



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

**SEP 28 2011**

11-AMCP-0235

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

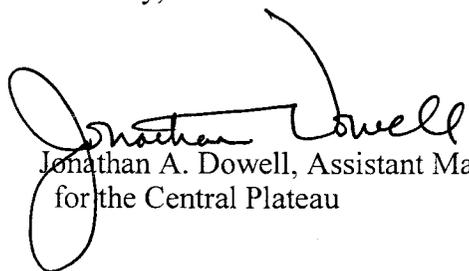
Dear Mr. Faulk:

WASTE SITE RECLASSIFICATION FORM (CONTROL NUMBER 2011-076), AND  
RESPONSE ACTION REPORT FOR THE 200-MG-1 OPERABLE UNIT WASTE SITE  
600-49, DOE/RL-2011-87, REVISION 0

This letter transmits signed copies of the Waste Site Reclassification Form (Control  
Number 2011-076), and the approved Response Action Report for the 200-MG-1 Operable Unit  
Waste Site 600-49, DOE/RL-2011-87, Revision 0.

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

Sincerely,

  
Jonathan A. Dowell, Assistant Manager  
for the Central Plateau

AMCP:PGE

Attachments

cc: See Page 2

Mr. D. A. Faulk  
11-AMCP-0235

-2-

SEP 28 2011

cc w/attachs:

G. Bohnee, NPT  
L. Buck, Wanapum  
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J. A. Hedges, Ecology  
R. Jim, YN  
S. L. Leckband, HAB  
N. M. Menard, Ecology  
K. Niles, ODOE  
D. Rowland, YN (4) plus 2 CDs  
Administrative Record  
Environmental Portal

cc w/o attachs:

D. G. Black, CHPRC  
R. L. Cathel, CHPRC  
R. E. Piippo, MSA  
J. G. Vance, MSA

**WASTE SITE RECLASSIFICATION FORM**

|                                  |   |                          |
|----------------------------------|---|--------------------------|
| Date Submitted: <u>8/10/2011</u> | Operable Unit(s): <u>200-MG-1</u>   | Control Number: 2011-076 |
| Originator: <u>N. Chandran</u>   | Waste Site Code: <u>600-49</u>  |                          |
| Phone: <u>373-4716</u>           | Type of Reclassification Action:  |                          |
|                                  | Closed Out <input type="checkbox"/> Interim Closed Out <input checked="" type="checkbox"/> No Action <input type="checkbox"/> |                          |
|                                  | RCRA Postclosure <input type="checkbox"/> Rejected <input type="checkbox"/> Consolidated <input type="checkbox"/>             |                          |

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 condition:

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

The 600-49 waste site, also known as H-42 Anti-Aircraft Artillery site, is located south of the 200 East Area and northeast of State Route 240. The 600-49 waste site consists of six concrete foundations and footings, walkways, four artillery emplacements, a shooting range, and some sheet metal and pipe. The selected alternative authorized by DOE/RL-2009-86, *Action Memorandum for Non-Time-Critical Removal Action for 37 Waste Sites in the 200-MG-1 Operable Unit* (Action Memorandum) via TPA-CN-350, *Tri-Party Agreement Change Notice Form: DOE/RL-2009-86 Action Memorandum for Non-Time-Critical Removal Action for 37 Waste Sites in the 200-MG-1 Operable Unit, Rev. 0*, was removal, treatment, and disposal (RTD). Based on observations made during site evaluation, and available historical information and process knowledge, the shooting range backstop was identified as the area with the highest potential for impacted soil, resulting in the implementation of RTD activities in that area, in accordance with DOE/RL-2009-53, Rev. 1, *Removal Action Work Plan for 48 Waste Sites in the 200-MG-1 Operable Unit* (RAWP). Following RTD of the shooting range backstop, verification sampling was performed in accordance with DOE/RL-2009-60, Rev. 1, *Sampling and Analysis Plan for Selected 200-MG-1 Operable Unit Waste Sites*, which demonstrated the 600-49 waste site had achieved compliance with the RALs and corresponding removal action objectives (RAOs).

The results show that residual soil concentrations of COPCs less than or equal to the RALs supports a reclassification of this site to interim closed out. The current site conditions achieve the RALs and the corresponding RAOs established in the RAWP. The results of waste site sampling are used to make reclassification decisions for the 600-49 waste site in accordance with the TPA-MP-14 (DOE-RL 2007) process. Finalization of a backfill concurrence form provided to the agency(ies) constitutes concurrence that the waste site has achieved the established RAOs and thus backfill and/or contouring may occur at the 600-49 waste site with minimal risk. No depression was created in the ground surface of the waste site during RTD activities, which consisted of removing a portion of the shooting range backstop; therefore, backfill is not required at the 600-49 waste site.

Basis for reclassification:

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

The current site conditions meet RALs and the corresponding RAOs specified in the Action Memorandum. The results show that the residual soil concentrations support reasonably anticipated future land uses recognized in DOE/RL-2008-44, *Engineering Evaluation/Cost Analysis for the 200-MG-1 Operable Unit Waste Sites*, and the Action Memorandum. The results also demonstrate that residual concentrations of COPCs in soil support unrestricted future use of shallow zone soil (i.e., surface to 4.6 m [15 ft] below ground surface) and that COPC concentrations remaining in the soil are protective of groundwater and the Columbia River. There is no deep zone for the 600-49 waste site therefore no institutional controls are required. The basis for reclassification to interim closed out is described in detail in DOE/RL-2011-87, *Response Action Report for 200-MG-1 Operable Unit Waste Site 600-49*, 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.

|  |                                 |                             |
|--|---------------------------------|-----------------------------|
| <u>O.A. Farabee</u><br>DOE Federal Project Director (printed)          | <u>[Signature]</u><br>Signature | <u>8/10/11</u><br>Date      |
| <u>Larry Gadbois for Dennis Faulk</u><br>EPA Project Manager (printed) | <u>[Signature]</u><br>Signature | <u>Aug 11, 2011</u><br>Date |

# Response Action Report for 200-MG-1 Operable Unit Waste Site 600-49

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**

# Response Action Report for 200-MG-1 Operable Unit Waste Site 600-49

Date Published  
August 2011

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

*A. D. Sordal* 08/10/2011  
Release Approval Date

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## Approval Page

**Title:** *Response Action Report for 200-MG-1 Operable Unit Waste Site 600-49*

O. A. Farabee  
U.S. Department of Energy, Richland Operations Office

\_\_\_\_\_  
Signature

*O. A. Farabee*

\_\_\_\_\_  
Date

*8/10/11*

## Executive Summary

This response action report documents the successful completion of the removal action conducted at the 600-49 waste site, also known as the H-42 Gun Site. The alternative proposed in DOE/RL-2008-44, *Engineering Evaluation/Cost Analysis for the 200-MG-1 Operable Unit Waste Sites*<sup>1</sup> (EE/CA) and selected in DOE/RL-2009-86, *Action Memorandum for Non-Time-Critical Removal Action for 37 Waste Sites in 200-MG-1 Operable Unit*<sup>2</sup> (Action Memorandum) via TPA-CN-350, *Tri-Party Agreement Change Notice Form: DOE/RL-2009-86 Action Memorandum for Non-Time-Critical Removal Action for 37 Waste Sites in the 200-MG-1 Operable Unit, Rev. 0*<sup>3</sup>, was removal, treatment, and disposal (RTD).

The available 600-49 waste site historical information and process knowledge was sufficient, per the provisions of the Action Memorandum, to proceed directly to implementation of the RTD alternative in accordance with DOE/RL-2009-53, *Removal Action Work Plan for 48 Waste Sites in the 200-MG-1 Operable Unit*<sup>4</sup> without requiring additional field observations or sampling to determine the nature and extent of contaminants of potential concern (COPCs) present in the waste site soil. Verification sampling, conducted after RTD activities in accordance with DOE/RL-2009-60, *Sampling and Analysis Plan for Selected 200-MG-1 Operable Unit Waste Sites*,<sup>5</sup> confirmed that the waste site achieved compliance with removal action levels and, therefore, met the established removal action objectives without further removal action.

---

<sup>1</sup> DOE/RL-2008-44, 2009, *Engineering Evaluation/Cost Analysis for the 200-MG-1 Operable Unit Waste Sites*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: <http://www2.hanford.gov/arpir/?content=findpage&AKey=0096350>.

<sup>2</sup> DOE/RL-2009-86, 2009, *Action Memorandum for Non Time Critical Removal Action for 37 Waste Sites in the 200-MG-1 Operable Unit*, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: <http://www5.hanford.gov/arpir/?content=findpage&AKey=0084449>.

<sup>3</sup> TPA-CN-350, 2010, *Tri Party Agreement Change Notice Form: DOE/RL 2009 86, Action Memorandum for Non-Time-Critical Removal Action for 37 Waste Sites in the 200 MG 1 Operable Unit, Rev. 0*, dated October 10, U.S. Department of Energy, Richland Operations Office, and Washington State Department of Ecology, Richland, Washington. Available at: <http://www5.hanford.gov/arpir/?content=findpage&AKey=1010270164>.

<sup>4</sup> DOE/RL-2009-53, 2010, *Removal Action Work Plan for 48 Waste Sites in the 200-MG-1 Operable Unit*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: <http://www2.hanford.gov/arpir/?content=findpage&AKey=1010180132>.

<sup>5</sup> DOE/RL-2009-60, 2011, *Sampling and Analysis Plan for Selected 200-MG-1 Operable Unit Waste Sites*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: <http://www5.hanford.gov/arpir/?content=findpage&AKey=1003290272>.

The results show that the residual soil concentrations of COPCs support reasonably anticipated future land use described in the EE/CA (DOE/RL-2008-44) and Action Memorandum (DOE/RL-2009-86). These results also support reclassification to “interim closed out” status in accordance with the process described in RL-TPA-90-0001, *Tri-Party Agreement Handbook Management Procedures*, Guideline Number TPA-MP-14, “Maintenance of the Waste Information Data System”<sup>6</sup>. No institutional controls are required because no deep vadose zone contamination is associated with the 600-49 waste site.

This waste site and the data obtained from the subject sampling evolution will be included in the risk assessment and remedial investigation/feasibility study for final remedial decisions for the Outer Area.

---

<sup>6</sup> RL-TPA-90-0001, 2007, *Tri-Party Agreement Handbook Management Procedures*, Guideline Number TPA-MP-14, “Maintenance of the Waste Information Data System (WIDS),” Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: <http://www.hanford.gov/hanford/files/TPA-MP14.pdf>.

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## Terms

|         |  |
|---------|--|
| AAA     | anti-aircraft artillery  |
| bgs     | below ground surface   |
| CERCLA  | <i>Comprehensive Environmental Response, Compensation, and Liability Act of 1980</i>   |
| COPC    | contaminant of potential concern   |
| DOE     | U.S. Department of Energy  |
| DQA     | data quality assessment  |
| Ecology | Washington State Department of Ecology   |
| EE/CA   | <i>Engineering Evaluation/Cost Analysis for the 200-MG-1 Operable Unit Waste Sites</i> |
| EPA     | U.S. Environmental Protection Agency   |
| HEIS    | Hanford Environmental Information System   |
| N/A     | not available  |
| NPL     | National Priorities List   |
| O&M     | operations and maintenance   |
| OU      | operable unit  |
| PCB     | polychlorinated biphenyl   |
| QA      | quality assurance  |
| QC      | quality control  |
| RAL     | removal action level   |
| RAO     | removal action objective   |
| RAWP    | <i>Removal Action Work Plan for 48 Waste Sites in the 200-MG-1 Operable Unit</i>       |
| RDL     | required detection limit   |
| RI/FS   | remedial investigation/feasibility study   |
| ROD     | record of decision   |
| RTD     | removal, treatment, and disposal   |
| SAP     | <i>Sampling and Analysis Plan for Selected 200-MG-1 Operable Unit Waste Sites</i>      |
| TPH     | total petroleum hydrocarbon  |

Tri-Party Agreement  
WIDS

*Hanford Federal Facility Agreement and Consent Order*  
Waste Information Data System

1

## 1 Introduction

This report documents the successful completion of a non-time-critical removal action conducted at the 600-49 waste site. The removal action alternative of removal, treatment, and disposal (RTD) was selected for this waste site, as proposed in DOE/RL-2008-44, *Engineering Evaluation/Cost Analysis for the 200-MG-1 Operable Unit Waste Sites (EE/CA)*, and selected in DOE/RL-2009-86, *Action Memorandum for Non-Time-Critical Removal Action for 37 Waste Sites in 200-MG-1 Operable Unit* (Action Memorandum) via TPA-CN-350, *Tri-Party Agreement Change Notice Form: DOE/RL-2009-86 Action Memorandum for Non-Time-Critical Removal Action for 37 Waste Sites in the 200-MG-1 Operable Unit, Rev. 0*. Using the methodology prescribed in the Action Memorandum, waste site historical information and process knowledge substantiated the implementation of the RTD alternative. This report provides the basis for the successful completion of the RTD action performed at the 600-49 waste site. This documentation has been prepared based on U.S. Environmental Protection Agency (EPA) guidance provided in EPA 540-R-98-016, *Close Out Procedures for National Priorities List Sites*.

This report provides a summary of the actions taken and resulting data to support a determination that, through performance of the RTD alternative, conditions remaining at the 600-49 waste site have achieved the established removal action levels (RALs) and have met the removal action objectives (RAOs) provided in the Action Memorandum (DOE/RL-2009-86). The documentation process is consistent with the U.S. Department of Energy (DOE) *Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) Remedial Action Site Closure Guidance* (DOE, 2010).

Statutory authority for the action taken is in accordance with CERCLA (as amended by the *Superfund Amendments and Reauthorization Act of 1986*); *Superfund Implementation* (Executive Order 12580); the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al., 1989), also known as the Tri-Party Agreement; and 40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan" (National Contingency Plan).

The non-time-critical removal action for the 600-49 waste site was completed in June 2011 in accordance with DOE/RL-2009-53, *Removal Action Work Plan for 48 Waste Sites in the 200-MG-1 Operable Unit (RAWP)*. This report provides the following information relative to the completion of the subject removal action:

- Background, historical information, regulatory enforcement history, and environmental setting pertinent to this removal action
- Descriptions of the selected alternative, RAOs, and exposure and land use assumptions provided in the related regulatory documents
- A summary of the completed actions, the resulting data collected in support of completion of that removal action, a comparison of data against objectives, and demonstration that RAOs have been met

### 1.1 Site Description

General information on the Hanford Site and the 200-MG-1 Operable Unit (OU) provides the background and development of the removal action for the 600-49 waste site and is described in the subsections that follow.

#### 1.1.1 Hanford General Site Information

The Hanford Site, which is part of the DOE nuclear weapons complex, occupies approximately 1,517 km<sup>2</sup> (586 mi<sup>2</sup>) and is located along the Columbia River in Benton County, northwest of the City of Richland in

the Lower Columbia Basin in southeastern Washington State (Figure 1-1). From the early 1940s to approximately 1989, the Hanford Site mission included building the world's first large-scale plutonium production facility, and until the 1980s, the site was used to produce plutonium for nuclear weapons. Other activities included nuclear research, development, and nuclear materials production. These activities created a wide variety of chemical and radioactive wastes that were released into the environment. The Hanford Site mission is now focused on the cleanup of those wastes and ultimate closure of the Hanford Site.

### **1.1.2 200-MG-1 Operable Unit**

The Washington State Department of Ecology (Ecology), DOE, and EPA created the 200-MG-1 OU through the Tri-Party Agreement Milestone M-015-06-02 and Tri-Party Agreement Change Request C-06-02 (Ecology et al., 2006). The 200-MG-1 OU is made up of waste sites in the 200 East and 200 West Areas, and the 600 Area of the Hanford Site. The 600 Area encompasses those areas south of the Columbia River that are not part of another designated area (i.e., 300 Area, 200 East Area, and 100-K) and are not specifically identified (Figure 1-1). The 200-MG-1 OU waste sites consist of French drains, trenches, cribs, ditches, and retention basins with shallow contamination (generally less than 4.6 m [15 ft] deep), and where chemical and radioactive contaminants were released during material transfers (i.e., unplanned release sites). Additionally, some 200-MG-1 OU sites were produced by airborne dissemination of radioactive particles, or biodegradation and dispersion of plant or animal matter. For those sites containing radionuclides, the radionuclide inventory for this conceptual model group does not include transuranic isotopes greater than or equal to 100 nCi/g.

All of the waste sites contained in the 200-MG-1 OU are located within the Central Plateau, as described in the EE/CA (DOE/RL-2008-44) and Action Memorandum (DOE/RL-2009-86). The 600-49 waste site, formerly known as the H-42 Gun Site, is located south of 200 East Area northeast of State Route 240, as shown in Figure 1-2.

## **1.2 Regulatory and Enforcement History**

As discussed in Section 1, statutory authority for this removal action is taken in accordance with CERCLA. Further governing requirements for compliance with CERCLA and the *Resource Conservation and Recovery Act of 1976* activities at the Hanford Site are in accordance with the Tri-Party Agreement (Ecology et al., 1989). The Hanford Site was proposed for inclusion in 53 FR 23988, "National Priorities List for Uncontrolled Hazardous Waste Sites – Update 7", and was placed on the National Priorities List (NPL) on November 3, 1989 (54 FR 41015, "National Priorities List for Uncontrolled Hazardous Waste Sites—Final Rule 10/04/89," October 4, 1989) by the EPA. The EPA placed the four aggregate areas (i.e., the 100, 200, 300, and 1100 Areas) on the NPL. The 200 Area NPL site consists of the 200 West and 200 East Areas, which contain waste management facilities and inactive irradiated-fuel reprocessing facilities. The site also includes the 200 North Area, formerly used for interim storage and staging of irradiated fuel, and the waste sites assigned to the 200-MG-1 OU.

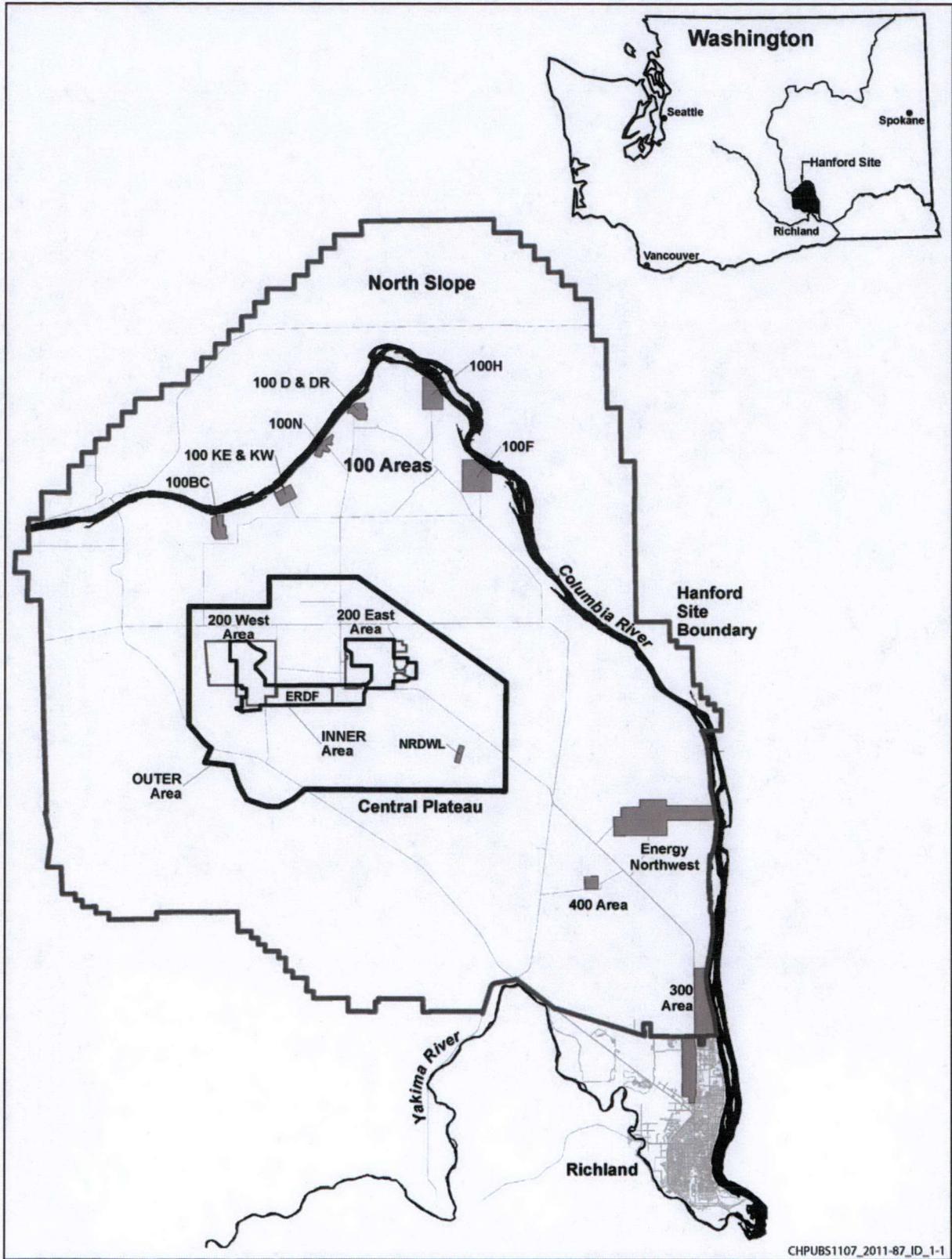


Figure 1-1. Location of the Hanford Site in Washington State

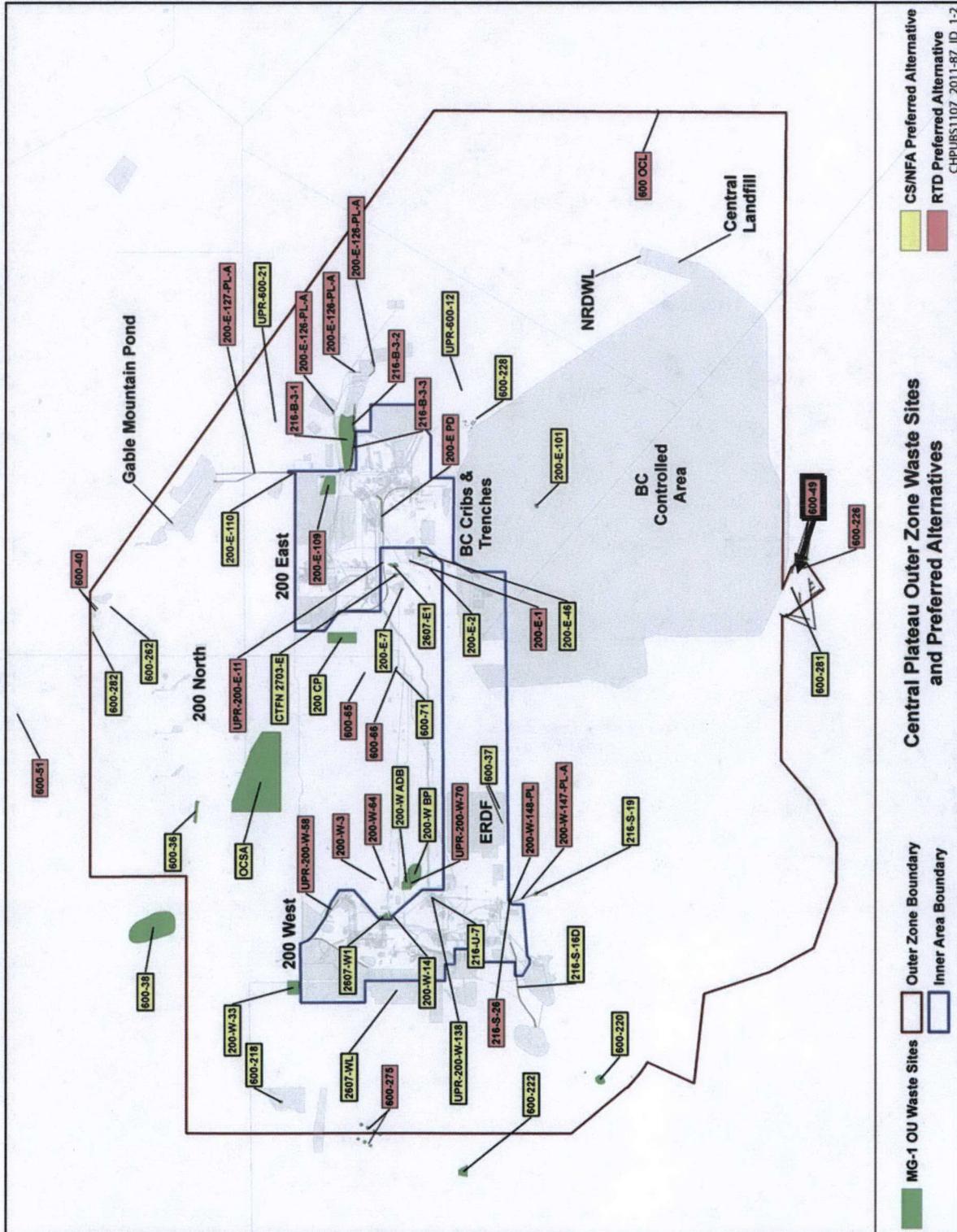


Figure 1-2. 200-MG-1 Operable Unit and Waste Site 600-49

### 1.3 Environmental Setting

The Hanford Site is located within the semiarid Pasco Basin in the northern portion of the Columbia Plateau. Normal annual precipitation is 17.7 cm (7 in.). According to PNL-10285, *Estimated Recharge Rates at the Hanford Site*, there is an estimated 2.6 to 17.3 mm (0.1 to 0.7 in.) per year of recharge in the 100 Area. Bedrock beneath the site is basalt of the Columbia River Basalt group.

The Ringold Formation and the Hanford formation cover the basalt throughout the Central Plateau. Poorly consolidated, river-deposited, well-drained sands, gravels, cobbles, and boulders dominate these units. The Ringold Formation is an interstratified sequence of unconsolidated clay, silt, sand, and gravel-to-cobble sediment deposited by the ancestral Columbia River. The Hanford formation consists of uncemented gravels, sands, and silts deposited by Pleistocene cataclysmic floodwaters. Groundwater from the Hanford Site discharges to the Columbia River, the dominant surface-water body of the Hanford Site. The direction of groundwater flow beneath the Central Plateau is toward the east-northeast. The uses of the Columbia River include the production of hydroelectric power, irrigation, drinking water, recreation, and natural resources.

The average depth from ground surface to groundwater beneath the 200 Area ranges from 50 m (164 ft) to greater than 100 m (328 ft). Additional details on the geology and hydrogeology underlying the 200 Area and the 200-MG-1 OU are not provided in the base response action documents because the 200-MG-1 OU was created for shallow zone (less than 4.6 m [15 ft] in depth) waste sites, which are assumed not to be a threat to groundwater quality. This assumption is based on historical and process knowledge regarding volumes of liquids discharged, lack of mobility of contaminants, and shallow depth of the discharge(s).

The nearest natural surface water body to the 600-49 waste site is the Yakima River, located approximately 14 km (8.7 mi) southeast of the waste site. The potential for natural groundwater recharge within the 200 Area is limited to precipitation infiltration. Estimates of recharge from precipitation at the Hanford Site range from 0 to 10 cm (0 to 4 in.) per year.

## 2 Waste Site Background

This section provides a description of the 600-49 waste site and information on process and background, describes the selected alternative, and delineates the RAOs and cleanup standards applicable to this removal action as prescribed in the Action Memorandum (DOE/RL-2009-86).

### 2.1 600-49- Site Background

The H-42 Gun Site is located south of 200 East Area and northeast of State Route 240. The waste site was identified and entered into the Waste Information Data System (WIDS) in 1994. The 600-49 waste site was one of 16 anti-aircraft artillery (AAA) sites installed around the 100 and 200 Areas to protect the chemical separation plants and reactors from air attack. Each of the AAA sites cover approximately 8.1 ha (20 ac) and contained gun emplacements and buildings, often constructed of prefabricated wood, metal, and concrete block, and included four artillery placements situated within semi-circular revetments made of sandbags and wood planking separated from the residential and administrative facilities. The southeast side of the emplacement has a shooting range with three shooting positions and a shooting backstop. The waste site location, along with the shooting range detail, is shown in Figure 2-1. Observations made during previous site evaluations indicated the presence of six concrete foundations and footings, walkways, four artillery emplacements marked by revetments, and some sheet metal and pipe.

The release mechanism for the 600-49 waste site is solid from abandoned military encampment structures, facilities, and the shooting range. The form of all current waste materials is solid. No chemical or radiological processes involving sustained releases of material are associated with this site.

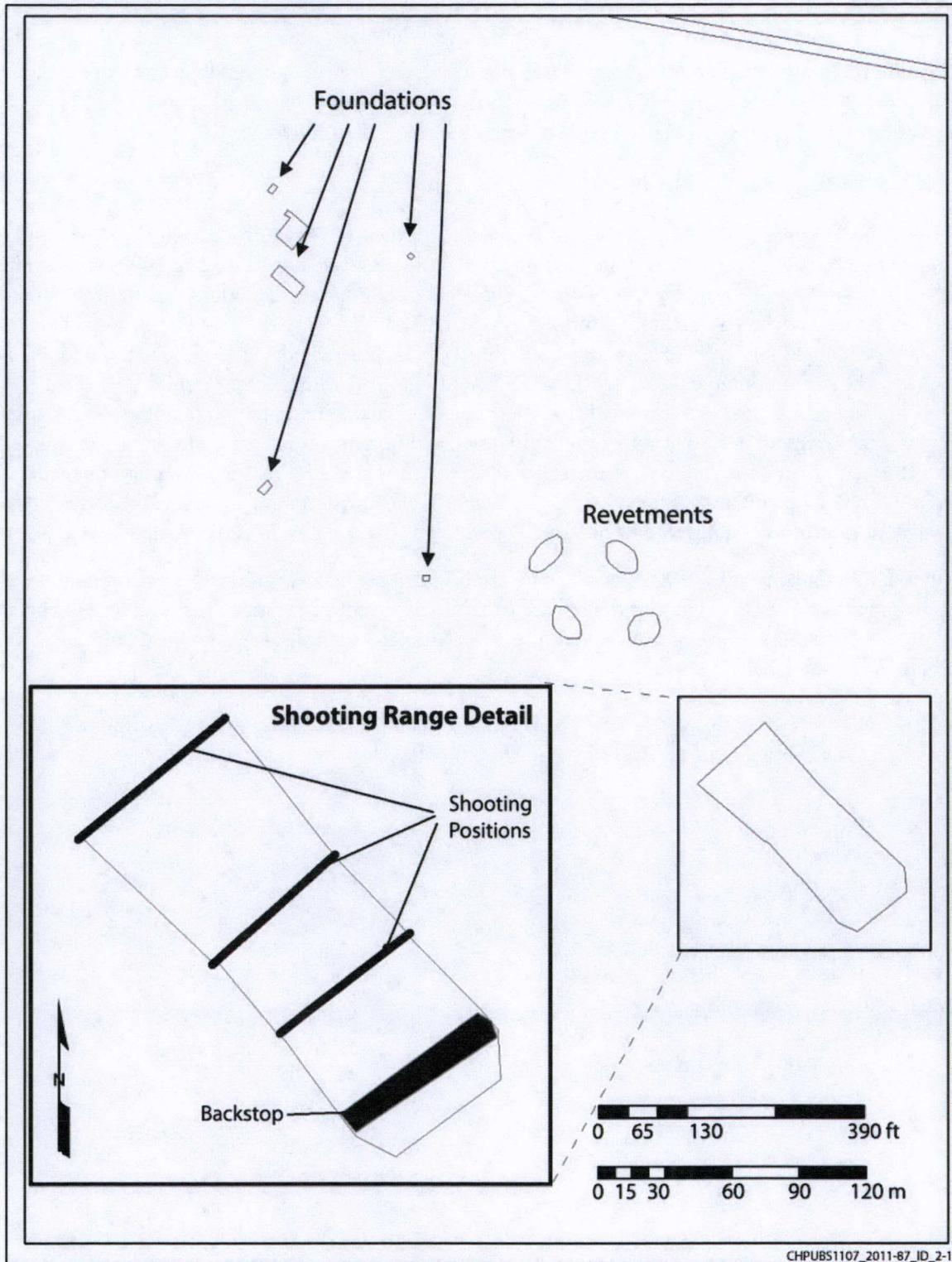


Figure 2-1. 600-49 Waste Site Location

## 2.2 Description of the Selected Alternative

As stated in the EE/CA (DOE/RL-2008-44) and Action Memorandum (DOE/RL-2009-86), the selected alternative for the subject waste site was RTD. This alternative was selected because, based on historical activity and process knowledge, concentrations of contaminants of potential concern (COPCs) had the potential to exceed the RALs. Activities involved in the RTD action set forth in the RAWP (DOE/RL-2009-53) and DOE/RL-2009-60, *Sampling and Analysis Plan for Selected 200-MG-1 Operable Unit Waste Sites* (SAP) include soil excavation and verification sampling to demonstrate that concentrations of COPCs in soil are less than or equal to the established RALs, and that no additional removal action is required. The general removal action sampling design criteria are provided in this section followed by a summary of waste site history, specific sampling design and methodology, and analytical results for the 600-49 waste site.

The following key features relevant to the 600-49 waste site were considered during the development of the sample design:

- Direct visual inspection of the waste site using available site information as a guide for visual cues such as staining, discoloration, absence of vegetation, presence of debris, and other anomalies.
- Radiological field screening performed at the surface of the waste site to provide an indication of the presence of radiological COPCs.
- Random sampling was performed, per the methodology prescribed in the SAP (DOE/RL-2009-60), in the excavated areas for the verification sampling evolution.

Based on these key design features, implementation of the selected alternative of RTD was performed. Soil was removed from the shooting range backstop area, and a verification sampling evolution was conducted. The results of the verification sampling evolution confirmed that remaining residual COPC concentrations in soil were less than or equal to the RALs. Table 5-2 provides the maximum concentrations for each COPC from the verification sampling analytical data. Table A-1 provides a detailed summary of all analytical data results for sampling conducted at the 600-49 waste site (Appendix A).

Radiological surveying of the waste site was performed during site evaluation, removal of backstop soil, and during the sampling evolutions. Survey methods and practices were performed in accordance with established contractor methods and protocols by trained and qualified personnel. All of the radiological does rate surveys performed on the 600-49 waste site were at or below measured background, and no radiological contamination was found. As a result, the site was confirmed to be a nonradiological waste site, and the radiological constituents were eliminated from the list of COPCs to be included for laboratory analysis.

### 2.2.1 Removal Action Objectives

The removal action alternatives for the 200-MG-1 OU waste sites were evaluated based on their overall ability to protect human health and the environment and their effectiveness in maintaining both short-term and long-term protection. The selected alternative must meet the following RAOs established in the Action Memorandum:

- **RAO 1:** Prevent unacceptable risk to human health and ecological receptors from exposure to soils and/or debris contaminated with nonradiological constituents to 4.6 m (15 ft) below ground surface (bgs) at concentrations above the appropriate RALs.

- **RAO 2:** Prevent unacceptable risk to human health and ecological receptors from exposure to soils and/or debris contaminated with radiological constituents to 4.6 m (15 ft) bgs at concentrations above the appropriate RALs.
- **RAO 3:** Control the sources of groundwater contamination to minimize impacts to groundwater resources, protect the Columbia River from adverse impacts, and reduce the degree of groundwater cleanup that may be required under future action.
- **RAO 4:** Prevent adverse impacts to cultural resources and threatened or endangered species, and minimize wildlife habitat disruption.

The RALs for the waste sites identified in the Action Memorandum (DOE/RL-2009-86) are based on the RAOs noted above. These RALs are based on attainment of acceptable levels of human health, ecological risk, and protection of groundwater, but are not lower than background levels or detection limits for waste sites. Attainment of RALs is intended to meet the first three RAOs and is expected to satisfy the remedial action objectives established in the final record of decision (ROD). The fourth RAO is met through cultural and ecological reviews performed before starting removal action activities. Table 2-1 lists the nonradiological RALs applicable to the 200-MG-1 OU. Attainment of established RALs and corresponding RAOs is described in Chapter 5 of this report.

Table 2-1. Nonradiological Removal Action Levels

| Contaminant of Concern  | Background Concentration <sup>a</sup><br>(mg/kg) | Direct Exposure <sup>b</sup><br>(mg/kg) | Groundwater Protection <sup>c</sup><br>(mg/kg) | Required Detection Limit<br>(mg/kg) | Removal Action Levels<br>(mg/kg) | Ecological Risk Screening Values<br>(mg/kg) |
|-------------------------|--|---|--|-------------------------------------|----------------------------------|---|
| Antimony                | 5  | 32                                      | 5.4  | 0.6                                 | 5.4                              | 5   |
| Arsenic                 | 6.5  | 6.5 <sup>d</sup>                        | 6.5 <sup>d</sup>                               | 1.0                                 | 6.5 <sup>d</sup>                 | 7   |
| Barium                  | 132  | 16,000                                  | 1,650  | 2                                   | 1,650                            | 102   |
| Beryllium               | 1.51   | 160                                     | 63.2   | 0.5                                 | 63.2                             | 10  |
| Boron                   | N/A  | 16,000                                  | 210  | 2                                   | 210                              | 0.5   |
| Cadmium                 | 0.81   | 80                                      | 0.81 <sup>d</sup>                              | 0.5                                 | 0.81 <sup>d</sup>                | 4   |
| Chromium Total          | 18.5   | 120,000                                 | 2,000  | 1                                   | 2,000                            | 42  |
| Chromium (VI)           | N/A  | 240                                     | -- <sup>e</sup>                                | 0.5                                 | -- <sup>e</sup>                  | N/A   |
| Cobalt                  | 15.7   | 24                                      | 15.7 <sup>d</sup>                              | 2                                   | 15.7 <sup>d</sup>                | 20  |
| Copper                  | 22.0   | 3,200                                   | 284  | 1                                   | 284                              | 50  |
| Lead                    | 10.2   | 250                                     | 3,000  | 5.0                                 | 250                              | 50  |
| Lithium                 | 33.5   | 160                                     | 192  | 2.5                                 | 160                              | 35  |
| Manganese               | 512  | 3,760                                   | 512 <sup>d</sup>                               | 5                                   | 512 <sup>d</sup>                 | 1,100                                       |
| Mercury                 | 0.33   | 24                                      | 2.09   | 0.2                                 | 2.09                             | 0.1   |
| Nickel                  | 19.1   | 1,600                                   | 130  | 4                                   | 130                              | 30  |
| Selenium                | 0.78   | 400                                     | 5.2  | 1                                   | 5.2                              | 0.3   |
| Silver                  | 0.73   | 400                                     | 13.6   | 0.2                                 | 13.6                             | 2   |
| Strontium               | N/A  | 48,000                                  | 2,920  | 1                                   | 2,920                            | N/A   |
| Thallium                | N/A  | 5.6                                     | 1.59   | 1                                   | 1.59                             | 1   |
| Tin                     | N/A  | 48,000                                  | 48,000   | 10                                  | 48,000                           | 50  |
| Uranium (Soluble Salts) | 3.21   | 240                                     | 3.21 <sup>d</sup>                              | 1                                   | 3.21 <sup>d</sup>                | 5   |
| Vanadium                | 85.1   | 560                                     | 2,240  | 2.5                                 | 560                              | 2   |
| Zinc                    | 67.8   | 24,000                                  | 5,970  | 1                                   | 5,970                            | 86  |
| PCB Aroclor 1016        | N/A  | 0.5                                     | 0.094  | 0.017                               | 0.094                            | 0.65  |
| PCB Aroclor 1221        | N/A  | 0.5                                     | 0.017 <sup>d</sup>                             | 0.017                               | 0.017 <sup>d</sup>               | 0.65  |
| PCB Aroclor 1232        | N/A  | 0.5                                     | 0.017 <sup>d</sup>                             | 0.017                               | 0.017 <sup>d</sup>               | 0.65  |
| PCB Aroclor 1242        | N/A  | 0.5                                     | 0.039  | 0.017                               | 0.039                            | 0.65  |
| PCB Aroclor 1248        | N/A  | 0.5                                     | 0.039  | 0.017                               | 0.039                            | 0.65  |
| PCB Aroclor 1254        | N/A  | 0.5                                     | 0.066  | 0.017                               | 0.066                            | 0.65  |

Table 2-1. Nonradiological Removal Action Levels

| Contaminant of Concern            | Background Concentration <sup>a</sup><br>(mg/kg) | Direct Exposure <sup>b</sup><br>(mg/kg) | Groundwater Protection <sup>c</sup><br>(mg/kg) | Required Detection Limit<br>(mg/kg) | Removal Action Levels<br>(mg/kg) | Ecological Risk Screening Values<br>(mg/kg) |
|-----------------------------------|--|---|--|-------------------------------------|----------------------------------|---|
| PCB Aroclor 1260                  | N/A  | 0.5                                     | 0.72   | 0.017                               | 0.5                              | 0.65  |
| Acenaphthene                      | N/A  | 4,800                                   | 98   | 0.33                                | 98                               | 20  |
| Acenaphthylene                    | N/A  | 4,800                                   | 98   | 0.33                                | 98                               | N/A   |
| Anthracene                        | N/A  | 24,000                                  | 2,270  | 0.33                                | 2,270                            | N/A   |
| Benzo(a)anthracene                | N/A  | 1.37                                    | 0.86   | 0.33                                | 0.86                             | N/A   |
| Benzo(a)pyrene                    | N/A  | 0.137                                   | 0.233 <sup>f</sup>                             | 0.33                                | 0.33 <sup>d</sup>                | 12  |
| Benzo(b)fluoranthene              | N/A  | 1.37                                    | 2.95   | 0.33                                | 1.37                             | N/A   |
| Benzo(g,h,i)perylene              | N/A  | 2,400                                   | 25,700   | 0.33                                | 2,400                            | N/A   |
| Benzo(k)fluoranthene              | N/A  | 1.37                                    | 2.95 <sup>f</sup>                              | 0.33                                | 1.37                             | N/A   |
| Chrysene                          | N/A  | 13.7                                    | 9.56   | 0.33                                | 9.56                             | N/A   |
| Dibenz(a,h)anthracene             | N/A  | 1.37                                    | 4.29   | 0.33                                | 1.37                             | N/A   |
| Fluoranthene                      | N/A  | 3,200                                   | 631  | 0.33                                | 631                              | N/A   |
| Fluorene                          | N/A  | 3,200                                   | 101  | 0.33                                | 101                              | 30  |
| Indeno(1,2,3-cd)pyrene            | N/A  | 1.37                                    | 8.33   | 0.33                                | 1.37                             | N/A   |
| Naphthalene                       | N/A  | 1,600                                   | 4.46   | 0.33                                | 4.46                             | N/A   |
| Phenanthrene                      | N/A  | 24,000                                  | 1,140  | 0.33                                | 1,140                            | N/A   |
| Pyrene                            | N/A  | 2,400                                   | 655  | 0.33                                | 655                              | N/A   |
| Carbon Tetrachloride <sup>g</sup> | N/A  | 7.69                                    | 0.0031   | 0.005                               | 0.005                            | N/A   |
| Xylene <sup>h</sup>               | N/A  | 16,000                                  | 14.6   | 0.01                                | 14.6                             | N/A   |
| Nitrate (as Nitrogen)             | 11.8   | 128,000                                 | 40   | 0.75                                | 40                               | N/A   |
| TPH-Diesel                        | N/A  | 2,000                                   | 2,000  | 5                                   | 2,000                            | 200   |
| TPH-Kerosene                      | N/A  | 2,000                                   | 2,000  | 5                                   | 2,000                            | 200   |
| Fluoride <sup>i</sup>             | N/A  | 4,800                                   | 16   | 5                                   | 16                               | N/A   |
| Asbestos                          | N/A  | N/A <sup>j</sup>                        | N/A <sup>j</sup>                               | N/A <sup>j</sup>                    | 1 % <sup>j</sup>                 | N/A   |

**Table 2-1. Nonradiological Removal Action Levels**

| Contaminant of Concern | Background Concentration <sup>a</sup><br>(mg/kg) | Direct Exposure <sup>b</sup><br>(mg/kg) | Groundwater Protection <sup>c</sup><br>(mg/kg) | Required Detection Limit<br>(mg/kg) | Removal Action Levels<br>(mg/kg) | Ecological Risk Screening Values<br>(mg/kg) |
|------------------------|--|---|--|-------------------------------------|----------------------------------|---|
|------------------------|--|---|--|-------------------------------------|----------------------------------|---|

a. If Hanford Site-specific background data are not available, values are then taken from Ecology Publication No. 94-115, *Natural Background Soil Metals Concentrations in Washington State*. Hanford Site background values are available from nonradiological background data in DOE/RL-92-24, *Hanford Site Soil Background: Part 1, Soil Background for Nonradioactive Analytes*, Rev. 4, Table D9-2.

b. Direct contact values were calculated based on WAC 173-340-740, "Model Toxics Control Act—Cleanup," "Unrestricted Land Use Soil Cleanup Standards," using Method B methodology and assumptions.

c. The groundwater protection values were obtained using equations provided in WAC 173-340-747(4), "Deriving Soil Concentrations for Groundwater Protection," with the physical parameters obtained from <http://www.ecy.wa.gov/>.

d. Where cleanup levels are less than background or required detection limits, cleanup levels default to background or required detection limits in accordance with WAC 173-340-700(6)(d), "Overview of Cleanup Standards," and WAC 173-340-707(2), "Analytical Considerations," respectively.

e. Based on process knowledge, chromium(VI) is not expected to be present at 200-MG-1 OU waste sites. The following values are given to help guide cleanup:

- 0.2 mg/kg—calculated value using  $K_d = 0$ , based on PNNL-13895, *Hanford Contamination Distribution Coefficient Database and Users Guide*, and WAC 173-340-747, equation 747-1.
- 2.1 mg/kg—based on DOE/RL-96-17, *Remedial Design Report/Remedial Action Work Plan for the 100 Area*.
- 18.4 mg/kg—based on Ecology, 2007, *Cleanup Levels and Risk Calculations (CLARC) database*.

f. The soil concentrations for protection of groundwater values for benzo(a)pyrene and benzo(k)fluoranthene were incorrectly reported in DOE/RL-2009-48, *Action Memorandum for Non-Time-Critical Removal Action for 11 Waste Sites in 200-MG-1 Operable Unit*, and have been corrected.

g. Carbon tetrachloride is applicable to the 11 waste sites authorized by DOE/RL-2009-48.

h. Xylene is applicable only to the 200-W-3, 216-S-19, and 216-S-26.

i. Fluoride is added as a contaminant of potential concern for select sites, such as 216-S-19 and 216-S-26, based on process history.

j. The removal action level for asbestos in soil is 1 percent by weight (measured using polarized light microscopy). EPA has used this value for determining if response actions for asbestos should be undertaken (Cook, 2004, "Clarifying Cleanup Goals and Identification of New Assessment Tools for Evaluating Asbestos at Superfund Cleanups"). Further evaluation of removal actions for asbestos will be conducted as needed on a site-specific basis in the Outer Area RI/FS.

Ecological screening values, which are based on WAC 173-340-900 "Model Toxics Control Act-Cleanup," "Tables," Table 749-3, are used for screening purposes only and are not considered cleanup levels for this CERCLA removal action (described more fully in Chapter 5 of the Action Memorandum [DOE/RL-2009-86]). If analytical results exceed the ecological screening values, the results will be further evaluated during the final ecological risk assessment in accordance with the remedial investigation/feasibility study (RI/FS) for the Central Plateau in order to make final cleanup decisions.

### 2.2.2 Exposure and Land-Use Assumptions

The 600-49 waste site is located within the Central Plateau, as discussed in more detail in the EE/CA (DOE/RL-2008-44) and Action Memorandum (DOE/RL-2009-86) for the 200-MG-1 OU. Land use for the Central Plateau is designated for reasonably anticipated future land uses recognized in the EE/CA and

Action Memorandum (for the purposes of this interim action, RAOs were selected that would support unrestricted land use).

### **2.2.3 Design Summary**

The RTD action alternative was the selected alternative for 600-49 waste site based on available historical information and process knowledge. Following the removal of soil from the vicinity of the shooting range backstop, verification sampling was conducted to confirm that residual concentrations of COPCs in soil were less than or equal to the RALs. The sampling objectives for the 600-49 waste site included visual inspection of the shooting range, and the collection of soil samples from the waste site as described in Section 3.1 of this report.

Key features of the site-specific sampling design for the 600-49 waste site included the following:

- Direct visual inspection of the waste site using available site information as a guide for visual cues such as staining, discoloration, absence of vegetation, presence of debris and other anomalies.
- Radiological field screening performed at the surface of the waste site to provide an indication of the presence of radiological COPCs.
- Random sampling was performed, per the methodology prescribed in the SAP (DOE/RL-2009-60), in the excavated areas for the verification sampling evolution.

## **2.3 Decision Document Amendments, Significant Differences, or Waivers**

No amendments to the EE/CA (DOE/RL-2008-44) or Action Memorandum (DOE/RL-2009-86), or technical impracticability waivers were associated with this removal action. A Tri-Party Agreement change notice (TPA-CN-350) has been approved for the Action Memorandum to add sites, including the 600-49 waste site, to the scope of the removal action, as authorized by Section 1.5.2 of the EE/CA (DOE/RL-2008-44).

### **3 Response Activity Summary**

As stated in the EE/CA (DOE/RL-2008-44) and Action Memorandum (DOE/RL-2009-86), the selected alternative for the 600-49 waste site was RTD. Available historical information and process knowledge, per the provisions of the Action Memorandum, substantiated the implementation of the RTD at the waste site without requiring additional site investigation. Upon completion of RTD activities, verification sampling was conducted to demonstrate that COPCs concentrations in soil at the 600-49 waste site were less than or equal to the RALs, thus demonstrating that the RAOs for this interim action were met.

#### **3.1 Summary of Activities**

The removal action at the 600-49 waste site was conducted between May and June 2011, and included the collection of random verification samples from locations within the shooting range backstop of the waste site, as specified in Section 2.2 per the methodologies prescribed in the SAP. The sampling process as described in the SAP was based on the use of an observational approach and included visual inspections, field screening for radiological COPCs, and collection of soil samples from areas identified during site evaluation.

Key activities pertinent to the removal action at the 600-49 waste site are listed as follows:

- Direct visual inspection of the site surface using available site information as a guide, for visual cues such as staining, discoloration, absence of vegetation and other anomalies.
- Excavation of soil under the RTD alternative from shooting range backstop to eliminate a source of contamination from lead slugs remaining in the soil.
- Collection of random verification samples from affected area of the shooting range backstop for verification purposes, laboratory analysis of soil samples for COPCs, and evaluation of analytical results to demonstrate achievement of RALs.

##### **3.1.1 Waste Site 600-49 Initial Sampling**

A site evaluation at the 600-49 waste site was performed on August 3, 2010. Based on observations made during the visual inspection, and available site information, the shooting range portion of the waste site was identified as the area with the highest potential for impacted soil. No visual indicators were observed at the remainder of the waste site. Available historical information and process knowledge substantiated implementation of the RTD alternative at the shooting range backstop without requiring initial sampling; therefore, this section is not applicable.

##### **3.1.2 Waste Site Excavation**

The RTD alternative was applied to the waste site area in accordance with the Action Memorandum (DOE/RL-2009-86), and removal of soil from the firing range backstop at the 600-49 waste site was completed in May 2011. Process knowledge was used to define the extent of excavation at the 600-49 waste site. Lead slugs remaining in soil at the backstop, which served as the impact area to the firing range, presented the highest potential for a source of soil contamination. The excavation began at the peak of the backstop with 0.6m (2 ft) of the surface soil removed from the northwestern slope of the backstop.

### 3.1.3 Waste Site Verification Sampling

The total area of excavation was approximately 327 m<sup>2</sup> (3520 ft<sup>2</sup>); therefore, seven surface samples from the base of the excavation were selected utilizing Visual Sample Plan™ software, as depicted in Figure 3-1. Process knowledge and historical information were used to refine the list of COPCs targeted to metals analysis only.

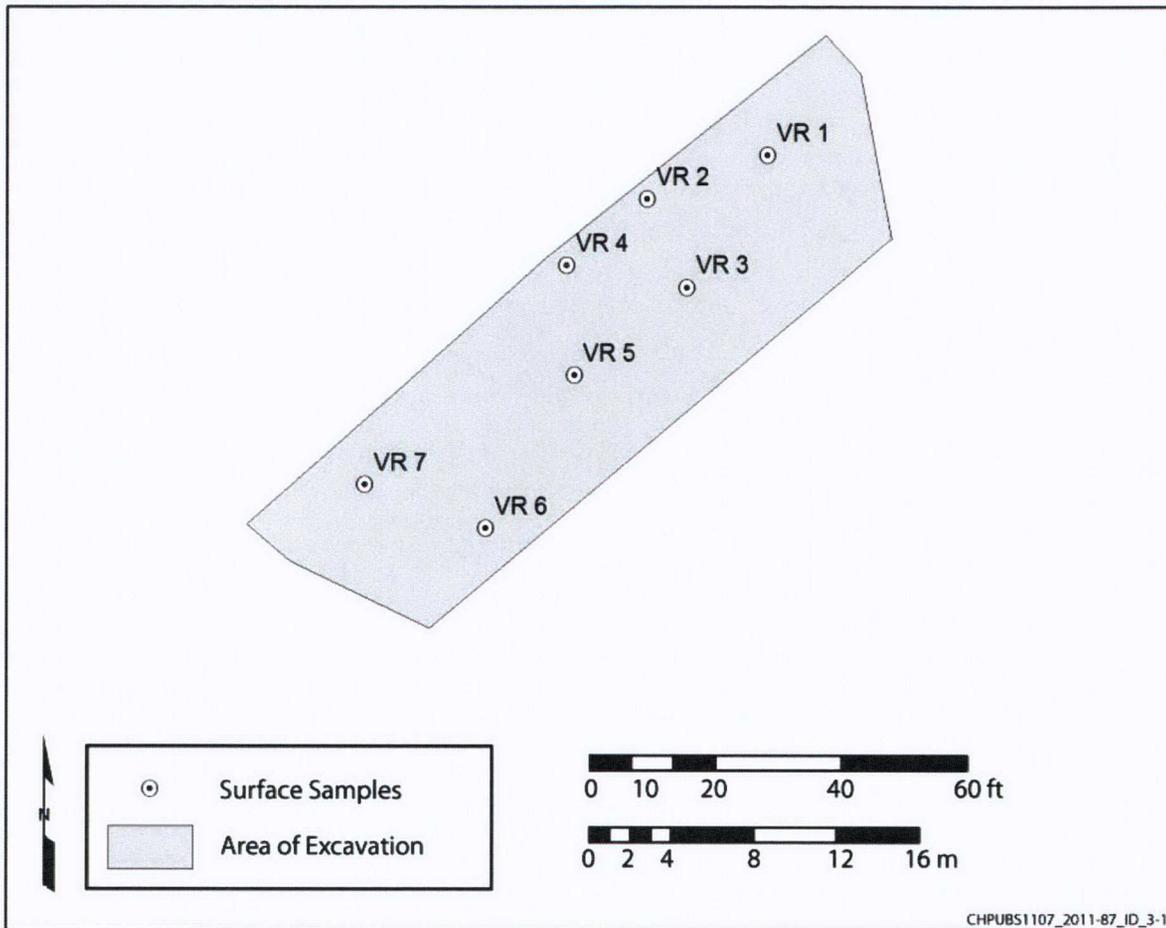


Figure 3-1. Verification Sample Locations at Shooting Range Backstop

### 3.1.4 Backfill and Revegetation

As described in Section 2.1 and Section 5.5.1 of the RAWP (DOE/RL-2009-53), backfill and/or contouring may take place at the 600-49 waste site upon concurrence by the signing parties that the RAOs have been attained. A portion of the shooting range backstop, which consisted of soil mounded to an elevation greater than the general surface grade of the area, was removed. No depression was created in the ground surface of the waste site during RTD activities; therefore, backfill is not required at the 600-49 waste site.

In accordance with the ecological compliance review conducted for the 600-49 waste site, this area does not meet the requirements of a Level III or Level IV designation as described in DOE/RL-96-32, *Hanford*

™ PNNL-16939, *Visual Sample Plan, Version 5.0 User's Guide*. Visual Sample Plan is a registered trademark of Pacific Northwest National Laboratory, Richland, Washington.

*Site Biological Resources Management Plan*; therefore, revegetation at the 600-49 waste site is not required. DOE may elect to revegetate the waste site at a future date for aesthetic purposes.

### **3.1.5 Statement of Protectiveness**

In accordance with the SAP, the soil at the 600-49 waste site has been sampled, analyzed, and evaluated. The results obtained through the implementation of the RTD alternative demonstrate that contaminant concentrations in the soil at the 600-49 waste site are less than RALs (discussed in further detail in Chapter 5). These results also indicate that residual concentrations will support reasonably anticipated future land uses recognized in the EE/CA (DOE/RL-2008-44) and Action Memorandum (DOE/RL-2009-86), and demonstrate that residual concentrations of COPCs in soil throughout the site are unlikely to affect groundwater or the Columbia River. As summarized in Chapter 5, a review of the sampling results showed that the removal action at the 600-49 waste site has demonstrated achievement of the RAOs established in the Action Memorandum and identified in the RAWP (DOE/RL-2009-53).

## 4 Chronology of Events

A chronology of major events associated with sampling the subject waste site is presented in Table 4-1. The chronology includes approval of the regulatory documents that form the basis of the removal action and key fieldwork activities associated with the removal action.

**Table 4-1. Removal Action Chronology**

| Date             | Event  |
|------------------|--|
| June 5, 2009     | DOE/RL-2008-44, <i>Engineering Evaluation/Cost Analysis for the 200-MG-1 Operable Unit Waste Sites</i> , approved  |
| April 15, 2010   | DOE/RL-2009-86, Rev. 0, <i>Action Memorandum for Non-Time-Critical Removal Action for 37 Waste Sites in 200-MG-1 Operable Unit</i> , approved.   |
| April 21, 2010   | Draft of DOE/RL-2009-53, Rev. 1, <i>Removal Action Work Plan for 48 Waste Sites in the 200-MG-1 Operable Unit</i> , completed and routed for approval.   |
| May 20, 2010     | Draft of DOE/RL-2009-60, Rev. 1, <i>Sampling and Analysis Plan for Selected 200-MG-1 Operable Unit Waste Sites</i> , completed and routed for approval.  |
| August 3, 2010   | Site evaluation  |
| October 7, 2010  | DOE/RL-2009-53, Rev. 1, approved.  |
| October 20, 2010 | TPA-CN-350, <i>Tri-Party Agreement Change Notice Form: DOE/RL-2009-86 Action Memorandum for Non-Time-Critical Removal Action for 37 Waste Sites in the 200-MG-1 Operable Unit, Rev. 0</i> , approved |
| January 10, 2011 | DOE/RL-2009-60, Rev. 1, approved.  |
| May 23, 2011     | RTD of the 600-49 waste site commenced   |
| May 25, 2011     | RTD of the 600-49 waste site completed   |
| June 16, 2011    | Verification sampling of the 600-49 waste site conducted   |
| June 30, 2011    | Laboratory analytical data evaluation completed  |

## 5 Performance Standards and Construction Quality Control

This chapter addresses the process for demonstrating achievement of performance standards, which include attaining RALs and RAOs and maintaining the required quality control (QC) during removal activities.

### 5.1 Attainment of Performance Standards

Verification soil sampling, laboratory analysis, and data evaluation conducted after RTD activities confirm that the 600-49 waste site meets the RAOs identified in the Action Memorandum (DOE/RL-2009-86), and residual levels of COPCs remaining in the soil are less than or equal to the RALs. As shown in Table 5-1, RAOs 1 and 2 are achieved by preventing unacceptable risk to human health and the environment through direct exposure to soils and debris by reducing the soil concentration of COPCs to less than or equal to the RALs. RAO 3 is achieved by preventing migration and/or leaching of radiological and nonradiological contamination to groundwater by reducing the soil concentration of COPCs to less than or equal to the RALs. RAO 4 is met through cultural and ecological evaluation, performed in June 2010 and October 2010, respectively, and by the implementation of considerations and recommendations during work activities. Demonstration that the soil concentration of COPCs is less than or equal to RALs (Table 5-2) meets RAOs 1, 2, and 3.

Per the methodology prescribed in the RAWP (DOE/RL-2009-53) and SAP (DOE/RL-2009-60), and based on the available site historical information and process knowledge, the RTD alternative was implemented at the 600-49 waste site. Excavation of soil was conducted at the waste site, followed by verification sampling performed in May and June 2011. The maximum verification sampling analytical results, provided in Table 5-2, demonstrate that there are no chemical COPC concentrations greater than the RALs remaining in soil at the 600-49 waste site, thus meeting RAOs 1, and 3. Radiological survey performed during removal action activities demonstrated no radiological dose rates greater than background and no contamination found, thus meeting RAO 2. A complete summary of analytical results can be found in Table A-1 (Appendix A).

This waste site and the data obtained from the subject sampling evolutions will be included in the risk assessment and RI/FS for final remedial action of the Outer Area.

**Table 5-1. Summary of Attainment of Cleanup Objectives**

| Removal Action Objective  | Compliance Methods   | Removal Action Objectives Attained? |
|---|--|-------------------------------------|
| <b>RAO 1:</b> Prevent unacceptable risk to human health and ecological receptors from exposure to soils and/or debris contaminated with nonradiological constituents to 4.6 m (15 ft) bgs at concentrations above the appropriate RALs.               | Achieved through verification soil sampling, performed upon completion of RTD activities, which demonstrated that all individual COPC concentrations are less than the RALs.   | Yes                                 |
| <b>RAO 2:</b> Prevent unacceptable risk to human health and ecological receptors from exposure to soils and/or debris contaminated with radiological constituents to 4.6 m (15 ft) bgs at concentrations above the appropriate RALs.                  | Achieved through the radiological survey of soils within the waste site, conducted during site evaluation and the sampling evolution, which resulted in no measured dose rates greater than background established for the waste site and no detectable radiological contamination. This demonstrates that COPC concentrations are below the RALs as a result. | Yes                                 |
| <b>RAO 3:</b> Control the sources of groundwater contamination to minimize impacts to groundwater resources, protect the Columbia River from adverse impacts, and reduce the degree of groundwater cleanup that may be required under future actions. | Achieved through verification soil sampling, performed upon completion of RTD activities, which demonstrated that concentrations of COPCs in soil were less than established RALs.   | Yes                                 |
| <b>RAO 4:</b> Prevent adverse impacts to cultural resources and threatened or endangered species, and minimize wildlife habitat disruption.   | Achieved through cultural and ecological evaluations and the implementation of considerations during removal activities to minimize wildlife habitat and cultural artifact disruption.   | Yes                                 |

### 5.1.1 Performance Standard Documentation

This response action report addresses the individual 600-49 waste site and not an OU; therefore, this section is not applicable.

### 5.1.2 Response Action Objectives Verification

RAO performance standard attainment involves comparison of soil analytical data to RALs. The RALs, identified in the Action Memorandum (DOE/RL-2009-86) and RAWP (DOE/RL-2009-53), are directly compared to the maximum results from the verification analytical data (Table 5-2). The full set of analytical results from all samples collected is provided in Appendix A.

### 5.1.3 Contaminant Identification

Table 5-2 provides a direct comparison of verification sample analytical results for each nonradiological COPC, as determined from process knowledge and historical information, against the established RALs for the 600-49 waste site.

Table 5-2. Comparison of Verification Sample Results Against Removal Action Levels for Nonradiological COPCs

| Contaminant of Potential Concern | Background Concentration <sup>a</sup> (mg/kg) | Removal Action Level (mg/kg) | Maximum Concentration in Soil (mg/kg) | Does the Maximum Exceed Removal Action Levels? |
|----------------------------------|---|------------------------------|---------------------------------------|--|
| <b>Metals</b>                    |   |                              |                                       |  |
| Antimony                         | 5   | 5.4                          | U                                     | No   |
| Arsenic                          | 6.5   | 6.5 <sup>b</sup>             | 2.86                                  | No   |
| Barium                           | 132   | 1,650                        | 74.6                                  | No   |
| Beryllium                        | 1.51  | 63.2                         | 0.235                                 | No   |
| Boron                            | N/A   | 210                          | 1.62                                  | No   |
| Cadmium                          | 0.81  | 0.81 <sup>b</sup>            | U                                     | No   |
| Chromium Total                   | 18.5  | 2,000                        | 13.0                                  | No   |
| Chromium (VI)                    | N/A   | 2.1 <sup>c</sup>             | 0.0877                                | No   |
| Cobalt                           | 15.7  | 15.7 <sup>b</sup>            | 6.33                                  | No   |
| Copper                           | 22  | 284                          | 38.6                                  | No   |
| Lead                             | 10.2  | 250                          | 5.3                                   | No   |
| Lithium                          | 33.5  | 160                          | 11.3                                  | No   |
| Manganese                        | 512   | 512 <sup>b</sup>             | 336                                   | No   |
| Mercury                          | 0.33  | 2.09                         | 0.056                                 | No   |
| Nickel                           | 19.1  | 130                          | 15.8                                  | No   |
| Selenium                         | 0.78  | 5.2                          | 0.616                                 | No   |
| Silver                           | 0.73  | 13.6                         | U                                     | No   |
| Strontium                        | N/A   | 2,920                        | 20.4                                  | No   |
| Thallium                         | 0.1   | 1.59                         | U                                     | No   |
| Tin                              | N/A   | 48,000                       | 0.374                                 | No   |
| Uranium                          | 3.21  | 3.21 <sup>b</sup>            | 0.54                                  | No   |
| Vanadium                         | 85.1  | 560                          | 38.5                                  | No   |
| Zinc                             | 67.8  | 5970                         | 38.8                                  | No   |

a. If Hanford Site-specific background data are not available, values are then taken from Ecology Publication 94-115, *Natural Background Soil Metals Concentrations in Washington State*. Hanford Site background values are available from nonradiological background data in DOE/RL-92-24, *Hanford Site Soil Background: Part 1, Soil Background for Nonradioactive Analytes*, Table D9-2. Hanford Site background values are available from radiological background data from DOE/RL-96-12, *Hanford Site Background: Part 2, Soil Background for Radionuclides*, Table 4.

b. Where cleanup levels are less than background or RDLs, cleanup levels default to background or RDLs in accordance with

**Table 5-2. Comparison of Verification Sample Results Against Removal Action Levels for Nonradiological COPCs**

| Contaminant of Potential Concern  | Background Concentration <sup>a</sup> (mg/kg) | Removal Action Level (mg/kg) | Maximum Concentration in Soil (mg/kg) | Does the Maximum Exceed Removal Action Levels? |
|---|---|------------------------------|---------------------------------------|--|
| WAC 173-340-700(6)(d), "Model Toxics Control Act—Cleanup," "Overview of Cleanup Standards," and WAC 173-340-707(2), "Analytical Considerations," respectively.  |   |                              |                                       |  |
| c. Based on process knowledge, chromium (VI) is not expected to be present at 200-MG-1 OU waste sites. The following values are given to help guide cleanup:  |   |                              |                                       |  |
| <ul style="list-style-type: none"> <li>• 0.2 mg/kg is the calculated value using <math>K_d=0</math>, based on PNNL-13895, <i>Hanford Contamination Distribution Coefficient Database and Users Guide</i>, and WAC 173-340-747, "Deriving Soil Concentrations for Groundwater Protection," equation 747-1.</li> <li>• 2.1 mg/kg is based on DOE/RL-96-17, <i>Remedial Design Report/Remedial Action Work Plan for the 100 Area</i>.</li> <li>• 18.4 mg/kg is based on Ecology, 2007, Cleanup Levels and Risk Calculations database.</li> </ul> |   |                              |                                       |  |
| N/A = not available   |   |                              |                                       |  |
| U = Analyzed for but not detected above laboratory detection limit  |   |                              |                                       |  |

## 5.2 Construction Quality Assurance/Quality Control

No construction-related aspects were implemented as part of the selected alternative for the 600-49 waste site; therefore, this section is not applicable.

## 5.3 Cleanup Verification Quality Assurance/Quality Control

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. 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/540-R-00-007, *Soil Screening Guidance for Radionuclides: User's Guide*). 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 contractors' validation procedures, which are based on EPA functional guidelines (for example, Bleyler, 1988a, *Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses*; Bleyler 1988b, *Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses*), was performed for the entire sampling and analysis data package for the samples collected for the 600-49 waste site. Level C validation is a review of the 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 spikes/matrix spike duplicates; surrogate recoveries; duplicates; and analytical method blanks. Specific data quality objectives for the site are found in the SAP.

All of the sampling and analysis data generated from the sampling at the 600-49 waste site are tracked through Hanford Environmental Information System (HEIS) identification numbers. All of the sampling and analysis data for the 600-49 waste site were found to be useable for decision-making purposes as provided in the following summary:

**HEIS Identification Numbers:** B2F8H7, B2F8H8, B2F8H9, B2F8J0, B2F8J1, B2F8J3, B2F8J4,

**Blanks:** Equipment blanks (B2F8J9) was received intact to the laboratory and holding times were acceptable.

**Field Duplicates:** The duplicate (B2F8J2) result was acceptable.

**Data Completeness:** 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 percent. The data has been determined to be useable for decision-making purposes. The final results, narrative supporting the sampling analysis activities and findings, and copies of chains of custody were transmitted in letter reports from the laboratory.

**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 (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 (such as Geiger-Müller and portable alpha meters) 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 in support of waste site sampling and investigation. These checks are made on standard materials that are sufficiently like the matrix under consideration that direct comparison of data can be made. Daily calibration checks of radiological field instruments were performed by trained and qualified radiological control technicians in accordance with established program requirements.

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 the 600-49 waste site 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 because of QA/QC deficiencies. All analytical data were found acceptable for decision-making purposes. All of the sampling analytical data are stored in HEIS.

## 5.4 Regulatory Oversight

This document provides a summary of the removal action taken at the 600-49 waste site; it shows a comparison of the data collected to RALs authorized in approved regulatory documents and provides the basis to reclassify the waste site status (see Section 9). Though this report does not require approval by Ecology or EPA, concurrence of those agencies is necessary, under CERCLA Section 120 and the Tri-Party Agreement (Ecology et al., 1989), for determinations concerning follow-on remedial actions. This report is therefore provided to the agency (or agencies) for review, in accordance with the approval process for waste site reclassification, as supporting documentation. Upon approval of the waste site reclassification, a copy of this report shall be maintained in the Administrative Record. No additional regulatory oversight was required for the sampling at the 600-49 waste site.

## **6 Final Inspection and Certifications**

There were no final inspections or certification required in the implementation of the selected alternative for the 600-49 waste site; therefore, this chapter is not applicable.

## **7 Operation & Maintenance Activities**

This section discusses the operations and maintenance (O&M) for the 600-49 waste site.

### **7.1 Remedy-Related Operations and Maintenance or Monitoring**

There are no O&M activities or monitoring requirements for the 600-49 waste site; therefore, this section is not applicable.

### **7.2 Institutional Controls**

Based on the analyses performed and presented in this report, there are no waste site specific institutional controls required at the 600-49 waste site; therefore, this section is not applicable.

### **7.3 Five-Year Reviews**

Five-year reviews are required by CERCLA for post-ROD remedial actions, but do not apply to the 600-49 waste site. This waste site and the data obtained from the subject sampling evolution will be included in the risk assessment and RI/FS for final remedial decision for the Outer Area.

## 8 Summary of Project Costs

For the purposes of reporting costs of removal action for the 600-49 waste site, costs are pro rated utilizing an activity/schedule-based methodology (Table 8-1). This method is not considered to be audit quality data. Actual costs for waste site cleanup will continue to be collected for each OU or closure area in accordance with the current cost tracking methodology. These costs will then be included, in accordance with CERCLA requirements, in the response action report for the final remedial action of the OU or closure area.

**Table 8-1. Cost Summary**

| <b>Cost Item</b>                                  | <b>Actual Cost<br/>Fiscal Year<br/>2010 (\$)</b> | <b>Actual Cost<br/>Fiscal Year<br/>2011 (\$)</b> | <b>Actual Total Cost<br/>(\$)</b> |
|---|--|--|-----------------------------------|
| Removal Action Capital (Construction) Costs       | 0  | 0  | 0                                 |
| Removal Action Operating Costs                    | 9,430.5  | 144,296.48                                       | 153,726.99                        |
| Total Removal Action Cost                         | 9,430.5  | 144,296.48                                       | 153,726.99                        |
| Projected Yearly Operations and Maintenance Costs | 0  | 0  | 0                                 |

## 9 Waste Site Reclassification

The waste site reclassification form for the subject waste site is proposed and processed in accordance with the procedures and definitions described in *Tri-Party Agreement Handbook Management Procedures* (RL-TPA-90-0001), TPA-MP-14, "Maintenance of the WIDS." Reclassification form 2011-076 for the 600-49 waste site proposes the status of this waste site be changed to "interim closed out." Per TPA-MP-14, "interim closed out" status indicates that a site meets the cleanup standards specified in the approved action memorandum (i.e., the interim response action decision document). This site will be evaluated under the cleanup standards established for the final ROD for the Outer Area.

## 10 Observations and Lessons Learned

There were no observations or lessons learned applicable for inclusion in this report.

## 11 Contact Information

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**Appendix A**  
**Sampling Results for the 600-49 Waste Site**

## **A1 Sampling Results for the 600-49 Waste Site**

This appendix contains laboratory analytical results, provided in Table A-1 from the sampling conducted at the 600-49 waste site. The following information is provided in the table headings: Hanford Environmental Information System identification numbers and field sample identifier. Surface samples were collected from 0 to 0.3 m (0 to 1 ft) below the base of the excavation

Table A-1 provides final verification sampling results for nonradiological contaminants of potential concern (COPCs). The results demonstrate that concentrations of COPCs were less than removal action levels, thereby attesting to the achievement of the corresponding removal action objectives.

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Table A-1. Analytical Results for Verification Sampling for Nonradiological Contaminants of Potential Concern

| Contaminant of Potential Concern | Removal Action Levels <sup>a</sup> | Required Detection Limit | Maximum Reported Laboratory Method Detection Limit | Background Concentration <sup>b</sup> | B2F8H7 VR 1 Surface | B2F8H8 VR 2 Surface | B2F8H9 VR 3 Surface | B2F8J0 VR 4 Surface | B2F8J1 VR 5 Surface | B2F8J3 VR 6 Surface | B2F8J4 VR 7 Surface |
|----------------------------------|------------------------------------|--------------------------|--|---------------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| Metals                           | (mg/kg)                            | (mg/kg)                  | (mg/kg)  | (mg/kg)                               | (mg/kg)             | (mg/kg)             | (mg/kg)             | (mg/kg)             | (mg/kg)             | (mg/kg)             | (mg/kg)             |
| Antimony                         | 5.4                                | 0.6                      | 0.31   | 5                                     | U                   | U                   | U                   | U                   | U                   | U                   | U                   |
| Arsenic                          | 6.5 <sup>c</sup>                   | 1                        | 0.41   | 6.5                                   | 2.31                | 2.18                | 2.50                | 2.08                | 2.54                | 2.58                | 2.86                |
| Barium                           | 1,650                              | 2                        | 0.21   | 132                                   | 69.1                | 53.7                | 74.2                | 57.4                | 70.4                | 74.6                | 71.3                |
| Beryllium                        | 63.2                               | 0.5                      | 0.10   | 1.51                                  | 0.174               | 0.165               | 0.230               | 0.147               | 0.231               | 0.204               | 0.216               |
| Boron                            | 210                                | 2                        | 0.52   | N/A                                   | 1.55                | 0.698               | 1.58                | 0.649               | 1.11                | 1.62                | 0.707               |
| Cadmium                          | 0.81 <sup>c</sup>                  | 0.5                      | 0.1  | 0.81                                  | U                   | U                   | U                   | U                   | U                   | U                   | U                   |
| Chromium Total                   | 2,000                              | 1                        | 0.52   | 18.5                                  | 11.8                | 10.2                | 13.0                | 9.75                | 12.8                | 11.1                | 10.9                |
| Chromium (VI)                    | 2.1                                | 0.5                      | 0.033  | N/A                                   | 0.0504              | U                   | 0.0877              | U                   | U                   | 0.0680              | 0.0818              |
| Cobalt                           | 15.7 <sup>c</sup>                  | 2                        | 0.1  | 15.7                                  | 6.24                | 4.57                | 6.33                | 4.68                | 6.17                | 6.14                | 5.07                |
| Copper                           | 284                                | 1                        | 0.1  | 22                                    | 10.5                | 9.05                | 10.3                | 9.43                | 25.4                | 13.3                | 10.0                |
| Lead                             | 250                                | 5                        | 0.1  | 10.2                                  | 4.28                | 2.68                | 5.04                | 2.83                | 4.59                | 5.30                | 4.03                |
| Lithium                          | 160                                | 2.5                      | 1  | 33.5                                  | 11.3                | 10.3                | 7.61                | 8.75                | 9.50                | 10.1                | 8.32                |
| Manganese                        | 512 <sup>c</sup>                   | 5                        | 0.1  | 512                                   | 307                 | 249                 | 335                 | 212                 | 319                 | 336                 | 258                 |
| Mercury                          | 2.09                               | 0.2                      | 0.052  | 0.33                                  | 0.0569              | U                   | U                   | U                   | U                   | U                   | U                   |
| Nickel                           | 130                                | 4                        | 0.21   | 19.1                                  | 11.4                | 12.7                | 10.8                | 9.04                | 15.8                | 11.5                | 9.52                |
| Selenium                         | 5.2                                | 1                        | 0.31   | 0.78                                  | 0.616               | U                   | 0.558               | 0.431               | 0.551               | 0.388               | 0.573               |
| Silver                           | 13.6                               | 0.2                      | 0.1  | 0.73                                  | U                   | U                   | U                   | U                   | U                   | U                   | U                   |
| Strontium                        | 2,920                              | 1                        | 0.1  | N/A                                   | 15.6                | 20.4                | 18.4                | 19.0                | 18.1                | 19.4                | 17.1                |
| Thallium                         | 1.59                               | 1                        | 0.1  | 0.1                                   | U                   | U                   | U                   | U                   | U                   | U                   | U                   |
| Tin                              | 48,000                             | 10                       | 0.1  | N/A                                   | 0.374               | 0.206               | 0.324               | 0.231               | 0.311               | 0.303               | 0.280               |
| Uranium                          | 3.21 <sup>c</sup>                  | 1                        | 0.1  | 3.21                                  | 0.446               | 0.540               | 0.414               | 0.405               | 0.458               | 0.442               | 0.356               |
| Vanadium                         | 560                                | 2.5                      | 0.21   | 85.1                                  | 35.0                | 31.1                | 38.5                | 33.0                | 36.6                | 36.4                | 33.9                |
| Zinc                             | 5970                               | 1                        | 0.83   | 67.8                                  | 34.8                | 27.1                | 38.8                | 27.9                | 37.3                | 36.4                | 31.3                |

**Table A-1. Analytical Results for Verification Sampling for Nonradiological Contaminants of Potential Concern**

| Contaminant of Potential Concern | Removal Action Levels <sup>a</sup> | Required Detection Limit | Maximum Reported Laboratory Method Detection Limit | Background Concentration <sup>b</sup> | B2F8H7<br>VR 1<br>Surface | B2F8H8<br>VR 2<br>Surface | B2F8H9<br>VR 3<br>Surface | B2F8J0<br>VR 4<br>Surface | B2F8J1<br>VR 5<br>Surface | B2F8J3<br>VR 6<br>Surface | B2F8J4<br>VR 7<br>Surface |
|----------------------------------|------------------------------------|--------------------------|--|---------------------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
|----------------------------------|------------------------------------|--------------------------|--|---------------------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|

a. Removal action levels are from DOE/RL-2009-53, *Removal Action Work Plan for 48 Waste Sites in the 200-MG-1 Operable Unit*

b. If Hanford Site-specific background data is not available, values are then taken from Ecology Publication 94-115, *Natural Background Soil Metals Concentrations in Washington State*. Hanford Site background values are available in nonradiological background data from DOE/RL-92-24, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes*, Rev. 4, Table D39-2.

c. Where cleanup levels are less than background or required detection limits, cleanup levels default to background or required detection limits per Ecology Publication 94-06, *Model Toxics Control Act Cleanup Regulation Chapter 173-340 WAC*; WAC 173-340-700(4)(d), "Model Toxics Control Act—Cleanup," "Overview of Cleanup Standards;" and WAC 173-340-707(2), "Analytical Considerations," respectively.

N/A = not available

U = analyzed for but not detected above laboratory method detection limit.