Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

10-AMCP-0056

DEC 29 2009

Mr. D. A. Faulk, Program Manager
Office of Environmental Cleanup
Hanford Project Office
U. S. Environmental Protection Agency
309 Bradley Boulevard, Suite 115
Richland, Washington 99352

Dear Mr. Faulk:

REMAINING SITES VERIFICATION PACKAGE FOR THE 600-285-PL, 600-286-PL, AND 600-287-PL WASTE SITES LOCATED IN THE 200-CW-3 OPERABLE UNIT, DOE/RL-2009-84, REVISION 0

This letter transmits the approved Remaining Sites Verification Package for the 600-285-PL, 600-286-PL, and 600-287-PL Waste Sites Located in the 200-CW-3 Operable Unit, DOE/RL-2009-84, Revision 0 for your information. This document was signed by the U.S. Environmental Protection Agency on October 27, 2009, and will be entered into the Administrative Record.

Per our discussion, the U.S. Department of Energy Richland Operations Office has agreed to run an Interim Site-Specific RESRAD Model and provide a copy within 60 days of the date of this letter, to allow a review of the generic model contained in the both the Remedial Design/Remedial Action Work Plan for the 200 North Area Waste Sites and Remaining Sites Record of Decision against site-specific parameters.

If you have any questions, please contact me, or your staff may contact Al Farabee, of my staff, on (509) 376-8089.

Sincerely,

Matthew S. McCormick, Assistant Manager
for the Central Plateau

AMCP:WCW

Attachment

cc: See Page 2

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DOE/RL-2009-84
Revision 0

Remaining Sites Verification Package for the 600-285-PL, 600-286-PL and 600-287-PL Waste Sites Located in the 200-CW-3 Operable Unit

Documentation for Waste Site Reclassification Form 2009-022, 2009-023 and 2009-024

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

U.S. DEPARTMENT OF ENERGY

Richland Operations Office

P.O. Box 550
Richland, Washington 99352

Approved for Public Release;
Further Dissemination Unlimited

DOE/RL-2009-84
Revision 0

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Date Published
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Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

U.S. DEPARTMENT OF ENERGY
Richland Operations Office

P.O. Box 550
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Release Approval

09/14/2009
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Waste Site Reclassification Form

Date Submitted: 08/04/2009 **Originator:** Whitley, K **Phone:** 942-6580	**Operable Units:** 200-CW-3 **Waste Site ID:** 600-285-PL **Type of Reclassification Action:** Closed Out: ☐ Interim Closed Out: ☐ No Action: ☒ RCRA Postclosure ☐ Rejected: ☐ Consolidated ☐	**Control Number:** 2009-022

This form documents agreement among parties listed authorizing classification of the subject unit as Closed Out, Interim Closed Out, No Action, RCRA Postclosure, Rejected, or Consolidated. This form also authorizes backfill of the waste management unit, if appropriate, for Closed Out and Interim Closed Out units. Final removal from the NPL of No Action and Closed Out waste management units will occur at a future date.

Description of Current Waste Site Conditions:

(Summarize status of investigation/remediation of the waste sites.)

The 600-285-PL waste site is an 18 inch (46 centimeter) diameter vitrified clay underground pipeline that serviced the 212-N Building. The pipeline was used to transfer overflow cooling water (gravity flow) from the 212-N Fuel Storage Facility basin to the 216-N-1 pond. The results of the focused sampling performed per DOE/RL-2007-54, Sampling and Analysis Plan for Remediation of 200 North Area Waste Sites Located in the 200-CW-3 Operable Unit, identified no contaminants above the Remedial Action Goals (RAGs) and are in compliance with the Remedial Action Objectives (RAOs).

The waste site confirmatory sampling results support a reclassification of this site to No Action. The waste site confirmatory sampling results indicate current site conditions are in compliance with the RAOs and RAGs established in the Remedial Design/Remedial Action Work Plan for 200 North Area Waste Sites located in the 200-CW-3 Operable Unit (DOE/RL-2007-55) and the Interim Action Record of Decision for the 100-BC-1,100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington (Remaining Sites ROD) (EPA, 1999). The results of the waste site sampling are used to make reclassification decisions for the 600-285 PL waste site in accordance with the TPA-MP-14 (DOE/RL, 2007) process.

Basis for Reclassification:

(For closeout, reference supporting documentation, as listed in Table 3.)

The current site conditions achieve the remedial action objectives and the corresponding remedial action goals specified in the Remaining Sites ROD. These results show that residual soil concentrations support future land uses that can be represented (or bounded) by a rural residential scenario. The results also demonstrate that residual contaminant concentrations support unrestricted future use of shallow zone soil [i.e., surface to 4.6 meters (15 feet)] and that contaminant levels remaining in the soil are protective of groundwater and the Columbia River. There is no deep zone for the 600-285-PL waste site therefore no institutional controls are required. The basis for reclassification no action is described in detail in the Remaining Sites Verification Package for the 600-285-PL, 600-286-PL, 600-287-PL Waste Sites located in the 200-CW-3 Operable Unit (DOE/RL-2009-84), U.S. Department of Energy, Richland Operation Office, Richland, Washington.

Waste Site Controls

Engineered Controls: Yes ☐ No ☒ Institutional Controls: Yes ☐ No ☒ O&M requirements: Yes ☐ No ☒

If any of the Waste Site Controls are checked Yes specify control requirements including reference to the Record of Decision, TSD Closure Letter, or other relevant documents.

D. A. Farabee **DOE Project Manager**	D A Farabee **Signature**	9/16/09 **Date**
N/A **Ecology Project Manager**	**Signature**	**Date**
C. E. Cameron **EPA Project Manager**	Craig E. Cameron **Signature**	10/27/09 **Date**

Waste Site Reclassification Form

Date Submitted: 08/04/2009 **Originator:** Whitley, K **Phone:** 942-6580	**Operable Units:** 200-CW-3 **Waste Site ID:** 600-286-PL **Type of Reclassification Action:** Closed Out: ☐ Interim Closed Out: ☐ No Action: ☒ RCRA Postclosure ☐ Rejected: ☐ Consolidated ☐	**Control Number:** 2009-023

This form documents agreement among parties listed authorizing classification of the subject unit as Closed Out, Interim Closed Out, No Action, RCRA Postclosure, Rejected, or Consolidated. This form also authorizes backfill of the waste management unit, if appropriate, for Closed Out and Interim Closed Out units. Final removal from the NPL of No Action and Closed Out waste management units will occur at a future date.

Description of Current Waste Site Conditions:

(Summarize status of investigation/remediation of the waste sites.)

The 600-286-PL waste site is an 18 inch (46 centimeter) diameter vitrified clay underground pipeline that serviced the 212-P Building. The pipeline was used to transfer overflow cooling water (gravity flow) from the 212-P Fuel Storage Facility basin to the 216-N-4 pond. The results of the focused sampling performed per DOE/RL 2007-54, Sampling and Analysis Plan for Remediation of 200 North Area Waste Sites Located in the 200-CW-3 Operable Unit, identified no contaminants above the Remedial Action Goals (RAGs) and are in compliance with the Remedial Action Objectives (RAOs).

The waste site confirmatory sampling results support a reclassification of this site to No Action. The current site conditions achieve the RAOs and the corresponding RAGs established in the Remedial Design/Remedial Action Work Plan for 200 North Area Waste Sites located in the 200-CW-3 Operable Unit (DOE/RL-2007-55) and the Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington (Remaining Sites ROD) (EPA 1999). The results of the waste site sampling after remediation are used to make reclassification decisions for the 600-286-PL waste site in accordance with the TPA-MP-14 (DOE/RL-2007) process.

Basis for Reclassification:

(For closeout, reference supporting documentation, as listed in Table 3.)

The current site conditions achieve the remedial action objectives and the corresponding remedial action goals specified in the Remaining Sites ROD. These results show that residual soil concentrations support future land uses that can be represented (or bounded) by a rural residential scenario. The results also demonstrate that residual contaminant concentrations support unrestricted future use of shallow zone soil [i.e., surface to 4.6 meters (15 feet)] and that contaminant levels remaining in the soil are protective of groundwater and the Columbia River. There is no deep zone for the 600-286-PL waste site therefore no institutional controls are required. The basis for reclassification The basis for reclassification to no action is described in detail in the Waste Sites Verification Package for the 600-285-PL, 600-286-PL, 600-287-PL Remaining Sites located in the 200-CW-3 Operable Unit (DOE/RL-2009-84), U.S. Department of Energy, Richland Operation Office, Richland, Washington.

Waste Site Controls

Engineered Controls: Yes ☐ No ☒ Institutional Controls: Yes ☐ No ☒ O&M requirements: Yes ☐ No ☒

If any of the Waste Site Controls are checked Yes specify control requirements including reference to the Record of Decision, TSD Closure Letter, or other relevant documents.

O. A. Farabee **DOE Project Manager**	O A Farabee **Signature**	9/16/09 **Date**
N/A **Ecology Project Manager**	**Signature**	**Date**
C.E. Cameron **EPA Project Manager**	Craig E Cameron **Signature**	10/27/09 **Date**

Waste Site Reclassification Form

Date Submitted: 08/04/2009 **Originator:** Whitley, K **Phone:** 942-6580	**Operable Units:** 200-CW-3 **Waste Site ID:** 600-287-PL **Type of Reclassification Action:** Closed Out: ☐ Interim Closed Out: ☐ No Action: ☒ RCRA Postclosure ☐ Rejected: ☐ Consolidated ☐	**Control Number:** 2009-024

This form documents agreement among parties listed authorizing classification of the subject unit as Closed Out, Interim Closed Out, No Action, RCRA Postclosure, Rejected, or Consolidated. This form also authorizes backfill of the waste management unit, if appropriate, for Closed Out and Interim Closed Out units. Final removal from the NPL of No Action and Closed Out waste management units will occur at a future date.

Description of Current Waste Site Conditions:

(Summarize status of investigation/remediation of the waste sites.)

The 600-287-PL waste sites is an 18 inch (46 centimeter) diameter vitrified clay underground pipeline that serviced the 212-R Building. The pipeline was used to transfer overflow cooling water (gravity flow) from the 212-R Fuel Storage Facility basin to the 216-N-6 pond. The results of the focused sampling performed per DOE/RL-2007-54, Sampling and Analysis Plan for Remediation of 200 North Area Waste Sites Located in the 200-CW-3 Operable Unit, identified no contaminants above the Remedial Action Goals (RAGs) and have achieved compliance with the Remedial Action Objectives (RAOs).

The waste site confirmatory sampling results support a reclassification of this site to No Action. The current site conditions achieve the RAOs and the corresponding RAGs established in the Remedial Design/Remedial Action Work Plan for 200 North Area Waste Sites located in the 200-CW-3 Operable Unit (DOE/RL-2007-55) and the Interim Action Record of Decision for 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington (Remaining Sites ROD) (EPA 1999). The results of the waste site sampling after remediation are used to make reclassification decisions for the 600-287-PL waste site in accordance with the TPA-MP-14 (DOE/RL-2007) process.

Basis for Reclassification:

(For closeout, reference supporting documentation, as listed in Table 3.)

The current site conditions achieve the remedial action objectives and the corresponding remedial action goals specified in the Remaining Sites ROD. These results show that residual soil concentrations support future land uses that can be represented (or bounded) by a rural residential scenario. The results also demonstrate that residual contaminant concentrations support unrestricted future use of shallow zone soil [i.e., surface to 4.6 meters (15 feet)] and that contaminant levels remaining in the soil are protective of groundwater and the Columbia River. There is no deep zone for the 600-287-PL waste site therefore no institutional controls are required. The basis for reclassification to no action is described in detail in the Remaining Sites Verification Package for the 600-285-PL, 600-286-PL, and 600-287-PL Waste Sites located in the 200-CW-3 Operable Unit (DOE/RL-2009-84), U.S. Department of Energy, Richland Operation Office, Richland, Washington.

Waste Site Controls

Engineered Controls: Yes ☐ No ☒ Institutional Controls: Yes ☐ No ☒ O&M requirements: Yes ☐ No ☒

If any of the Waste Site Controls are checked Yes specify control requirements including reference to the Record of Decision, TSD Closure Letter, or other relevant documents.

O.A. Farabee **DOE Project Manager**	O.A. Farabee **Signature**	9/16/09 **Date**
N/A **Ecology Project Manager**	**Signature**	**Date**
C.E. Cameron **EPA Project Manager**	Craig E. Cameron **Signature**	10/27/09 **Date**

REMAINING SITES VERIFICATION PACKAGE FOR THE 600-285-PL, 600-286-PL AND 600-287-PL WASTE SITES LOCATED IN THE 200-CW-3 OPERABLE UNIT

EXECUTIVE SUMMARY

The Waste Information Data System (WIDS) describes the 600-285-PL, 600-286-PL, 600-287-PL waste sites as 18-inch (46-centimeter) diameter vitrified clay pipelines. Each underground pipeline serviced one 212 Building and extended to one of the 216-N Ponds for gravity fed discharge of basin liquids (212-N to 216-N-1 Pond, 212-P to 216-N-4 Pond and 212-R to 216-N-6 Pond, respectively).

The 600-285-PL, 600-286-PL, 600-287-PL waste sites were investigated through field observations and focused sampling and analysis for the purpose of determining if hazardous or radiological contaminants were present. The results of the focused sampling of test pits identified levels of contaminants of concern below the Remedial Action Goals (RAGs). Consequently, the results support the 'No Action' determination described in the *Remedial Design/Remedial Action Work Plan for 200 North Area Waste Sites located in the 200-CW-3 Operable Unit* (DOE/RL-2007-55) and the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD) (EPA 1999). In accordance with this evaluation, the waste site confirmatory sampling results support a reclassification of this site to "no action".

The sample results indicate that the 600-285-PL, 600-286-PL, 600-287-PL waste sites achieved compliance with the remedial action objectives (RAOs) and the RAGs. The analytical results show that residual soil concentrations support future land uses that can be represented (or bounded) by a rural-residential scenario. The results also demonstrate that residual contaminant concentrations support unrestricted future use of shallow zone soil [i.e., surface to 4.6 meters (15 feet)] and that contaminant levels remaining in the soil are protective of groundwater and the Columbia River. There is no deep zone for the 600-285-PL, 600-286-PL and 600-287-PL waste sites therefore no institutional controls are required. As the objective of this process, the results of the waste site sampling are used to make reclassification decisions for the 600-285-PL, 600-286-PL and 600-287-PL waste sites in accordance with the reclassification process described in TPA-MP-14, *Maintenance of the Waste Identification Data System* (WIDS) (DOE-RL 2007).

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REMAINING SITES VERIFICATION PACKAGE FOR THE 600-285-PL, 600-286-PL AND 600-287-PL WASTE SITES LOCATED IN THE 200-CW-3 OPERABLE UNIT

1.0 STATEMENT OF PROTECTIVENESS

This report demonstrates that the 600-285-PL, 600-286-PL and 600-287-PL waste sites meet the objectives for the 'no further action' remedy described in the *Remedial Design/Remedial Action Work Plan for 200 North Area Waste Sites located in the 200-CW-3 Operable Unit* (RD/RAWP) (DOE/RL-2007-55) and the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD) (EPA 1999). The results presented show that residual soil concentrations support future land uses that can be represented (or bounded) by a rural-residential scenario. The results also demonstrate that residual contaminant concentrations support unrestricted future use of shallow zone soil [i.e., surface to 4.6 meters (15 feet)] and that contaminant levels remaining in the soil are protective of groundwater and the Columbia River. These results support the 'no action' determination and reclassification to "no action" status in accordance with the process described in TPA-MP-14, *Maintenance of the Waste Identification Data System (WIDS)* (DOE-RL 2007). There is no deep zone for the 600-285-PL, 600-286-PL or 600-287-PL waste sites therefore no institutional controls are required.

Soil cleanup levels were established in the Remaining Sites ROD (EPA 1999) based on a limited ecological risk assessment. These soil cleanup levels are referred to as Look-Up Values. A baseline risk assessment for the outer area will include a more complete quantitative ecological risk assessment. When complete, this risk assessment will be used to support a future final closeout decision for the 600-285-PL, 600-286-PL and 600-287-PL waste sites as part of final closure of the outer area.

2.0 GENERAL SITE INFORMATION AND BACKGROUND

The Waste Information Data System (WIDS) describes the 600-285-PL, 600-286-PL, and 600-287-PL waste sites as 18-inch (46-centimeter) diameter vitrified clay pipelines. Each underground pipeline serviced one of the three 212 Buildings that were used for fuel storage. Each pipeline extended to one of the 216-N Ponds for gravity fed discharge of basin overflow cooling water; 212-N to the 216-N-1 Pond, 212-P to the 216-N-4 Pond, and 212-R to the 216-N-6 Pond, respectively (see Figure 1). Each has two access manholes, one approximately 3 meters south of the respective building, and the second about half way between the building and the pond serviced. Each of the pipelines is estimated to have carried approximately 946,000,000 L (250,000,000 gallons) of low activity cooling water. Historical information found indicates no leaks or unplanned releases were associated with the pipelines. Historical radiological survey information at various points along the pipeline showed no radiological dose above background and no radiological contamination (all surveys were at surface and easily accessible points).

3.0 SUMMARY OF REMEDIAL ACTION OBJECTIVES FOR THE 600-285-PL, 600-286-PL AND 600-287-PL WASTE SITES

The results from the confirmatory sampling and analysis of the 600-285-PL, 600-286-PL and 600-287-PL waste sites clay pipelines indicate compliance with the remedial action objectives (RAOs) and the remedial action goals (RAGs) identified in the Remaining Sites ROD (EPA 1999) and the RD/RAWP (DOE/RL-2007-55). Table 1 summarizes the confirmatory sampling results against the applicable criteria. Detailed analysis results are presented by Hanford Environmental Information System (HEIS) identification number in Appendix F.

Table 1. Summary of Attainment of Remedial Action Objectives for the 600-285-PL, 600-286-PL and 600-287-PL Waste Sites

Regulatory Requirement	Remedial Action Goals [a]	Results	Remedial Action Objectives Attained?
Direct Exposure – Radionuclides	Attain 15-mrem/year dose rate above background over 1,000 years.	Residual concentrations of radionuclide COPCs are below background or less than one-tenth the single radionuclide soil concentration equivalent to a 15 mrem/year dose rate calculated by RESRAD (see Appendix A).	Yes
Direct Exposure – Nonradionuclides	Attain individual COPC RAGs.	All individual COPC concentrations are below the direct exposure criteria presented in Appendix B and Appendix F, Table F-1.	Yes
Risk Requirements – Nonradionuclides	Attain a hazard quotient of <1 for all individual noncarcinogens.	Lead and chromium III were the noncarcinogen COPCs detected above Hanford Specific background value (see Appendix B and Appendix F, Table F-1). The individual hazard quotients calculated for these constituents meet the < 1 criteria. See Appendix C for calculations.	Yes
	Attain a cumulative hazard quotient of <1 for non-carcinogens.	Lead and chromium III were the noncarcinogen COPCs detected above background levels. The cumulative hazard quotient meets the < 1 criteria. See Appendix C for calculation.	
	Attain an excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	No carcinogens were detected above background levels. See Appendix C.	
	Attain a cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	There is no cumulative excess cancer risk for the COPCs. See Appendix C.	

Table 1. Summary of Attainment of Remedial Action Objectives for the 600-285-PL, 600-286-PL and 600-287-PL Waste Sites

Regulatory Requirement	Remedial Action Goals [a]	Results	Remedial Action Objectives Attained?
Groundwater/River Protection – Radionuclides	Attain single COPC groundwater and river protection RAGs.	Maximum residual concentrations of radionuclide COPCs were detected below groundwater and river protection exposure criteria (Table 2 and Appendix D). Values calculated by RESRAD that are protective of the groundwater are also protective of the Columbia River, since contaminant access to the Columbia River is through the groundwater. ***NOTE:*** *For uranium-233/234 and uranium-238, the groundwater MCL of 21.2 pCi/L corresponds to a soil concentration of 0.185 pCi/g. However, the Hanford specific background for these uranium isotopes is 1.1 pCi/g. The RAG therefore defaults to 1.1 pCi/g.* [d]	Yes
	Attain national primary drinking water standards [b] 4 mrem/yr (beta/gamma) dose rate to target receptor/organs.	Maximum residual concentrations of beta/gamma radionuclide COPCs were detected below groundwater and river protection exposure criteria (Table 2 and Appendix A, Footnote a).	
	Meet drinking water standards for alpha emitters: the most stringent of 15 pCi/L MCL or 1/25th of the derived concentration guides from DOE Order 5400.5. [c]	Maximum residual concentrations of alpha emitting radionuclide COPCs were detected below groundwater and river protection exposure criteria (Table 2 and Appendix D). RESRAD calculations predict that the only alpha emitting radionuclide COPCs with the potential to reach groundwater within 1,000 years are the uranium isotopes. ***NOTE:*** *For uranium-233/234 and uranium-238, the groundwater MCL of 21.2 pCi/L corresponds to a soil concentration of 0.185 pCi/g. However, the Hanford specific background for these two uranium isotopes is 1.1 pCi/g. The RAG therefore defaults to 1.1 pCi/g.* [d]	Yes
	Meet total uranium standard of 21.2 pCi/L. [d]	For uranium-233/234 and uranium-238, the groundwater MCL of 21.2 pCi/L corresponds to a soil concentration of 0.185 pCi/g (Appendix D). However, the Hanford specific background for these two uranium isotopes is 1.1 pCi/g. The RAG therefore defaults to 1.1 pCi/g. [d]	

Table 1. Summary of Attainment of Remedial Action Objectives for the 600-285-PL, 600-286-PL and 600-287-PL Waste Sites

Regulatory Requirement	Remedial Action Goals [a]	Results	Remedial Action Objectives Attained?
Groundwater/River Protection – Non-radionuclides	Attain individual non-radionuclide groundwater and river protection cleanup requirements.	Maximum detected results for all nonradionuclides are below the RAGs for protection of groundwater except for lead and chromium. However, the RESRAD calculation predicts that chromium total and lead will not reach groundwater within 1,000 years based on the 100 Area generic site model using soil column layers and depths. (Appendix E).	Yes

Notes:

[a] Remaining Sites ROD

[b] "National Primary Drinking Water Regulations" (40 *Code of Federal Regulations* 141).

[c] *Radiation Protection of the Public and the Environment* (DOE Order 5400.5).

[d] Based on the isotopic distribution of uranium in the 100 Areas, 30 μg/L MCL corresponds to 21.2 pCi/L. Concentration-to-activity calculations are documented in *Calculation of Total Uranium Activity Corresponding to a Maximum Contaminant Level for Total Uranium of 30 Micrograms per Liter in Groundwater*, 0100X-CA-V0038 (BHI 2001).

[e] RESRAD calculation predicts that manganese, which has a Kd value of 50 mL/g, will not reach groundwater within 1,000 years based on the 100 Area generic site model using soil column layers and depths. Described in the text of Calculation Number 0100X-CA-V0046, *100 Area Radionuclide and Nonradionuclide Lookup Values for the 1995 Interim Remedial Action Record of Decision* (BHI 2004) July 2004, Bechtel Hanford, Inc., Richland, WA.

Abbreviations: COPC = contaminant of potential concern MCL = maximum contaminant level (drinking water standard)
RAG = remedial action goal

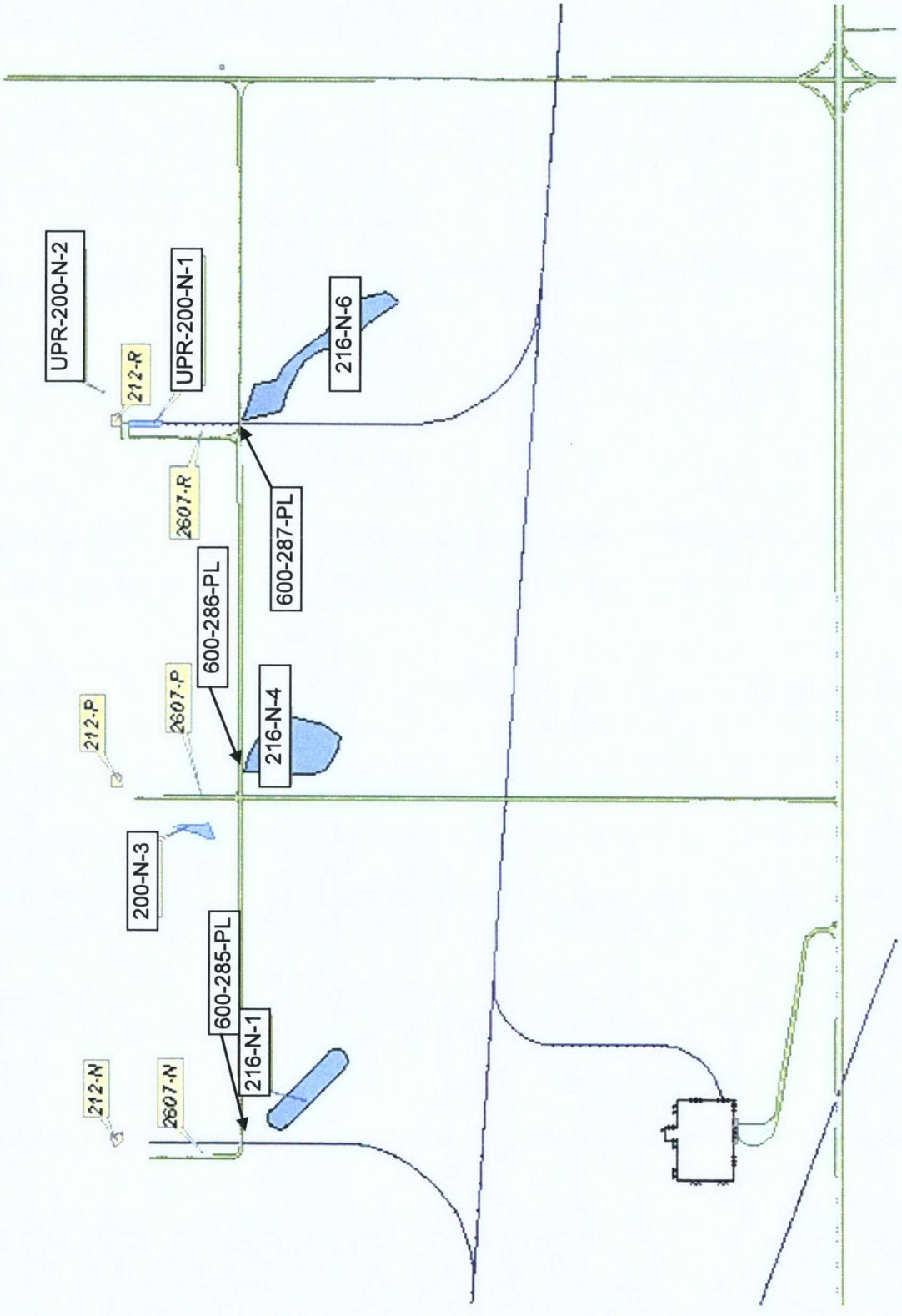

Figure 1. 600-285-PL, 600-286-PL and 600-287-PL Waste Site Location Map.

4.0 PRE-REMEDIATION WASTE SITE CHARACTERIZATION AND CONCEPTUAL MODEL CONFIRMATION SAMPLING

To determine if remediation of the 600-285-PL, 600-286-PL and 600-287-PL waste sites was required, the waste site was characterized in accordance with the RD/RAWP and SAP. No action was confirmed through radiological soil screening, sampling and analysis.

4.1 Geophysical Survey Results

The Hanford Site lies in a sediment-filled basin on the Columbia Plateau in southeastern Washington. The 200-CW-3 operable unit waste sites are located in the 200 North Area which is situated on the 200 Areas Plateau north of a relatively flat prominent terrace (Cold Creek Bar), on a flood channel formed during the late Pleistocene flooding. The elevation in the vicinity ranges from approximately 180 m (593 ft) in the northern part of the unit to about 170 m (560 ft) above mean sea level (msl) in the southern part. There are no natural surface drainage channels within the 200 North area.

The vadose zone beneath the 200 Areas ranges in thickness from approximately 55 m (180 ft) beneath the former U Pond in the 200 West Area to approximately 104 m (341 ft) in the southern portion of the 200 East Area to 49 m (160 ft) along the western part of the 200 North Area. The vadose zone thins from the 200 Areas north to 0.3 m (1 ft) near West Lake (the 216-N-8 Pond). Basalt of the Columbia River Basalt Group and a sequence of overlying sediments comprise the local geology. Sediments in the vadose zone consist primarily of the Hanford formation, Plio-Pleistocene unit/early Palouse soil, and Ringold Formation.

Groundwater beneath the Hanford Site is found in an upper primarily unconfined aquifer system and in deeper confined aquifers within the basalt. The Columbia River is the primary discharge area for both the unconfined and confined aquifer. The unconfined aquifer in the 200 North area of the Central Plateau occurs in the Hanford Formation. In general, groundwater flow through the Central Plateau occurs in a predominantly easterly direction from the 200 West Area to the 200 East Area.

The nearest natural surface water body to the 200 North area is West Lake (the 216-N-8 Pond) located approximately 0.8 km (0.5 mi) east. The potential for natural groundwater recharge within the 200 North area is limited to precipitation infiltration. Estimates of recharge from precipitation at the Hanford Site range from 0 to 10 cm/yr (0 to 4 in/yr).

The subject vitrified clay pipeline waste sites, 600-285-PL, 600-286-PL, and 600-287-PL, are located underground starting from 212-N, 212-P, and 212-R, respectively, and terminate at a discharge pond waste site, and unless structurally compromised, would not contribute to saturated conditions in the vadose zone resulting in vertical contaminant migration to the unconfined aquifer. Each pipeline extends in a southerly direction 905 feet from the 'headwall' of a 212-series structure to the outfall at the corresponding pond. Each has two access manholes, one approximately 3 meters south of the respective building and the second about half way between the building and the pond serviced. Gravity flow of liquids from each facility basin to its corresponding pond occurs across a 0.3 % slope running the length of the pipeline. The pipelines were covered with earthen backfill and allowed to re-vegetate naturally. No evidence of subsidence was identified during visual examination of the work area in preparation for these sampling activities, and as identified in section 2.0, the historic review coupled with the radiological surveys indicate no leaks or unplanned releases (structurally compromised sections) were associated with these waste site pipelines, and, as a result, no potential impacts to the vadose zone were identified.

4.2 Contaminants of Concern

The contaminants of potential concern (COPCs) for the 600-285-PL, 600-286-PL and 600-287-PL waste sites were identified based on existing information for the site and the COPCs listed in the Remaining Sites ROD. The COPC list identified in the *Sampling and Analysis Plan for Remediation of 200 North Area Waste Sites located in the 200-CW-3 Operable Unit* (SAP) (DOE/RL-2007-54) includes americium-241, cobalt-60, cesium-137, europium-152, europium-154, europium-155, tritium, strontium-90, plutonium-238, plutonium-239/240, nickel-63, thorium-232, technetium-99, uranium-233/234, uranium-235, uranium-238, hexavalent chromium, mercury, lead, barium, trivalent chromium, cadmium, antimony, arsenic, manganese, zinc, and polychlorinated biphenyls.

4.3 Waste Site Sample Design for Waste Site Characterization and Conceptual Model Confirmation Activities

Judgment/focused sampling and field screening were determined to be appropriate for the waste site investigations in the 200-CW-3 OU based on EPA guidance (EPA/240-R-02-005, *Guidance on Choosing a Sampling and Design for Environmental Data Collection*), the decision rules and conceptual models developed to support the Remaining Sites ROD, and the nature/process knowledge of these waste sites.

The 200-CW-3 waste sites have attributes such as visible surface debris, known discharge release points in engineered structures such as ponds, or subsurface debris that can be identified by surface geophysical techniques, or have a primary constituent which has a gamma and/or beta emitter that can be identified by surface/near surface radiological surveys. When combined with process knowledge, these physical attributes support the use of focused or judgment (versus statistical) sampling to select potential "worst-case" candidate sites.

Radiological field screening is used to establish site radiological contamination levels. Data from field screening alone is not sufficient to support final no-action decisions in accordance with the Remaining Sites ROD. Field screening can, however, assist in the focused or judgment sampling for sites with indicator constituents. Although a negative result cannot be used to support a final no-action decision, it can be used to focus on the area of potential contamination. Positive results (contamination detected above background readings) serve several purposes including providing bases for focused sample collection and providing an "indicator" of chemical contamination.

The specific sampling design for the 600-285-PL, 600-286-PL and 600-287-PL waste sites is detailed in the Sampling and Analysis Plan, DOE/RL-2007-54, and follows the conceptual site model for underground pipelines developed with data quality objectives for the Remaining Sites ROD. The conceptual model for underground pipelines includes the physical components of the site, sampling access, spatial boundaries and sampling media. The manholes and the outfall (discharge end) at each pipeline were determined to be sampling locations that would be representative of the entire vitreous clay pipeline. The following elements make up the sampling approach for the subject pipeline waste sites (from SAP DOE/RL-2007-54):

- Radiological field surveys performed using Cs-137 or Sr-90 (as appropriate) as an indicator for each pipeline outfall and collection of sample media from each pipeline.
- Collection of focused sample(s) at each pipe outfall at the highest field radiological survey reading (additional detail is provided in the SAP for QC samples and trip, field and equipment blanks).
- Collection of smear samples from manholes for each pipeline for field screening.

Based on the sampling design, the combination of the radiological surveys and samples taken from the most likely candidate for contamination, i.e. the vitreous clay pipe, the pipeline was not a source of contamination or a contributor to the spread of contamination in the surrounding media. As a result, the findings from these sampling activities are considered representative of the waste sites and are adequate to conclusively support a decision of no action.

4.4 Sample Summary

On June 3 and 9, 2009, focused, discrete samples were collected from 600-285-PL, 600-286-PL and 600-287-PL waste site outfalls. The clay pipe samples were pulverized and divided into two samples (duplicate samples). As described in the SAP, radiological screening was performed prior to and during sampling. Surveys were performed near the origins of the pipelines located at the building each pipeline serviced via a manhole and at the discharge point of the pipelines into the ponds. The culvert and pipelines radiological survey readings did not exceed background. A portion of each pipeline was removed and pulverized before analysis.

The analytical results from the sampling campaign were compared to the Deep Zone [$\geq$ 4.6 meters (15 feet) below surface to groundwater] and Shallow Zone [surface to 4.6 meters (15 feet)] Look-Up Values, to determine whether further remediation was required. The analytical results from the clay pipe samples are below their applicable Look-Up Values.

Photographs and results for the 600-285-PL, 600-286-PL and 600-287-PL waste sites waste characterization/conceptual model remedy confirmation sampling and analysis data are presented in Appendix F. The Hanford Environmental Information System (HEIS) sample numbers are listed for each sample with a description of the sample.

5.0 DATA EVALUATION

Results for the 600-285-PL, 600-286-PL and 600-287-PL waste sites sampling and analysis for verification of remedy completion are summarized in Appendix F. All detected analytes were reported at concentrations below direct exposure, groundwater protection, and river protection RAGs, or below the Hanford Specific Background default value RAGs in the case of uranium-233/234 and uranium-238.

Nonradionuclide risk requirements for the 600-285-PL, 600-286-PL and 600-287-PL waste sites include an individual and cumulative hazard quotient of less than 1.0, individual contaminant carcinogenic risks of less than 1×10^{-6}, and a cumulative carcinogenic risk of less than 1×10^{-5}. Risk values are not calculated for constituents that are either not detected or are detected at concentrations below Hanford Site or Washington State background values (Appendix F).

- All individual hazard quotients for noncarcinogenic constituents were less than 1.0. Chromium and lead were the only constituents detected above its Hanford Specific Background value. Therefore, chromium and lead were the only constituents used in the hazard quotient calculation. The hazard quotient for chromium (2.64×10^{-4}) and lead (0.0637) were less than 1.0.

- The cumulative hazard quotient for all noncarcinogenic constituents was less than 1.0. Again, chromium and lead were the only constituents detected above its Hanford Specific Background value. Therefore, chromium and lead were the only constituents used in the hazard quotient calculation. The cumulative hazard quotient for chromium and lead (0.0641) is less than 1.0.

- The individual carcinogenic risk values for carcinogenic constituents above background are all below 1×10^{-6}. No carcinogens were detected above background levels.

- The cumulative excess carcinogenic risk value for carcinogenic constituents above background is below 1×10^{-5}. No carcinogens were detected above background levels.

All calculations are provided in Appendix C.

6.0 DATA QUALITY ASSESSMENT

A data quality assessment (DQA) review was performed to compare the sampling approach and analytical data with the sampling and data requirements specified by the SAP (DOE/RL-2007-54). This review involves evaluation of the data to determine if they are of the right type, quality, and quantity to support the intended use (EPA 2000). The assessment review completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality process.

Level C data validation as defined in the contractor's validation procedures, which are based on EPA functional guidelines [e.g., *Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses* (Bleyler 1988a); *Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses* (Bleyler 1988b)], was performed for the entire sampling and analysis data package for the confirmatory samples collected for 600-285-PL, 600-286-PL and 600-287-PL. Level C validation is a review of the quality control (QC) data and specifically requires verification of deliverables and requested versus reported analyses and qualification of the results based on: analytical holding times; method blank results; matrix spike/matrix spike duplicate; surrogate recoveries; duplicates; and analytical method blanks.

Specific data quality objectives for the site are found in the SAP (DOE/RL-2007-54). All samples were collected per the sample design described in Section 4.3. The COPCs for 600-285-PL, 600-286-PL and 600-287-PL are in listed Section 4.2.

All of the sampling and analysis data generated from the confirmatory sampling of 600-285-PL, 600-286-PL and 600-287-PL waste sites are tracked through the following Hanford Environmental Information System (HEIS) identification numbers: B20LK1, B20LK2, B20LK3, B20LK4, B20LK5, B20LK6, B20V84 (equipment blank), B20V85 (field blank), and B20V86 (trip blank). All of the 600-285-PL, 600-286-PL and 600-287-PL sampling and analysis data were found to be useable for decision-making purposes as provided in the following summary:

HEIS Identification Numbers: B20LK1, B20LK2, B20LK3, B20LK4, B20LK5, B20LK6, B20V84 (equipment blank), B20V85 (field blank), and B20V86 (trip blank)

Blanks: Trip, field, and equipment blanks with complete analyses were acceptable. The only anomaly was identified with a field blank that was collected for 600-286-PL. Due to a paperwork error, tritium was the only constituent requested instead of all the constituents. The laboratory was requested to re-run the sample to include the other constituents, but there was not enough of the field blank material to perform the analysis. The impact of this error is minimal considering that the constituents of potential concern do not include volatile or semi-volatile organic compounds that would be readily seen in a field blank for this project. In lieu of the field blank, the equipment blank can be used. The equipment blank not only verifies the cleaning method, but it also verifies the ambient conditions in the field. The equipment blank, which was collected in the field, did not show any indications of contaminants.

Field Duplicates: All duplicates were acceptable.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) and Laboratory Control Standard/Laboratory Control Standards Duplicate (LCS/LCSD): MS/MSD and LCS/LCSD were run to an acceptable percentage recovery test as a result for calculation or relative percent difference (RPD) for QC purposes based on laboratory QA/QC procedures.

Radiochemistry, ICP Metals, PCB, and Chromium (VI) Analyses: Analytical reports submitted for validation and verified for completeness based on the percentage of data determined to be valid (i.e., not rejected). The completion percentage was 100%. The data has been determined to be useable for decision-making purposes. Detailed notes, copies of chains of custody, and validation information are provided in letter report number 3B700-09-004.

Field Screening: Relative to analytical data in sample media, physical data and/or field screening results are of lesser importance in making inferences of risk. Because of the secondary importance of such data, no validation for physical property data and/or field screening results was performed. However, field quality assurance/quality control (QA/QC) was reviewed to ensure that the data are useable. Field instrumentation, calibration, and QA checks were performed in accordance with the following.

- Calibration of radiological field instruments on the Hanford Site is performed under contract by Pacific Northwest National Laboratory, as specified in their program documentation.

- Daily calibration checks are performed and documented for each instrument used to characterize areas that are under investigation. These checks are made on standard materials that are sufficiently like the matrix under consideration that direct comparison of data can be made.

The review and approval of completed field radiation surveys by the radiological controls organization represents the data validation and usability review for handheld field radiological measurements.

The DQA review for these waste sites found the analytical results to be accurate within the standard errors associated with the methods, including sampling and sample handling. The data are of the correct type, quality, and quantity to support the intended use. Detection limits, precision, accuracy, and sampling data group completeness were assessed to determine if any analytical results should be rejected as a result of quality assurance and quality control deficiencies. All analytical data were found acceptable for decision-making purposes. All of the sampling analytical data are stored in the Hanford Environmental Information System and are summarized in Appendix F. All qualifiers have also been added accordingly into the data for Appendix F.

7.0 SUMMARY SUPPORTING NO ACTION RECLASSIFICATION

On June 3 and 9, 2009, focused, discrete clay pipe samples were collected from 600-285-PL, 600-286-PL and 600-287-PL at the termination or outfall (point of discharge at the respective pond). The analytical results were compared to the Deep and Shallow Zone Look-Up Values to determine whether further remediation was required. The analytical results from the clay pipe samples are below their applicable Look-Up Values.

The analytical results from the clay pipe sample meet the remedial action objectives for direct exposure, groundwater protection, and river protection as specified in the Remaining Sites Record of Decision. In accordance with this evaluation, the sampling results support a reclassification of the 600-285-PL, 600-286-PL and 600-287-PL waste sites to 'No action' status, as recorded on Waste Site Reclassification Forms included with this report. Per TPA-MP-14, 'no action' status indicates that a waste site does not require any further remedial action under RCRA Corrective Action, CERCLA, or other cleanup standards based on an assessment of quantitative data collected for the waste site as evaluated under this interim Record of Decision. These waste sites and the data obtained from the subject sampling evolution will be included in the risk assessment and remedial investigation and feasibility study for final closure of this area.

Table 2. Comparison of Maximum Soil Analyses to Remedial Action Goals for the 600-285-PL, 600-286-PL and 600-287-PL Waste Sites *

Contaminant of Concern	Hanford Site-Specific Background Activity (pCi/g)	Maximum Soil Analyses (pCi/g)	Remedial Action Goals (pCi/g)			Does the Maximum Exceed RAGs?
			Direct Exposure (pCi/g)	Soil Cleanup Level for Groundwater Protection (pCi/g)	Soil Cleanup Level for River Protection (pCi/g)	
Americium-241	N/A	0.0710	31.1	NA [c]	NA [c]	No
Cesium-137	1.1	4.92	6.2	1,465	1,465	No
Cobalt-60	0.008	0.0212	1.4	13,900	13,900	No
Europium-152	N/A	0.809	3.3	NA [c]	NA [c]	No
Europium-154	0.033	0.180	3.0	NA [c]	NA [c]	No
Europium-155	0.054	U	125	NA [c]	NA [c]	No
Nickel-63	N/A	U	4,026	83	83	No
Plutonium-238	0.004	U	34	NA [c]	NA [c]	No
Plutonium-239/240	0.025	0.710	35.1	NA [c]	NA [c]	No
Strontium-90	0.18	1.00	4.5	27.6	27.6	No
Technetium-99	N/A	U	5.7	0.46	0.46	No
Throium-232	1.3	0.0856	1.0	NA [c]	NA [c]	No
Tritium (H-3)	35.5	U	459	12.6	12.6	No
Uranium-233/234	1.1	0.0670	0.57	1.1 [a]	1.1 [a]	No
Uranium-235	0.11	U	0.61	1.0 [b]	1.0 [b]	No
Uranium	1.1	0.0490	0.61	1.1 [a]	1.1 [a]	No
Contaminant of Concern	**Hanford Site-Specific Background Activity (mg/kg)**	**Maximum Soil Analyses (mg/kg)**	**Remedial Action Goals (mg/kg)**			**Does the Maximum Exceed RAGs?**
			Direct Exposure (mg/kg)	**Soil Cleanup Level for Groundwater Protection (mg/kg)**	**Soil Cleanup Level for River Protection (mg/kg)**	
Antimony	5 [d]	U	32	6.0 [b]	6.0 [b]	No
Arsenic	6.5	1.54	6.5 [d]	6.5 [d]	6.5 [d]	No
Barium	132	50.4	5,600	NA [c]	NA [c]	No
Cadmium [f]	0.81 [d]	U	80	NA [c]	NA [c]	No
Chromium Total	18.5	21.1 [e]	80,000	NA [c]	NA [c]	No [e]
Chromium (VI)	N/A	U	400	8.0	2.2	No
Lead	10.2	22.5 [f]	353	NA [c]	NA [c]	No [f]
Manganese	512	57.0	11,200	NA [c]	NA [c]	No
Mercury	0.33	U	24	NA [c]	NA [c]	No
Zinc	67.8	27.9	24,000	NA [c]	NA [c]	No
Polychlorinated Biphenyls	N/A	U	0.5	NA [c]	NA [c]	No

Notes:

[a] The calculated soil concentration cleanup level of 0.185 pCi/g is below the Hanford Specific Background Activity of 1.1 pCi/g. Therefore the soil concentration protection of groundwater defaults to 1.1 pCi/g.

[b] The remedial action goal is below the practical quantitation limit (PQL). The value presented is the PQL.

[c] NA = Not Applicable. RESRAD predicts constituent will not reach groundwater within 1,000 years based on 100 Area generic site model using soil column layers and depths.

[d] Where cleanup levels are less than background or required detection limit (RDLs), cleanup levels default to background or RDLs per Ecology 1996, WAC 173-340-700(4)(d) and WAC 173-340-707(2), respectively. The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement Project Managers (the basis is documented in DOE/RL-96-17, Rev 5, 2.1.2.1).

[e] The maximum chromium total result of 21.1 mg/kg exceeds the Hanford Site-Specific background of 18.5 mg/kg. However, the RESRAD calculation predicts that chromium total, which has a Kd value of 200 mL/g, will not reach groundwater within 1,000 years based on the 100 Area generic site model using soil column layers and depths.

[f] The maximum lead result of 22.5 mg/kg exceeds the Hanford Site-Specific background of 10.2 mg/kg. However, the RESRAD calculation predicts that lead, which has a Kd value of 30 mL/g, will not reach groundwater within 1,000 years based on the 100 Area generic site model using soil column layers and depths.

* Site RAGs are taken from the RD/RAWP (DOE/RL-2007-55), where available, without further consideration of updated toxicity data or amendments (2004) to cleanup regulations in WAC 173-340.

Abbreviations: NA = Not Applicable (see note c above) N/A = Not Available RAG = Remediation Action Goal
U = Analyte was not detected above detection limits. Detection limits are below RAGs.

8.0 REFERENCES

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APPENDIX A

COMPARISON OF MAXIMUM COMFIRMATORY SAMPLE ANALYSES TO 100 AREA RADIONUCLIDE SOIL CONCENTRATIONS CORRESPONDING TO AN EQUIVALENT DOSE OF 15 MREM/YR.

Table A-1. Comparison of Maximum Confirmatory Soil Analyses to 100 Area Radionuclide Soil Concentrations Corresponding to an Equivalent Dose of 15 mrem/yr.

Radionuclide	Soil Activity for 15 mrem/yr Dose (except as noted) (pCi/g)	Source of Single Radionuclide Soil Concentration	Maximum Results (pCi/g)
Americium-241	31.1	WDOH/320-015 [c]	0.0710
Cesium-137	6.2	WDOH/320-015 [c]	4.92
Cobalt-60	1.4 [a]	WDOH/320-015 [c]	0.0212
Europium-152	3.3 [a]	WDOH/320-015 [c]	0.809
Europium-154	3.0 [a]	WDOH/320-015 [c]	0.180
Europium-155	125 [a]	RESRAD Calc [b]	U
Nickel-63	4,026 [a]	RESRAD Calc [b]	U
Plutonium-238	37.4	RESRAD Calc [b]	U
Plutonium-239/240	33.9	WDOH/320-015 [c]	0.710
Strontium-90	4.5 [a]	WDOH/320-015 [c]	1.00
Technetium-99	8.5 [a]	WDOH/320-015 [c]	U
Thorium-232	1.0	RESRAD Calc [b]	0.0856 (<BG)
Tritium (H-3)	510 [a]	RESRAD Calc [b]	U
Uranium-233/234	0.78	RESRAD Calc [b]	0.0670 (<BG)
Uranium-235	0.84	RESRAD Calc [b]	U
Uranium-238	0.84	RESRAD Calc [b]	0.0490 (<BG)

Notes:

[a] Radionuclide concentrations for beta/gamma in water corresponding to a 4 mrem/yr dose (C4 mrem/yr) from Soil Screening Guidance for Radionuclides: User's Guide, EPA/540-R-00-007, U.S. Environmental Protection Agency, Office or Radiation and Indoor Air, Washington D.C.

[b] Per Table 2-2, DOE/RL-96-17, *Remedial Design Report / Remedial Action Work Plan for the 100 Area*, Rev. 5, November 2004

[c] From State of Washington Department of Health Interim Regulatory Guidance: Hanford Guidance for Radiological Cleanup, WDOH/320-015, Rev. 1 (WDOH 1997) Washington State Department of Health, Richland, Washington.

Abbreviations: BG = Hanford Site-Specific Background.
U = Analyte was not detected above detection limits. Detection limits are below RAGs.

APPENDIX B

COMPARISON OF MAXIMUM COMFIRMATORY SAMPLE ANALYSES TO NONRADIONUCLIDE DIRECT EXPOSURE CLEANUP LEVELS

Table B-1. Comparison of Maximum Confirmatory Sample Analyses to Nonradionuclide Direct Exposure Cleanup Levels.

Contaminant	Background [i] (mg/kg)	RDL (mg/kg)	Direct Exposure Cleanup Levels [a] (mg/kg)		Direct Exposure Cleanup Level (mg/kg)	Maximum Results (mg/kg)
			Carcinogen	Noncarcinogen		
Metals						
Antimony	5 [b]	0.6	N/A	32	32	U
Arsenic	6.5	10	0.667	24	20 [c]	1.54
Barium	132	2	N/A	5,600	5,600	50.4
Cadmium	0.81 [b]	0.5	13.9 [d]	80	13.9	U
Chromium, Total	18.5	1	N/A	120,000	120,000	21.1 [g]
Chromium VI	NA	0.5	2.1 [d]	240	2.1	U
Lead	10.2	5	N/A	353 [e]	353	22.5 [h]
Manganese	512	5	N/A	11,200	11,200	57.0
Mercury	0.33	0.2	N/A	24	24	U
Zinc	67.8	1	N/A	24,000	24,000	27.9
PCBs						
Polychlorinated Biphenyls [f]	NA	0.017	0.5	N/A	0.5	U

Notes:

[a] Calculated using the appropriate formulas from Ecology 1996, WAC 173-340-740, with toxicity values updated through July 2004, from the EPA Integrated Risk Information System (IRIS) at http://www.epa.gov/iris or from the Risk Assessment Information System (RAIS) database of the Oak Ridge National Laboratory (ORNL) on the Internet at http://risk.lsd.ornl.gov.

[b] Hanford Site-specific background not available. Value is from Ecology, 1994, *Natural Background Soil Metals Concentrations in Washington State,* Publication No. 94-115, Washington State Department of Ecology, Olympia, Washington.

[c] The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement Project Managers (the basis is documented in DOE/RL-96-17, Rev 5, 2.1.2.1).

[d] Carcinogenic cleanup level calculated based on the inhalation exposure pathway; WAC 173-340-750(3), 1996.

[e] Calculated using EPA, 1994, *Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children,* EPA/540/R-93/081, Publication No. 9285.7, U.S. Environmental Protection Agency, Washington, D.C.

[f] The soil cleanup value for PCBs is based on the formula presented in WAC 173-340-740(3)(a)(iii)(B), Ecology 1996, and the cancer potency factor for ingestion of PCBs of 2.0 kg-day/mg (soils) from the EPA Integrated Risk Information System (IRIS) on the internet at http://www.epa.gov/iris on January 3, 2006.

[g] The maximum chromium total result of 21.1 mg/kg exceeds the Hanford Site-Specific background of 18.5 mg/kg. However, the RESRAD calculation predicts that chromium total, which has a Kd value of 200 mL/g, will not reach groundwater within 1,000 years based on the 100 Area generic site model using soil column layers and depths.

[h] The maximum lead result of 22.5 mg/kg exceeds the Hanford Site-Specific background of 10.2 mg/kg. However, the RESRAD calculation predicts that lead, which has a Kd value of 30 mL/g, will not reach groundwater within 1,000 years based on the 100 Area generic site model using soil column layers and depths.

[i] Unless otherwise noted, background concentrations are 90th percentile values of the log normal distribution of site-wide soil background data. Source: Hanford Site Background: Part 1 Soil Background for Nonradionuclide Analytes (DOE-RL-92-24)

Abbreviations: N/A = Not Applicable NA = Not Available
RDL = Required Detection Limit
U = Analyte was not detected above detection limits. Detection limits are below RAGs.

APPENDIX C

HAZARD QUOTIENTS AND EXCESS CARCINOGENIC RISK

PURPOSE:

Provide documentation to support the calculation of the hazard quotient (HQ) and carcinogenic (excess cancer) risk values for the 600-285-PL, 600-286-PL and 600-287-PL Waste Site remedial action. In accordance with the remedial action goals (RAGs) in the *Remedial Design/Remedial Action Work Plan for 200 North Area Waste Sites located in the 200-CW-3 Operable Unit* (DOE/RL-2007-55), the following criteria must be met:

1) An HQ of <1.0 for all individual noncarcinogens
2) A cumulative HQ of <1.0 for noncarcinogens
3) An excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens
4) A cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.

GIVEN/REFERENCES:

DOE/RL-2007-55, *Remedial Design/Remedial Action Work Plan for 200 North Area Waste Sites located in the 200-CW-3 Operable Unit*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

WAC 173-340, "Model Toxics Control Act – Cleanup," *Washington Administrative Code*, 1996.

SOLUTION:

1) Calculate an HQ for each noncarcinogenic constituent detected above background and compare it to the individual HQ of <1.0 (DOE/RL-2007-55).

2) Sum the HQs and compare to the cumulative HQ criterion of <1.0.

3) Calculate an excess cancer risk value for each carcinogenic constituent detected above background and compare it to the individual excess cancer risk criterion of $<1 \times 10^{-6}$ (DOE/RL-2007-55).

4) Sum the excess cancer risk values and compare to the cumulative cancer risk criterion of $<1 \times 10^{-5}$.

METHODOLOGY:

Hazard quotient and carcinogenic risk calculations were computed using the data from Appendix F, Table F-1. Of the contaminants of concern listed in Appendix F, Table F-2, chromium and lead require the HQ and risk calculations because these analytes were detected above the Hanford Site background value. An explanation of the HQ and risk calculations is presented in the following:

1) For example, the maximum value for lead is 22.5 mg/kg, divided by the RAG value of 353 mg/kg, is 0.222. Comparing this value to the requirement <1.0, this criteria is met.

2) After the HQ calculations are completed for the appropriate analytes, the cumulative HQ is obtained by summing the individual values. Comparing this value to the requirement of <1.0.

3) To calculate the excess cancer risk, the maximum value is divided by the carcinogenic RAG value, then multiplied by 1 x 10^{-6}. Three constituents in the COPC list are carcinogens: arsenic, cadmium and hexavalent chromium. Because results for cadmium and hexavalent chromium indicate undetectable amounts in the sampled soil, the cumulative excess cancer risk is not applicable. Results for arsenic showed levels that are detectable, but that are below cleanup levels agreed to by the Tri-Party Agreement Project Managers (see Appendix B, Note "c"). Comparing the aresenic value to the requirement of < 1x 10^{-5}, therefore, is not applicable.

RESULTS:

1) List individual noncarcinogens and corresponding HQs >1.0: None.
2) List the cumulative noncarcinogenic HQ >1.0: None.
3) List individual carcinogens and corresponding excess cancer risk >1 x 10^{-6}: None.
4) List the cumulative excess cancer risk for carcinogens >1 x10^{-5}: None.

Table C-1 shows the results of the calculation:

Table C-1. Hazard Quotient and Excess Cancer Risk Results

Contaminants of Concern	Maximum Value [a] (mg/kg)	Noncarcinogen RAG [b] (mg/kg)	Hazard Quotient	Carcinogen RAG (mg/kg)	Carcinogen Risk
Metals					
Chromium (III)	21.1	80,000	2.64 x 10-4	NA	NA
Lead	22.5	353	0.0637	NA	NA
Totals					
Cumulative Hazard Quotient:			**0.0641**		
Cumulative Excess Cancer Risk:					NA

Notes:

[a] From Appendix F, Table F-1 and F-2.

[b] Value obtained from Washington Administrative Code (WAC) 173-340-740(3), Method B, 1996, unless otherwise noted.

Abbreviations: RAG = Remedial Action Goal NA = Not Applicable

CONCLUSION:

This calculation demonstrates that the 600-285-PL, 600-286-PL and 600-287-PL Waste Sites meets the requirements for the hazard quotients and carcinogenic (excess cancer) risk as identified in RD/RAWP (DOE/RL-2007-55).

APPENDIX D

COMPARISON OF MAXIMUM CONFIRMATORY SAMPLE ANALYSES TO SOIL ACTIVITIES CALCULATED BY RESRAD TO BE PROTECTIVE OF 100 AREA GROUNDWATER

Table D-1. Comparison of Maximum Confirmatory Sample Analyses to Soil Activities Calculated by RESRAD to be Protective of 100 Area Groundwater.

Radionuclide	Groundwater MCL[a] (pCi/L)	Soil Concentration Protective of Groundwater [b] (pCi/g)	Maximum Results (pCi/g)
Americium-241	1.2	1,577,000	0.0710
Cesium-137	60	NA [c]	4.92
Cobalt-60	100	NA [c]	0.0212
Europium-152	200	NA [c]	0.809
Europium-154	60	NA [c]	0.180
Europium-155	600	NA [c]	U
Nickel-63	50	NA [c]	U
Plutonium-238	1.6	1,123	U
Plutonium-239/240	1.2	718,600	0.710
Strontium-90	8	NA [c]	1.00
Technetium-99	900	15	U
Thorium-232	2	NA [c]	0.0856 (<BG)
Tritium (H-3)	20,000	35.5	U
Uranium-233/234	21.2	1.1 [d]	0.0670 (<BG)
Uranium-235	21.2	1.0	U
Uranium-238	21.2	1.1 [d]	0.0490 (<BG)

Notes:

[a] MCL = Maximum contaminant level calculated from National Bureau of Standards (NBS Handbook 69) maximum permissible concentration (MPC) as cited in EPA/540-R-00-007, the RAG from the RD/RAWP (DOE/RL-2007-55), or the MCL from 40 CFR 141.66.

[b] From DOE/RL-2007-55, Remedial Design/Remedial Action Work Plan for 200 North Area Waste Sites Located in the 200-CW-3 Operable Unit.

[c] NA = Not Applicable. RESRAD predicts constituent will not reach groundwater within 1,000 years based on 100 Area generic site model using soil column layers and depths. Described in the text of Calculation Number 0100X-CA-V0046, *100 Area Radionuclide and Nonradionuclide Lookup Values for the 1995 Interim Remedial Action Record of Decision* (BHI 2004) July 2004, Bechtel Hanford, Inc., Richland, WA.

[d] The calculated soil concentration cleanup level of 0.185 pCi/g is below the Hanford Specific Background Activity of 1.1 pCi/g. Therefore the soil concentration protection of groundwater defaults to 1.1 pCi/g.

Abbreviations: BG = Hanford Site-Specific Background
U = Analyte was not detected above detection limits. Detection limits are below RAGs.

APPENDIX E

SUMMARY OF COMPARISON OF MAXIMUM SAMPLE ANALYSES TO 100 AREA NONRADIONUCLIDE CLEANUP LEVELS FOR PROTECTION OF GROUNDWATER AND THE COLUMBIA RIVER

Table E-1. Summary of Comparison of Maximum Confirmatory Sample Analyses to 100 Area Nonradionuclide Cleanup Levels for Protection of Groundwater and the Columbia River.

Contaminant	Soil Cleanup Levels [a] (mg/kg)		Maximum Results (mg/kg)
	Protective of Groundwater	Protective of the Columbia River	
Metals			
Antimony	6.0 [b]	6.0 [b]	U
Arsenic	6.5 [c]	6.5 [c]	1.54
Barium	NA [d]	NA [d]	50.4
Cadmium	NA [d]	NA [d]	U
Chromium, Total	NA [d]	NA [d]	21.1 [e]
Chromium VI	8.0	2.2	U
Lead	NA [d]	NA [d]	22.5 [f]
Manganese	NA [d]	NA [d]	57.0
Mercury	NA [d]	NA [d]	U
Zinc	NA [d]	NA [d]	27.9
PCBs			
Polychlorinated Biphenyl	NA [d]	NA [d]	U

Notes:

[a] Soil cleanup levels are established in DOE/RL-2007-55.

[b] Goal is below the practical quantitation limit (PQL). The value presented is the PQL.

[c] The remedial action goal is below background. The value presented is background.

[d] The RESRAD model predicts the contaminant will not reach the groundwater within a 1,000 year time frame (DOE/RL-2007-55, Table 2-1).

[e] The maximum chromium total result of 21.1 mg/kg exceeds the Hanford Site-Specific background of 18.5 mg/kg. However, the RESRAD calculation predicts that chromium total, which has a Kd value of 200 mL/g, will not reach groundwater within 1,000 years based on the 100 Area generic site model using soil column layers and depths.

[f] The maximum lead result of 22.5 mg/kg exceeds the Hanford Site-Specific background of 10.2 mg/kg. However, the RESRAD calculation predicts that lead, which has a Kd value of 30 mL/g, will not reach groundwater within 1,000 years based on the 100 Area generic site model using soil column layers and depths.

Abbreviations: U = Analyte was not detected above detection limits. Detection limits are below RAGs.

APPENDIX F

WASTE SITE SAMPLING PHOTOGRAPHS, WASTE CHARACTERIZATION AND CONCEPTUAL MODEL CONFIRMATION SAMPLING

Figure F-1. Radiological survey reading of pipeline 600-285-PL.

Figure F-2. Pulverized clay pipeline sample 600-286-PL.

NOTE: Field work was performed using approved work plans based on WIDS data and historical knowledge, with consideration of potential radiological and hazardous contaminant concerns. Field screening of potential contaminants confirmed work plan assumptions and ensured protection of personnel.

Figure F-3. Pipeline excavation 600-286-PL.

A summary of the radiological survey information collected during pipeline sampling activities is provided below. All radiological dose rates collected were below detection limits and no radiological contamination was found.

Table F-1. Radiological Survey Information for Pipeline Sampling

Survey Point [e]	Location	Coordinates	Summary of Dose Readings	Summary of Contamination Readings
600-285-PL, North Manhole	South of 212-N	46° 33.072 N by 119° 34.038 W	All dose rates < 0.5 mrem/hr [a]	No detectable contamination [b]
600-285-PL, South Manhole	South of 212-N	46° 33.449 N by 119° 35.282 W	All dose rates < 0.5 mrem/hr [a]	No detectable contamination [b]
600-285-PL, Pipe Outfall	Pipe Sample at Northern-most point of 216-N-1 Pond	Not recorded	All dose rates < 0.5 mrem/hr [a, c]	No detectable contamination [c]
600-286-PL, North Manhole	South of 212-P	46° 35.520 N by 119° 34.651 W	All dose rates < 0.5 mrem/hr [a]	No detectable contamination [b]
600-286-PL, South Manhole	South of 212-P	46° 35.447 N by 119° 34.652 W	All dose rates < 0.5 mrem/hr [a]	No detectable contamination [b]
600-286-PL, Pipe Outfall	Pipe Sample at Northern-most point of 216-N-4 Pond	Not recorded	All dose rates < 0.5 mrem/hr [a, c]	No detectable contamination [c]
600-287-PL, North Manhole	South of 212-R	46° 35.516 N by 119° 34.021 W	All dose rates < 0.5 mrem/hr [a]	No detectable contamination [b]
600-287-PL, South Manhole	South of 212-R	46° 35.441 N by 119° 34.021 W	All dose rates < 0.5 mrem/hr [a]	No detectable contamination [b]
600-287-PL, Pipe Outfall	Pipe Sample at Northern-most point of 216-N-6 Pond	Not recorded	All dose rates < 0.5 mrem/hr [c]	No detectable contamination [d]

Notes:
[a] Deep dose; field measurement (≥ 30 cm)
[b] Large area wipes of walls and pits and tech smears of walls obtained with long reach tools in accordance with accepted practices and procedures.
[c] Field surveys documented on field survey reports for 600-285-PL and 600-286-PL. No documented field survey found for 600-287-PL. Gross alpha and gross beta analyses were performed for all pipeline samples and were documented on individual analytical reports including 600-287-PL. Laboratory analyses confirmed dose rates < 0.5 mrem/hr for all pipeline samples.
[d] Individual contamination surveys for 600-287-PL were not recorded. As a result, a comparison of the analytical data for each of the pipelines was conducted and the results identified the isotopic concentrations for the 600-287-PL pipeline were less than 1/3 of the values reported in 600-286-PL. The measurable contamination reading for the 600-286-PL was non-detectable, thus supporting non-detectable determination for 600-287-PL.
[e] Soil surveys at the pipe outfall are addressed with the data for each pond.

Table F-2. Results for Pipeline Radionuclide COPCs

Contaminants of Potential Concern	Look-Up Values Summary Remedial Action Goal Shallow Zone [<4.6 Meters (15 Feet)] [a] (pCi/g)	Hanford Specific Background Activity [d] (pCi/g)	Sample HEIS#B20LK1 600-285-PL (pCi/g)	Sample HEIS#B20LK2 600-285-PL Duplicate (pCi/g)	Sample HEIS#B20LK3 600-286-PL (pCi/g)	Sample HEIS#B20LK4 600-286-PL (pCi/g)	Sample HEIS#B20LK5 600-287-PL (pCi/g)	Sample HEIS#B20LK6 600-287-PL (pCi/g)	Sample HEIS#B20V85 Field Blank (pCi/g)	Sample HEIS#B20V84 Equipment Blank (pCi/g)	Water HEIS#B20V86 Trip Blank (pCi/g)
Americium-241	31.1	NA	0.0300	0.0360	0.0520	0.0710	0.0250	0.0230	-----	U	-----
Cesium-137	6.2	1.1	0.0505	U	1.42	4.92	0.481	0.446	-----	U	-----
Cobalt-60	1.4	0.008	U	U	0.0212	0.0195	U	U	-----	U	-----
Europium-152	3.3	NA	U	U	0.292	0.809	U	0.0905	-----	U	-----
Europium-154	3.0	0.033	U	U	U	0.180	U	U	-----	U	-----
Europium-155	125	0.054	U	U	U	U	U	U	-----	U	-----
Nickel-63	4,026	NA	U	U	U	U	U	U	-----	U	-----
Plutonium-238	37.4	0.004	U	U	U	U	U	U	-----	U	-----
Plutonium-239/240	33.9	0.025	U	0.0180	0.240	0.710	0.0650	0.0440	-----	U	-----
Strontium-90	4.5	0.18	U	U	1.00	0.900	U	U	-----	U	-----
Technetium-99	15 [b]	NA	U	U	U	U	U	U	-----	U	-----
Thorium-232 [e]	1.3	1.3	0.0856	0.0702	0.0570	0.0570	0.0702	0.0570	-----	U	-----
Tritium (H-3)	35.5	NA	U	U	U	U	U	U	U	U	U
Uranium-233/234	1.1 [c]	1.1	0.0480	0.0300	0.0470	0.0670	0.0280	0.0390	-----	U	-----
Uranium-235	1.0 [b]	0.11	7.6E-3	U	U	U	U	U	-----	U	-----
Uranium-238	1.1 [c]	1.1	0.0330	0.0270	0.0340	0.0490	0.0280	0.0230	-----	U	-----

Notes:

[a] In the shallow zone, cleanup must achieve the direct exposure remedial action objectives (RAO) and the groundwater/Columbia River RAO; therefore, the lowest value among the "protection from Direct Exposure," "Protective of Groundwater," and "Protective of the Columbia River" values is the applicable look-up value.

[b] The remedial action goal is below the practical quantitation limit (PQL). The value presented is the PQL.

[c] The remedial action goal is below background. The value presented is background.

[d] Unless otherwise noted, background concentrations are 90th percentile values of the log normal distribution of site-wide soil background data. Source: Hanford Site Background: Part 1 Soil Background for Nonradionuclide Analytes (DOE-RL-92-24, 2001b)

[e] Thorium conversion:

Soil Samples	Test Results	Converted Test Results
W090000330/B20LK2	0.780 mg/kg	0.0856 pCi/g
W090000331/B20LK2	0.640 mg/kg	0.0702 pCi/g
W090000332/B20LK3	0.520 mg/kg	0.0570 pCi/g
W090000333/B20LK4	0.520 mg/kg	0.0570 pCi/g
W090000370/B20LK5	0.640 mg/kg	0.0702 pCi/g
W090000371/B20LK6	0.520 mg/kg	0.0570 pCi/g
90592001/B20V84	U<0.10ug/L	U<1.09E-05 pCi/g

1 mg/kg = 1 µg/g

Th-232 Specific Activity – 1.09E-07 Ci/g*

pCi/g = (Result µg/g)(SpA Ci/g)(1 g/10^6 µg)(10^{12} pCi/1 Ci)

*_Handbook of Health Physics and Radiological Health_, Bernard Shleien, Lester A. Slaback, Jr., and Brian Kent Birky, 1998, Williams and Wilkins Co.

Abbreviations:
U = Analyte was not detected above limiting criteria
----- = sampling and analysis for this analyte not requested and not completed
NA = Not Available
HEIS = Hanford Environmental Information System

Table F-3. Results for Shallow Zone Pipeline Nonradionuclide COPCs

Contaminants of Potential Concern	Look-Up Values Summary Remedial Action Goal – Shallow Zone [<4.6 Meters (15 Feet)] [a] (mg/kg)	Hanford Specific Background Activity [e] (mg/kg)	Sample HEIS#B20LK1 600-285-PL (mg/kg)	Sample HEIS#B20LK2 600-285-PL Duplicate (mg/kg)	Sample HEIS#B20LK3 600-286-PL (mg/kg)	Sample HEIS#B20LK4 600-286-PL (mg/kg)	Sample HEIS#B20LK5 600-287-PL (mg/kg)	Sample HEIS#B20LK6 600-287-PL (mg/kg)	Sample HEIS#B20V85 Field Blank (mg/kg)	Sample HEIS#B20V84 Equipment Blank (mg/kg)	Water HEIS#B20V86 Trip Blank (mg/kg)
Antimony	6.0 [b]	5 [d]	U	U	U	U	U	U	-----	U	-----
Arsenic	6.5 [c]	6.5	1.54	1.19	0.820	0.660	0.420	U	-----	U	-----
Barium	5,600	132	50.4	41.4	13.2	15.9	12.4	9.82	-----	0.00475	-----
Cadmium	80	0.81 [d]	U	U	U	U	U	U	-----	U	-----
Chromium (III)	80,000	18.5	6.01	4.85	7.33	21.1	7.39	4.15	-----	U	-----
Chromium (VI)	2.2	NA	U	U	U	U	U	U	-----	U	-----
Lead	353	10.2	0.500	0.390	6.68	22.5	1.38	0.740	-----	U	-----
Manganese	11,200	512	57.0	47.4	23.1	34.9	21.4	16.8	-----	B 8.47E-4	-----
Mercury	24	0.33	U	U	U	U	U	U	-----	U	-----
Zinc	24,000	67.8	11.3	10.7	11.1	27.9	4.07	2.43	-----	B 0.0008	-----
Polychlorinated Biphenyl	0.5	NA	U	U	U	U	U	U	-----	U	-----

Notes:

[a] In the shallow zone, cleanup must achieve the direct exposure remedial action objectives (RAO) and the groundwater/Columbia River RAO; therefore, the lowest value among the "protection from Direct Exposure," "Protective of Groundwater," and "Protective of the Columbia River" values is the applicable look-up value. Look-up values are established in DOE/RL-2007-55.

[b] The remedial action goal is below the practical quantitation limit (PQL). The value presented is the PQL.

[c] The remedial action goal is below background. The value presented is background.

[d] Hanford-specific background not available; therefore values were taken from Natural Background Soil Metals Concentrations in Washington State, Publication No. 94-115, Washington State Department of Ecology, Olympia, Washington (Ecology 1994).

[e] Unless otherwise noted, background concentrations are 90th percentile values of the log normal distribution of site-wide soil background data. Source: Hanford Site Background: Part 1 Soil Background for Nonradionuclide Analytes (DOE-RL-92-24, 2001b)

Abbreviations:
B = Analyte < the RDL but >= the IDL/MDL
NA = Not Available
HEIS = Hanford Environmental Information System
----- = sampling and analysis for this analyte not requested and not completed
U = Analyzed for but not detected above limiting criteria