant roots to bring groundwater contaminants from the aquifer to the surface of the sites.

Remediation of contaminated groundwater beneath the Central Plateau is the subject of the RI/FS activities underway for the 200-BP-5, 200-PO-1, 200-UP-1, and 200-ZP-1 groundwater OUs and is not included in the scope of this FS.

B1.2.3 Points of Compliance

As shown in Figures B-1 through B-2, all potentially complete exposure pathways for the unrestricted scenarios are associated with exposure to shallow-zone soils (0 to 4.6 m [0 to 15 ft] below ground surface [bgs]) and for the intruder scenarios completed exposure pathways are associated with all soil depths (0 m to groundwater [0 ft to groundwater]).

The shallow-zone soil depth is associated with potential exposure under unrestricted land-use in WAC 173-340-740(6)(d). WAC 173-340-740(6)(d) establishes a point of compliance for soil cleanup levels based on potential human exposure to soils via direct contact or other exposure pathways where contact with the soil is required to complete the pathway. This point of compliance is established in the soils throughout the site from the ground surface to 4.6 m (15 ft) bgs. This is intended to represent a reasonable estimate of the depth of soil that could be excavated and distributed at the soil surface as a result of site development activities and could result in the potential for human receptors to contact soil contaminants. In compliance with WAC 173-340-740(6)(d), the unrestricted scenarios assume that human receptors have the potential to contact shallow-zone soils from the ground surface to a depth of 4.6 m (15 ft) bgs.

For the intruder scenarios (e.g., a residential intruder exposed to drill cuttings from a well), it is assumed that human receptors have the potential to contact contamination in soils from the ground surface throughout the vadose zone to groundwater (soils from 0 m to groundwater).

B1.2.4 Exposure Pathways

The exposure pathways for potential future human receptors at the 200-CS-1 OU have been formulated based on the conceptual model, in accordance with standards provided in specific sections of CERCLA and WAC guidance. Because the land-use of the four waste sites is considered unrestricted, depending on the exposure scenario, the most probable human receptor is a resident, a Tribal member who uses the site for hunting and gathering activities, or a residential intruder. The exposure point for all scenarios is direct soil contact.

Complete exposure pathways considered for human receptors in each exposure scenario are described below in the corresponding risk assessment section.

B1.3 SELECTION OF CONTAMINANTS OF POTENTIAL CONCERN

Contaminants of potential concern (COPC) are chemicals or radionuclides that are present in the environment at levels that may place exposed humans at risk for experiencing adverse health effects and may partially or wholly originate from site-related sources. To identify COPCs at the 200-CS-1 OU, a stepwise selection process described by the CERCLA and WAC guidance (EPA/540/1-89/002; WAC 173-340, “Model Toxics Control Act – Cleanup”) was used. This selection process is described in detail in Section 3.3 and briefly summarized below.

B1.3.1 Data Assessment and Summary

The data used in the risk assessments described in this Section were extracted from the Hanford Environmental Information System database. These data were divided into three depth ranges (shallow-zone soils: 0 to 4.6 m [0 to 15 ft], deep-zone soils: 4.6 m [15 ft] to groundwater, and all depths: 0 m to groundwater). Section 3.3.1 provides a broad summary of

the analytical data. Appendix C provides a detailed summary and presents the minimum and maximum detected and nondetected concentrations for all analytes, as well as the detection frequency, by waste site. Prior to comparison and risk analyses, the data were evaluated and validated in a data quality assessment described in Appendix A of the *Remedial Investigation Report for the 200-CS-1 Chemical Sewer Group Operable Unit* (DOE/RL-2004-17).

B1.3.2 Selection of Contaminants of Potential Concern

To identify COPCs at the 200-CS-1 OU for the unrestricted land-use scenario, radiological and nonradiological constituents in shallow-zone soils (i.e., 0 to 4.6 m [0 to 15 ft] bgs) were evaluated for potential human health impacts. For the intruder land-use scenario, no constituents were evaluated for potential human health impacts (see Section B1.4.3 for details).

The selection process used in identifying COPCs at the 200-CS-1 OU include the following: 1) identification of detected constituents (Section 3.3.2.1), 2) comparison to Hanford Site background concentrations (Section 3.3.2.2.), 3) elimination of essential nutrients (Section 3.3.2.3), and 4) certain analytical considerations (Section 3.3.2.4).

B1.3.3 Contaminants of Potential Concern

Upon completion of the data evaluation phase described above, the COPCs were carried forward into their respective risk assessment. COPCs are described in the appropriate risk assessment presented below. Section B1.4.1 presents the human health risk assessment for the rural residential land-use scenario; Section B1.4.2 presents the human health risk assessment for the Tribal use and the intruder scenarios; and Section B1.4.3 presents the uncertainty discussion for the human health risk assessments.

B1.4 HUMAN HEALTH RISK ASSESSMENT APPROACH

The risk assessment approach for the unrestricted land-use and intruder scenarios is illustrated in Figure 3-4. In the first phase of the risk assessment, COPCs were identified on the basis of criteria described in Section 3.3 of the risk assessment and briefly in Section B1.3 in this appendix. A similar approach was completed for the risk assessments in this appendix. The COPCs are then evaluated in the risk assessment phase as shown in Figure 3-4. Potential risks are evaluated for nonradionuclides by following WAC 173-340-740 guidance, and radionuclides are characterized following CERCLA guidance (EPA/540/1-89/002). The results of the human health risk assessments in the following sections are presented below and the associated uncertainty discussion is presented in Section B1.4.3.

As discussed in Section 3.5, it should be noted that the exposure point concentrations (EPC) used for both nonradionuclides and radionuclides at these waste sites are the detected maximum concentrations.

B1.4.1 Future Rural Residential Land-Use Scenario Risk Assessment

This section develops and presents the rural residential land-use scenario and risk assessment through the following steps.

- The rural residential land-use scenario exposure and chemical-specific factors are described.
- Potential receptors and complete exposure pathways are identified.
- COCs are identified and site risks are characterized by 1) comparing the maximum concentrations of nonradiological COPCs to unrestricted land-use cleanup levels (CUL) as described in WAC 173-340-708, "Human Health Risk Assessment Procedures" and 2) estimating the annual radiation dose and excess lifetime cancer risk from direct contact with radiological contaminants using RESidual RADioactive materials (RESRAD) Version 6.3.

B1.4.1.1 Conceptual Site Model

Figure B-1 shows the CSM and complete exposure pathways considered for the rural residential land-use scenario. A key feature of the rural residential CSM shown in Figure B-1 is that rural residential receptors consume 1) plants that grow in the shallow soils and 2) beef and milk from a cow pastured at the site.

Exposure pathways common to the industrial and rural residential land-use scenarios include incidental soil ingestion, inhalation, dermal absorption (nonradionuclides only) and external irradiation (radionuclides only). For nonradionuclides, these exposure pathways were employed in both the industrial and rural residential land-use scenarios. For nonradionuclides, the receptors and the exposure intensity differ (i.e., children for rural residential land-use and adults only for industrial; and more frequent and longer exposure under rural residential land-use scenario). For radionuclides, the rural residential land-use scenario also incorporates ingestion of homegrown foodstuffs such as fruits and vegetables, beef, and milk. These foodstuffs serve as potential exposure routes because the plants and animals may incorporate radionuclides present in soil into their tissues. These differences between radionuclide and nonradionuclide rural residential land-use exposure pathways are associated with differences between WAC 173-340-740 Standard Method B for nonradionuclides and Hanford Site guidance for evaluating radionuclides using RESRAD (WDOH/320-015, *Hanford Guidance for Radiological Cleanup*). More generally, common practice in radiation dose assessment has been to consider potential human exposure via agricultural pathways, whereas in chemical risk assessment this practice has historically been limited.

B1.4.1.2 Exposure Assessment

The overall goal of the exposure assessment is to characterize the nature and magnitude of actual or potential exposures to COPCs present in environmental media. The exposure

pathways, scenarios and routes to residential receptors introduced in Section B1.1.1 and identified in Figure B-1 as potentially complete were included in this risk assessment.

- Completed exposure pathways for nonradiological constituents in soil include ingestion, inhalation and dermal contact.

- Completed exposure pathways for radionuclides in soil include external radiation (irradiation from radionuclides in the soil), ingestion, inhalation, and dermal contact. Receptors in this scenario are also exposed to radionuclides via consumption of vegetables and fruits that grow in the contaminated soils and animals that graze and feed on vegetation that grows in the contaminated soils.

B1.4.1.3 Nonradionuclide Risk Assessment

The Model Toxics Control Act (MTCA) – Cleanup (WAC 173-340) requires that site cleanups protect the State's citizens and the environment. The Washington State Department of Ecology (Ecology) has established standards for hazardous waste sites in order to implement this statutory mandate. This has resulted in CULs to ensure unacceptable risks are not presented to human health. For an unrestricted human health scenario, the unacceptable risk level is one in one million or 1×10^{-6} for carcinogens and a hazard quotient greater than one for noncarcinogens. The MTCA approach was used to complete the unrestricted land-use risk assessment for nonradionuclides at the 200-CS-1 OU waste sites.

The WAC established cleanup standards and requirements, and Ecology has published an online database that contains pre-calculated CULs for a large number of chemicals based on the unacceptable risk levels stated above. CULs integrate toxicological and exposure information. The subsequent comparison of the maximum concentrations for COPCs to the established CULs is considered the risk assessment phase for nonradionuclides.

B1.4.1.3.1 Washington Administrative Code 173-340-740 Human Health Cleanup Levels. The unrestricted land-use direct soil exposure Standard Method B CULs (WAC 173-340-740) presented in *Cleanup Levels and Risk Calculations under the Model Toxics Control Act Cleanup Regulations; CLARC, Version 3.1* (Ecology 94-145 2001) are precalculated and were downloaded from the CLARC online database on February 6, 2007, as documented in Appendix F. Toxicological information and exposure assumptions that represent reasonable maximum exposures are used to develop the precalculated WAC 173-340-740 CULs.

The purpose of the toxicity information is to identify the potential adverse health effects associated with exposure to contaminants and to estimate the likelihood that these adverse health effects may occur based on the extent of exposure, using the numerical toxicity values. For nonradioactive chemicals, two general types of health effects are evaluated: cancer effects and adverse noncancer health effects. Carcinogens and noncarcinogens have separate toxicity criteria called slope factors and reference doses, respectively, and are further explained in Appendix D. In general, the toxicological effects of a compound are the dominant health effects of the chemical as determined by the EPA. The reference doses and slope factors are contained in the CLARC database.

Exposure factors are those factors that define the exposure pathway, such as exposure duration and frequency, soil ingestion and air inhalation rates. WAC 173-340-740 contains exposure factors used to calculate the risk-based CULs. These factors are summarized in the equations listed below. Exposure factors used to develop CULs are considered representative of the reasonable maximum exposure for a child to soil contamination under unrestricted land-use conditions and are shown below in parentheses for each parameter in the equations.

The following equations describe the information used to establish the CULs reported in the CLARC database. If a cleanup level was not reported in the CLARC database, it was calculated in accordance with equations in Table 740-1 and 740-2 of WAC 173-340-740. Tributyl phosphate was the only chemical that had toxicity values from an accepted source that was not reported in CLARC. A CUL was calculated using the available toxicity values (e.g., the slope factor and reference dose) and the equations below. The equations are as follows:

For noncarcinogens (equation 740-1):

CUL = (RfD x ABW x UCF x HQ x AT)/(SIR x AB1 x EF x ED)

Where:

CUL	=	Cleanup level for soil (mg/kg)
RfD	=	Reference Dose as specified in WAC 173-340-708(7) (mg/kg-day)
ABW	=	Average body weight over exposure duration (16 kg)
UCF	=	Unit conversion factor (1,000,000 mg/kg)
SIR	=	Soil ingestion rate (200 mg/day)
AB1	=	Gastrointestinal absorption fraction (1.0) (unitless)
EF	=	Exposure frequency (1.0) (unitless)
HQ	=	Hazard quotient (1) (unitless)
AT	=	Averaging time (6 years)
ED	=	Exposure duration (6 years)

For carcinogens (equation 740-2):

CUL = (RISK x ABW x AT x UCF)/(CPF x SIR x AB1 x ED x EF)

Where:

CUL	=	Cleanup level for soil (mg/kg)
RISK	=	Acceptable cancer risk level (1 in 1,000,000 or 10^{-6}) (unitless)
ABW	=	Average body weight over exposure duration (16 kg)
AT	=	Averaging time (75 years)
UCF	=	Unit conversion factor (1,000,000 mg/kg)
CPF	=	Carcinogenic Potency Factor (also referred to as Slope Factor) as specified in WAC 173-340-708(8) (kg-day/mg)
SIR	=	Soil ingestion rate (200 mg/day)
AB1	=	Gastrointestinal absorption fraction (1.0) (unitless)
ED	=	Exposure duration (6 years)
EF	=	Exposure frequency (1.0) (unitless)

B1.4.1.3.2 Comparison to Washington Administrative Code Cleanup Levels. The COPCs identified in the data evaluation phase are compared to the CULs for each representative waste site and are presented in Tables B-1a-b. As seen in Tables B-1a-b, the unrestricted land-use direct soil exposure Standard Method B CULs (WAC 173-340-740) reported in the CLARC database were used to compare to the maximum concentrations of nonradionuclide COPCs. For lead and total petroleum hydrocarbons, the Method A cleanup levels were used. When a COPC is considered both a carcinogen and noncarcinogen, the lower of the two CULs provided in CLARC was selected for comparison purposes.

Exposure routes and exposure factors are considered in conjunction with other chemical-specific toxicity information in order to calculate risk-based CULs as described above. Some constituents do not have enough toxicological information available to calculate risk-based CULs. If a toxicity value was not available from EPA's Integrated Risk Information System the Provisional Peer-Reviewed Toxicity Values database, or other acceptable source, then a surrogate toxicity value for a structurally similar chemical was used. In some cases, surrogate or other compounds from the same class were used for those analytes with no risk-based CULs. For example, phenanthrene and benzo(g,h,i)perylene, both polycyclic aromatic hydrocarbons (PAH), do not have established toxicity levels and therefore no established CULs. As a result, other PAH risk-based cleanup levels were examined and compared to the detected site concentrations (as discussed in Section 3.3.2.4, pyrene is used as a surrogate for benzo(g,h,i)perylene and anthracene was used as a surrogate for phenanthrene). Toxicity values were also not available for Aroclor-1260, the CUL for polychlorinated biphenyls was used for Aroclor-1260.

Constituents for which an appropriate surrogate could not be identified and no CUL is available for comparison are considered qualitative COPCs. The effect of qualitative COPCs on overall risk is discussed in the uncertainty discussion.

B1.4.1.3.3 Nonradionuclide Contaminants of Concern. A constituent with a maximum concentration that did not exceed the corresponding unrestricted land-use CUL was not considered a COC. All other constituents with maximum concentrations greater than the CUL were retained as COCs under the unrestricted land-use direct soil exposure scenario. The nonradionuclide COCs are listed below and shown in Table B-1a-b.

216-A-29 Ditch:

COCs with maximum concentrations greater than CULs:

- Aroclor-1254
- Arsenic
- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(b)fluoranthene
- Chrysene
- Lead.

216-B-63 Trench:

COCs with maximum concentrations greater than CULs:

- Aroclor-1260.

216-S-10 Ditch:

COCs with maximum concentrations greater than CULs:

- Aroclor-1254
- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(b)fluoranthene
- Benzo(k)fluoranthene
- Chrysene
- Indeno(1,2,3-cd)pyrene.

216-S-10 Pond:

No COCs with maximum concentrations greater than CULs were identified.

B1.4.1.4 Radionuclide Risk Assessment

RESRAD Version 6.3 was used to estimate the annual radiation dose and ELCR from direct contact with radiological contaminants. A 1,000 year time frame was selected for all analyses

to capture the peak radiation dose and ELCR estimates from exposure to radiological contaminants in each representative waste site.

With the exception of the occupancy and dietary ingestion factors, the input parameters and activity concentrations described in Appendix E were used for all analyses. It should also be noted that an uncontaminated cover is currently placed over 216-A-29 Ditch, 216-B-63 Trench, and the 216-S-10 Pond. Currently the 216-S-10 Ditch is partially uncovered. The northern 2/3 of the Ditch was dredged and placed into the southern 1/3. This makes the northern 2/3 wider and deeper. The northern 2/3 of 216-S-10 Ditch is typically filled with tumbleweeds that have blown into the Ditch.

The rural residential exposure scenario represents an individual exposed to radiological contaminants from soil and through the food chain. The exposure pathways for the rural residential scenario (as shown in Figure B-1) include direct contact with soil (external radiation, incidental ingestion, and dermal contact); inhalation of fugitive dust; and food chain exposure from ingestion of garden produce, meat, and milk. Exposure to groundwater beneath this operable unit will be evaluated during the groundwater RI/FS process.

A summary of the external dose parameters used for the rural residential is provided in Table B-2. A summary of the occupancy and dietary ingestion factors is provided in Table B-3. Table 3-4 presents the comparison of detected site maximum values to the Hanford Site background values. The radionuclides greater than the background concentrations were further assessed in Appendix E. Table E-10 of Appendix E presents the radionuclides considered COPCs used in the RESRAD analysis.

Since each waste site currently has a clean soil cover and minimal cover erosion is assumed, the resulting doses and risk estimates are small. Because the rural resident is not directly exposed to the contaminated soil beneath the cover; the inhalation, incidental soil ingestion, and food ingestion exposure routes are incomplete resulting in no dose or risk. The external dose is small due to shielding by the soil cover. The annual radiation doses and ELCR for each exposure scenario and each year evaluated are summarized in Table B-4.

The total radiation dose for each representative waste site evaluated does not exceed the target radiation dose level of 15 mrem/y at any of the exposure times evaluated. With the exception of the 216-S-10 Ditch, the ELCR for each representative waste site was less than the threshold value of 1×10^{-6} for all exposure times evaluated. The ELCR for the 216-S-10 Ditch was within or less than the target risk range of 1.0×10^{-4} to 1.0×10^{-6} for all of the exposure times evaluated.

B1.4.2 Tribal Use Scenario Risk Assessment

The DOE, EPA, and Ecology (Tri-Parties) have interacted with the stakeholder Tribes over the past several years to obtain input on developing a Tribal use exposure scenario or scenarios, including key parameters for the Central Plateau risk assessment models.

The Tribes were involved in the risk assessment framework workshops during the summer of 2002, and in October 2002, they were asked to provide written suggestions on specific risk assessment parameters (exposure assumptions) for Tribal-use scenarios (DOE-RCA-2002-0584, 2002a, Letter [no title; topic: Tribal Input on the CERCLA Risk Assessment], to Richard Gay, Confederated Tribes of the Umatilla Indian Reservation, from the Tri-Party Agreement signatories; DOE-RCA-2002-0584, 2002b, Letter [no title; topic: Tribal Input on CERCLA Risk Assessment], to Russell Jim, Confederated Tribes and Bands of the Yakama Nation, from the Tri-Party Agreement signatories; DOE-RCA-2002-0584, 2002c, Letter [no title; topic: Tribal Input on CERCLA Risk Assessment], to Patrick Sobotta, Nez Perce Tribe, from the Tri-Party Agreement signatories). This request culminated in a workshop in December 2002 that included the Tri-Parties and representatives from the Confederated Tribes of the Umatilla Indian Reservation, the Confederated Tribes and Bands of the Yakama Nation, and the Nez Perce Tribe. The Yakamas and the Nez Perce participated in the workshop but believed they needed additional time to provide input. The Umatillas asked that the information from DOE/RL-91-45, *Hanford Site Baseline Risk Assessment Methodology,* and, "A Native American Exposure Scenario," (Harris and Harper 1997) be used to calculate risk estimates for a Tribal use scenario.

The Tribal use scenario proposed in Harris and Harper (1997) represents a "typical" Native American culture that incorporates the use of the entire Columbia Basin for food, water, and shelter. The Harris and Harper (1997) scenario has been revised, based on additional work by Harris, and it is now referred to as the "Exposure Scenario for (CTUIR) Traditional Subsistence Lifeways" (Harris 2004). Harris (2004) provides updated consumption exposure factors that emerge from distinguishing between a fish-focused diet (applicable for Hanford Reach areas near the Columbia River) and a game-focused diet (applicable to locations that do not rely on consumption from the river). In this risk assessment, the game-focused diet is used because the Central Plateau, where the 200-CS-1 OU sites are located, is in the dry upland portion of the Hanford Site; nearly five miles from the Columbia River.

This section develops and presents the Tribal use scenario and risk assessment through the following steps.

1. The Tribal use scenario exposure and chemical-specific factors are described.

2. Potential receptors and complete exposure pathways are identified.

3. COCs are identified and site risks are characterized by 1) comparing the maximum concentrations of nonradionuclide COPCs to unrestricted land-use CULs that were modified based on Tribal use exposures factors (Harris 2004) and 2) estimating the annual radiation dose and excess lifetime cancer risk from direct contact with radiological contaminants using RESRAD Version 6.3.

B1.4.2.1 Conceptual Site Model

The CSM for the Tribal use scenario, illustrated in Figure B-2, identifies the means by which Tribal members on the 200-CS-1 OU waste sites could be exposed to chemicals in environmental media. The CSM addresses exposures that could result from potential future

traditional Tribal uses for the sites and the surrounding areas. The CSM provides a current understanding of the sources of contamination, physical setting, and current and future land-use, and identifies potentially complete human exposure pathways for the study areas. Information generated during the RI/FS process has been incorporated into this CSM to help identify potential exposure scenarios. Key features of the CSM are listed below.

- Soil contamination existing within the 0 to 4.6 m (0 to 15 ft), resulting from surface deposition is the principal source of contamination for all pathways.

- No soil cleanup activities have been accomplished at the site and current (pre-ROD) soil concentrations remain.

- The deep-zone groundwater is not accessible to Tribal members. This is due to its significant depth, typically about 82 m (270 ft), beneath the surface. This fact eliminates domestic use of groundwater and the application of contaminated groundwater for sweat lodge use as a potential exposure pathway.

- The pathway from soils at the sites to fish in the Columbia River is, for practical purposes incomplete. Migration of soil contaminants from the vadose zone to the deep groundwater has been largely been discounted as a viable transport pathway in the RI/FS. Moreover, even if migration of soil contaminants from the vadose zone to the deep groundwater were a viable pathway, contaminant concentrations in the surface water would be so low that they would not accumulate in the edible tissues of fish in the River. This is because of significant reduction in concentration that would come about from initially mixing in the deep groundwater, followed by additional concentration reduction from saturated zone adjective migration over five miles, and further mixing upon discharge into the Columbia River.

- Future Tribal members residing on the Central Plateau are not likely to obtain a principal portion of their protein intake from consumption of fish obtained from the Columbia River.

- Future Tribal members participate in a subsistence lifestyle described by Harris and Harper (1997) and Harris (2004) as "hunting, fishing, and gathering activities." Tribal member consume 1) plants that grow in the shallow soils and 2) local game that consume plants growing in the soil and also consume contaminated soils while grazing. The agricultural pathway in the Tribal use scenario differs from the rural residential scenario and the residential intruder. The scenarios are similar only in that food chain pathways are important exposure considerations in both assessments. The Tribal use scenario is similar to a "living off the land" situation in that significant portions of the Tribal members' dietary intake is consumption of native plants and game.

- For the Tribal use scenario, native plants grow in the unadulterated, though contaminated soils and includes a simplified game-based food chain model

incorporating consumption of native animals that graze and forage in the affected soils.

B1.4.2.2 Exposure Assessment

The Tribal use scenario assumes that a Tribal member is residing within the boundaries of the specific 200-CS-1 OU waste sites and obtain all of their daily caloric need from plant intake and game consumption from local plants and animals. The exposure pathways, scenarios and routes to Tribal members are introduced in Section B1.1.1 and identified in Figure B-2 as potentially complete were included in this risk assessment.

- Completed exposure pathways for nonradiological constituents in soil include ingestion, inhalation and dermal contact.

- Completed exposure pathways for radionuclides in soil include external radiation (irradiation from radionuclides in the soil), ingestion, inhalation, and dermal contact. Receptors in this scenario are also exposed to radionuclides via consumption of vegetables and fruits that grow in the contaminated soils, and game that graze and feed on vegetation that grows in the contaminated soils.

B1.4.2.3 Nonradionuclide Risk Assessment

B1.4.2.3.1 Modified Washington Administrative Code 173-340-740 Human Health Cleanup Levels. For the Tribal use risk assessment, CULs were calculated using the Modified Method B approach (WAC 173-340-705, "Use of Method B"). The Modified Method B approach provides for the use of chemical-specific or site-specific information to change selected default assumptions. In this case, soil ingestion rates and other exposure parameters identified in Harris (2004) were used in equations 740-1 and 740-2 in order to calculate CULs for Tribal uses. The only difference in the exposure parameters for the Standard Method B equations shown in Section B1.4.1.3.1 was the soil ingestion rate changed to 400 mg/day. All other exposure factors used were the same values shown in Section B1.4.1.3.1, most of which are the same values defined in Harris (2004). CULs developed under both the Standard and Modified Method B approach are protective of the reasonable maximum exposure expected to occur at the site. As shown in the equations in Section B1.4.1.3.1, both the Standard and Modified Method B approach establish that the human health risk levels may not exceed one in one million or 1×10^{-6} for carcinogens and a hazard quotient greater than one for noncarcinogens.

B1.4.2.3.2 Comparison to Washington Administrative Code Cleanup Levels. Maximum concentrations of nonradiological COPCs were compared to unrestricted land-use CULs calculated using a Modified Method B (WAC 173-340-705) approach for direct soil exposure. These comparisons are presented in Table B-5a-b. As seen in Table B-5a-b, the unrestricted land-use direct soil exposure Modified Method B cleanup levels (WAC 173-340-705) were used to compare to the maximum concentrations of nonradionuclide COPCs. For lead and total petroleum hydrocarbons, the Method A cleanup levels were used. When a COPC is considered both a carcinogen and noncarcinogen, the lower of the two CULs provided in CLARC was selected for comparison purposes.

In some cases, surrogate or other compounds from the same class were used for those analytes with no risk-based CULs (See Section B1.4.1.3.2). Constituents for which an appropriate surrogate could not be identified are considered qualitative COPCs. The effect of these qualitative COPCs on overall risk is discussed in the uncertainty discussion.

B1.4.2.3.3 Nonradionuclide Contaminants of Concern. A constituent with a maximum concentration that did not exceed the corresponding unrestricted land-use CUL was not considered a COC. All other constituents with maximum concentrations greater than the CUL were retained as COCs under the unrestricted land-use direct soil exposure scenario. The nonradionuclide COCs are listed below.

216-A-29 Ditch:

COCs with maximum concentrations greater than CULs:

- Aroclor-1254
- Arsenic
- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(b)fluoranthene
- Chrysene
- Lead.

216-B-63 Trench:

COCs with maximum concentrations greater than CULs:

- Aroclor-1260.

216-S-10 Ditch:

COCs with maximum concentrations greater than CULs:

- Aroclor-1254
- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(b)fluoranthene
- Benzo(k)fluoranthene
- Chrysene
- Dibenzo[a,h]anthracene
- Indeno(1,2,3-cd)pyrene.

216-S-10 Pond:

No COCs with maximum concentrations greater than CULs were identified.

B1.4.2.4 Radionuclide Risk Assessment

Similar to the other risk assessments, RESRAD Version 6.3 was used to estimate the annual radiation dose and ELCR from direct contact with radiological contaminants. A 1,000 year

time frame was selected for all analyses to capture the peak radiation dose and ELCR estimates from exposure to radiological contaminants in each representative waste site.

The Confederated Tribes of the Umatilla Indian Reservation exposure scenario represents an individual exposed to radiological contaminants from soil and through the food chain. The exposure pathways for this scenario include direct contact with soil (external radiation, incidental ingestion, and dermal contact); inhalation of fugitive dust; and food chain exposure from consumption of garden produce, fruits, berries, wild plants, poultry, livestock, game birds, and wild game. Ingestion of fish is not evaluated as it is being considered in the River Corridor Baseline Risk Assessment. Similar to the rural residential scenario, exposure to groundwater beneath this operable unit will be evaluated during the groundwater RI/FS process.

A summary of the external dose parameters used for the rural residential is provided in Table B-2. A summary of the occupancy and dietary ingestion factors is provided in Table B-3. Table 3-4 presents the comparison of detected site maximum values to the Hanford Site background values. The radionuclides greater than the background concentrations were further assessed in Appendix E. Table E-10 of Appendix E presents the radionuclides considered COPCs used in the RESRAD analysis.

Because each waste site currently has a clean soil cover and minimal cover erosion is assumed, the resulting doses and risk estimates are small. Because the rural resident is not directly exposed to the contaminated soil beneath the cover; the inhalation, incidental soil ingestion, and food ingestion exposure routes are incomplete resulting in no dose or risk. The external dose is small due to shielding by the soil cover. The annual radiation doses and ELCR for each exposure scenario and each year evaluated are summarized in Table B-4.

The total radiation dose for each representative waste site evaluated does not exceed the target radiation dose level of 15 mrem/y at any of the exposure times evaluated. With the exception of the 216-S-10 Ditch, the ELCR for each representative waste site less than the threshold value of 1×10^{-6} for all exposure times evaluated. The ELCR for the 216-S-10 Ditch was within or less than the target risk range of 1.0×10^{-4} to 1.0×10^{-6} for all of the exposure times evaluated.

B1.4.3 Intruder Scenario Risk Assessments

The evaluation of intruder scenarios is not specifically required by CERCLA; however, it has been requested that an intruder scenario consistent with DOE Order 435.1, *Radioactive Waste Management* be evaluated. The proposed DOE/RL position acknowledges that the intruder scenario is a reasonable means of assessing the potential consequences of remedy failure and supports the evaluation of the CERCLA balancing criteria of long-term effectiveness and permanence.

For purposes of evaluating risk, it is assumed that, although institutional controls would remain in place, an intruder could obtain access to the area after 150 years. Three intruder scenarios are considered for evaluation:

- Future Construction Trench Worker Intruder Scenario
- Future Well Driller Intruder Scenario (drill cuttings)
- Future Rural Residential Intruder Scenario (drill cuttings).

Of the three intruder scenarios, the third is considered the worst case scenario because it would have the longest exposure time. However, the results of future rural residential scenario indicated there was no potential for the radiation dose limit to exceed the 15 mrem/y standard at any time. As a result, no additional intruder analyses were performed.

B1.4.4 Human Health Risk Assessments Summary and Uncertainty Discussion

Similar to the findings in Chapter 3 of the main document, this uncertainty discussion concludes that the sampling strategy employed in the RI, coupled with adherence to CERCLA and WAC guidance, results in risk determinations that are more likely overestimated than underestimated. It is important to note the biased sampling strategy targeted worst-case/maximum concentrations at the expense of fully characterizing each site. As a result, this risk assessment is based on biased and limited data, and the approach followed purposefully avoids false negative risk conclusions. The limitations associated with the characterization data were not considered severe because it is anticipated additional sampling will be incorporated in the remedial design/remedial action process to better characterize the site and address, the more likely, false positive errors.

However, it is important to note that the industrial land-use evaluation discussed in Chapter 3.0 found no significant COCs for human health risk. There were qualitative COPCs identified because there were no evaluation criteria available for those constituents, but none of these were indicative of excessive human health risk under the industrial scenario. As a result, risk managers were advised that the combination of no adverse findings, coupled with the bias toward overestimation of risk, provides confidence in concluding that the site offers minimal risk to human health.

This conclusion does not apply to the unrestricted residential and Tribal use scenarios. It is likely that human health risks have been overestimated for these scenarios, it should not be extended to include the probability that there is minimal or no human health risk. Rather, it can be inferred that it is unlikely that human health risk is greater than that estimated in this appendix.

As discussed in Section 3.7.2, uncertainty in these results can be classified into four types:

- Parameter uncertainty
- Model uncertainty
- Decision-rule uncertainty
- Variability.

The first two are the main source of uncertainty for the risk assessments in this appendix. Health risk evaluation procedures are inherently designed to err on the side of retaining COPCs for further evaluation in risk characterizations. Risk assessment methodology is less

likely to indicate that chemicals are not a health risk when they actually are. This process is necessary to ensure the protection of human health.

As described in Section 3.4.3, the most important considerations relate to:

- Development of representative media concentrations,
- Exposure factors,
- Toxicity information, and
- Characterization of risks.

In addition to the uncertainty discussions presented in those sections of the FS (Sections 3.4.3 and 3.7.2), it is important to note that CULs used for these unrestricted land-use scenarios were developed based on a single soil ingestion pathway. The CSM for this site suggests other pathways and exposure routes. As a result, risks may be underestimated if other routes are sufficiently active.

Figure B- 1. Rural Residential Land-Use Scenario Conceptual Site Model for Human Health.

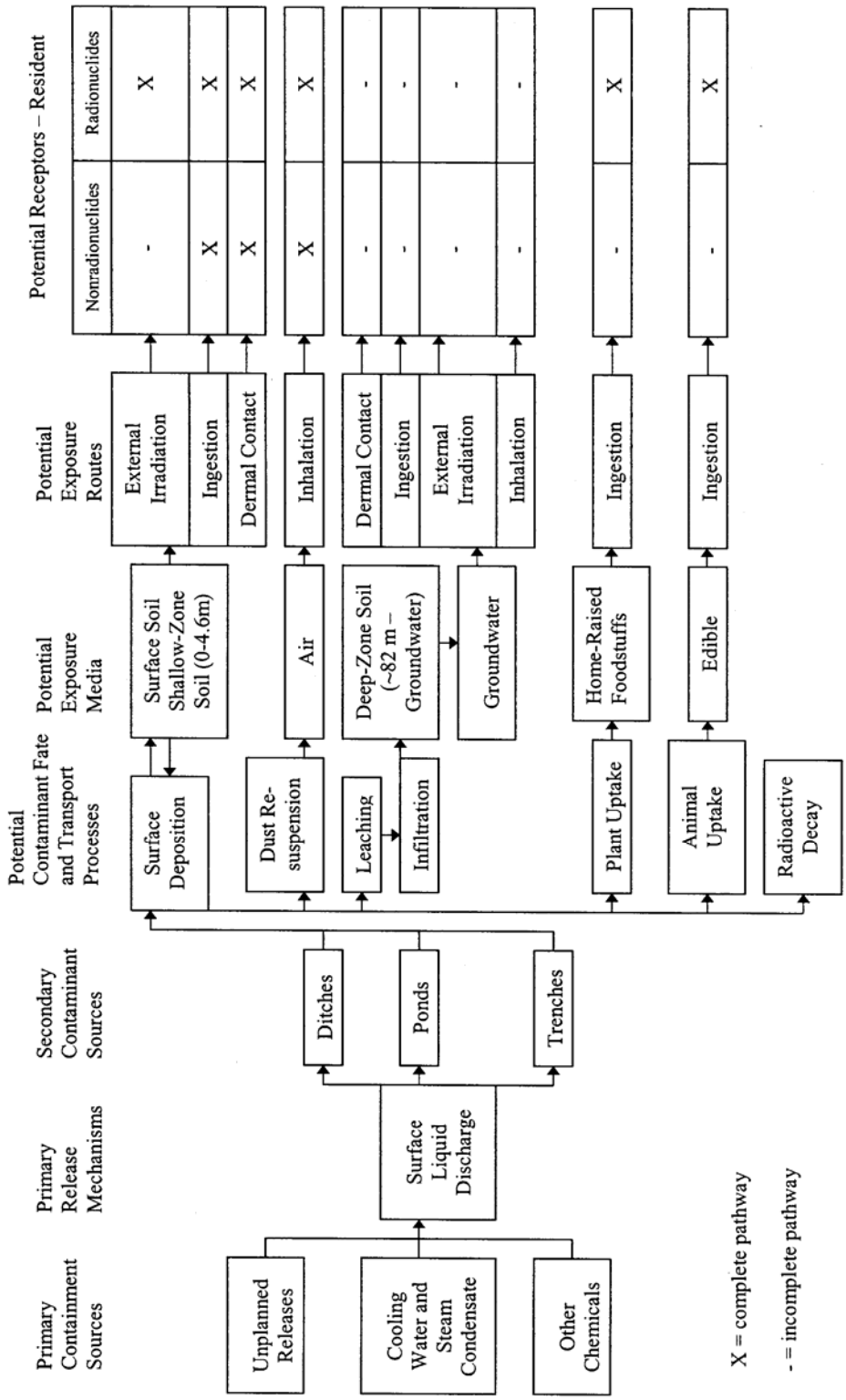

Figure B- 2. Game-Based Tribal Use Scenario (e.g., Native American Traditional Subsistence Lifeways) Conceptual Site Model.

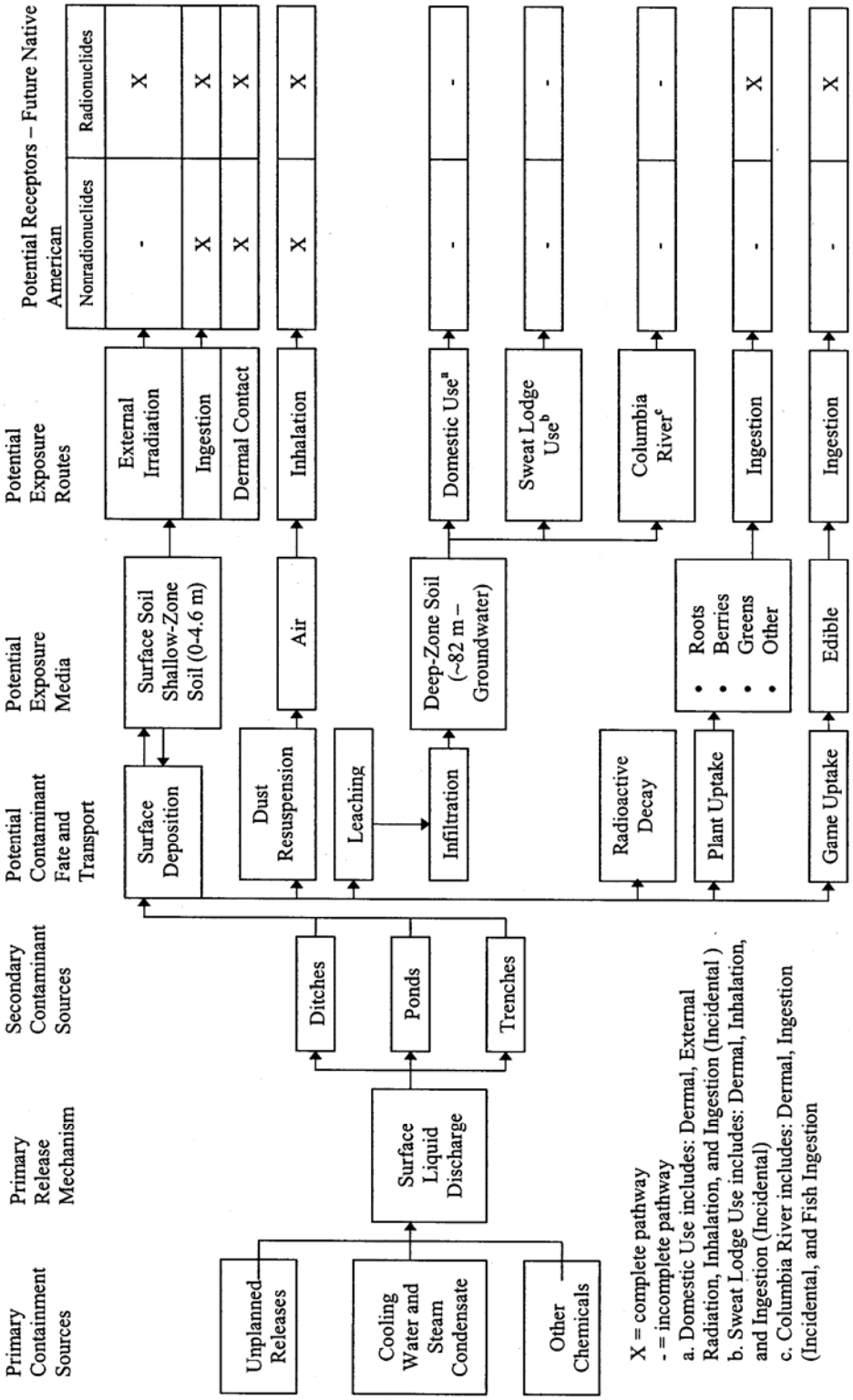

Table B-1a. Comparison of Maximum Values for Organic Chemicals Detected in Shallow-Zone (0 to 4.6 m [0 to 15 ft]) with WAC 173-340-740 (Unrestricted Land-Use Direct Soil Exposure) Screening Levels. (4 sheets)

Constituent Name[a]	Units	Maximum Detected Concentration from 0 to 4.6 m[b] [0 to 15 ft]	Depth of Maximum Detected from 0 to 4.6 m [0 to 15 ft]	Unrestricted Surface Use Direct Exposure Screening Level[c]	Does Maximum Detected Exceed Screening Level?
216-S-10 Ditch					
Acenaphthene	µg/kg	61	0.0 - 0.46 [0.0 - 1.5]	4.80E+06	No
Acetone	µg/kg	9	4.1 - 4.4 [13.5 - 14.5]	8.00E+06	No
Anthracene	µg/kg	150	0.0 - 0.46 [0.0 - 1.5]	2.40E+07	No
Aroclor-1254[d]	µg/kg	3700	0.0 - 0.46 [0.0 - 1.5]	1.60E+03	Yes
Benzo(a)anthracene	µg/kg	550	0.0 - 0.46 [0.0 - 1.5]	1.40E+02	Yes
Benzo(a)pyrene	µg/kg	600	0.0 - 0.46 [0.0 - 1.5]	1.40E+02	Yes
Benzo(b)fluoranthene	µg/kg	530	0.0 - 0.46 [0.0 - 1.5]	1.40E+02	Yes
Benzo(g,h,i)perylene[e]	µg/kg	660	0.0 - 0.46 [0.0 - 1.5]	2.40E+06	No
Benzo(k)fluoranthene	µg/kg	450	0.0 - 0.46 [0.0 - 1.5]	1.40E+02	Yes
Bis(2-ethylhexyl)phthalate	µg/kg	580	0.0 - 0.46 [0.0 - 1.5]	7.10E+04	No
Butyl benzyl phthalate	µg/kg	580	0.0 - 0.46 [0.0 - 1.5]	1.60E+07	No
Carbazole	µg/kg	97	0.0 - 0.46 [0.0 - 1.5]	5.00E+04	No
Chrysene	µg/kg	680	0.0 - 0.46 [0.0 - 1.5]	1.40E+02	Yes
Dibenzo[a,h]anthracene	µg/kg	110	0.0 - 0.46 [0.0 - 1.5]	1.40E+02	No
Dibutyl phthalate	µg/kg	2300	0.0 - 0.46 [0.0 - 1.5]	8.00E+06	No
Diesel Range TPH[f]	µg/kg	31,000	0.0 - 0.46 [0.0 - 1.5]	2.00E+06	No
Fluoranthene	µg/kg	1500	0.0 - 0.46 [0.0 - 1.5]	3.20E+06	No
Fluorene	µg/kg	59	0.0 - 0.46 [0.0 - 1.5]	3.20E+06	No
Indeno(1,2,3-cd)pyrene	µg/kg	400	0.0 - 0.46 [0.0 - 1.5]	1.40E+02	Yes

Table B-1a. Comparison of Maximum Values for Organic Chemicals Detected in Shallow-Zone (0 to 4.6 m [0 to 15 ft]) with WAC 173-340-740 (Unrestricted Land-Use Direct Soil Exposure) Screening Levels. (4 sheets)

Constituent Name[a]	Units	Maximum Detected Concentration from 0 to 4.6 m[b] [0 to 15 ft]	Depth of Maximum Detected from 0 to 4.6 m [0 to 15 ft]	Unrestricted Surface Use Direct Exposure Screening Level[c]	Does Maximum Detected Exceed Screening Level?
Methylene chloride	µg/kg	10	0.46 - 0.91 [1.5 - 3.0]; 2.6 - 2.9 [8.5 - 9.5]	1.30E+05	No
Phenanthrene[g]	µg/kg	930	0.0 - 0.46 [0.0 - 1.5]	2.40E+07	No
Pyrene	µg/kg	1,600	0.0 - 0.46 [0.0 - 1.5]	2.40E+06	No
216-S-10 Pond					
Acetone	µg/kg	26	2.6 - 2.9 [8.5 - 9.5]	8.00E+06	No
Bis(2-ethylhexyl)phthalate	µg/kg	140	1.2 - 1.5 [4.0 - 5.0]	7.10E+04	No
Methylene chloride	µg/kg	15	2.9 - 3.2 [9.5 - 10.5]	1.30E+05	No
Toluene	µg/kg	4.2	2.9 - 3.2 [9.5 - 10.5]	6.40E+06	No
Xylenes (total)	µg/kg	1.4	1.8 - 2.1 [6.0 - 7.0]	1.60E+07	No
216-B-63 Trench					
2-Ethylhexanol	µg/kg	6	13.0 - 15.5	--	Detected, no screening value
Acetone	µg/kg	66	1.5 - 1.8 [5.0 - 6.0]	8.00E+06	No
Aroclor-1254[d]	µg/kg	77	3.1 - 4.0 [10.0 - 13.0]	1.60E+03	No
Aroclor-1260[h]	µg/kg	9200	8.0 - 10.5	5.00E+02	Yes
Benzene	µg/kg	8	1.5 - 1.8 [5.0 - 6.0]	1.80E+04	No
Bis(2-ethylhexyl)phthalate	µg/kg	21	2.4 - 2.9 [8.0 - 9.5]	7.10E+04	No
Di-n-octyl phthalate	µg/kg	52	13.0 - 15.5	1.60E+06	No
Methylene chloride	µg/kg	27	2.9 - 3.2 [9.5 - 10.5]	1.30E+05	No
Toluene	µg/kg	3	2.1 - 2.4 [7.0 - 8.0]	6.40E+06	No
216-A-29 Ditch					
1,2-Dichloroethane	µg/kg	13	1.2 - 1.5 [4.0 - 5.0]	1.10E+04	No

Table B-1a. Comparison of Maximum Values for Organic Chemicals Detected in Shallow-Zone (0 to 4.6 m [0 to 15 ft]) with WAC 173-340-740 (Unrestricted Land-Use Direct Soil Exposure) Screening Levels. (4 sheets)

Constituent Name[a]	Units	Maximum Detected Concentration from 0 to 4.6 m[b] [0 to 15 ft]	Depth of Maximum Detected from 0 to 4.6 m [0 to 15 ft]	Unrestricted Surface Use Direct Exposure Screening Level[c]	Does Maximum Detected Exceed Screening Level?
Acetone	µg/kg	30	2.3 - 2.6 [7.5 - 8.5]	8.00E+06	No
Aroclor-1254[d]	µg/kg	9400	1.2 - 1.5 [4.0 - 5.0]	1.60E+03	Yes
Benzo(a)anthracene	µg/kg	180	1.2 - 1.5 [4.0 - 5.0]	1.40E+02	Yes
Benzo(a)pyrene	µg/kg	160	1.2 - 1.5 [4.0 - 5.0]	1.40E+02	Yes
Benzo(b)fluoranthene	µg/kg	240	1.2 - 1.5 [4.0 - 5.0]	1.40E+02	Yes
Bis(2-ethylhexyl)phthalate	µg/kg	6200	1.2 - 1.5 [4.0 - 5.0]	7.10E+04	No
Butyl benzyl phthalate	µg/kg	290	1.2 - 1.5 [4.0 - 5.0]	1.60E+07	No
Chrysene	µg/kg	210	1.2 - 1.5 [4.0 - 5.0]	1.40E+02	Yes
Dibutyl phthalate	µg/kg	2741	1.2 - 1.5 [4.0 - 5.0]	8.00E+06	No
Diethyl phthalate	µg/kg	330	2.7 - 3.5 [9.0 - 11.5]	6.40E+07	No
Fluoranthene	µg/kg	370	1.2 - 1.5 [4.0 - 5.0]	3.20E+06	No
Kerosene range TPH[f]	µg/kg	440,000	1.2 - 2.0 [4.0 - 6.5]	2.00E+06	No
Mesityl oxide	µg/kg	390	2.7 - 3.5 [9.0 - 11.5]	--	Detected, no screening value
Methylene chloride	µg/kg	78	1.2 - 1.5 [4.0 - 5.0]	1.30E+05	No
Motor oil TPH[f]	µg/kg	760,000	1.2 - 1.5 [4.0 - 5.0]	2.00E+06	No
N-Butylbenzenesulfonamide	µg/kg	4,400	2.7 - 3.5 [9.0 - 11.5]	--	Detected, no screening value
Phenanthrene[g]	µg/kg	370	1.2 - 1.5 [4.0 - 5.0]	2.40E+07	No
Pyrene	µg/kg	350	1.2 - 1.5 [4.0 - 5.0]	2.40E+06	No
Tetrachloroethylene	µg/kg	6	1.2 - 1.5 [4.0 - 5.0]	1.90E+03	No

Table B-1a. Comparison of Maximum Values for Organic Chemicals Detected in Shallow-Zone (0 to 4.6 m [0 to 15 ft]) with WAC 173-340-740 (Unrestricted Land-Use Direct Soil Exposure) Screening Levels. (4 sheets)

Constituent Name[a]	Units	Maximum Detected Concentration from 0 to 4.6 m[b] [0 to 15 ft]	Depth of Maximum Detected from 0 to 4.6 m [0 to 15 ft]	Unrestricted Surface Use Direct Exposure Screening Level[c]	Does Maximum Detected Exceed Screening Level?
Tributyl phosphate[i]	µg/kg	543	1.2 - 1.5 [4.0 - 5.0]	1.85E+05	No

[a]Constituents that only have non-detect results for all analyzed shallow-zone soil samples are not included in this table.

[b]Shallow depth maximum concentration determination included all samples down to and including the 4.6 m (15 ft) depth. A sample was included if the 4.6 m (15 ft) depth was the shallowest point of the sample depth range (for example, a sample collected from 4.6 to 5.2 meters [15 to 17 feet] would be considered a shallow-zone sample).

[c]The unrestricted direct exposure cleanup levels reported in this table are the most conservative Method B standard formula values reported in the CLARC online database as of 2/6/07. Where Method B values were unavailable, this table defers to the Method A unrestricted land use values reported in the CLARC online database (2/6/07) and in Table 740-1 of the MTCA Cleanup Regulation (WAC 173-340).

[d]Aroclor-1254 value based on carcinogenic effects using the upper bound slope factor of 2 from EPA, 2003, *Integrated Risk Information System* (IRIS) database.

[e]A cleanup level for this constituent was unavailable, so the cleanup level for pyrene was used.

[f]WAC 173-340-740 values for kerosene and diesel range TPH based on noncarcinogenic effects. Method A values (Tables 740-1) for carcinogenic effects are based on groundwater protection and are proposed to be 2000 mg/kg (currently 200 mg/kg).

[g]A cleanup level for this constituent was unavailable, so the cleanup level for anthracene was used.

[h]A cleanup level for this constituent was unavailable, so the cleanup level for PCB was used for this constituent.

[i]The cleanup level for this constituent was unavailable in CLARC, so a cleanup level was calculated using WAC equations 740-1 and 740-2 and the toxicity factors provide by the Risk Assessment Information System (RAIS).

WAC = Washington State Administrative Code.

TPH = total petroleum hydrocarbons.

-- = no screening level is available

Shaded cells indicate that the chemical was retained as a contaminant of potential concern after screening.

Table B-1b. Comparison of Maximum Values for Inorganic Chemicals Higher than Background in Shallow-Zone Soil (0 to 4.6 m [0 to 15 ft]) with WAC 173-340-740 (Unrestricted Land-Use Direct Soil Exposure) Screening Levels. (5 sheets)

Constituent Class	Constituent Name[a]	Units	Maximum Detected Concentration from 0 to 4.6 m[b] [0 to 15 ft]	Depth range of Maximum Detected from 0 to 4.6 m [0 to 15 ft]	Unrestricted Surface Use Direct Exposure Screening Level[c]	Does Maximum Detected Exceed Screening Level?
216-S-10 Ditch						
METAL	Bismuth	mg/kg	2	0.0 - 0.46 [0.0 - 1.5]	--	Detected, no screening value
METAL	Boron	mg/kg	1.5	0.0 - 0.46 [0.0 - 1.5]; 1.8 - 2.1 [6.0 - 7.0]	1.60E+04	No
METAL	Chromium (total)[d]	mg/kg	815	0.0 - 0.46 [0.0 - 1.5]	1.20E+05	No
METAL	Chromium VI	mg/kg	14.1	0.46 - 0.91 [1.5 - 3.0]	2.40E+02	No
METAL	Copper	mg/kg	244	0.0 - 0.46 [0.0 - 1.5]	3.00E+03	No
METAL	Lead[e]	mg/kg	30	0.0 - 0.46 [0.0 - 1.5]	2.50E+02	No
METAL	Mercury	mg/kg	4.3	0.0 - 0.46 [0.0 - 1.5]	2.40E+01	No
METAL	Molybdenum	mg/kg	0.88	0.0 - 0.46 [0.0 - 1.5]	4.00E+02	No
METAL	Nickel	mg/kg	20.3	0.0 - 0.46 [0.0 - 1.5]	1.60E+03	No
METAL	Selenium	mg/kg	0.44	2.6 - 2.9 [8.5 - 9.5]	4.00E+02	No
METAL	Silver	mg/kg	30.4	0.0 - 0.46 [0.0 - 1.5]	4.00E+02	No
METAL	Thallium	mg/kg	0.99	0.0 - 0.46 [0.0 - 1.5]	5.60E+00	No
METAL	Vanadium	mg/kg	87.5	2.6 - 2.9 [8.5 - 9.5]	5.60E+02	No
METAL	Zinc	mg/kg	506	0.0 - 0.46 [0.0 - 1.5]	2.40E+04	No
CONV	Nitrate (total)[f]	mg/kg	18	0.0 - 0.46 [0.0 - 1.5]	1.28E+05	No
CONV	Nitrite (total)[f]	mg/kg	0.35	2.6 - 2.9 [8.5 - 9.5]	8.00E+03	No
CONV	Nitrate/nitrite as N[g]	mg/kg	10.6	0.0 - 0.46 [0.0 - 1.5]	--	Detected, no screening value
CONV	Phosphate	mg/kg	1.5	0.91 - 1.2 [3.0 - 4.0]	--	Detected, no screening value

Table B-1b. Comparison of Maximum Values for Inorganic Chemicals Higher than Background in Shallow-Zone Soil (0 to 4.6 m [0 to 15 ft]) with WAC 173-340-740 (Unrestricted Land-Use Direct Soil Exposure) Screening Levels. (5 sheets)

Constituent Class	Constituent Name[a]	Units	Maximum Detected Concentration from 0 to 4.6 m[b] [0 to 15 ft]	Depth range of Maximum Detected from 0 to 4.6 m [0 to 15 ft]	Unrestricted Surface Use Direct Exposure Screening Level[c]	Does Maximum Detected Exceed Screening Level?
216-S-10 Pond						
METAL	Boron	mg/kg	1	1.8 - 2.1 [6.0 - 7.0]	1.60E+04	No
METAL	Chromium (total)[d]	mg/kg	26.2	2.7 - 3.1 [9.0 - 10.0]; 3.4 - 3.7 [11.0 - 12.0]	1.20E+05	No
METAL	Chromium VI	mg/kg	2.7	2.1 - 2.4 [7.0 - 8.0]	2.40E+02	No
METAL	Mercury	mg/kg	0.43	3.5 - 3.8 [11.5 - 12.5]	2.40E+01	No
METAL	Molybdenum	mg/kg	0.29	2.0 - 2.3 [6.5 - 7.5]	4.00E+02	No
METAL	Selenium	mg/kg	0.46	2.7 - 3.1 [9.0 - 10.0]	4.00E+02	No
METAL	Silver	mg/kg	8.3	2.7 - 3.1 [9.0 - 10.0]	4.00E+02	No
METAL	Thallium	mg/kg	0.62	1.2 - 1.5 [4.0 - 5.0]	5.60E+00	No
CONV	Cyanide	mg/kg	0.2	2.9 - 3.2 [9.5 - 10.5]	1.60E+03	No
CONV	Nitrite (total)[f]	mg/kg	0.48	2.9 - 3.2 [9.5 - 10.5]	8.00E+03	No
CONV	Nitrate/nitrite as N[g]	mg/kg	14.9	2.0 - 2.3 [6.5 - 7.5]	--	Detected, no screening value
CONV	Phosphate	mg/kg	3.8	3.5 - 3.8 [11.5 - 12.5]	--	Detected, no screening value
CONV	Sulfide	mg/kg	59	3.4 - 3.7 [11.0 - 12.0]	--	Detected, no screening value
216-B-63 Trench						
METAL	Antimony	mg/kg	5	1.2 - 2.0 [4.0 - 6.5]	3.20E+01	No
METAL	Bismuth	mg/kg	37.1	2.4 - 3.2 [8.0 - 10.5]	--	Detected, no screening value
METAL	Boron	mg/kg	6.3	2.4 - 3.2 [8.0 - 10.5]	1.60E+04	No
METAL	Chromium (total)[d]	mg/kg	21.9	3.8 - 4.4 [12.5 - 14.5]	1.20E+05	No

Table B-1b. Comparison of Maximum Values for Inorganic Chemicals Higher than Background in Shallow-Zone Soil (0 to 4.6 m [0 to 15 ft]) with WAC 173-340-740 (Unrestricted Land-Use Direct Soil Exposure) Screening Levels. (5 sheets)

Constituent Class	Constituent Name[a]	Units	Maximum Detected Concentration from 0 to 4.6 m[b] [0 to 15 ft]	Depth range of Maximum Detected from 0 to 4.6 m [0 to 15 ft]	Unrestricted Surface Use Direct Exposure Screening Level[c]	Does Maximum Detected Exceed Screening Level?
METAL	Chromium VI	mg/kg	0.45	2.9 - 3.2 [9.5 - 10.5]	2.40E+02	No
METAL	Copper	mg/kg	30.6	3.7 - 4.0 [12.0 - 13.0]	3.00E+03	No
METAL	Molybdenum	mg/kg	0.55	1.5 - 1.8 [5.0 - 6.0]	4.00E+02	No
METAL	Selenium	mg/kg	0.75	2.3 - 2.6 [7.5 - 8.5]	4.00E+02	No
METAL	Silver	mg/kg	0.86	2.4 - 3.2 [8.0 - 10.5]	4.00E+02	No
METAL	Thallium	mg/kg	0.53	1.8 - 2.1 [6.0 - 7.0]	5.60E+00	No
METAL	Vanadium	mg/kg	86.9	2.3 - 2.6 [7.5 - 8.5]	5.60E+02	No
METAL	Zinc	mg/kg	80.8	3.7 - 4.0 [12.0 - 13.0]	2.40E+04	No
CONV	Ammonia as NH_3	mg/kg	9.99	4.6 - 5.2 [15.0 - 17.0]	--	Detected, no screening value
CONV	Nitrate (total)[f]	mg/kg	187	1.5 - 1.8 [5.0 - 6.0]	1.28E+05	No
CONV	Nitrite (total)[f]	mg/kg	0.38	1.2 - 2.0 [4.0 - 6.5]	8.00E+03	No
CONV	Nitrate/nitrite as N[g]	mg/kg	230	1.5 - 1.8 [5.0 - 6.0]	--	Detected, no screening value
CONV	Phosphate	mg/kg	6.4	2.1 - 2.4 [7.0 - 8.0]	--	Detected, no screening value
CONV	Sulfide	mg/kg	43.8	3.4 - 3.7 [11.0 - 12.0]	--	Detected, no screening value
216-A-29 Ditch						
METAL	Arsenic	mg/kg	12.2	2.6 - 2.9 [8.5 - 9.5]	6.70E-01	Yes
METAL	Bismuth	mg/kg	0.766	1.2 - 2.0 [4.0 - 6.5]	--	Detected, no screening value
METAL	Boron	mg/kg	3.4	1.2 - 1.5 [4.0 - 5.0]	1.60E+04	No
METAL	Cadmium	mg/kg	28	1.2 - 1.5 [4.0 - 5.0]	8.00E+01	No
METAL	Calcium	mg/kg	24,300	1.8 - 2.1 [6.0 - 7.0]	--	Essential Nutrient

Table B-1b. Comparison of Maximum Values for Inorganic Chemicals Higher than Background in Shallow-Zone Soil (0 to 4.6 m [0 to 15 ft]) with WAC 173-340-740 (Unrestricted Land-Use Direct Soil Exposure) Screening Levels. (5 sheets)

Constituent Class	Constituent Name[a]	Units	Maximum Detected Concentration from 0 to 4.6 m[b] [0 to 15 ft]	Depth range of Maximum Detected from 0 to 4.6 m [0 to 15 ft]	Unrestricted Surface Use Direct Exposure Screening Level[c]	Does Maximum Detected Exceed Screening Level?
METAL	Chromium (total)[d]	mg/kg	37	1.2 - 1.5 [4.0 - 5.0]	1.20E+05	No
METAL	Chromium VI	mg/kg	8.8	1.2 - 1.5 [4.0 - 5.0]	2.40E+02	No
METAL	Copper	mg/kg	172	1.2 - 1.5 [4.0 - 5.0]	3.00E+03	No
METAL	Lead[e]	mg/kg	390	2.3 - 2.6 [7.5 - 8.5]	2.50E+02	Yes
METAL	Mercury	mg/kg	5.2	1.2 - 1.5 [4.0 - 5.0]	2.40E+01	No
METAL	Molybdenum	mg/kg	3.2	1.2 - 1.5 [4.0 - 5.0]	4.00E+02	No
METAL	Nickel	mg/kg	27.6	1.2 - 1.5 [4.0 - 5.0]	1.60E+03	No
METAL	Potassium	mg/kg	2260	1.8 - 2.1 [6.0 - 7.0]	--	Essential Nutrient
METAL	Selenium	mg/kg	2.52	2.7 - 3.5 [9.0 - 11.5]	4.00E+02	No
METAL	Silver	mg/kg	42	1.2 - 1.5 [4.0 - 5.0]	4.00E+02	No
METAL	Sodium	mg/kg	873	1.2 - 1.5 [4.0 - 5.0]	--	Essential Nutrient
METAL	Thallium	mg/kg	0.52	1.8 - 2.1 [6.0 - 7.0]	5.60E+00	No
METAL	Uranium[h]	mg/kg	5.3	2.3 - 2.6 [7.5 - 8.5]	2.40E+02	No
METAL	Vanadium	mg/kg	104	2.3 - 2.6 [7.5 - 8.5]	5.60E+02	No
METAL	Zinc	mg/kg	224	1.2 - 1.5 [4.0 - 5.0]	2.40E+04	No
CONV	Ammonia as NH_3	mg/kg	41.7	1.2 - 1.5 [4.0 - 5.0]	--	Detected, no screening value
CONV	Chloride	mg/kg	226	1.2 - 1.5 [4.0 - 5.0]	--	Detected, no screening value
CONV	Fluoride	mg/kg	5.26	2.7 - 3.5 [9.0 - 11.5]	4.80E+03	No
CONV	Nitrate (total)[f]	mg/kg	209	1.2 - 1.5 [4.0 - 5.0]	1.28E+05	No

Table B-1b. Comparison of Maximum Values for Inorganic Chemicals Higher than Background in Shallow-Zone Soil (0 to 4.6 m [0 to 15 ft]) with WAC 173-340-740 (Unrestricted Land-Use Direct Soil Exposure) Screening Levels. (5 sheets)

Constituent Class	Constituent Name[a]	Units	Maximum Detected Concentration from 0 to 4.6 m[b] [0 to 15 ft]	Depth range of Maximum Detected from 0 to 4.6 m [0 to 15 ft]	Unrestricted Surface Use Direct Exposure Screening Level[c]	Does Maximum Detected Exceed Screening Level?
CONV	Nitrate/nitrite as N[g]	mg/kg	210	1.2 - 1.5 [4.0 - 5.0]	--	Detected, no screening value
CONV	Sulfate	mg/kg	2,970	1.2 - 1.5 [4.0 - 5.0]	--	Detected, no screening value

[a]Constituents that only have non-detect results for all analyzed shallow-zone soil samples are not included in this table.

[b]Shallow depth maximum concentration determination included all samples down to and including the 4.6 m (15 ft) depth. A sample was included if the 4.6 m (15 ft) depth was the shallowest point of the sample depth range (for example, a sample collected from 4.6 to 5.2 meters [15 to 17 feet] would be considered a shallow-zone sample).

[c]The unrestricted direct exposure cleanup levels reported in this table are the most conservative Method B standard formula values reported in the CLARC online database as of 2/6/07. Where Method B values were unavailable, this table defers to the Method A unrestricted land use values reported in the CLARC online database (2/6/07) and in Table 740-1 of the MTCA Cleanup Regulation (WAC 173-340).

[d]WAC 173-340-740 values for total chromium as trivalent chromium.

[e]WAC 173-340-740 lead value based on Method A value.

[f]Maximum total nitrate and total nitrite results were converted to Nitrate as nitrogen (N) and Nitrite as N in order to compare concentrations to cleanup levels calculated using toxicity values for nitrate as N and nitrite as N. Nitrate results were converted to nitrate as N with a factor of 0.225 and nitrite results were converted to nitrite as N with a factor of 0.304.

[g]Nitrate/nitrite as N was not evaluated because the total nitrate and total nitrite concentrations have their own criterion.

[h]WAC 173-340-740 for uranium as "uranium, soluble salts." Screening levels are based on chemical toxicity, not effects of ionizing radiation.

WAC = Washington State Administrative Code.

CONV = conventional parameter.

-- = no screening level is available.

Shaded cells indicate that the chemical was retained as a contaminant of potential concern after screening.

Table B-2. Summary of External Dose Parameters for Rural Residential and Confederated Tribes of the Umatilla Indian Reservation Scenarios.

RESRAD Parameter	Rural Residential	CTUIR
Annual time at Residence	8760 h/y	8760 h/y
Indoor shielding factor for gamma	0.4	0.4
Indoor time fraction	0.6	0.4
Outdoor time fraction	0.2	0.6
Effective annual external exposure time	7008 h/y	8760 h/y

Notes:

- Rural residential scenario assumes that 80% of the year is spent at home. During that time 60% of the time is spent indoors and 40% of the time is spent outdoors.
- Traditional subsistence lifeways scenario assumes that 100% of the year is spent on the site. During that time 40% of the time is spent indoors and 60% of the time is spent outdoors.

Table B-3. Summary of Occupancy Factors for the Rural Residential and the Confederated Tribes of the Umatilla Indian Reservation Scenarios.

RESRAD Parameter	Rural Residential[a]	CTUIR[b]
Inhalation Rate	7,300 m^3/y	10,950 m^3/y
Mass Loading for Inhalation	0.0001g/m^3	0.0001g/m^3
Exposure Duration	30 y	70 y
Fruits, Vegetables, and Grain Consumption	110 kg/y	493 kg/y[c]
Leafy Vegetable Consumptions	2.7 kg/y	--
Milk Consumption	100	NA
Meat and Poultry Consumption	36 kg/y	91.4 kg/y[d]
Soil Ingestion	73 g/y	146 g/y
Fish and Other Seafood Consumption	NA	NA

Notes:

a. WDOH-32/015

b. Exposure Scenario for CTUIR Tradition subsistence Lifeways, September, 15,2004.

c. All fruit and vegetable consumption is included with this input parameter.

d. Game ingestion is included with beef and poultry consumption.

- Rural residential scenario assumes that 80% of the year is spent at home. During that time 60% of the time is spent indoors and 40% of the time is spent outdoors.
- Traditional subsistence lifeways scenario assumes that 100% of the year is spent on the site. During that time 40% of the time is spent indoors and 60% of the time is spent outdoors.

Table B-4. Summary of All Radionuclides, All Pathways Dose and Risk Estimates for Representative Waste Sites.

Time (y)[1]	216-A-19 Ditch		216-B-63 Trench		216-S-10 Ditch		216-S-10 Pond & 216-S-11 Pond	
	Dose (mrem/y)	Risk	Dose (mrem/y)	Risk	Dose (mrem/y)	Risk	Dose (mrem/y)	Risk
Rural Residential Scenario								
0	2.34E-08	3.83E-13	9.39E-11	1.54E-15	1.04E+00	1.08E-05	7.76E-13	1.16E-16
50	7.45E-09	1.22E-13	2.99E-11	4.89E-16	5.89E-01	4.02E-06	1.58E-11	4.61E-16
150	8.03E-10	1.35E-14	3.02E-12	4.94E-17	3.92E-01	1.07E-06	4.59E-11	1.15E-15
300	9.44E-11	2.05E-15	9.70E-14	1.59E-18	3.53E-01	5.96E-07	9.00E-11	2.15E-15
500	1.09E-10	2.58E-15	1.04E-15	1.74E-20	3.34E-01	4.96E-07	1.47E-10	3.44E-15
1000	2.71E-10	6.34E-15	1.59E-16	3.71E-21	3.09E-01	4.48E-07	2.78E-10	6.44E15
CTUIR Scenario								
0	4.05E-08	1.06E-12	1.63E-10	4.27E-15	4.42E+00	7.51E-05	1.34E-12	1.02E-15
50	1.29E-08	3.41E-13	5.16E-11	1.36E-15	2.54E+00	2.95E-05	2.72E-11	2.41E-15
150	1.39E-09	3.93E-14	5.21E-12	1.37E-16	1.71E+00	9.34E-06	7.92E-11	5.17E-15
300	1.63E-10	8.07E-15	1.68E-13	4.41E-18	1.54E+00	5.83E-06	1.55E-10	9.21E-15
500	1.89E-10	1.08E-14	1.80E-15	5.02E-20	1.46E+00	5.00E-06	2.53E-10	1.44E-14
1000	4.69E-10	2.63E-14	2.75E-16	1.55E-20	1.35E+00	4.56E-06	4.8E-10	2.64E-14

1. Time zero represents the current year of 2007.

Table B-5a. Comparison of Maximum Values for Organic Chemicals Detected in Shallow-Zone (0 to 4.6 m [0 to 15 ft]) with Tribal Use Direct Soil Exposure Screening Levels. (3 sheets)

Constituent Name[a]	Units	Maximum Detected Concentration from 0 to 4.6 m[b] [0 to 15 ft]	Depth of Maximum Detected from 0 to 4.6 m [0 to 15 ft]	Unrestricted Surface Use Direct Exposure Screening Level[c]	Does Maximum Detected Exceed Screening Level?
216-S-10 Ditch					
Acenaphthene	µg/kg	61	0.0 - 0.46 [0.0 - 1.5]	2.40E+06	No
Acetone	µg/kg	9	4.1 - 4.4 [13.5 - 14.5]	4.00E+06	No
Anthracene	µg/kg	150	0.0 - 0.46 [0.0 - 1.5]	1.20E+07	No
Aroclor-1254[d]	µg/kg	3700	0.0 - 0.46 [0.0 - 1.5]	8.00E+02	Yes
Benzo(a)anthracene	µg/kg	550	0.0 - 0.46 [0.0 - 1.5]	6.85E+01	Yes
Benzo(a)pyrene	µg/kg	600	0.0 - 0.46 [0.0 - 1.5]	6.85E+01	Yes
Benzo(b)fluoranthene	µg/kg	530	0.0 - 0.46 [0.0 - 1.5]	6.85E+01	Yes
Benzo(g,h,i)perylene[e]	µg/kg	660	0.0 - 0.46 [0.0 - 1.5]	1.20E+06	No
Benzo(k)fluoranthene	µg/kg	450	0.0 - 0.46 [0.0 - 1.5]	6.85E+01	Yes
Bis(2-ethylhexyl)phthalate	µg/kg	580	0.0 - 0.46 [0.0 - 1.5]	3.57E+04	No
Butyl benzyl phthalate	µg/kg	580	0.0 - 0.46 [0.0 - 1.5]	8.00E+06	No
Carbazole	µg/kg	97	0.0 - 0.46 [0.0 - 1.5]	2.50E+04	No
Chrysene	µg/kg	680	0.0 - 0.46 [0.0 - 1.5]	6.85E+01	Yes
Dibenzo[a,h]anthracene	µg/kg	110	0.0 - 0.46 [0.0 - 1.5]	6.85E+01	Yes
Dibutyl phthalate	µg/kg	2300	0.0 - 0.46 [0.0 - 1.5]	4.00E+06	No
Diesel Range TPH[f]	µg/kg	31,000	0.0 - 0.46 [0.0 - 1.5]	1.00E+06	No
Fluoranthene	µg/kg	1500	0.0 - 0.46 [0.0 - 1.5]	1.60E+06	No
Fluorene	µg/kg	59	0.0 - 0.46 [0.0 - 1.5]	1.60E+06	No
Indeno(1,2,3-cd)pyrene	µg/kg	400	0.0 - 0.46 [0.0 - 1.5]	6.85E+01	Yes

Table B-5a. Comparison of Maximum Values for Organic Chemicals Detected in Shallow-Zone (0 to 4.6 m [0 to 15 ft]) with Tribal Use Direct Soil Exposure Screening Levels. (3 sheets)

Constituent Name[a]	Units	Maximum Detected Concentration from 0 to 4.6 m[b] [0 to 15 ft]	Depth of Maximum Detected from 0 to 4.6 m [0 to 15 ft]	Unrestricted Surface Use Direct Exposure Screening Level[c]	Does Maximum Detected Exceed Screening Level?
Methylene chloride	µg/kg	10	0.46 - 0.91 [1.5 - 3.0]; 2.6 - 2.9 [8.5 - 9.5]	6.67E+04	No
Phenanthrene[g]	µg/kg	930	0.0 - 0.46 [0.0 - 1.5]	1.20E+07	No
Pyrene	µg/kg	1,600	0.0 - 0.46 [0.0 - 1.5]	1.20E+06	No
216-B-63 Trench					
2-Ethylhexanol	µg/kg	6	4.0 - 4.7 [13.0 - 15.5]	--	Detected, no screening value
Acetone	µg/kg	66	1.5 - 1.8 [5.0 - 6.0]	4.00E+06	No
Aroclor-1254[d]	µg/kg	77	3.1 - 4.0 [10.0 - 13.0]	8.00E+02	No
Aroclor-1260[h]	µg/kg	9200	2.4 - 3.2 [8.0 - 10.5]	8.00E+02	Yes
Benzene	µg/kg	8	1.5 - 1.8 [5.0 - 6.0]	9.09E+03	No
Bis(2-ethylhexyl)phthalate	µg/kg	21	2.4 - 2.9 [8.0 - 9.5]	3.57E+04	No
Di-n-octyl phthalate	µg/kg	52	4.0 - 4.7 [13.0 - 15.5]	8.00E+05	No
Methylene chloride	µg/kg	27	2.9 -3.2 [9.5 - 10.5]	6.67E+04	No
Toluene	µg/kg	3	2.1 - 2.4 [7.0 - 8.0]	3.20E+06	No
216-A-29 Ditch					
1,2-Dichloroethane	µg/kg	13	1.2 - 1.5 [4.0 - 5.0]	5.49E+03	No
Acetone	µg/kg	30	2.3 - 2.6 [7.5 - 8.5]	4.00E+06	No
Aroclor-1254[d]	µg/kg	9400	1.2 - 1.5 [4.0 - 5.0]	8.00E+02	Yes
Benzo(a)anthracene	µg/kg	180	1.2 - 1.5 [4.0 - 5.0]	6.85E+01	Yes
Benzo(a)pyrene	µg/kg	160	1.2 - 1.5 [4.0 - 5.0]	6.85E+01	Yes
Benzo(b)fluoranthene	µg/kg	240	1.2 - 1.5 [4.0 - 5.0]	6.85E+01	Yes
Bis(2-ethylhexyl)phthalate	µg/kg	6200	1.2 - 1.5 [4.0 - 5.0]	3.57E+04	No
Butyl benzyl phthalate	µg/kg	290	1.2 - 1.5 [4.0 - 5.0]	8.00E+06	No
Chrysene	µg/kg	210	1.2 - 1.5 [4.0 - 5.0]	6.85E+01	Yes

Table B-5a. Comparison of Maximum Values for Organic Chemicals Detected in Shallow-Zone (0 to 4.6 m [0 to 15 ft]) with Tribal Use Direct Soil Exposure Screening Levels. (3 sheets)

Constituent Name[a]	Units	Maximum Detected Concentration from 0 to 4.6 m[b] [0 to 15 ft]	Depth of Maximum Detected from 0 to 4.6 m [0 to 15 ft]	Unrestricted Surface Use Direct Exposure Screening Level[c]	Does Maximum Detected Exceed Screening Level?
Dibutyl phthalate	µg/kg	2741	1.2 - 1.5 [4.0 - 5.0]	4.00E+06	No
Diethyl phthalate	µg/kg	330	2.7 - 3.5 [9.0 - 11.5]	3.20E+07	No
Fluoranthene	µg/kg	370	1.2 - 1.5 [4.0 - 5.0]	1.60E+06	No
Kerosene range TPH[f]	µg/kg	440,000	1.2 - 2.0 [4.0 - 6.5]	1.00E+06	No
Mesityl oxide	µg/kg	390	2.7 - 3.5 [9.0 - 11.5]	--	Detected, no screening value
Methylene chloride	µg/kg	78	1.2 - 1.5 [4.0 - 5.0]	6.67E+04	No
Motor oil TPH[f]	µg/kg	760,000	1.2 - 1.5 [4.0 - 5.0]	1.00E+06	No
N-Butylbenzenesulfonamide	µg/kg	4,400	2.7 - 3.5 [9.0 - 11.5]	--	Detected, no screening value
Phenanthrene[g]	µg/kg	370	1.2 - 1.5 [4.0 - 5.0]	1.20E+07	No
Pyrene	µg/kg	350	1.2 - 1.5 [4.0 - 5.0]	1.20E+06	No
Tetrachloroethylene	µg/kg	6	1.2 - 1.5 [4.0 - 5.0]	9.26E+02	No
Tributyl phosphate[i]	µg/kg	543	1.2 - 2.0 [4.0 - 6.5]	9.26E+04	No

[a]Constituents that only have non-detect results for all analyzed shallow-zone soil samples are not included in this table.

[b]Shallow depth maximum concentration determination included all samples down to and including the 4.6 m (15 ft) depth. A sample was included if the 4.6 m (15 ft) depth was the shallowest point of the sample depth range (for example, a sample collected from 4.6 to 5.2 meters [15 to 17 feet] would be considered a shallow-zone sample).

[c]The unrestricted direct exposure cleanup levels reported in this table are the most conservative Method B standard formula values reported in the CLARC online database as of 2/6/07. Where Method B values were unavailable, this table defers to the Method A unrestricted land use values reported in the CLARC online database (2/6/07) and in Table 740-1 of the MTCA Cleanup Regulation (WAC 173-340).

[d]Aroclor-1254 value based on carcinogenic effects using the upper bound slope factor of 2 from EPA, 2003, *Integrated Risk Information System* (IRIS) database.

[e]A cleanup level for this constituent was unavailable, so the cleanup level was calculated using toxicity values for pyrene.

[f]One half the WAC 173-340-740 value for kerosene and diesel range TPH based on noncarcinogenic effects was used. Method A values (Tables 740-1) for carcinogenic effects are based on groundwater protection and are proposed to be 2000 mg/kg (currently 200 mg/kg).

[g]A cleanup level for this constituent was unavailable, so the cleanup level was calculated using toxicity values for anthracene.

[h]A cleanup level for this constituent was unavailable, so the cleanup level was calculated using toxicity values for PCBs.

[i]The cleanup level for this constituent was unavailable in CLARC, so a cleanup level was calculated using WAC equations 740-1 and 740-2 and the toxicity factors provide by the Risk Assessment Information System (RAIS).

WAC = Washington State Administrative Code.

TPH = total petroleum hydrocarbons.

-- = no screening level is available

Shaded cells indicate that the chemical was retained as a contaminant of potential concern after screening.

Table B-5b. Comparison of Maximum Values for Inorganic Chemicals Higher than Background in Shallow-Zone Soil (0 to 4.6 m [0 to 15 ft]) with Tribal Use Direct Soil Exposure Screening Levels. (5 sheets)

Constituent Class	Constituent Name[a]	Units	Maximum Detected Concentration from 0 to 4.6 m[b] [0 ft to 15 ft]	Depth range of Maximum Detected from 0 to 4.6 m [0 ft - 15 ft]	Unrestricted Surface Use Direct Exposure Screening Level[c]	Does Maximum Detected Exceed Screening Level?
216-S-10 Ditch						
METAL	Bismuth	mg/kg	2	0.0 - 0.46 [0.0 - 1.5]	--	Detected, no screening value
METAL	Boron	mg/kg	1.5	0.0 - 0.46 [0.0 - 1.5]; 1.8 - 2.1 [6.0 - 7.0]	8.00E+03	No
METAL	Chromium (total)[d]	mg/kg	815	0.0 - 0.46 [0.0 - 1.5]	6.00E+04	No
METAL	Chromium VI	mg/kg	14.1	0.46 - 0.91 [1.5 - 3.0]	1.20E+02	No
METAL	Copper	mg/kg	244	0.0 - 0.46 [0.0 - 1.5]	1.48E+03	No
METAL	Lead[e]	mg/kg	30	0.0 - 0.46 [0.0 - 1.5]	1.25E+02	No
METAL	Mercury	mg/kg	4.3	0.0 - 0.46 [0.0 - 1.5]	1.20E+01	No
METAL	Molybdenum	mg/kg	0.88	0.0 - 0.46 [0.0 - 1.5]	2.00E+02	No
METAL	Nickel	mg/kg	20.3	0.0 - 0.46 [0.0 - 1.5]	8.00E+02	No
METAL	Selenium	mg/kg	0.44	2.6 - 2.9 [8.5 - 9.5]	2.00E+02	No
METAL	Silver	mg/kg	30.4	0.0 - 0.46 [0.0 - 1.5]	2.00E+02	No
METAL	Thallium	mg/kg	0.99	0.0 - 0.46 [0.0 - 1.5]	2.80E+00	No
METAL	Vanadium	mg/kg	87.5	2.6 - 2.9 [8.5 - 9.5]	2.80E+02	No
METAL	Zinc	mg/kg	506	0.0 - 0.46 [0.0 - 1.5]	1.20E+04	No
CONV	Nitrate (total)[f]	mg/kg	18.1	0.0 - 0.46 [0.0 - 1.5]	6.40E+04	No
CONV	Nitrite (total)[f]	mg/kg	0.35	2.6 - 2.9 [8.5 - 9.5]	4.00E+03	No
CONV	Nitrate/nitrite as N[g]	mg/kg	10.6	0.0 - 0.46 [0.0 - 1.5]	--	Detected, no screening value

Table B-5b. Comparison of Maximum Values for Inorganic Chemicals Higher than Background in Shallow-Zone Soil (0 to 4.6 m [0 to 15 ft]) with Tribal Use Direct Soil Exposure Screening Levels. (5 sheets)

Constituent Class	Constituent Name[a]	Units	Maximum Detected Concentration from 0 to 4.6 m[b] [0 ft to 15 ft]	Depth range of Maximum Detected from 0 to 4.6 m [0 ft - 15 ft]	Unrestricted Surface Use Direct Exposure Screening Level[c]	Does Maximum Detected Exceed Screening Level?
CONV	Phosphate	mg/kg	1.5	0.91 - 1.2 [3.0 - 4.0]	--	Detected, no screening value
216-S-10 Pond						
METAL	Boron	mg/kg	1	1.8 - 2.1 [6.0 - 7.0]	8.00E+03	No
METAL	Chromium (total)[d]	mg/kg	26.2	9.0 - 10.0; 11.0 - 12.0	6.00E+04	No
METAL	Chromium VI	mg/kg	2.7	2.1 - 2.4 [7.0 - 8.0]	1.20E+02	No
METAL	Mercury	mg/kg	0.43	3.5 - 3.8 [11.5 - 12.5]	1.20E+01	No
METAL	Molybdenum	mg/kg	0.29	2.0 - 2.3 [6.5 - 7.5]	2.00E+02	No
METAL	Selenium	mg/kg	0.46	2.7 - 3.1 [9.0 - 10.0]	2.00E+02	No
METAL	Silver	mg/kg	8.3	2.7 - 3.1 [9.0 - 10.0]	2.00E+02	No
METAL	Thallium	mg/kg	0.62	2.7 - 3.1 [9.0 - 10.0]	2.80E+00	No
CONV	Cyanide	mg/kg	0.2	9.5 - 10.5	8.00E+02	No
CONV	Nitrite (total)[f]	mg/kg	0.48	9.5 - 10.5	4.00E+03	No
CONV	Nitrate/nitrite as N[g]	mg/kg	14.9	2.0 - 2.3 [6.5 - 7.5]	--	Detected, no screening value
CONV	Phosphate	mg/kg	3.8	3.5 - 3.8 [11.5 - 12.5]	--	Detected, no screening value
CONV	Sulfide	mg/kg	59	3.4 - 3.7 [11.0 - 12.0]	--	Detected, no screening value
216-B-63 Trench						
METAL	Antimony	mg/kg	5	1.2 - 2.0 [4.0 - 6.5]	1.60E+01	No
METAL	Bismuth	mg/kg	37.1	2.4 - 3.2 [8.0 - 10.5]	--	Detected, no screening value
METAL	Boron	mg/kg	6.3	2.4 - 3.2 [8.0 - 10.5]	8.00E+03	No

Table B-5b. Comparison of Maximum Values for Inorganic Chemicals Higher than Background in Shallow-Zone Soil (0 to 4.6 m [0 to 15 ft]) with Tribal Use Direct Soil Exposure Screening Levels. (5 sheets)

Constituent Class	Constituent Name[a]	Units	Maximum Detected Concentration from 0 to 4.6 m[b] [0 ft to 15 ft]	Depth range of Maximum Detected from 0 to 4.6 m [0 ft - 15 ft]	Unrestricted Surface Use Direct Exposure Screening Level[c]	Does Maximum Detected Exceed Screening Level?
METAL	Chromium (total)[d]	mg/kg	21.9	3.8 - 4.4 [12.5 - 14.5]	6.00E+04	No
METAL	Chromium VI	mg/kg	0.45	29 - 3.2 [9.5 - 10.5]	1.20E+02	No
METAL	Copper	mg/kg	30.6	3.7 - 4.0 [12.0 - 13.0]	1.48E+03	No
METAL	Molybdenum	mg/kg	0.55	1.5 - 1.8 [5.0 - 6.0]	2.00E+02	No
METAL	Selenium	mg/kg	0.75	2.3 - 2.6 [7.5 - 8.5]	2.00E+02	No
METAL	Silver	mg/kg	0.86	2.4 - 3.2 [8.0 - 10.5]	2.00E+02	No
METAL	Thallium	mg/kg	0.53	1.8 - 2.1 [6.0 - 7.0]	2.80E+00	No
METAL	Vanadium	mg/kg	86.9	2.3 - 2.6 [7.5 - 8.5]	2.80E+02	No
METAL	Zinc	mg/kg	80.8	3.7 - 4.0 [12.0 - 13.0]	1.20E+04	No
CONV	Ammonia as NH_3	mg/kg	9.99	1.6 - 5.2 [15.0 - 17.0]	--	Detected, no screening value
CONV	Nitrate (total)[f]	mg/kg	187.4	1.5 - 1.8 [5.0 - 6.0]	6.40E+04	No
CONV	Nitrite (total)[f]	mg/kg	0.38	1.2 - 2.0 [4.0 - 6.5]	4.00E+03	No
CONV	Nitrate/nitrite as N[g]	mg/kg	230	1.5 - 1.8 [5.0 - 6.0]	--	Detected, no screening value
CONV	Phosphate	mg/kg	6.4	2.1 - 2.4 [7.0 - 8.0]	--	Detected, no screening value
CONV	Sulfide	mg/kg	43.8	3.4 - 3.7 [11.0 - 12.0]	--	Detected, no screening value
216-A-29 Ditch						
METAL	Arsenic	mg/kg	12.2	2.6 - 2.9 [8.5 - 9.5]	3.33E-01	Yes
METAL	Bismuth	mg/kg	0.766	1.2 - 2.0 [4.0 - 6.5]	--	Detected, no screening value

Table B-5b. Comparison of Maximum Values for Inorganic Chemicals Higher than Background in Shallow-Zone Soil (0 to 4.6 m [0 to 15 ft]) with Tribal Use Direct Soil Exposure Screening Levels. (5 sheets)

Constituent Class	Constituent Name[a]	Units	Maximum Detected Concentration from 0 to 4.6 m[b] [0 ft to 15 ft]	Depth range of Maximum Detected from 0 to 4.6 m [0 ft - 15 ft]	Unrestricted Surface Use Direct Exposure Screening Level[c]	Does Maximum Detected Exceed Screening Level?
METAL	Boron	mg/kg	3.4	1.2 - 1.5 [4.0 - 5.0]	8.00E+03	No
METAL	Cadmium	mg/kg	28	1.2 - 1.5 [4.0 - 5.0]	4.00E+01	No
METAL	Calcium	mg/kg	24,300	1.8 - 2.1 [6.0 - 7.0]	--	Essential Nutrient
METAL	Chromium (total)[d]	mg/kg	37	1.2 - 1.5 [4.0 - 5.0]	6.00E+04	No
METAL	Chromium VI	mg/kg	8.8	1.2 - 1.5 [4.0 - 5.0]	1.20E+02	No
METAL	Copper	mg/kg	172	1.2 - 1.5 [4.0 - 5.0]	1.48E+03	No
METAL	Lead[e]	mg/kg	390	2.3 - 2.6 [7.5 - 8.5]	1.25E+02	Yes
METAL	Mercury	mg/kg	5.2	1.2 - 1.5 [4.0 - 5.0]	1.20E+01	No
METAL	Molybdenum	mg/kg	3.2	1.2 - 1.5 [4.0 - 5.0]	2.00E+02	No
METAL	Nickel	mg/kg	27.6	1.2 - 1.5 [4.0 - 5.0]	8.00E+02	No
METAL	Potassium	mg/kg	2260	1.8 - 2.1 [6.0 - 7.0]	--	Essential Nutrient
METAL	Selenium	mg/kg	2.52	2.7 - 3.5 [9.0 - 11.5]	2.00E+02	No
METAL	Silver	mg/kg	42	1.2 - 1.5 [4.0 - 5.0]	2.00E+02	No
METAL	Sodium	mg/kg	873	1.2 - 1.5 [4.0 - 5.0]	--	Essential Nutrient
METAL	Thallium	mg/kg	0.52	1.8 - 2.1 [6.0 - 7.0]	2.80E+00	No
METAL	Uranium[g]	mg/kg	5.3	2.3 - 2.6 [7.5 - 8.5]	1.20E+02	No
METAL	Vanadium	mg/kg	104	2.3 - 2.6 [7.5 - 8.5]	2.80E+02	No
METAL	Zinc	mg/kg	224	1.2 - 1.5 [4.0 - 5.0]	1.20E+04	No
CONV	Ammonia as NH_3	mg/kg	41.7	1.2 - 1.5 [4.0 - 5.0]	--	Detected, no screening value

Table B-5b. Comparison of Maximum Values for Inorganic Chemicals Higher than Background in Shallow-Zone Soil (0 to 4.6 m [0 to 15 ft]) with Tribal Use Direct Soil Exposure Screening Levels. (5 sheets)

Constituent Class	Constituent Name[a]	Units	Maximum Detected Concentration from 0 to 4.6 m[b] [0 ft to 15 ft]	Depth range of Maximum Detected from 0 to 4.6 m [0 ft - 15 ft]	Unrestricted Surface Use Direct Exposure Screening Level[c]	Does Maximum Detected Exceed Screening Level?
CONV	Chloride	mg/kg	226	1.2 - 1.5 [4.0 - 5.0]	--	Detected, no screening value
CONV	Fluoride	mg/kg	5.26	2.7 - 3.5 [9.0 - 11.5]	2.40E+03	No
CONV	Nitrate (total)[f]	mg/kg	208.6	1.2 - 1.5 [4.0 - 5.0]	6.40E+04	No
CONV	Nitrate/nitrite as N[g]	mg/kg	210	1.2 - 1.5 [4.0 - 5.0]	--	Detected, no screening value
CONV	Sulfate	mg/kg	2,970	1.2 - 1.5 [4.0 - 5.0]	--	Detected, no screening value

[a]Constituents that only have non-detect results for all analyzed shallow-zone soil samples are not included in this table.

[b]Shallow depth maximum concentration determination included all samples down to and including the 4.6 m (15 ft) depth. A sample was included if the 4.6 m (15 ft) depth was the shallowest point of the sample depth range (for example, a sample collected from 4.6 to 5.2 meters [15 to 17 feet] would be considered a shallow-zone sample).

[c]The unrestricted direct exposure cleanup levels reported in this table are the most conservative Method B standard formula values reported in the CLARC online database as of 2/6/07. Where Method B values were unavailable, this table defers to the Method A unrestricted land use values reported in the CLARC online database (2/6/07) and in Table 740-1 of the MTCA Cleanup Regulation (WAC 173-340).

[d]WAC 173-340-740 values for total chromium as trivalent chromium.

[e]WAC 173-340-740 lead value based on Method A value.

[f]Maximum total nitrate and total nitrite results were converted to Nitrate as nitrogen (N) and Nitrite as N in to order compare concentrations to cleanup levels calculated using toxicity values for nitrate as N and nitrite as N. Nitrate results were converted to nitrate as N with a factor of 0.225 and nitrite results were converted to nitrite as N with a factor of 0.304.

[g]Nitrate/nitrite as N was not evaluated because the total nitrate and total nitrite concentrations have their own criterion.

[h]WAC 173-340-740 for uranium as "uranium, soluble salts." Screening levels are based on chemical toxicity, not effects of ionizing radiation.

WAC = Washington State Administrative Code.

CONV = conventional parameter.

-- = no screening level is available.

Shaded cells indicate that the chemical was retained as a contaminant of potential concern after screening.

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