DOE/RL-2004-74
Revision 0

300-FF-1 Operable Unit Remedial Action Report

United States
Department of Energy

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300-FF-1 Operable Unit Remedial Action Report

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United States Department of Energy

P.O. Box 550, Richland, Washington 99352

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ACRONYMS

ACL	above cleanup level
AOC	area of contamination
APT	(300) Area Process Trenches
BCL	below cleanup level
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CFR	*Code of Federal Regulations*
COA	code of account
COC	contaminant of concern
COPC	contaminant of potential concern
CVP	cleanup verification package
DOE	U.S. Department of Energy
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ERA	expedited response action
ERC	Environmental Restoration Contractor
ERDF	Environmental Restoration Disposal Facility
ESD	explanation of significant difference
FE&C	Federal Engineers and Constructors
HQ	hazard quotient
IH	industrial hygiene
K_d	distribution coefficient
LDR	Land Disposal Restriction
NPL	National Priorities List
OU	operable unit
PCB	polychlorinated biphenyl
PPE	personal protective equipment
RAG	remedial action goal
RAO	remedial action objective
RCBRA	River Corridor Baseline Risk Assessment
RCI	RCI Environmental, Inc.
RCRA	*Resource Conservation and Recovery Act of 1976*
RDR/RAWP	remedial design report/remedial action work plan
RESRAD	RESidual RADioactivity
RL	U.S. Department of Energy, Richland Operations Office
ROD	record of decision
ROM	rough order of magnitude
SAP	sampling and analysis plan
TPH	total petroleum hydrocarbon
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
TSD	treatment, storage, and disposal
UCL	undetermined contamination level

UMM	Unit Managers Meeting
WAC	*Washington Administrative Code*
Weston	Roy F. Weston
WIDS	Waste Information Data System

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

The purpose of this report is to document the completion of remedial actions for the 300-FF-1 Operable Unit (OU). The report is generally constructed following U.S. Environmental Protection Agency (EPA) guidance for remedial action reports. The scope of the report includes the waste sites and remedial action activities addressed as part of the record of decision (ROD) for the 300-FF-1 OU (EPA 1996). In addition, this report includes several 300-FF-2 OU waste sites that were remediated as part of the 300-FF-1 OU actions based on proximity to other sites in the 300-FF-1 OU.

1.2 HANFORD SITE 300 AREA

The Hanford Site is a 1,517-km^2 (586-mi^2) Federal facility located in southeastern Washington State along the Columbia River. From 1943 to 1990, the primary mission of the Hanford Site was the production of nuclear materials for national defense. During construction, areas of the Hanford Site were assigned codes based on functions performed and geographic location. The primary codes included the 100 Area (reactor sites and support facilities), 200 Area (chemical separations facilities), 300 Area (fuel manufacturing), and 1100 Area (commercial services).

The 300 Area began operations in 1943 as a fuels fabrication complex for the nuclear reactors located in the 100 Areas. Most of the facilities in the area were involved in the fabrication of nuclear reactor fuel elements. In addition to the fuel manufacturing processes, technical support, service support, and research and development related to fuels fabrication also occurred within the 300 Area. In the early 1950s, the Hanford Laboratories were constructed for research and development. As the Hanford Site production reactors were shut down, fuel fabrication in the 300 Area ceased. Research and development activities expanded over the years.

Fuel fabrication operations, research and development, and construction/demolition activities in the 300 Area generated both liquid and solid wastes. Prior to 1994, liquid wastes were discharged to a series of unlined ponds and trenches just north of the 300 Area. A series of unlined pits, called burial grounds, were used for disposal of 300 Area solid wastes and debris generated before 1973. The burial grounds were located north and west of the 300 Area Complex. These disposal practices, coupled with various spills and unplanned releases that occurred, contributed to areas of soil and groundwater contamination in the 300 Area.

The Hanford Site mission transitioned from production to cleanup in the 1980s. In July 1989, the Hanford Site was listed on the National Priorities List (NPL) pursuant to the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA). The Hanford Site was listed as four NPL sites consisting of the 100 Area, the 200 Area, the 300 Area, and the 1100 Area. Each of the NPL sites was divided into OUs, which consisted of groups of waste sites based on geographic area and common waste sources. The 300 Area NPL site encompasses approximately 1.35 km^2 (0.52 mi^2) adjacent to the Columbia River and consists of three OUs (Figure 1-1). The 300-FF-1 and 300-FF-2 OUs address "source" or soil and debris waste sites, whereas the 300-FF-5 OU addresses contaminated groundwater beneath the area.

1.2.1 300-FF-1 Operable Unit

The 300-FF-1 OU covered an area of approximately 47.4 ha (117 acres). The scope of remedial actions for the 300-FF-1 OU included the major 300 Area liquid/process waste disposal sites, the 618-4 Burial Ground, and three small landfills. The 300-FF-1 OU liquid/process waste sites were unlined trenches and ponds that routinely received discharges of millions of gallons of contaminated wastewater from 300 Area operations between 1943 and 1994. These liquid/process waste sites are thought to be the primary source of groundwater contamination in the 300-FF-5 OU.

A final ROD for the 300-FF-1 OU was approved in July 1996 (*Record of Decision for the 300-FF-1 and 300-FF-5 Operable Units* [EPA 1996]). The remedy selected in the 300-FF-1 ROD was to remove contaminated soil and debris, treat as necessary, and dispose of the waste in the Environmental Restoration Disposal Facility (ERDF). Soil cleanup levels established in the ROD were based on anticipated future industrial land uses. The remedy also included implementation of institutional controls because the selected cleanup actions for industrial land use would not necessarily result in conditions that would permit unrestricted land use and unlimited exposure. Remedial actions at the 300-FF-1 OU were initiated in 1997 and completed in 2004.

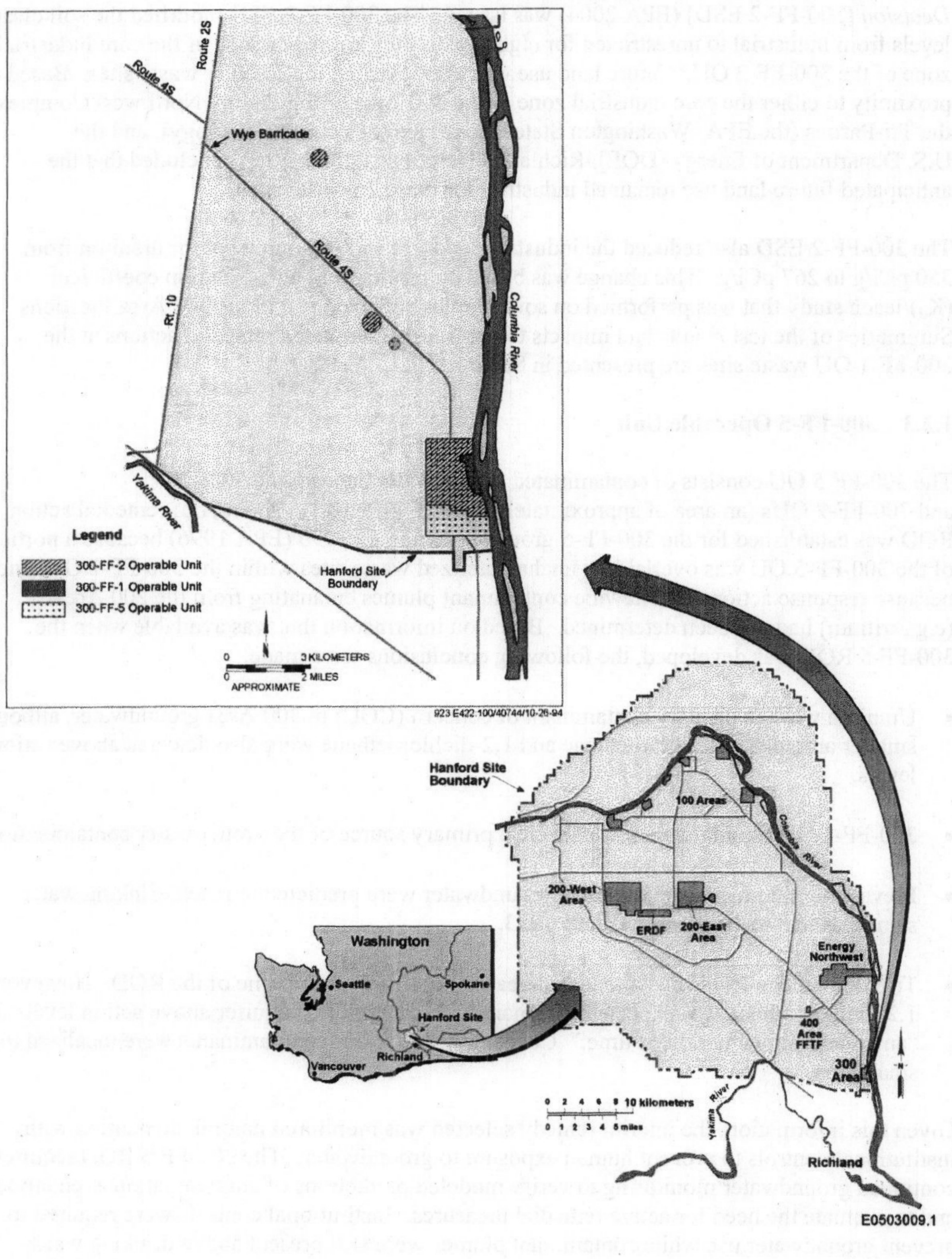
1.2.2 300-FF-2 Operable Unit

The 300-FF-2 OU is an interim source control action. The 300-FF-2 OU addresses waste sites that fall into four general categories:

- Waste sites in the 300 Area Industrial Complex
- Outlying waste sites north and west of the 300 Area Industrial Complex
- General content burial grounds
- Transuranic-contaminated burial grounds.

Four of the 300-FF-2 OU waste sites (300-10, 300-45, 300-262, and 618-5 Burial Ground) were remediated as part of the 300-FF-1 OU actions based on proximity to other sites in the 300-FF-1 OU. The 300-FF-2 ROD (EPA 2001) requires that waste sites be remediated to industrial cleanup levels as well as be protective of ecological receptors, groundwater, and river water quality. The basis for these requirements is an assessment of the reasonably anticipated future land use for the areas where these waste sites are located. The 300-FF-2 ROD also identifies institutional control requirements associated with industrial cleanup of the waste sites. Remedial actions at the 300-FF-2 OU are ongoing.

Figure 1-1. Hanford Site Map.



In 2004, the *Explanation of Significant Differences for the 300-FF-2 Operable Unit Record of Decision* (300-FF-2 ESD) (EPA 2004) was issued. The 300-FF-2 ESD modified the soil cleanup levels from industrial to unrestricted for eight waste sites located outside of the core industrial zone of the 300-FF-2 OU. Future land use was also revisited for 26 other waste sites. Based on proximity to either the core industrial zone of the 300 Area or the Energy Northwest Complex, the Tri-Parties (the EPA, Washington State Department of Ecology [Ecology], and the U.S. Department of Energy [DOE], Richland Operations Office [RL]) concluded that the anticipated future land use remained industrial for those 26 waste sites.

The 300-FF-2 ESD also reduced the industrial land-use soil cleanup level for uranium from 350 pCi/g to 267 pCi/g. This change was based on results from a distribution coefficient (K_d)/leach study that was performed on soil samples collected at various 300 Area locations. Summaries of the test results and impacts to previously completed remedial actions at the 300-FF-1 OU waste sites are presented in Section 5.0.

1.2.3 300-FF-5 Operable Unit

The 300-FF-5 OU consists of contaminated groundwater beneath the 300-FF-1 and 300-FF-2 OUs (an area of approximately 4.1 km^2 [1.6 mi^2]). An interim remedial action ROD was established for the 300-FF-5 groundwater OU in 1996 (EPA 1996) because a portion of the 300-FF-5 OU was overlaid by uncharacterized waste sites within the 300-FF-2 OU, and because response actions for sitewide contaminant plumes emanating from the 200 Areas (e.g., tritium) had not been determined. Based on information that was available when the 300-FF-5 ROD was developed, the following conclusions were made.

- Uranium was the primary contaminant of concern (COC) in 300 Area groundwater, although smaller amounts of trichloroethene and 1,2-dichloroethene were also detected above action levels.

- 300-FF-1 OU liquid disposal sites were a primary source of the groundwater contamination.

- Elevated uranium concentrations in groundwater were predicted to reach drinking water standards in 3 to 10 years from late 1993.

- Trichloroethene levels had attenuated near action levels at the time of the ROD. However, 1,2-dichloroethene was expected to remain in the unconfined aquifer above action levels for "an undetermined period of time." Concentrations of both contaminants were localized to small areas.

Given this information, the interim remedy selected was monitored natural attenuation with institutional controls to prevent human exposure to groundwater. The 300-FF-5 ROD required continued groundwater monitoring to verify modeled predictions of contamination attenuation and to evaluate the need for active remedial measures. Institutional controls were required to prevent groundwater use while contaminant plumes were still present above drinking water standards. The 300-FF-5 OU ROD assumed that the groundwater aquifer is a potential future source of drinking water and will be restored to drinking water standards in a reasonable time frame (EPA 1996).

The remedial action objectives (RAOs) defined in the 300-FF-5 ROD were to protect human and ecological receptors from exposure to contaminants in the groundwater and protect the Columbia River such that contaminants in the groundwater do not result in an impact to the Columbia River that could exceed the Washington State Surface Water Quality Standards. The operation and maintenance plan for 300-FF-5 OU (DOE-RL 2002a) defined three primary activities to accomplish these goals including groundwater monitoring, near-shore river monitoring, and warning sign postings.

An ESD to the 300-FF-5 ROD was developed by the EPA in June 2000 (EPA 2000). The ESD expanded the scope of 300-FF-5 OU to include groundwater beneath all 300-FF-2 OU waste sites and burial grounds (i.e., the original 300-FF-5 boundary as it was defined in the 1996 ROD was expanded). The ESD also required an update to the operation and maintenance plan for 300-FF-5 to ensure that adequate groundwater monitoring requirements and institutional controls are in place. The ESD did not make any fundamental changes to the 1996 remedy selection decision.

Contaminated plumes that exceed the established groundwater action levels remain within the 300-FF-5 Operable Unit. Consequently, a focused feasibility study is being developed to evaluate potential remedies to address the remaining contamination in groundwater and the deep vadose zone soil. The focused feasibility study is scheduled to be issued in 2007 and will include a conceptual site model to explain the source of remaining contamination as well as a protectiveness determination for remedies implemented in the 300 Area to date.

2.0 300-FF-1 OPERABLE UNIT BACKGROUND

The basis and authorization for cleanup actions at the 300-FF-1 OU was established in 1996 by a final ROD (EPA 1996). Background information associated with the baseline risk assessment, land-use assumptions, remedial action requirements, and remedial design is summarized in the following subsections.

2.1 ECOLOGICAL BASELINE RISK ASSESSMENT

An ecological risk assessment (ERA) for the 300-FF-1 OU was performed in 1994 as part of the *Phase III Feasibility Study Report for the 300-FF-1 Operable Unit* (DOE-RL 1994). Sites investigated included the South Process Pond, North Process Pond, 618-4 Burial Ground, 618-5 Burial Ground, and Filter Backwash Pond. At the time the evaluation was performed, none of these sites had been remediated. Soil at these sites was contaminated with solid and liquid waste from fuel fabrication and research and development operations in the 300 Area. Contaminants of potential concern (COPCs) identified for the risk assessment included metals, organic compounds, and radionuclides.

Receptors selected for the risk evaluation were the Great Basin pocket mouse (*Perognathus parvus*), Swainson's hawk (*Buteo swainsoni*), and the burrowing owl (*Athene cunicularia*). Because the Swainson's hawk and burrowing owl were listed as candidate species by the State of Washington, they were selected as endpoints for the risk assessment. The measures associated with the hawk and owl were the risks of potential adverse effects resulting from the estimated contaminant intake by individual receptors based on a food web model. Although the pocket mouse was an integral component of the foodweb exposure to the hawk and owl, it was not selected as an endpoint receptor.

The foodweb model calculated uptake of contaminants in soil by plants, the intake of plants by herbivores (pocket mice), and intake of herbivores by carnivores (hawks and owls) in a series of equations. Environmental hazard quotients (HQs) were calculated for all contaminants for the pocket mice, hawks, and owls. Hazard indices were also calculated for each receptor by summing the HQs for all chemicals.

Modeled exposures were compared to literature-based effects concentrations for each receptor. Except for the filter backwash pond, all sites resulted in exposures likely to result in adverse effects to the Great Basin pocket mouse. However, because contaminant transfer from the mouse to the hawk and owl was the focus of the evaluation, the ecological impact of contaminant uptake by the mouse was not considered significant. Based on assessment results for the pre-remediation conditions, it was determined that adverse affects to key receptors were unlikely to result from contaminants in the 300-FF-1 OU waste sites (DOE-RL 1994).

2.2 LAND-USE ASSUMPTIONS

Cleanup actions for the 300-FF-1 OU were based on anticipated future industrial land uses for the area. In the industrial land-use scenario, a worker was assumed to spend approximately 2,000 hr/yr on site for 30 years. Each year, it was estimated that approximately 1,500 hours would be spent indoors and approximately 500 hours would be spent outdoors. The remainder of time would be spent off site. The scenario assumed that exposure to contaminants occurs only through the direct exposure, inhalation, and soil ingestion pathways. Pathways for food or water ingestion were not evaluated because it was assumed that drinking water is not obtained from groundwater sources and food products are not grown on the site. The industrial land-use scenario assumes that institutional controls are in place specifying industrial land use only and controlling all excavations or borehole and well drilling.

2.3 REMEDIAL ACTION REQUIREMENTS AND GOALS

Major components of the selected final remedy for the 300-FF-1 OU included the following:

- Removal of contaminated soil and debris
- Disposal of contaminated material at the ERDF
- Recontouring and backfilling waste sites, followed by revegetation
- Institutional controls to ensure that unanticipated changes in land use do not occur that could result in unacceptable exposures to residual contamination.

Specific RAOs associated with the selected remedy and the method for achieving the objectives through 300-FF-1 OU remedial actions are summarized in Table 2-1.

The EPA issued an ESD to the 300-FF-1 ROD in December 1999, granting a site-specific treatability variance for Landfill 1D (Waste Information Data System [WIDS] site 628-4) so that a small quantity of soil and debris (925 m^3 [1,210 yd^3]) could be removed from the 300 Area and disposed of in the ERDF. The soils met the criteria for a *Resource Conservation and Recovery Act of 1976* (RCRA) Land Disposal Restriction (LDR) treatability variance under 40 *Code of Federal Regulations* (CFR) 268.44(h). The ESD resulted in a reduction in cleanup cost and complexity while maintaining protection for human health and the environment. This is the only modification to the remedy selection decision document that has occurred since the ROD was signed.

Table 2-1. 300-FF-1 Operable Unit Cleanup Objectives.

Remedial Action Objective	300-FF-1 Compliance Methods
Protect human and ecological receptors from exposure to contaminants in soil and debris by exposure, inhalation, or ingestion of radionuclides, metals, or organics.	Achieve MTCA cleanup levels for chemical constituents in soil to support industrial land use (WAC 173-340-745). Achieve human health standards of less than 15 mrem/yr above background for radionuclides in soil.
Protect human and ecological receptors from exposure to contaminants in the groundwater and control sources of groundwater contamination in the operable unit to minimize future impacts to groundwater resources.	Achieve residual soil levels after remediation that will not result in further degradation of groundwater quality.
Protect the Columbia River such that contaminants in the groundwater or remaining in the soil after remediation do not result in an impact to the Columbia River that could exceed the Washington State Surface Water Quality Standards.	Prevent further degradation of groundwater quality.

MTCA = *Model Toxics Control Act*
WAC = *Washington Administrative Code*

2.4 ESTIMATED COST AND DURATION

A rough-order-of-magnitude (ROM) cost estimate totaling $27.3 million was published in the 300-FF-1 ROD (EPA 1996) for implementation of the selected remedy. The ROM estimate was considered accurate to plus 50%, minus 30%, and was subdivided into costs for process waste site and burial ground groupings. The process waste site grouping cost estimate was $24 million, including the 300 Area Process Trenches, South Process Pond, North Process Pond and Scraping Disposal Area, Ash Pits, Landfill 1A, Landfill 1B, and Landfill 1D. The burial ground cost estimate was $3.3 million for the 618-4 Burial Ground. All values were present value costs, estimated for mid-1994.

Remedial actions for excavation and disposal of the process waste site grouping were estimated to be complete in 4 to 7 years. Excavation and disposal of the 618-4 Burial Ground contents was estimated to be complete in 3 years.

2.5 REMEDIAL DESIGN SUMMARY

The general design for the OU was established by the *300-FF-1 Remedial Design Report/Remedial Action Work Plan* (300-FF-1 RDR/RAWP) (DOE-RL 1997). In 2002, the *Remedial Design Report/Remedial Action Work Plan for the 300 Area* (300 Area RDR/RAWP) (DOE-RL 2002b) was issued to update the design for remaining actions at the 300-FF-1 OU and to establish the design for planned actions at the 300-FF-2 OU.

3.0 CHRONOLOGY OF EVENTS

A chronology of the major events associated with remedial actions at the 300-FF-1 OU is presented in Table 3-1, beginning with signature of the ROD in 1996 and ending with completion of backfill/revegetation operations in 2004. The chronology includes information on issuance of infrastructure documents, initiation and completion of field operations, and issuance of closeout documents. A summary of the 300-FF-1 OU events by waste site is depicted in Figure 3-1.

Table 3-1. 300-FF-1 Operable Unit Chronology. (3 Pages)

Date	Event
July 1996	*300-FF-1 and 300-FF-5 Operable Unit Record of Decision* issued (EPA 1996).
February 1997	*300-FF-1 Remedial Design Report/Remedial Action Work Plan* issued (DOE-RL 1997). Sampling and analysis plan included as Appendix C.
June 1997	Mobilization of Weston personnel and equipment completed as remedial action subcontractor for the 300-FF-1 OU. Test pit/trench excavations initiated at the South Process Pond (WIDS site 316-1), North Process Pond (WIDS site 316-2), 300 Area Process Trenches (WIDS site 316-5), North Process Pond Scraping Disposal Area (WIDS site 618-12), and 300 Area Ash Pits.
July 1997	Excavation operations initiated at the 300 Area Process Trenches.
September 1997	Test pit/trench excavations completed. Excavation operations and loadout of contaminated soil at the 300-10 (300-FF-2 OU), 300-44, and 300-45 (300-FF-2 OU) sites completed.
November 1997	Excavation operations and loadout of contaminated soil initiated at Landfill 1D (WIDS site 628-4). Work later suspended at 1D until safety evaluation could be performed; prompted by unexpected excavation of drummed liquid waste. Decision made to use Level B PPE at 300-FF-1 OU landfills (1A, 1B, and 1D) and 618-4 Burial Ground until adequate information exists to downgrade.
December 1997	Excavation operations resumed at Landfill 1D under Level B PPE. *Verification Package for the 300-FF-1 Operable Unit Ash Pits* issued (BHI 1997d). *300-FF-2 Waste Site 300-10 Verification Package* issued (BHI 1997c). *300-FF-1 Waste Site 300-44 Verification Package* issued (BHI 1997a). *300-FF-1 Waste Site 300-45 Verification Package* issued (BHI 1997b).
January 1998	Demobilization from Landfill 1D initiated pending identification of disposal pathway for large volume of excavated and stockpiled lead-contaminated soil. Mobilization to the 618-4 Burial Ground initiated.
February 1998	Excavation operations and loadout of contaminated soil at the 300 Area Process Trenches completed. Excavation operations initiated at the 618-4 Burial Ground.
March 1998	*300 Area Process Trenches Verification Package* issued (BHI 1998b).
April 1998	Excavation operations suspended at the 618-4 Burial Ground pending identification of a treatment and disposal pathway for 338 drums containing depleted uranium waste that were removed from the site.

Table 3-1. 300-FF-1 Operable Unit Chronology. (3 Pages)

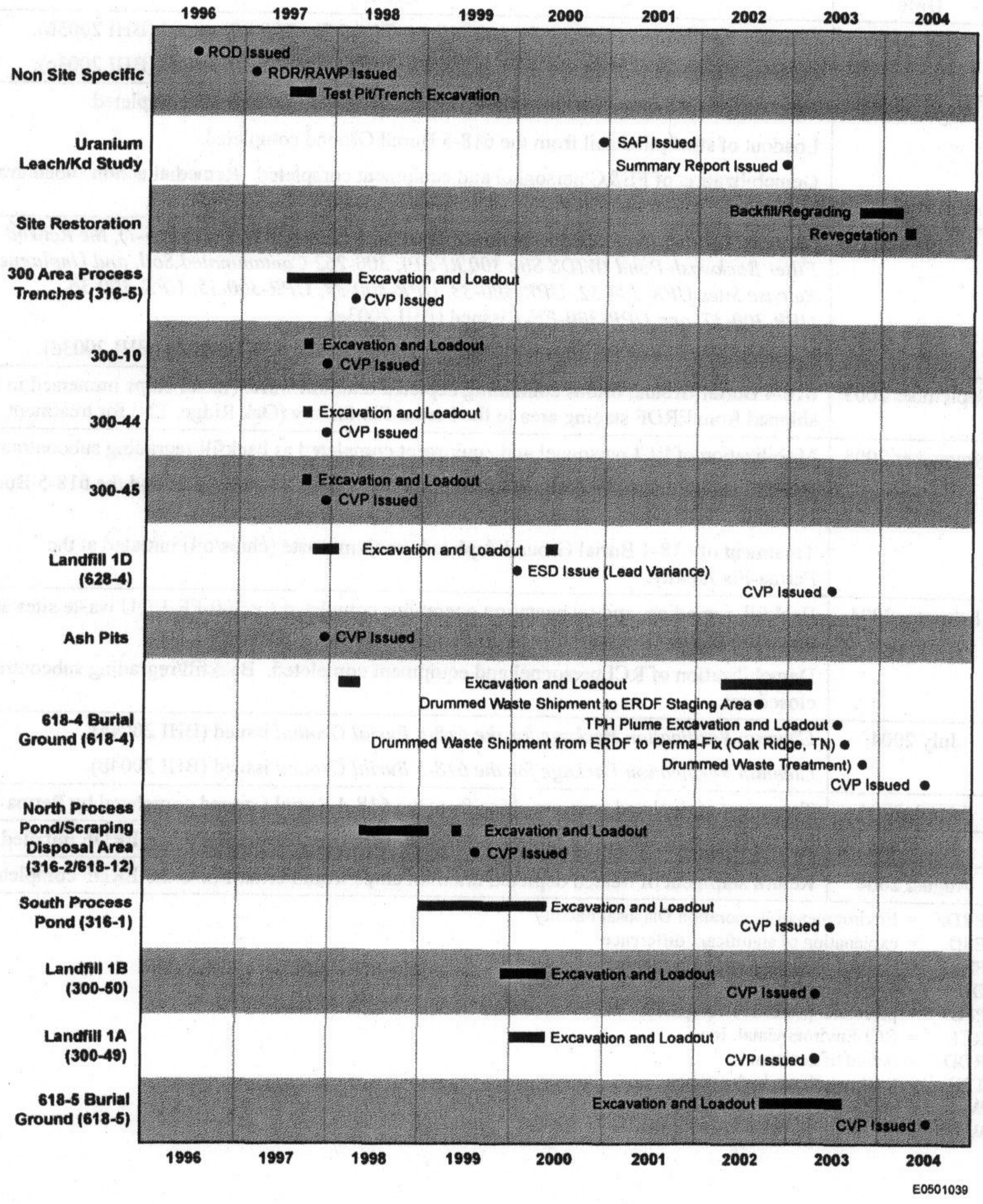
Date	Event
May 1998	Excavation operations initiated at the North Process Pond. *Vadose Zone Clean Closure Report for the 300 Area Process Trenches* issued (BHI 1998f) to supplement verification package.
January 1999	Excavation operations shifted from the North Process Pond to the South Process Pond (WIDS site 316-1) pending resolution of contractual issues with remedial action subcontractor. Excavation operations initiated at the South Process Pond.
March 1999	*Treatment/Disposal Plan for Drummed Waste from the 300-FF-1 Operable Unit, 618-4 Burial Ground* issued (BHI 1999b).
June 1999	Remedial action subcontractor remobilized to North Process Pond. Excavation operations and loadout of contaminated soil at North Process Pond completed.
August 1999	*300-FF-1 Operable Unit, North Process Pond/Scraping Disposal Area Verification Package* issued (BHI 1999a).
December 1999	Excavation operations initiated at Landfill 1B (WIDS site 300-50).
January 2000	Excavation operations initiated at Landfill 1A (WIDS site 300-49). ESD issued to the 300-FF-1 ROD to establish treatability variance for lead-contaminated soil from Landfill 1D and authorize direct disposal at ERDF (EPA 2000).
June 2000	Excavation operations and loadout of contaminated soil at South Process Pond, Landfill 1A, Landfill 1B, and Landfill 1D completed. Demobilization of Weston personnel and equipment completed; remedial action subcontract terminated.
December 2000	*Sampling and Analysis Plan for the 300 Area Uranium Leach/Kd Study* issued (DOE-RL 2002c).
April 2002	*One-Time Request for Shipment for 618-4 Burial Ground Depleted Uranium Drums* issued (BHI 2002a). Mobilization of FE&C completed as remedial action subcontractor for remainder of the 618-4 Burial Ground and 618-5 Burial Ground. Excavation operations resumed at the 618-4 Burial Ground.
June 2002	*Remedial Design Report/Remedial Action Work Plan for the 300 Area* issued (DOE-RL 2002b). Document updated design for remaining 300-FF-1 actions and established approach for planned 300-FF-2 remedial actions.
September 2002	Excavation operations for removal of 618-4 Burial Ground contents to native soil completed. Transport of drummed depleted uranium waste to ERDF for disposal or interim staging completed.
October 2002	Excavation operations initiated at the 618-5 Burial Ground (300-FF-2 OU).
December 2002	*Protection of 300 Area Groundwater from Uranium-Contaminated Soils at Remediated Sites* issued (BHI 2002b).
January 2003	Plume of TPH contamination discovered at the 618-4 Burial Ground in native soil beneath the area where drums containing depleted uranium chips immersed in oil were unearthed and removed.
March 2003	Loadout of stockpiled contaminated soil and debris from the 618-4 Burial Ground completed. Excavation operations for removal of the 618-5 Burial Ground contents completed. *Treatment and Disposal Alternative Assessment/Implementation Plan for the 300-FF-1 Operable Unit Depleted Uranium Metal in Oil Drummed Waste* issued (BHI 2003h).

Table 3-1. 300-FF-1 Operable Unit Chronology. (3 Pages)

Date	Event
May 2003	*Cleanup Verification Package for Landfill 1A (WIDS Site 300-49)* issued (BHI 2003b). *Cleanup Verification Package for Landfill 1B (WIDS Site 300-50)* issued (BHI 2003c).
August 2003	Excavation and loadout of TPH plume from the 618-4 Burial Ground completed. Loadout of stockpiled soil from the 618-5 Burial Ground completed. Demobilization of FE&C personnel and equipment completed. Remedial action subcontract closed out.
July 2003	*Cleanup Verification Package for the South Process Pond (WIDS Site 316-1), the Retired Filter Backwash Pond (WIDS Site 300 RFBP), 300-262 Contaminated Soil, and Unplanned Release Sites UPR-300-32, UPR-300-33, UPR-300-34, UPR-300-35, UPR-300-36, UPR-300-37, and UPR-300-FF-1* issued (BHI 2003e). *Cleanup Verification Package for Landfill 1D (WIDS Site 628-4)* issued (BHI 2003d).
September 2003	618-4 Burial Ground drums containing depleted uranium waste (metal chips immersed in oil) shipped from ERDF staging area to the Perma-Fix facility (Oak Ridge, TN) for treatment.
November 2003	Mobilization of RCI personnel and equipment completed as backfill/regrading subcontractor. Backfill and regrading operations initiated for 300-FF-1 OU waste sites and the 618-5 Burial Ground. Treatment of 618-4 Burial Ground depleted uranium waste (chips/oil) initiated at the Perma-Fix facility.
February 2004	Backfill, regrading, and revegetation operations completed for 300-FF-1 OU waste sites and the 618-5 Burial Ground. Demobilization of RCI personnel and equipment completed. Backfill/regrading subcontract closed out.
July 2004	*Cleanup Verification Package for the 618-4 Burial Ground* issued (BHI 2004a). *Cleanup Verification Package for the 618-5 Burial Ground* issued (BHI 2004b).
March 2004	Treatment of depleted uranium chips from the 618-4 Burial Ground completed by Perma-Fix.
June 2004	Return shipment of treated depleted uranium chips from Perma-Fix to the ERDF initiated.
August 2004	Return shipment of treated depleted uranium chips from Perma-Fix to the ERDF completed.

ERDF = Environmental Restoration Disposal Facility
ESD = explanation of significant difference
FE&C = Federal Engineers and Constructors
OU = operable unit
PPE = personnel protective equipment
RCI = RCI Environmental, Inc.
ROD = record of decision
TPH = total petroleum hydrocarbon
Weston = Roy F. Weston
WIDS = Waste Information Data System

Figure 3-1. Summary of Major 300-FF-1 Operable Unit Events.



4.0 CONSTRUCTION ACTIVITY SUMMARY

Field operations supporting remedial actions at the 300-FF-1 OU began in July 1997 and were completed in February 2004. The work was performed under two separate remedial action subcontracts awarded to Roy F. Weston (Weston) and Federal Engineers and Constructors (FE&C). The cleanup actions resulted in the disposal of more than 600,000 tons of contaminated soil and debris at the ERDF from the 300-FF-1 OU waste sites and three 300-FF-2 OU waste sites that were addressed as part of the 300-FF-1 OU field operations. Summaries of the excavation operations and disposal activities for each waste site are presented in Tables 4-1 and 4-2, respectively. Results of pre- and post-excavation civil surveys of the waste site areas are depicted in Figures 4-1 and 4-2, respectively. Additional information associated with the waste sites and construction activities is presented in the following subsections.

Table 4-1. Remedial Action Approach.

Site	Site Code	Site Type	Remedial Action Subcontractor	Excavation Approach	PPE
Process Trenches	316-5	Effluent disposal	Weston	Direct load	Level D
300-10[a]	300-10	Surface contamination	Weston	Direct load	Level D
300-44	300-44	Surface contamination	Weston	Direct load	Level D
300-45[a]	300-45	Surface contamination	Weston	Direct load	Level D
North Process Pond	316-2	Effluent disposal	Weston	Direct load	Level D
South Process Pond	316-1	Effluent disposal	Weston	Direct load	Level D
Landfill 1A	300-49	Solid waste disposal pit	Weston	Sort, stockpile, load	Level B
Landfill 1B	300-50	Solid waste disposal pit	Weston	Sort, stockpile, load	Graded Level B
Landfill 1D	628-4	Solid waste disposal/burn pit	Weston	Sort, stockpile, load	Level D, Level B
618-4 Burial Ground	618-4	Solid waste disposal pit	Weston, FE&C	Sort, stockpile, load	Level B
618-5 Burial Ground[a]	618-5	Solid waste disposal/burn pit	FE&C	Sort, stockpile, load	Graded Level B

[a] 300-FF-2 waste site remediated as part of 300-FF-1 remedial action operations.
FE&C = Federal Engineers and Constructors
PPE = personal protective equipment
Weston = Roy F. Weston

Table 4-2. ERDF Waste Disposal Summary for the 300-FF-1 Operable Unit.

Site	Site Code	Radioactive Soil/Debris (Direct Disposal)[d] (U.S. tons)	Hazardous or Mixed Soil (Stabilization) (U.S. tons)	Hazardous or Mixed Debris (Macroencapsulation) (U.S. tons)	Total[c] (U.S. tons)
Process Trenches	316-5	37,961	--	--	37,961
300-10[a]	300-10	1,993	--	--	1,993
300-44	300-44	451	--	--	451
300-45[a]	300-45	224	--	--	224
North Process Pond	316-2	154,825	--	--	154,825
South Process Pond	316-1	256,888	--	--	256,888
Landfill 1A	300-49	15,897	--	--	15,897
Landfill 1B	300-50	39,302	--	--	39,302
Landfill 1D	628-4	6,199[b]	--	--	6,199
618-4 Burial Ground	618-4	35,856	15,220	290	51,366
618-5 Burial Ground[a]	618-5	45,807	4,496	627	50,930
	Totals	595,403	19,716	917	616,036

[a]300-FF-2 waste site remediated as part of 300-FF-1 remedial action operations.
[b]Total value includes 4,530 U.S. tons of lead-contaminated soil shipped to ERDF for direct disposal under the Landfill 1D treatability variance.
[c] Listed waste quantities as weighed at 300 Area remedial action project scale prior to ERDF transport.
[d] Listed quantities include any unplanned releases that were addressed with the site.
ERDF = Environmental Restoration Disposal Facility

Figure 4-1. 300-FF-1 Operable Unit Pre-Excavation Topography.

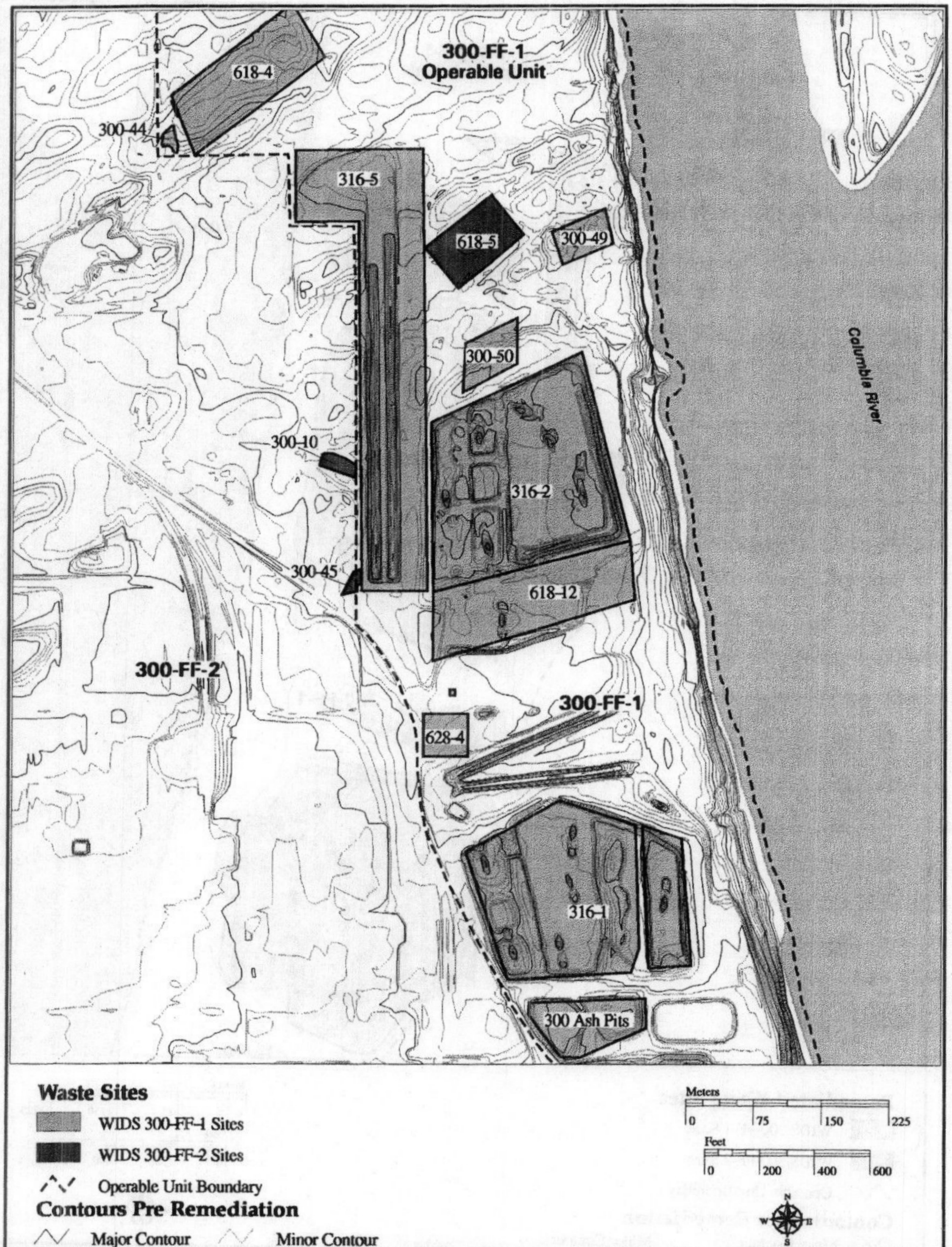
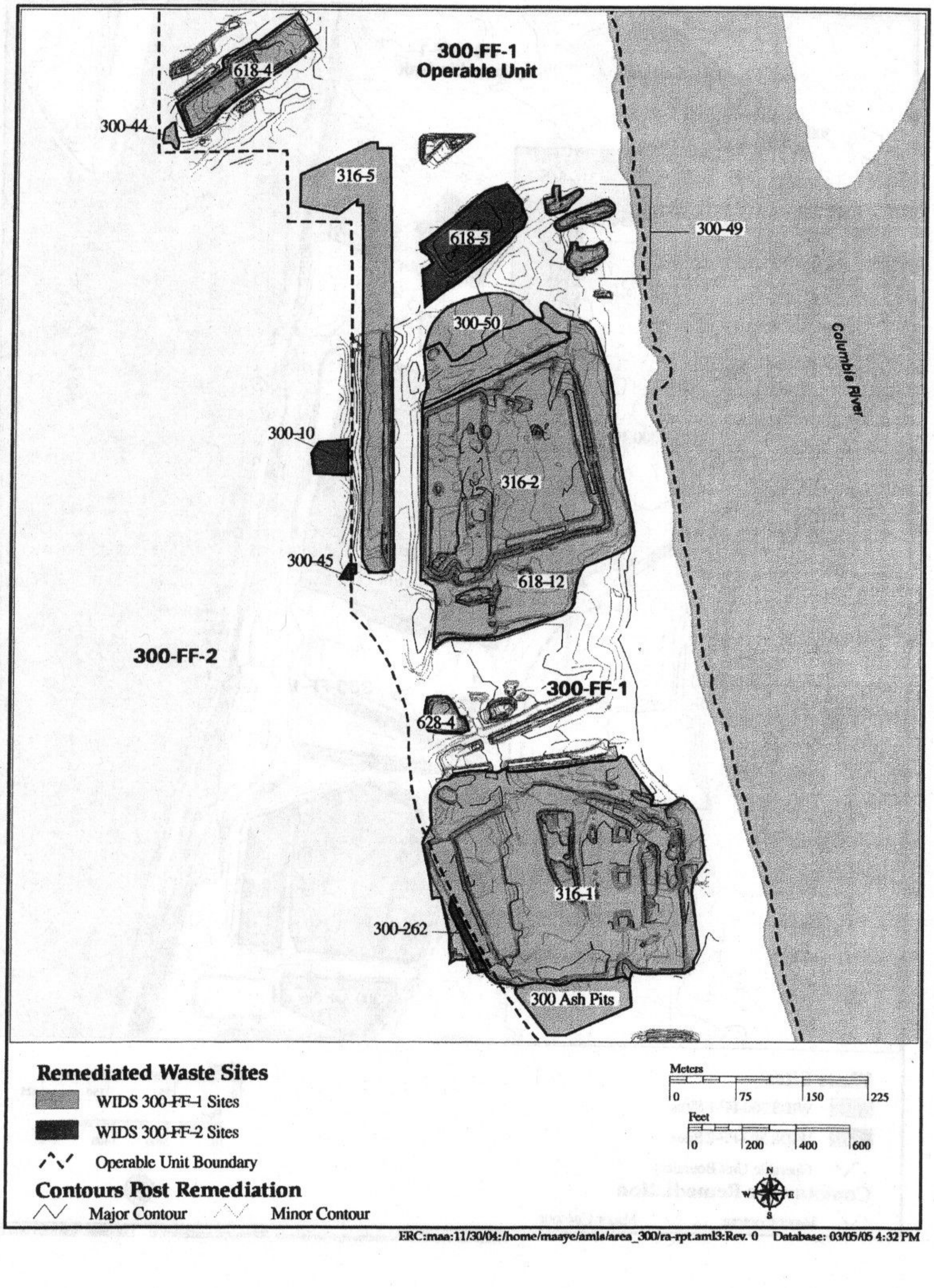


Figure 4-2. 300-FF-1 Operable Unit Post-Excavation Topography.



4.1 TEST PIT/TEST TRENCH EXCAVATION

Where remedial investigation data were insufficient to determine if cleanup was required, test pits and test trenches were prescribed by the 300-FF-1 RDR/RAWP (DOE-RL 1997) for additional data collection. The test trench and test pit excavation operations were conducted between June and September 1997 under the Weston subcontract. Test trenches were excavated through the perimeter dikes and interior berms of the South Process Pond and North Process Pond. Test pits were excavated in the Process Trenches (WIDS site 316-5) spoils area, North Process Pond Scraping Disposal Area (WIDS site 618-12), and Ash Pits. Survey and sample results from the test pit and test trench excavations were used to help define excavation limits where cleanup was required or to support a no action decision and/or closeout of the waste site.

4.2 300 AREA PROCESS TRENCHES

4.2.1 History

The 300 Area Process Trenches (APT) were a RCRA treatment, storage, and disposal (TSD) unit on the western boundary of the 300-FF-1 OU toward its northern end. The 300 APT consisted of two parallel unlined trenches approximately 468 m (1,535 ft) long, 3 m (10 ft) wide, 3.7 m (12 ft) deep, and spaced 15 m (50 ft) apart. Until 1991, there was a 30-m (90-ft) by 50-m (150-ft) by 3-m (10-ft) depression located in the northwest corner of the west trench. Process sewer effluent reached the trenches through a 61-cm (24-in.)-diameter clay pipe connected to a concrete weir box located at the south end of the trenches.

The 300 APT became active in 1975 as a replacement for the North and South Process Ponds, which were also addressed as part of the 300-FF-1 OU. The trenches received 300 Area process effluent from the uranium fuel fabrication facilities. Waste from the 300 Area laboratories that was determined to be below discharge limits based on monitoring performed at the 307 retention basin was also released to the trenches. From the beginning of operations in 1975 until 1993, a continuous composite sampler was located at the headwork structure to analyze process effluent at the point of discharge. After 1993, the effluent was analyzed outside of the unit. All of the effluent either infiltrated the soil column or evaporated as there was no outlet from the trenches.

The trenches gained RCRA interim status as the 300 APT TSD and were administratively closed to discharges of dangerous waste in 1985. Discharge to the 300 APT was permanently discontinued in December 1994 in support of the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) Milestone M-17-10 (Ecology et al. 1989). Since that time, the 300 Area effluents have been directed to the 300 Area Treated Effluent Disposal Facility or transported to the 200 Area for disposal.

In 1991, an ERA was performed to reduce the migration of radioactive and inorganic (heavy metals) contaminants to groundwater. The ERA uniformly excavated approximately 0.3 m (1 ft) and 1.3 m (4 ft) of contaminated soil from the sides and bottom of each trench, respectively. The contaminated material was stockpiled in the northwest corner of the west trench and the north end of the east trench (referred to as a spoils area). Based on process history, the Part A submitted by RL assigned several listed waste codes to the stockpiled soil. The stockpiled soil was covered with plastic and aggregate to allow continued operation of the trenches without flushing residual contaminants into the groundwater. Post-excavation sample results indicated that the ERA successfully reduced contamination in all areas of the trenches other than the spoils area as described in the *Expedited Response Action Assessment for the 316-5 Process Trenches* (DOE-RL 1992).

4.2.2 Excavation Operations

Remediation of the 300 APT included removal and disposal of bird screens covering the trenches, demolition and disposal of the headworks structure located at the southern end of the trenches, demolition and disposal of the blockhouse structure, and excavation and disposal of contaminated soil (including several unplanned release sites). Remediation activities were initiated in July 1997 and completed in February 1998 under the Weston subcontract. A remedial action summary for the process trenches is presented in Table 4-3 and the following subsections.

Table 4-3. Process Trenches Remedial Action Summary.

Item	Disposal Facility	Quantity (metric tons)
Bird screens	ERDF	158
Headworks – Concrete structure, clay pipe, handrails, and grating	ERDF	547
Blockhouse structure	ERDF	84
Contaminated soil – Spoils area (ACL) – Undetermined area (UCL) – Headworks sediment	 ERDF ERDF ERDF	 24,319 9,278 Six 208-L (55-gal) drums

ACL = above cleanup level
ERDF = Environmental Restoration Disposal Facility
UCL = undetermined contamination level

4.2.2.1 Removal and Disposal of Bird Screens. Bird screens used to minimize access to the process trench sediments were removed from the trenches and stockpiled. A determination was made that radiological release of the screens was not cost effective with respect to the disposal option. This determination was due to the porous nature of the wood screen frames and the associated radiological release criteria. Consequently, the bird screens removed from the two trenches were sized to meet waste acceptance criteria and were transported to the ERDF for disposal.

4.2.2.2 Demolition and Disposal of Headworks Structure. The headworks structure included a weir box, sluice gates, painted handrails and grating, and a clay inlet pipe. Prior to demolition of the concrete headworks weir box, a layer of fine sediments that had collected in the bottom of the structure was removed to minimize generation of dust during demolition activities. The sediments were containerized in six 208-L (55-gal) drums and set aside to permit the demolition to proceed. Disposition of the sediments from the headworks structure is discussed in Subsection 4.2.2.4.

Radiological survey results from the concrete surface indicated that portions of the headworks weir box had uranium contamination at levels that exceeded release criteria. Based on the survey results, a decision was made to dispose of the entire structure at the ERDF. The weir box was demolished using a hydraulic hammer. Representative samples of the radioactively contaminated concrete were collected to support a "contained-in" determination required from Ecology because the structure was in contact with 300 Area process effluents that contained listed wastes. The "contained-in" determination was granted by Ecology, with concurrence from the EPA, in a letter issued to RL (Ecology 1997). Based on the "contained-in" determination from Ecology, the concrete from the demolished headworks structure was transported to the ERDF for disposal.

Steel handrails and grating that were part of the headworks structure were covered with lead-based paint. A calculation was performed to document that the painted steel was not hazardous waste by toxicity characteristic. Because the metal surfaces had been covered with paint, the handrails and grating could not be released and were transported to the ERDF for disposal.

The clay inlet pipe that fed process effluent to the headworks structure was surveyed, and results indicated that the interior pipe surface had uranium contamination levels exceeding the cleanup criteria. In accordance with the 300-FF-1 RDR/RAWP (DOE-RL 1997), approximately 6 m (20 ft) of the pipe was removed between the headworks structure and the OU fence. Soil adjacent to the excavated pipe was surveyed and removed as necessary to meet the cleanup criteria. The clay pipe (with associated contaminated soil) and the sluice gates that had been removed earlier were transported to the ERDF for disposal based on a separate "contained-in" determination granted by Ecology to address the listed waste issue (Ecology 1998a).

4.2.2.3 Demolition and Disposal of Blockhouse Structure. Prior to demolition of the blockhouse east of the trenches, the roof structure was identified as suspect asbestos-containing material. A representative sample collected from the roof confirmed the presence of asbestos in the sample. The blockhouse roof was removed and demolished by trained asbestos workers, managed as asbestos-containing material, and transported to the ERDF for disposal. Radioactive contamination was found on the floor, walls, and ceiling of the structure that remained. Because decontamination of the structure was not cost effective, the concrete foundation, walls, and ceiling were demolished using a hydraulic hammer and transported to the ERDF for disposal.

4.2.2.4 Excavation and Disposal of Contaminated Soil. The remediation process for soil from the process trenches ERA spoils pile was divided into above cleanup level (ACL) and undetermined contamination level (UCL) areas. The listed waste codes that applied to the spoils pile were addressed by a conditional "contained-in" determination that was granted by Ecology

(Ecology 1995). The conditional "contained-in" determination stipulated disposal of the soil at an onsite landfill that met the minimum technical requirements of 40 CFR 264 (e.g., ERDF).

The ACL area consisted of stockpiled soil from the ERA that was known to exceed the cleanup levels (e.g., the western portion of the pile). The remediation strategy for this area was to remove the soil down to the original topography. Contaminated soil weighing more than 24,300 metric tons was excavated from the process trenches ACL area and transported to the ERDF for disposal. A radiological survey was performed to confirm that excavation was complete. Verification samples were then collected from the ACL area as specified in the 300-FF-1 RDR/RAWP (DOE-RL 1997).

In the UCL area (e.g., the eastern portion of the ERA spoils pile), six test pits were excavated at the locations specified in the 300-FF-1 RDR/RAWP (DOE-RL 1997) to guide the excavation process. Field screening and/or laboratory sample results from five of the six test pits indicated that excavation and removal of contaminated soil was required. Screening and sample results from the southernmost test pit (APT-6; east 594,070/north 116,816) indicated that the soil was below cleanup levels (BCL). Consequently, the EPA and RL agreed to leave the soil in the vicinity of the southernmost test pit in place once screening results from excavation activities to the north indicated that soil was below the cleanup levels.

The "Confirm as Clean" procedure described in the 300-FF-1 RDR/RAWP (DOE-RL 1997) was implemented for the remainder of the process trenches UCL area. Soil was excavated in 0.3-m (1-ft) lifts. At the completion of each lift, the remaining soil was surveyed to determine if additional excavation was required. Contaminated soil weighing over 9,200 metric tons (9,055 U.S. tons) was excavated from the process trenches UCL area and transported to the ERDF for disposal. A radiological survey was performed to confirm that excavation was complete. Verification samples were then collected from the UCL area.

Verification sample results from the UCL area indicated the existence of a small "hot spot" where uranium concentrations exceeded the cleanup level at one of the sample locations (east 594,070/north 116,857). A radiological survey of the area was performed to determine the extent of the "hot spot." Approximately 55 metric tons of contaminated soil were excavated from the "hot spot" and transported to the ERDF for disposal. A final radiological survey was then performed to confirm that the removal was complete. Consistent with agreements made at the December 1997 Unit Managers Meeting (UMM) (BHI 1998e), a new verification sample was then collected from the previous "hot spot" location.

The sediments from the headworks structure included visible paint chips that had fallen from the handrails of the structure. Because of a potential that the sediments/paint chips included concentrations of lead above regulatory limits, a representative sample was collected prior to removal. The material was then containerized in the six drums and managed as suspect material until a final designation was complete based on analytical results. The sediments were designated as nonhazardous and were subsequently transported to the ERDF for disposal as radioactive waste in accordance with a contained-in determination granted by Ecology (Ecology 1998b).

An independent assessment of the remedial action activities was performed by a registered professional engineer to verify that the *Washington Administrative Code* (WAC) 173-303-610 closure requirements were met during the process. The assessment included review of the closure plan documentation, biweekly meetings to exchange information and data, and site visits to observe remediation operations. Results of the independent certification were accepted by Ecology in 1998 (Ecology 1998c).

4.3 300-44 CONTAMINATION SITE

4.3.1 History

Waste site 300-44 was located west of the 618-4 Burial Ground at the north end of the 300-FF-1 OU and was posted as an Underground Radioactive Materials Area. The site consisted primarily of contaminated soil and was approximately 159 m^2 (1,711 ft^2) in area.

4.3.2 Excavation Operations

A layer of overburden ranging in depth from 0.3 to 0.9 m (1 to 3 ft) was removed prior to the excavation of waste site 300-44. The overburden was placed in a stockpile adjacent to the waste site on the east side. When excavation of the waste site was complete, two samples were collected from the overburden stockpile to confirm that the soil was acceptable to use as backfill material.

Waste site 300-44 was initially excavated to a depth of 0.3 m (1 ft) below grade based on the 300-FF-1 remedial design. The "Confirm as Clean" procedure in the 300-FF-1 RDR/RAWP (DOE-RL 1997) was then implemented to remove soil in 0.3-m (1-ft) lifts as needed to complete the excavation. After completion of the first lift, a radiological survey of the remaining soil was performed. Based on the survey results, it was determined that additional excavation was not required. Contaminated soil removed from waste site 300-44 was transported to the ERDF for disposal.

4.3.3 Verification Sampling

In accordance with the 300-FF-1 RDR/RAWP (DOE-RL 1997), verification sampling was not required to confirm cleanup of the 300-44 site. The stakeholders made this agreement based on the small size of the 300-44 site and its proximity to the 618-4 Burial Ground. At the discretion of the project manager, however, two random samples were collected in September 1997 and analyzed to verify that residual soil concentrations were within the cleanup standards. In November 1997, two random samples were collected from the adjacent overburden stockpile as documented on a 300 NPL Agreement/Change Control Form (control number 114).

The verification samples and stockpile samples were collected in accordance with the 300-FF-1 RDR/RAWP (DOE-RL 1997) and applicable procedures from BHI-EE-01, *Environmental*

Investigations Procedures. The sample collection activities were documented in field logbook number EL1395.

4.4 NORTH PROCESS POND

4.4.1 History

The North Process Pond (WIDS site 316-2) was originally a single, unlined infiltration basin that was later subdivided into six small settling ponds and one large infiltration basin over an area of approximately 40,000 m^2 (10 acres). The seven sections of the North Process Pond were separated by 3.7-m (12-ft)-wide interior dikes and were surrounded by a dike 4.6 m (15 ft) wide and approximately 3.0 m (10 ft) high on the exterior sides. Some of the subdividing dikes were later removed with a bulldozer to cover the bottom of the site. The inlet for the pond was in the southwest corner.

The North Process Pond was constructed and activated in 1948, following a dike failure at the existing South Process Pond. Both ponds operated until 1975, when they were replaced by the 300 APT. The site originally received cooling water and low-level liquid process waste directly from 300 Area fuel fabrication facilities and the early laboratories (313, 314, 3706, and 321 Buildings). Beginning in 1963, the North and South Process Ponds received laboratory waste via the 307 Retention Basins where waste that was above discharge limits was diverted to holding tanks for shipment and disposal in the Hanford Site 200 Area.

There was no effluent outlet from the North Process Pond. All of the effluent either infiltrated the soil column or evaporated. Lack of infiltration was a problem for the pond. Between 1948 and 1969, the basins were periodically dredged to improve infiltration when sludge in the bottom of the pond slowed the percolation rate. The sludge contained large amounts of uranium and copper and was deposited on the pond dikes and put in the Scraping Disposal Area (WIDS site 618-12) at the south end of the North Process Pond or put into Landfill 1B (WIDS site 300-50) at the north end. The Scraping Disposal Area was also used for disposal of contaminated soil that was excavated beneath the 321 Building during a hydraulic core mockup. The Scraping Disposal Area was subsequently backfilled with coal ash and covered with fill. During operation, there were several unplanned releases to the North Process Pond as identified in the WIDS database.

After deactivation of the North Process Pond in 1975, some of the dikes were removed to cover the basin soil and minimize the potential for contaminant migration via fugitive dust. Parts of the pond were also used for the disposal of flyash from the 300 Area Ash Pits (WIDS site 300 Ash Pits).

4.4.2 Excavation Operations

Remediation of the North Process Pond included removal and disposal of the tank and weir structure at the southwest corner of the pond as well as excavation and disposal of contaminated soil. The pond was divided into ACL, BCL, and UCL areas based on data collected during the remedial investigation. The UCL area included the Scraping Disposal Area.

Remediation activities were initiated in May 1998 and continued into January 1999, when a decision was made to suspend excavation activities at the North Process Pond and mobilize work crews to the South Process Pond pending resolution of contractual issues with the remedial action subcontractor. Work crews remobilized to the North Process Pond and completed excavation activities in June 1999. A remedial action summary for the North Process Pond is presented in Table 4-4.

Table 4-4. North Process Pond Remedial Action Summary.

Item	Disposition	Quantity (metric tons)
Tank and weir structure	ERDF	Included in ACL total
Contaminated soil (ACL area)	ERDF	109,586 (includes 29,675 attributed to plume)
Contaminated soil (BCL area)	ERDF	Included in UCL total
Contaminated soil (UCL area)	ERDF	29,618
Clean soil (sorted during excavation in the ACL and UCL areas)	Stockpiled within AOC	5,644

ACL = above cleanup level
AOC = area of contamination
BCL = below cleanup level
ERDF = Environmental Restoration Disposal Facility
UCL = undetermined contamination level

During excavation of contaminated soil in the pond areas, potential contamination associated with five unplanned releases identified in the WIDS database was addressed. In addition, cleanup was completed at a nearby site where a small tanker truck spill was documented. The remediation processes for the primary areas of the North Process Pond (including the Scraping Disposal Area) are discussed in the following subsections.

4.4.2.1 Tank and Weir Structure. A determination was made that the tank and weir structure at the southwest corner of the North Process Pond could not be released based on the media and its process history. The structure was removed and transported to the ERDF for disposal.

4.4.2.2 Above Cleanup Level Area. The ACL area consisted of soil in the western portion of the North Process Pond that was known to be above the cleanup levels. The ACL area was further subdivided into four cells, A through D. Excavation elevations were established for each cell based on the remedial investigation borehole and test pit results (DOE-RL 1993). The remediation strategy for this area was to remove contaminated soil to the design elevation in each cell.

Contaminated soil weighing 109,586 metric tons was excavated from the North Process Pond ACL area and transported to the ERDF for disposal. Radiological surveys were performed in each cell at the design elevation to confirm that excavation was complete. The surveys identified a plume of contamination below the design elevation in the southwest cell (Cell C) that exceeded cleanup levels. Of the total tonnage excavated from the ACL area and sent to the ERDF for disposal, approximately 29,600 metric tons of contaminated soil was attributed to the plume. In the southwest corner of the cell, depth of the plume approached the groundwater table. During excavation of the plume, some BCL soil was removed (guided by radiological surveys) to maintain a safe side slope and obtain access to the deeper, contaminated soil of the plume. More than 5,600 metric tons of BCL material (including BCL material sorted during removal of the interior dike) was stockpiled within the North Process Pond area of contamination (AOC). When radiological surveys indicated that excavation was complete based on the remediation goals, verification samples were collected from the ACL area as specified in the 300-FF-1 RDR/RAWP (DOE-RL 1997).

4.4.2.3 Below Cleanup Level Area. During remedial design, the eastern half of the pond was established as a BCL area based on subsurface results from remedial investigation test pits and boreholes (DOE-RL 1993). Radiological surveys of the surface soil that were conducted as part of preparation activities for remedial action at the North Process Pond identified surface contamination that required removal in the northwest corner of the BCL area where a flume connected the settling basin to the main pond. The surface surveys also identified contaminated soil in a trench that made up portions of the southern and eastern borders of the BCL area. The function of the trench was unknown. The earliest aerial photograph of the trench was in 1962, but it may have existed previously, covered under water.

The recommendations for remediation of the BCL area (including copies of the radiological surveys) were provided in an attachment to the May 1998 UMM minutes (BHI 1998e). The strategy consisted of removal of a 0.3-m (1-ft) lift of soil predetermined to be contaminated material and subsequent use of the "Confirm as Clean" procedure described in the 300-FF-1 RDR/RAWP (DOE-RL 1997) to determine if additional excavation was required. Approval of the remediation strategy was documented by the Tri-Parties via signature of the June 1998 UMM minutes (BHI 1998e).

A single 0.3-m (1-ft) lift of contaminated soil was excavated from the northwest corner of the BCL area and was transported to the ERDF for disposal. Following removal of the lift, radiological surveys identified that further excavation of the area was not needed. Excavation of three to four 0.3-m (1-ft) lifts was required in various parts of the contaminated trench in the BCL area until radiological surveys indicated that residual contamination levels met the remediation goals. The contaminated material was transported to the ERDF for disposal. When excavation was complete, verification samples were collected from the BCL area as specified in the 300-FF-1 RDR/RAWP (DOE-RL 1997).

4.4.2.4 Undetermined Contamination Level Area. The UCL area of the North Process Pond included the following areas:

- Eastern side of the interior dike that separated the main pond (BCL area) from the settling basins (ACL area)
- Eastern berm and portions of the southern and northern berms of the main pond area
- Scraping Disposal Area south of the pond.

In accordance with the 300-FF-1 RDR/RAWP (DOE-RL 1997) trenches and test pits were excavated in June and July 1997 to determine the need for remediation in the UCL area. Seven trenches were excavated through the dikes and berms of the pond, and eight test pits were excavated in the Scraping Disposal Area (WIDS site 618-12) at the south end of the pond at the locations. Results from the trenches and test pits as well as recommendations for remediation strategies in the UCL area were documented in the May 1998 UMM minutes (BHI 1998e). Samples were collected at the bottom of each trench and test pit to support the verification process in the event that a no action determination was made for the berms and/or Scraping Disposal Area.

Based on survey results, a small hot spot was identified at a depth of approximately 2.1 m (7 ft) in test pit 8 of the Scraping Disposal Area. Hot spots were not identified in any of the other test pits. Statistical analysis of test pit results showed that the Scraping Disposal Area was below the cleanup level and did not require remediation. However, removal of the hot spot was recommended. Results from trenches excavated through the eastern berm and portions of the southern and northern berms indicated that the berms consisted of original construction materials and pond scrapings that were below the cleanup level. No remediation was recommended in these areas. Intermittent contamination exceeding cleanup levels was identified in trenches excavated through the interior dike, resulting in a recommendation to remove the dike in accordance with the UCL process specified in the 300-FF-1 RDR/RAWP (DOE-RL 1997). These recommendations were approved by the Tri-Parties via signature of the June 1998 UMM minutes (BHI 1998e).

Contaminated soil from the hot spot at the location of test pit 8 in the Scraping Disposal Area was removed and sent to the ERDF. Removal of the interior dike was performed in sections using 0.3-m (1-ft) lifts. Radiological surveys were performed during removal of the dike to sort BCL from ACL material. Including material sorted during excavation of the contaminated plume, approximately 5,500 metric tons of BCL soil was stockpiled within the AOC. Removal of the interior dike generated more than 29,600 metric tons of contaminated soil that was transported to the ERDF for disposal. A radiological survey was performed to confirm that excavation was complete in the UCL area.

4.4.3 Verification Sampling

Verification samples were collected in accordance with the 300-FF-1 RDR/RAWP (DOE-RL 1997) and applicable procedures from BHI-EE-01, *Environmental Investigations Procedures*. The ACL and BCL area samples were documented in field logbook number EL-1395. The UCL area samples were collected from trenches and test pits documented in field logbook number EFL-1133.

4.5 SOUTH PROCESS POND

4.5.1 History

The South Process Pond site was a large infiltration pond used for disposal of liquid wastes generated by the 300 Area fuel fabrication facilities and the water treatment plant. Combined process waste discharges to the South and North Process Ponds ranged from 1,514,000 to 11,360,000 L/day (400,000 to 3,000,000 gal/day). The South Process Pond occupied an area approximately 34,240 m^2 (368,400 ft^2).

The original 316-1 South Process Pond was built in 1943 and was the first 300 Area process liquid disposal unit. It was originally a single large infiltration pond to which dikes were later added, forming three settling ponds and a large main infiltration pond. The east lobe of the site was used by the 300 Area water treatment plant as a filter backwash pond (WIDS site 300 RFBP). Effluent discharges to the process ponds was stopped in 1975. During their operational life, the process ponds received thousands of kilograms of uranium as dissolved material and finely divided solids. Much of the uranium was carried with the infiltration water, but some remained in the pond soils.

4.5.2 Excavation Operations

The South Process Pond was divided into ACL, UCL, and BCL areas based on contaminant concentrations from the 1993 remedial investigation (DOE-RL 1993). Remediation activities began in 1997 with the excavation of trenches at locations around the site perimeter. Trenching was performed to assess the lateral extent of contamination. The majority of remedial excavation and disposal activities were conducted in 1999 and 2000. During remediation, soil was primarily removed from the area on the west side of the process pond near the former pond inlet. The two north-south parallel soil berms in the pond were removed, and areas to the south and west of the original pond boundaries were removed during remediation. Contaminated soil that was removed adjacent to utility poles located in the South Process Pond was immediately replaced with clean material to maintain the integrity of the poles.

West of the South Process Pond, contaminated soil was discovered during excavation activities for pipeline utility work. The contaminated soil was suspected to be scrapings from the South Process Pond and was placed into the pipeline excavation during the utility work. The soil was identified as site 300-262 and assigned to the 300-FF-2 OU. During remediation of the South

Process Pond, the pipeline and contaminated soils were removed. Consequently, remediation of the 300-262 site was completed with the remediation of the South Process Pond.

Excavation and disposal operations at the South Process Pond were completed in June 2000. The general elevation at the bottom of the excavation used for analysis was 111.3 m (365 ft) (North American Vertical Datum of 1988) upon completion. The excavation depth was approximately 5.7 m (19 ft). Approximately 234,000 metric tons (257,000 tons) of material from the site were disposed at the ERDF.

4.5.3 Verification Samples

Verification samples were collected in accordance with the 300-FF-1 RDR/RAWP (DOE-RL 1997) and applicable procedures. The South Process Pond verification sampling is documented in the 300-FF-1 EL-1395 series field logbooks. All verification samples, with the exception of overburden samples, were collected from locations within the waste site. Sampling locations were randomly determined.

4.6 LANDFILL 1A

4.6.1 History

Landfill 1A was a former dumping area identified as waste site 300-49 in WIDS, located southeast of the 618-5 Burial Ground near the bank of the Columbia River. It consisted of three parallel east/west-oriented trenches in a rectangular area approximately 104 m (344 ft) long and 75 m (246 ft) wide. The site was identified as an undocumented landfill in 1990 during the 300-FF-1 OU remedial investigation (DOE-RL 1993). The original purpose of the landfill and its period of operation are unknown.

Review of historical aerial photographs suggested that the site was active in 1948. It is believed that the site was used for random disposal of miscellaneous waste from laboratory operations in the 300 Area. Surface observations prior to site remediation denoted areas of subsidence and visible debris (e.g., empty laboratory-type bottles and glassware that appeared to be of a laboratory origin, metal scraps, and a partially buried drum). Based on the location along the Columbia River and regional Native American history, the undisturbed land areas near Landfill 1A were considered culturally sensitive.

4.6.2 Excavation Operations

Remedial action at the Landfill 1A site began in January 2000. Excavation at the site involved removing the overburden (scraped surface) soils, buried landfill waste, and commingled soil. The buried landfill waste was sorted and stockpiled until approved for loadout. A detailed listing of removed landfill waste is included in field logbook series EL-1395 and project files. All visible buried debris was removed from the Landfill 1A site. Based on field screening, overburden materials and commingled soil identified as potentially clean were placed in stockpiles for potential use as backfill. Contaminated soil and buried waste and debris were sent to the ERDF for disposal.

Excavation of the Landfill 1A site was completed in June 2000. The general elevation at the bottom of the excavation was 109.8 m (360 ft) upon completion. The excavation depth was approximately 3 m (10 ft). Approximately 17,761 metric tons (19,578 tons) of material from the site were disposed at the ERDF.

4.6.3 Verification Samples

Final cleanup verification samples were collected after the final site radiological mapping survey indicated low contaminant variability. Verification samples were collected in accordance with the 300-FF-1 RDR/RAWP (DOE-RL 1997) and applicable procedures from BHI-EE-01, *Environmental Investigations Procedures*. Landfill 1A verification sampling is documented in field logbook number EL-1395-4. All verification samples were collected from random locations within and at the bottom of the waste site trenches.

4.7 LANDFILL 1B

4.7.1 History

Landfill 1B (WIDS site 300-50) was a former dumping area located directly north of the North Process Pond. The site was identified as an undocumented landfill in 1990 during the 300-FF-1 OU remedial investigation (DOE-RL 1993) and occupied an area greater than 10,000 m^2 (107,600 ft^2). Although there were no available records to document its purpose or period of operation, historical aerial photographs suggested that the site was active in 1953. Geophysical surveys performed in 1992 as part of the 300-FF-1 OU remedial investigation identified the presence of several discrete objects within the Landfill 1B boundary (WHC 1992).

A conservative pre-remediation boundary for Landfill 1B was established during remedial design (DOE-RL 1997). Subsequent geophysical and radiological survey results prior to and during remediation were used to establish the post-remediation boundaries for Landfill 1B, as documented in a *300 NPL Agreement/Change Control Form* (BHI 1998a).

4.7.2 Excavation Operations

Remedial actions at the Landfill 1B site began in December 1999. Excavation at the site involved removing the overburden (scraped surface) soils, buried landfill waste, and commingled soil. The buried landfill waste was sorted and stockpiled until approved for loadout. A detailed listing of removed landfill waste is included in field logbook series EL-1395 and project files. All visible buried debris was removed from the Landfill 1B site. Based on field screening, overburden materials and commingled soil identified as potentially clean were placed in stockpiles for potential use as backfill. Contaminated soil and buried waste and debris were sent to ERDF for disposal.

Excavation of the Landfill 1B site was completed in June 2000. The general post-remediation elevation at the bottom of the excavation was 109.0 m (357 ft) (North America Vertical Datum of 1988) upon completion. The excavation depth was approximately 3.1 m (10 ft). Approximately 35,652 metric tons (39,299 tons) of material from the site were disposed at the ERDF.

4.7.3 Verification Samples

Final cleanup verification samples were collected after a radiological mapping survey indicated low contaminant variability. Verification samples were collected in accordance with the 300-FF-1 RDR/RAWP (DOE-RL 1997) and applicable procedures from BHI-EE-01, *Environmental Investigations Procedures*. Landfill 1B verification sampling is documented in field logbook number EL-1395-4. All verification samples were collected from random locations within and at the bottom of the waste site excavation trenches.

4.8 LANDFILL 1D

4.8.1 History

Landfill 1D (WIDS site 628-4) was a former dumping area and burn pit that was located northwest of the South Process Pond. Landfill 1D was approximately 288 m (950 ft) from the bank of the Columbia River in the 300-FF-1 OU. The site occupied an area of approximately 2,100 m^2 (22,600 ft^2) and was identified as an undocumented landfill in 1990 during the remedial investigation (DOE-RL 1993). The site was used as an alternate burning site in conjunction with the 618-5 Burial Ground to allow cooling between burn events. Nonradioactive paper, wood, paint cans, and other debris were disposed of and burned in Landfill 1D. Some records indicated that incidental disposal/burning of radioactive materials may have occurred. Historical aerial photographs suggested that the site was active from about 1962 to 1974.

4.8.2 Excavation Operations

Remedial action at the Landfill 1D site began in 1999. Excavation at the site involved removing the overburden soil, buried landfill waste and ash, and commingled soil. During remediation, elevated concentrations of lead were identified in excavated soil. Because of the large volume of soil containing lead, a site-specific lead treatment standard was established for soil excavated from the Landfill 1D through an ESD (EPA 2000). In accordance with 40 CFR 268.44(h)(3), the ESD approved a site-specific variance from an applicable LDR treatment standard and established an alternative treatment standard for lead of 25 mg/L as determined using the Toxicity Characteristic Leaching Procedure. The RAOs established in the 1996 ROD (EPA 1996) were not changed by this ESD.

A detailed listing of removed landfill waste is included in field logbook series EL-1395 and project files. All visible buried debris was removed from the Landfill 1D site. Based on field screening, overburden materials and commingled soil identified as potentially clean were placed in stockpiles for potential use as backfill. Contaminated soil and buried waste and debris were sent to ERDF for disposal.

Excavation and disposal of the Landfill 1D remediation waste was completed in June 2000. The general elevation at the bottom of the excavation used was 111.3 m (365 ft) (North American Vertical Datum of 1988) upon completion. The excavation depth was approximately 5.7 m (19 ft) below ground surface. Approximately 5,635 metric tons (6,198 tons) of material from the site were disposed at the ERDF.

4.8.3 Verification Samples

Verification samples were collected in accordance with the 300-FF-1 RDR/RAWP (DOE-RL 1997) and applicable procedures. Landfill 1D verification sampling was documented in field logbook number EL-1395-4. A total of six discrete cleanup verification soil samples were collected from random locations within the site excavation during July 2000. Six cleanup verification soil samples were also collected from random locations within the stockpiled overburden soil during March 1999.

4.9 618-4 BURIAL GROUND

4.9.1 History

The 618-4 Burial Ground site was located approximately 1.6 km (1 mi) north of the Richland city limits and 340 m (1,115 ft) west of the Columbia River within the 300-FF-1 OU (Figure 1-1). It was a single disposal pit measuring approximately 32 m (105 ft) by 160 m (525 ft). Based on previous investigations, the main part of the disposal pit was estimated to be at least 6 m (19 ft) deep. It was believed that the 618-4 Burial Ground operated from 1955 through 1961. Other than information that the 618-4 Burial Ground contained miscellaneous uranium-contaminated materials, little historical information was available on its waste inventory. It was unknown if liquid waste materials were disposed of in the 618-4 Burial Ground. Previous investigations at the 618-4 Burial Ground included geophysical surveys, soil gas surveys, excavation of test pits, and groundwater monitoring.

4.9.2 Excavation Operations

Excavation of the 618-4 Burial Ground was initiated in February 1998 under the Weston subcontract. In April 1998, excavation and sorting operations were suspended pending identification of a treatment and disposal pathway for 338 drums containing depleted uranium waste that were unexpectedly unearthed in a central portion of the burial ground. Extensive searches of historical records and interviews with Hanford Site retirees yielded no information on the original source of the buried drums. It is possible that the drummed waste was produced offsite and shipped to the Hanford Site for disposal.

The drums containing depleted uranium represented two separate waste streams consisting of granular oxide material and chips/shavings immersed in oil (the oil was present to stabilize the pyrophoric property of finely divided uranium). In 1998, handling and characterization of the drums containing depleted uranium chips in oil provided evidence that some of the oil originally present in the drums had leaked during the period they were buried. Samples from the characterization effort verified that the uranium was depleted and identified the presence of polychlorinated biphenyls (PCBs), RCRA metals, and volatile organic compounds in the oil. New mineral oil (certified to be PCB free) was added to drums that had low oil levels to ensure the depleted uranium chips were in a stable configuration for staging. Additional information associated with the 1998 excavation operations and drummed waste discovery/characterization is presented in the excavation report (BHI 1998d) and characterization summary (BHI 1998c).

Excavation and sorting operations were resumed with a new remedial action subcontractor (FE&C) in April 2002. During the 2002 operations, 430 additional drums containing depleted uranium waste were unearthed. Consistent with 1998 operations, new mineral oil (certified to be PCB free) was added to drums containing depleted uranium chips with low oil levels to ensure a stable configuration for staging. By the end of September 2002, excavation/sorting operations for removal of the burial ground contents to native soil were complete and all drummed waste was transported to the ERDF for interim staging and/or disposal (drum treatment is summarized in Section 4.9.3). The remainder of stockpiled soil and debris from excavation operations was loaded into containers and transported to the ERDF intermittently between October 2002 and March 2003.

Following a period of heavy rainfall in late January 2003, several small surface oil stains appeared in the native soil of the excavated burial ground. Further investigation identified the presence of total petroleum hydrocarbon (TPH) contamination in the native soil beneath the former location of drums containing depleted uranium chips immersed in oil. The TPH plume was attributed to the original stabilizing oil presumed to have leaked into the native soil from the drums containing depleted uranium chips during the time they were buried at the site. Results from a test pit to determine the depth of the plume showed no uranium migration (all results were near or below site background levels) and identified the presence of RCRA metals and PCBs at concentrations below the applicable cleanup levels.

Excavation of the TPH plume to a maximum depth of approximately 5 m (16.4 ft) below the general native soil grade at the bottom of the burial ground trench was completed in May 2003. Loadout of approximately 5,000 metric tons (5,500 tons) of stockpiled TPH-contaminated soil and subsequent transport to the ERDF was completed in August 2003.

Major waste streams encountered at the 618-4 Burial Ground are summarized in Table 4-5. In addition to the major waste streams encountered, smaller quantities of asbestos, wood debris, miscellaneous drummed waste, intact bottles, dried paint, tar, and other items were unearthed in discrete areas of the burial ground. A complete listing of waste unearthed from the burial ground and managed as nonbulk material is maintained in the 300 Area project files (i.e., waste tracking sheet).

Table 4-5. 618-4 Burial Ground Major Waste Streams.

Waste Stream	Quantity[a]	Major Contaminants	ERDF Disposition
Soil and metal debris	30,300 U.S. tons	Uranium, lead, arsenic	Direct disposal
LDR soil (lead)	15,000 U.S. tons	Uranium, lead, arsenic	Stabilization/disposal
LDR soil (barium)	220 U.S. tons	Uranium, barium, lead, chromium	Stabilization/disposal
TPH-contaminated soil	5,550 U.S. tons	TPH	Direct disposal
Lead solids	290 U.S. tons	Lead, uranium	Encapsulation/disposal
Depleted uranium chips/oil	520 drums	Chips – uranium Oil – uranium, PCBs, lead, barium, trichloroethene, tetrachloroethene, 2-butanone, benzene, TPH	Staging area
Depleted uranium oxide	228 drums	Uranium	Direct disposal
LDR-depleted uranium oxide	38 drums	Uranium, cadmium, lead, barium	Staging area

[a]Listed values are approximate quantities of specific waste streams. The total quantity of bulk material transported to ERDF for treatment and/or disposal was approximately 51,360 U.S. tons.
ERDF = Environmental Restoration Disposal Facility
LDR = Land Disposal Restriction
PCB = polychlorinated biphenyl
TPH = total petroleum hydrocarbon

Other than the oil originally packaged with the depleted uranium chips for stabilization and small amounts of liquid present in some of the intact bottles, there was no liquid waste unearthed during the excavation operations. In addition, there was no evidence of historical bulk liquid disposal observed during excavation of the burial ground. However, there was evidence that oil had leaked from the drums containing depleted uranium chips (i.e., oil-stained soil surrounding drums and low levels of oil inside some of the drums). It is unlikely that the amount of liquid waste identified in the 618-4 Burial Ground provided a significant driver for migration of contaminants into the native soil outside of the area impacted by the TPH plume.

4.9.3 Drummed Waste Treatment

In September 2003, 520 drums containing depleted uranium chips immersed in oil were transported from the ERDF staging area to a Perma-Fix treatment facility in Oak Ridge, Tennessee. The drums were accepted at the treatment facility, weighed, and visually inspected for compliance with the waste profile. Treatment was initiated in November 2003. The drum contents were emptied into a 1/32-in. sieve to separate the liquid and solid phases. The liquid phase of the material was then separated and stored in totes based on the PCB concentration (i.e., ≥50 ppm was separated). The <50 ppm PCB liquid was sent to a RCRA-permitted, U.S. Nuclear Regulatory Commission licensed commercial high-efficiency boiler for thermal treatment. The PCB-regulated portion was set aside for later treatment at DOE's *Toxic Substances Control Act of 1976* incinerator. The solid phase (uranium chips) was rinsed with a solvent and subjected to multiple detergent washes to remove any residual liquid-phase material. The clean uranium chips were encapsulated in a proprietary grout mixture and returned to the

Hanford Site between June and August 2004 for disposal at the ERDF. The quantity of material returned to the ERDF for disposal was approximately 137 U.S. tons including treated uranium chips, empty drums, and personal protective equipment (PPE).

4.9.4 Bias Sampling

In accordance with the *300 Area Remedial Action Sampling and Analysis Plan* (SAP) (DOE-RL 2004a) and the *Closeout Plan for the 618-4 Burial Ground* (BHI 2003f), biased grab samples were collected to verify the absence of hot spots in the residual soil beneath locations where larger quantities of specific waste streams were unearthed from a common area or staged between the 1998 and 2002 operations. The biased sampling consisted of surface grab samples that were collected in August 2003 at locations intended to represent the worst case for potential residual contamination. The samples were submitted to offsite laboratories for analysis using EPA-approved analytical methods as described in the SAP (DOE-RL 2004a). All results were less than the applicable cleanup levels for industrial land use.

4.9.5 Vadose Zone Profile

In accordance with the closeout plan (BHI 2003f), results from a single test pit beneath the area where the depleted uranium drummed waste was encountered were used to establish the soil profile for the lower vadose zone at the 618-4 Burial Ground. As part of the TPH plume investigation, the test pit was excavated to groundwater in February 2003. Samples were collected at approximately 0.9-m (3-ft) intervals and analyzed for the constituents associated with the drummed waste. With the exception of TPH, all results were less than the applicable industrial land-use cleanup levels, indicating that there was little contaminant migration into the native soil at the bottom of the excavated pit. Approximately 5,000 metric tons (5,500 tons) of contaminated soil from the TPH plume were subsequently excavated and transported to the ERDF for disposal.

4.9.6 Verification Sampling

The preliminary list of potential contaminants for the 618-4 Burial Ground was developed from historical information, process knowledge, and/or available characterization data as presented in the 300-FF-1 RDR/RAWP and 300 Area RDR/RAWP (DOE-RL 1997, 2004b). The list was refined based on the historical information found in WIDS, the type and quantity of waste material excavated, radiological surveys, industrial hygiene monitoring, and visual observation of the excavation process. With concurrence from RL and the EPA, the following final list of COCs was identified to support site closeout (BHI 2003f):

- Uranium (total)
- Arsenic
- Lead.

Cleanup verification sampling was conducted at the 618-4 Burial Ground to confirm acceptability of residual soil levels in the excavated pit and stockpiled BCL soil. Final cleanup verification samples were collected during two sampling events that occurred in February and August 2003. The samples were submitted to offsite laboratories for analysis using EPA-approved analytical methods as described in the SAP (DOE-RL 2004a).

The 618-4 Burial Ground verification sampling events involved five decision units, including a shallow zone, deep zone, and three BCL soil stockpiles. The number of samples collected within each decision unit was determined by the overall footprint area of the decision unit. In accordance with the SAP, each verification sample was a composite of four soil aliquots collected from random locations.

4.10 300-10 (300-FF-2 OPERABLE UNIT)

4.10.1 History

Waste site 300-10 consisted of a Soil Contamination Area that was part of the 300-FF-2 OU. During preparation of the 300-FF-1 RDR/RAWP (DOE-RL 1997), RL and EPA agreed to address the 300-10 site as part of the 300-FF-1 OU activities because of its close proximity to the 300 APT and its small size. The site was expected to consist primarily of soil mixed with clean and contaminated metal shavings. Waste site 300-10 was identified by the remedial design to be approximately 1,494 m^2 (16,075 ft^2) in area. In July 1997, the design area was revised to approximately 657 m^2 (7069 ft^2) based on new ground-penetrating radar data.

4.10.2 Excavation Operations

Waste site 300-10 was initially excavated to a depth of 1.2 m (4 ft) below grade based on the 300-FF-1 remedial design. The "Confirm as Clean" procedure documented in the 300-FF-1 RDR/RAWP (DOE-RL 1997) was then implemented to remove 0.3-m (1-ft) lifts as necessary to complete the excavation. After completion of the 1.2-m (4-ft) excavation and one 0.3-m (1-ft) lift, a radiological survey of the remaining soil indicated that further excavation was not required. Contaminated soil removed from waste site 300-10 was transported to the ERDF for disposal.

In addition to the radiological surveys, a metal detector was used to identify metal shavings in the soil. Although radiological screening instruments did not indicate soil contamination, the detector identified metallic anomalies after completion of the 1.2-m (4-ft) and 0.3-m (1-ft) lifts. Metallic anomalies consisting of nails, iron scraps, and aluminum shavings were excavated by hand and transported to the ERDF for disposal. None of the identified metallic objects were radiologically contaminated.

4.10.3 Verification Sampling

In accordance with the 300-FF-1 RDR/RAWP (DOE-RL 1997), RL and EPA agreed that cleanup of the 300-10 surface radiation area west of the 300 APT would be confirmed by a surface radiation survey followed by a metal detector survey. This agreement was based on its small size, close proximity to the 300 APT, and nature of the waste (uncontaminated soil mixed with contaminated and uncontaminated metal shavings).

At the discretion of the project manager, four random samples were collected to verify that the remaining soil was within the cleanup standards. Two initial verification samples were collected from random locations in August 1997. A second pair of verification samples were collected after the completion of metal detector surveys in October 1997. Verification samples were collected in accordance with the 300-FF-1 RDR/RAWP (DOE-RL 1997) and applicable procedures from BHI-EE-01, *Environmental Investigations Procedures*. The sample collection activities were documented in field logbook number EFL-1133-4.

4.11 300-45 (300-FF-2 OPERABLE UNIT)

4.11.1 History

Waste site 300-45 was a Soil Contamination Area that was part of the 300-FF-2 OU. During preparation of the 300-FF-1 RDR/RAWP (DOE-RL 1997), RL and EPA agreed to address the 300-45 site as part of the 300-FF-1 OU activities because of its close proximity to the 300 APT and its small size. The remedial design estimated that waste site 300-45 was approximately 1,874 m^2 (20,174 ft^2) in area.

4.11.2 Excavation Operations

Waste site 300-45 was excavated to a depth of 0.3 m (1 ft) below grade. The "Confirm as Clean" procedure in the 300-FF-1 RDR/RAWP (DOE-RL 1997) was then implemented. A radiological survey of the remaining soil indicated that additional soil removal was not required. Contaminated soil removed from waste site 300-45 was transported to the ERDF for disposal.

4.11.3 Verification Sampling

In accordance with the 300-FF-1 RDR/RAWP (DOE-RL 1997), verification samples were not specifically required to confirm cleanup of the 300-45 surface radiation area. Field survey results were to be used to support closeout of the site based on its small surface area, close proximity to the 300 APT, and nature of the waste (surface contamination and contaminated animal droppings).

At the discretion of the project manager, two random samples were collected to verify the remaining soil was within the cleanup standards. In October 1997, the samples were collected from random locations in accordance with the 300-FF-1 RDR/RAWP (DOE-RL 1997) and applicable procedures from BHI-EE-01, *Environmental Investigations Procedures*. The sample collection activities were documented in field logbook number EFL-1133-4.

4.12 618-5 BURIAL GROUND (300-FF-2 OPERABLE UNIT)

4.12.1 History

The 618-5 Burial Ground site was a 300-FF-2 OU waste site located approximately 1.6 km (1 mi) north of the Richland city limits and 200 m (656 ft) west of the Columbia River. The site was addressed as part of the 300-FF-1 OU operations based on proximity to several of the 300-FF-1 OU waste sites and a decision to use a common subcontractor to finish remedial actions at the 618-4 Burial Ground in 2002. The 618-5 Burial Ground was a single disposal trench oriented northeast to southwest and measured approximately 56 m (184 ft) by 96 m (315 ft). The disposal trench was about 6 m (19.7 ft) deep.

Little information was available on the inventory and source of waste deposited in the 300 Area burial grounds. The 618-5 Burial Ground trench reportedly operated from 1945 through 1962 as a burn pit, as well as a storage area for aluminum silicate containing 17% uranium and bronze crucibles with reported radiation levels up to 200 mrem/hr. The site was also used for disposal of uranium-bearing trash and uranium-bearing organic wastes. It was unknown if liquid waste materials were disposed of in the 618-5 Burial Ground.

Previous investigations at the 618-5 Burial Ground included a 1987 geophysical survey, which identified buried waste outside the original fence on the south side of the site. Consequently, an additional fence was installed around the site to enclose the area of detected buried waste. Test pits excavated in 1992 identified radiologically contaminated lead bricks, steel pipes, wood debris, garbage, and asbestos.

4.12.2 Excavation Operations

Excavation of the 618-5 Burial Ground was initiated in October 2002. In accordance with the provisions established in the RDR/RAWP (DOE-RL 2004b), two staging pile areas were used to support remedial action operations at the 618-5 Burial Ground. Beginning in October 2002, material excavated from the burial ground was stockpiled in the staging pile areas pending authorization for transport to the ERDF.

Excavation and sorting operations at the 618-5 Burial Ground were completed in March 2003. Shipment of all project drummed[1] waste to the ERDF was completed in May 2003. The remainder of stockpiled soil and debris from excavation operations was loaded from the staging pile areas into containers and transported to the ERDF intermittently between March 2003 and August 2003. The staging pile areas were over-excavated by approximately 0.15 m (0.5 ft) to ensure complete waste removal.

Historical information documenting operation of the 618-5 Burial Ground as a burn pit was consistent with the type and condition of waste observed during the excavation process. Major waste streams encountered at the 618-5 Burial Ground and stockpiled in the staging pile areas

[1] Following excavation, selected discrete items were put into drums for waste management purposes.

are summarized in Table 4-6. In addition to the major waste streams encountered, smaller quantities of asbestos, wood debris, intact bottles, dried paint, tar, and other items were unearthed in discrete areas of the burial ground. A detailed listing of waste unearthed from the burial ground and managed as nonbulk material is maintained in the 300 Area project files (i.e., waste tracking sheet). Associated sample results supporting waste characterization can be found in the Hanford Environmental Information System.

Table 4-6. 618-5 Burial Ground Major Waste Streams.

Waste Stream	Quantity[a]	Major Contaminants	ERDF Disposition
ACL soil and debris	45,800	Uranium, lead, arsenic, and chromium	Direct disposal
LDR soil (lead)	3,400	Uranium, lead, arsenic, and chromium	Stabilization/disposal
LDR soil (lead and cadmium)	1,096	Uranium, barium, cadmium, lead, and chromium	Stabilization/disposal
Radioactive lead solids	627	Lead and uranium	Encapsulation/disposal

[a]Listed values are estimates in U.S. tons. The total quantity of bulk waste sent to ERDF was 50,930 U.S. tons.
ACL = above cleanup level
ERDF = Environmental Restoration Disposal Facility
LDR = Land Disposal Restriction

Other than small amounts of liquid present in some of the intact bottles (typically less than 250 mL), there was no liquid waste unearthed during the excavation operations. In addition, there was no evidence of historical bulk liquid disposal observed during excavation of the burial ground.

4.12.3 Bias Samples

Bias samples were not collected at the 618-5 Burial Ground. Waste streams were widespread throughout the burial ground rather than in discrete areas. There was no evidence of historical bulk liquid disposal observed during excavation of the burial ground. Consequently, RL and the EPA agreed that statistical verification sampling would be adequate for site closeout (BHI 2003g).

4.12.4 Vadose Zone Profile

In accordance with the closeout plan (BHI 2003g), the sample results from two test pits excavated in areas of elevated contamination were used to establish a residual soil profile for the 618-5 Burial Ground. The test pits were excavated to groundwater in February 2003 as part of the remedial action operations. Samples were collected above and below the water table in excavated areas that were close to the groundwater elevation and analyzed for the site COCs. All results were less than the applicable cleanup levels for industrial land use, indicating that there was little contaminant migration into the native soil at the bottom of the excavated pit.

4.12.5 Verification Sampling

The preliminary list of potential COCs for the 618-5 Burial Ground was developed from historical information, process knowledge, and/or available characterization data as presented in the 300 Area RDR/RAWP (DOE-RL 2004b). The preliminary list of potential contaminants was refined based on the historical information found in WIDS, the type and quantity of waste material excavated, radiological surveys, industrial hygiene monitoring, and visual observation of the excavation process. With approval from RL and the EPA (BHI 2003g), the following final list of COCs was identified to support site closeout:

- Uranium (total)
- Arsenic
- Cadmium
- Chromium
- Lead.

Cleanup verification sampling was conducted at the 618-5 Burial Ground to confirm acceptability of residual soil levels in the excavated pit and BCL stockpile. Final cleanup verification samples were collected in September 2003. The samples were submitted to offsite laboratories for analysis using EPA-approved analytical methods as described in the SAP (DOE-RL 2004a).

The 618-5 Burial Ground verification sampling event involved five decision units consisting of the shallow zone and deep zone (excavated pit), BCL soil stockpile, and west and south staging pile areas. The number of samples collected within each decision unit was determined by the overall footprint area of the decision unit. In accordance with the SAP (DOE-RL 2004a), each verification sample was a composite of four soil aliquots collected from random locations.

4.13 SITE BACKFILL AND REVEGETATION

A major component of the selected remedy for the 300-FF-1 OU was recontouring and backfilling of remediated waste sites, followed by revegetation (EPA 1996). Little need for fill material was originally contemplated to meet the endpoint established in the ROD. The anticipated backfill operation was to make use of clean soil stockpiles for regrading the waste sites to approximate the surrounding area, including backfilling as necessary. Although not required to ensure effectiveness of the remedy, the sites were to be revegetated to stabilize the surface and reduce erosion.

In 2003, RL and the EPA decided to modify the backfill approach with the intent of achieving an endpoint that would be more suited to future industrial redevelopment of the area. The selected backfill design included the following general attributes:

- Maximizing the creation of large flat areas suitable for industrial use with a general final elevation of approximately 115 m (377 ft) (vertical datum North American Vertical Datum of 1988) at the process pond area and to surrounding grade at the other sites.
- Using imported fill material from an approved borrow pit to supplement clean soil stockpiles developed during 300 Area remedial action operations
- Creating positive surface drainage away from areas where residual subsurface contamination could result in future groundwater impacts.

4.13.1 Backfill Operations

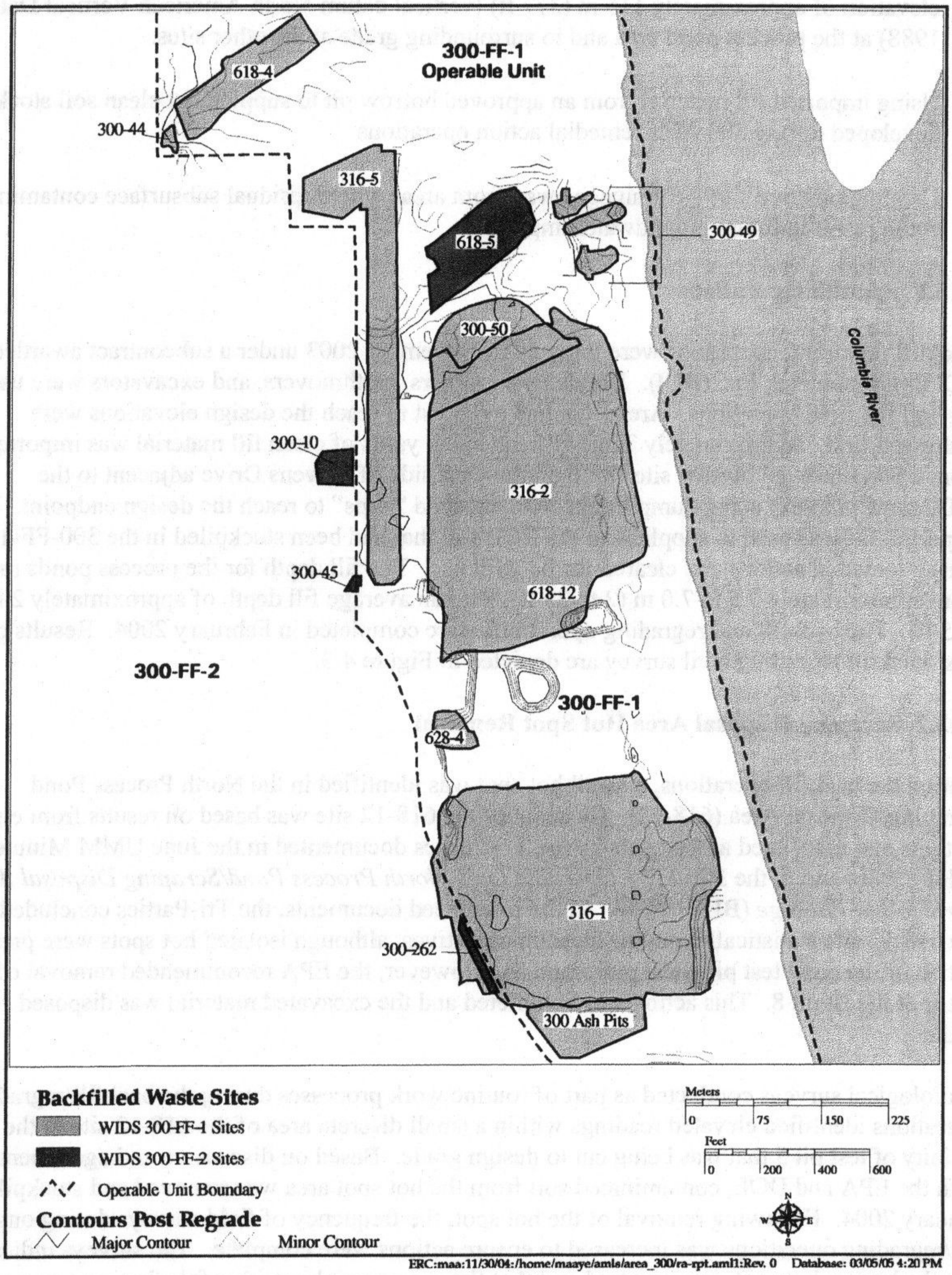
Backfill/regrading operations were initiated in November 2003 under a subcontract awarded to RCI Environmental, Inc. (RCI). Bulldozers, scrapers, earthmovers, and excavators were used to support the field operations. Areas that had to be cut to reach the design elevations were addressed first. Approximately 226,141 bank cubic yards of clean fill material was imported from a pre-approved borrow site (Pit 6 on the west side of Stevens Drive adjacent to the 300 Area Complex) using dump trucks with attached "pups" to reach the design endpoint. The imported fill was used to supplement the BCL soil that had been stockpiled in the 300-FF-1 OU during remedial actions and cleared for backfill use. The fill depth for the process ponds ranged from approximately 0.5 to 7.0 m (2 to 23 ft), with an average fill depth of approximately 2 m (6.5 ft). The backfill and regrading operations were completed in February 2004. Results of the post-backfill regrading civil survey are depicted in Figure 4-3.

4.13.2 Scraping Disposal Area Hot Spot Removal

During the backfill operations, a small hot spot was identified in the North Process Pond Scraping Disposal Area (618-12). Closeout of the 618-12 site was based on results from eight test pits and associated agreements by the Tri-Parties documented in the June UMM Minutes (BHI 1998e) and in the *300-FF-1 Operable Unit, North Process Pond/Scraping Disposal Area Verification Package* (BHI 1999b). In the referenced documents, the Tri-Parties concluded that the 618-12 site statistically met the cleanup objectives, although isolated hot spots were present in two of the eight test pits (test pits 5 and 8). However, the EPA recommended removal of one hot spot in test pit 8. This action was completed and the excavated material was disposed at the ERDF.

Radiological surveys conducted as part of routine work processes during the backfill/regrading operations identified elevated readings within a small discrete area of the 618-12 site in the vicinity of test pit 5 that was being cut to design grade. Based on discussion and agreements with the EPA and DOE, contaminated soil from the hot spot area was removed and stockpiled in January 2004. Following removal of the hot spot, the frequency of field surveys during ongoing cut/regrading operations was increased to ensure actions were complete. The surveys indicated that the known hot spot was removed and that the cut material outside of the hot spot area was acceptable for backfill. The remaining field operations were completed without discovery of additional hot spots.

Figure 4-3. 300-FF-1 Operable Unit Post-Backfill Topography.



A total of 79 U.S. tons of soil from the hot spot stockpile area was transported to the ERDF for disposal in February 2004. The loadout operation included over-excavating the former stockpile footprint by approximately 0.5 m (1.5 ft) to ensure complete removal of the stockpiled material. Subsequent radiological surveys and screening results (sample identification numbers J017H1, J017H2, J017H3) verified removal of the stockpiled material, which completed disposition of the hot spot discovery at the 618-12 site.

4.13.3 Revegetation

Revegetation of the 300-FF-1 OU was performed in April 2004, with guidance provided in the *Hanford Site Biological Resources Management Plan* (DOE-RL 2001). The *Hanford Site Biological Resources Management Plan* prescribed industrial areas to be stabilized with crested wheatgrass (*Agropyron cristatum*). To promote a more diverse plant community, the backfilled and recontoured area was broadcast seeded with 11.2 kg/ha Sandberg's bluegrass (*Poa sandbergii*), 11.2 kg/ha crested wheatgrass, 5.6 kg/ha Regreen (*Agropyron* hybrid), 5.6 kg/ha Indian ricegrass (*Oryzopsis hymenoides*), 5.6 kg/ha thickspike wheatgrass (*Agropyron dasytachyum*), 5.6 kg/ha bluebunch wheatgrass (*Agropyron spicatum*), and 2.45 kg/ha needle-and-thread grass (*Stipa comata*). To help prevent soil erosion and promote successful germination, 16.8 kg/ha Terra Bond was co-applied during seeding. Straw mulch was distributed across the site and crimped with a serrated disk.

Initial data for the revegetated area were collected in June 2004 using the methods described in *Steppe Vegetation of Washington* (Daubenmire 1970). All seven of the planted species were observed on the sites. Thickspike wheatgrass had the greatest percent coverage at 19%, followed by crested wheatgrass at 6.6% coverage with 80% frequency of occurrence, and bluebunch wheatgrass at 2.9% coverage with 60% frequency of occurrence. In addition to the planted species, several other native species were observed on the sites, including false yarrow (*Chaenactis douglasii*), scorpionweed (*Phacelia hastata*), primerose (*Oenothera pallida*), scurf pea (*Psoralea lanceolata*), and rabbitbrush. The presence of these species is likely a result of stockpiled soils that was redistributed across portions of the remediated sites.

5.0 PERFORMANCE STANDARDS AND CONSTRUCTION QUALITY CONTROL

This section addresses performance of the remedial actions with respect to future industrial land use, unrestricted land use, and ecological risk. Closeout of individual waste sites is documented in the cleanup verification packages (CVPs) and associated waste site reclassification forms referenced in Table 5-1. With closeout of the waste sites, several associated unplanned waste releases were addressed as summarized in Appendix A.

Table 5-1. Summary of Cleanup Verification Packages.

Document Number	Document Name	Reclassification Form
BHI-01132	*Verification Package for the 300-FF-1 Operable Unit Ash Pits*	98-04
BHI-01134	*300-FF-2 Waste Site 300-10 Verification Package*	99-105
BHI-01135	*300-FF-1 Waste Site 300-44 Verification Package*	99-109
BHI-01136	*300-FF-2 Waste Site 300-45 Verification Package*	99-110
BHI-01164	*300 Area Process Trenches Verification Package*	99-108
BHI-01171	*Vadose Zone Clean Closure Report for the 300 Area Process Trenches*	n/a
BHI-01298	*300-FF-1 Operable Unit, North Process Pond/Scraping Disposal Area Verification Package*	99-050
CVP-2000-00020	*Cleanup Verification Package for Landfill 1A (WIDS Site 300-49)*	2000-109
CVP-2000-00021	*Cleanup Verification Package for Landfill 1B (WIDS Site 300-50)*	2000-110
CVP-2003-00002	*Cleanup Verification Package for the South Process Pond (WIDS Site 316-1), the Retired Filter Backwash Pond (WIDS Site 300 RFBP), 300-262 Contaminated Soil, and Unplanned Release Sites UPR-300-32, UPR-300-33, UPR-300-34, UPR-300-35, UPR-300-36, UPR-300-37, and UPR-300-FF-1*	2000-112 2003-001 2003-002
CVP-2003-00001	*Cleanup Verification Package for Landfill 1D (WIDS Site 628-4),*	2000-111
CVP-2003-00020	*Cleanup Verification Package for the 618-4 Burial Ground*	2003-055
CVP-2003-00021	*Cleanup Verification Package for the 618-5 Burial Ground*	2003-056

5.1 INDUSTRIAL LAND USE

Remedial action goals (RAGs) are specific numeric cleanup levels that were developed to support industrial land use as documented in the 300-FF-1 RDR/RAWP (DOE-RL 1997) and updated in the 300 Area RDR/RAWP (DOE-RL 2004b). The industrial land-use assumptions used to support development of the cleanup levels are summarized in Section 2.0. The COCs for each waste site were established in the RDR/RAWP documents (DOE-RL 1997 and DOE-RL 2004b) and updated as needed to reflect actual contaminants identified during the remedial action process (Table 5-2).

Table 5-2. Summary of Waste Site Contaminants of Concern.

COC	Waste Site (WIDS Identification)											
	300-10	300-44	300-45	618-4	618-5	300-49	300-50	628-4	316-2	316-1	316-5	Ash Pits
Radionuclides												
Uranium-234	X	X	X	X	X	X	X	X	X	X	X	X
Uranium-235	X	X	X	X	X	X	X	X	X	X	X	X
Uranium-238	X	X	X	X	X	X	X	X	X	X	X	X
Cobalt-60						X	X	X	X	X	X	X
Chemicals												
Arsenic	X	X	X	X	X	X	X				X	X
Thallium	X	X	X			X	X				X	X
Benzo(a)pyrene	X	X	X			X	X				X	X
Chrysene	X	X	X			X	X				X	X
PCBs	X	X	X			X	X	X	X	X	X	X
Lead				X	X	X	X	X				
Cadmium					X							
Chromium					X							

COC = contaminant of concern
PCB = polychlorinated biphenyl
WIDS = Waste Information Data System

All of the waste sites addressed in this report have been shown to individually meet the cleanup objectives for future industrial land use summarized in Table 5-3. Closeout of individual waste sites was based on the statistical evaluation of COC results from random verification samples of residual soil that were analyzed by contract laboratories using approved EPA methods. Sample results were subjected to a data quality assessment and determined to be suitable for their intended use to support closeout decisions. Specific performance metrics of the verification data sets and closeout of individual waste sites based on anticipated future industrial use are formally documented in the applicable CVPs and waste site reclassification forms referenced in Table 5-1.

Table 5-3. Summary of Achieved Performance Standards for Industrial Land Use.

Regulatory Requirement	Remedial Action Goals	Evaluation Method
Direct Exposure – Radionuclides	Attained <15 mrem/yr dose rate above background over 1,000 years. Attained the CERCLA risk range of 10^{-4} to 10^{-6}.	Compared dose and risk goals to RESRAD model outputs based on industrial land use assumptions and verification data set values.
Direct Exposure – Nonradionuclides	Attained individual COC RAGs (MTCA Method C cleanup levels for industrial land use). Pass the WAC 173-340-740(7)(e) three-part test.	Compared goals with verification data set values.
Risk – Nonradionuclides	Achieved hazard quotient of <1 for noncarcinogens.	Compared goal with individual hazard quotients calculated from verification data set values.
	Achieved cumulative hazard quotient of <1 for noncarcinogens.	Compared goal with cumulative hazard quotients calculated from verification data set values.
	Achieved excess cancer risk of $<1 \times 10^{-5}$ for individual carcinogens.	Compared goal with individual carcinogen risks calculated from verification data set values.
	Attained a cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	Compared goal with cumulative carcinogen risks calculated from verification data set values.
Groundwater/River Protection – Radionuclides	Met total uranium standard of 21.2 pCi/L.[a]	Compared goals to RESRAD model outputs based on industrial land-use assumptions and verification data set values.
Groundwater/River Protection – Nonradionuclides	Attained individual nonradionuclide groundwater and river cleanup requirements.	Compared goals to RESRAD model outputs based on industrial land-use assumptions and verification data set values.

[a]Uranium limits selected in the *Record of Decision for the 300-FF-1 and 300-FF-5 Operable Unit* (ROD) (EPA 1996) and the *300-FF-1 Remedial Design Report/Remedial Action Work Plan* (DOE-RL 1997) were based on a proposed drinking water maximum contaminant level. Since the time of ROD signature, the U.S. Environmental Protection Agency has promulgated a maximum contaminant level of 30 µg/L for total uranium (65 *Federal Register* 76708). Based on the isotopic distribution of uranium in the Hanford Site background, the 30 µg/L maximum contaminant level 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* (BHI 2001).

CERCLA = *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
COC = contaminant of concern
MTCA = *Model Toxic Control Act*
RAG = remedial action goal
RESRAD = RESidual RADioactivity
ROD = record of decision
WAC = *Washington Administrative Code*

5.1.1 Groundwater Protection/K_d Study

A total uranium cleanup level of 350 pCi/g was established for the 300-FF-1 OU using a generic site RESidual RADioactivity (RESRAD) model (ANL 1993), as documented in the 300-FF-1 RDR/RAWP (DOE-RL 1997). The RESRAD model predicted that residual soil levels of

350 pCi/g for uranium would meet the RAG dose of 15 mrem/yr and also be protective of groundwater and the Columbia River.

During the preparation of the 300-FF-2 OU ROD (EPA 2001), concerns were raised regarding protectiveness of the 350 pCi/g soil cleanup level for groundwater. Consequently, the Tri-Parties agreed to conduct a uranium K_d/leach study to address the concerns. The study scope and design were developed using a formal data quality objectives process and documented in a SAP (DOE-RL 2002c). Pacific Northwest National Laboratory personnel conducted the study between 2000 and 2002 using five soil samples from representative 300 Area waste sites containing residual uranium contamination.

Results of the K_d/leach study were published in the *300 Area Uranium Leach and Adsorption Project* (Serne et al. 2002) report and further evaluated for impacts to 300 Area remedial actions in the *Protection of 300 Area Groundwater from Uranium-Contaminated Soils at Remediated Sites* (BHI 2002b). Using the most conservative K_d values derived from the study, the RESRAD model predicted that a uranium level of 267 pCi/g was needed to be protective of groundwater at the drinking water standard. This new uranium cleanup level was formally established for the 300-FF-2 OU waste sites in the 300-FF-2 ESD (EPA 2004). The 300 Area generic site model was also modified to reflect the study results.

Impacts of the reduced cleanup level for uranium were evaluated for revegetated and gravel surface conditions at each of the 300-FF-1 OU waste sites (BHI 2002b). Results indicated that lower residual uranium soil concentrations must be achieved to be protective of groundwater when remediated waste sites are not revegetated. The evaluation identified that areas of the 300 APT, North Process Pond, and South Process Pond were not suitable for gravel surfaces without additional soil removal or site-specific K_d/leach studies. With exception of the North Process Pond BCL decision unit, it was determined that a revegetated surface was predicted to be protective of groundwater for all of the 300-FF-1 waste sites without further action given the post-remediation residual soil concentrations.

A site-specific batch leach test was designed and conducted to further evaluate protectiveness of the North Process Pond BCL area. Results from the site-specific test and subsequent modeling indicated that the post-remediation uranium concentrations in the North Process Pond BCL area were predicted to be protective without further action (BHI 2003a).

5.2 UNRESTRICTED LAND USE

Residual soil concentrations at all of the sites addressed in this report were shown to meet the performance standards established for industrial use as presented in Section 5.1. In addition, residual soil concentrations met the performance standards for more stringent land use at the 618-4 Burial Ground, 618-5 Burial Ground, and Landfill 1A. Verification data from these sites were evaluated against performance standards associated with a 300 Area unrestricted land-use scenario established by the 300-FF-2 ESD (EPA 2004).

The 300 Area unrestricted land-use scenario is represented by an individual in a rural-residential setting. The exposure pathways considered in estimating dose from radionuclides in soil are inhalation; soil ingestion; ingestion of crops, meat, fish, drinking water, and milk; and external gamma exposure. This individual is conservatively assumed to spend 80% of his/her lifetime on site. It is assumed that drinking water and irrigation water are obtained from groundwater that has been impacted by the waste site.

Unrestricted land-use cleanup levels for chemicals or nonradionuclides are based on WAC 173-340-740(3), January 1996, which assumes that the exposure pathway for residual contamination will be from ingestion of contaminated soil. Soil cleanup levels are calculated using the equations provided by WAC 173-340-740(3) for carcinogens and for noncarcinogens. For both carcinogens and noncarcinogens, the calculations assume that a resident weighing 16 kg (35 lb) ingests soil at a rate of 200 mg/day (73 g/yr), with a frequency of contact of 100% and a gastrointestinal absorption rate of 100%. For carcinogens, the calculation is based on achieving a lifetime cancer risk goal of 1 in 1,000,000 (1×10^{-6}) for an exposure duration of 6 years and a lifetime of 75 years. For noncarcinogens, the calculation is based on achieving an HQ of 1.

The key assumptions in the 300 Area unrestricted land-use scenario that affect groundwater protection are irrigation at agronomic rates of 76 cm/yr (30 in./yr), surface vegetation resulting in an evapotranspiration coefficient of 91%, and a change in the exposure pathway to include drinking water ingestion. Details of this land-use scenario and associated RAGs are documented in the 300-FF-2 ESD (EPA 2004).

The 618-4 Burial Ground, 618-5 Burial Ground, and Landfill 1A were shown to individually meet the cleanup objectives for unrestricted land use summarized in Table 5-4. Closeout of individual waste with respect to unrestricted cleanup objectives was based on the same verification data set used to support the industrial land use evaluation. Specific performance metrics of the verification data sets and closeout of individual waste sites based on unrestricted land use are formally documented in the applicable CVPs and waste site reclassification forms referenced in Section 10.0. Because these sites meet the criteria for unrestricted use, implementation of institutional controls is not required.

5.3 ECOLOGICAL RECEPTORS

Because results of the baseline risk assessment indicated that adverse effects to key receptors were unlikely to result from contaminants in the 300-FF-1 OU waste sites even if no remediation were to occur, specific ecological performance objectives were not developed as part of the ROD (EPA 1996). As summarized in Table 2-1, the ROD included general objectives for protection of ecological receptors based on meeting the industrial land-use cleanup levels and preventing further degradation of groundwater. Remedial actions at the 300-FF-1 and 300-FF-2 OU waste sites addressed in this report reduced the contaminant concentrations at individual waste sites and met (at a minimum) the industrial land-use objectives as summarized in Section 5.1. Ongoing protectiveness evaluations for ecological receptors in the 300 Area are summarized in Section 6.0.

Table 5-4. Summary of Achieved Performance Standards for Unrestricted Land Use.

Regulatory Requirement	Remedial Action Goals	Evaluation Method
Direct Exposure – Radionuclides	Attained <15 mrem/yr dose rate above background over 1,000 years. Attained the CERCLA risk range of 10^{-4} to 10^{-6}.	Compared dose and risk goals to RESRAD model outputs based on unrestricted land use assumptions and verification data set values.
Direct Exposure – Nonradionuclides	Attained individual COC RAGs (MTCA Method B cleanup levels for unrestricted land use). Pass the WAC 173-340-740(7)(e) three-part test.	Compared goals with verification data set values.
Risk – Nonradionuclides	Achieved hazard quotient of <1 for noncarcinogens.	Compared goal with individual hazard quotients calculated from verification data set values.
	Achieved cumulative hazard quotient of <1 for noncarcinogens.	Compared goal with cumulative hazard quotients calculated from verification data set values.
	Achieved excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	Compared goal with individual carcinogen risks calculated from verification data set values.
	Attained a cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	Compared goal with cumulative carcinogen risks calculated from verification data set values.
Groundwater/River Protection – Radionuclides	Met total uranium standard of 21.2 pCi/L.[a]	Compared goals to RESRAD model outputs based on unrestricted land-use assumptions and verification data set values.
Groundwater/River Protection – Nonradionuclides	Attained individual nonradionuclide groundwater and river cleanup requirements.	Compared goals to RESRAD model outputs based on unrestricted land-use assumptions and verification data set values.

[a]Uranium limits selected in the *Record of Decision for the 300-FF-1 and 300-FF-5 Operable Unit* (ROD) (EPA 1996) and the *300-FF-1 Remedial Design Report/Remedial Action Work Plan* (DOE-RL 1997) were based on a proposed drinking water maximum contaminant level. Since the time of ROD signature, the U.S. Environmental Protection Agency has promulgated a maximum contaminant level of 30 µg/L for total uranium (65 *Federal Register* 76708). Based on the isotopic distribution of uranium in the Hanford Site background, the 30 µg/L maximum contaminant level 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* (BHI 2001).

CERCLA = *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
COC = contaminant of concern
MTCA = *Model Toxic Control Act*
RAG = remedial action goal
RESRAD = RESidual RADioactivity
ROD = record of decision
WAC = *Washington Administrative Code*

5.4 CONSTRUCTION QUALITY CONTROL

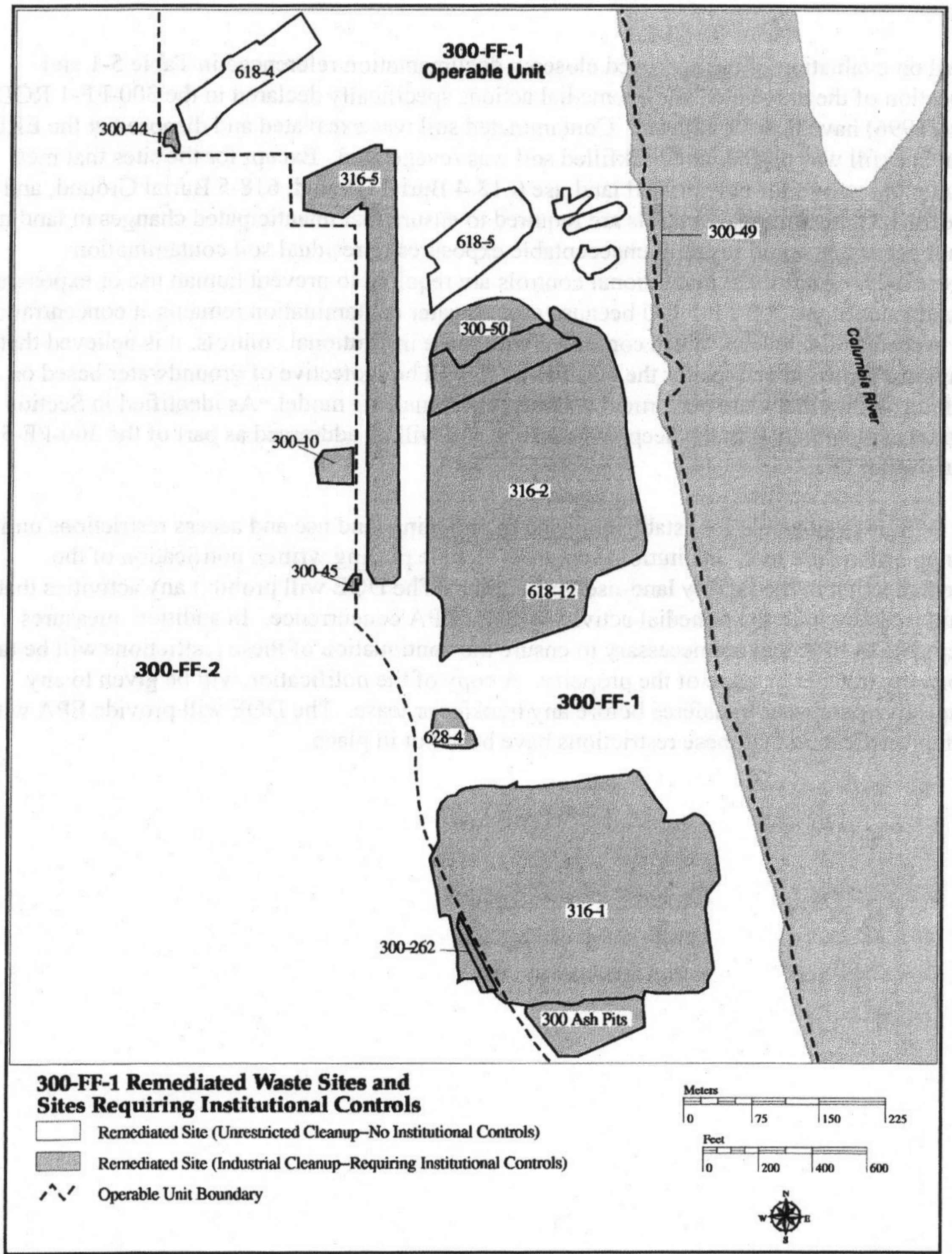
Samples that were used to demonstrate achieving the cleanup objectives for individual waste sites were collected and analyzed in accordance with the 300-FF-1 RDR/RAWP (DOE-RL 1997), which included a SAP as Appendix C of the document. The 300-FF-1 RDR/RAWP was later replaced by the 300 Area RDR/RAWP (DOE-RL 2002b) and the 300 Area SAP (DOE-RL 2004a) to complete 300-FF-1 OU remedial actions and proceed with remedial actions for the 300-FF-2 OU. Each of the SAP documents (DOE-RL 1997 and DOE-RL 2004a) contained a quality assurance project plan to establish the objectives, functional activities, methods, and quality assurance/quality control measures associated with the sampling activities. Verification data sets that were used to support closeout underwent a data quality assessment evaluation to ensure suitability for their intended use. Results of the data quality assessment evaluation are documented in the CVPs for individual waste sites.

6.0 FINAL INSPECTION AND CERTIFICATIONS

Based on evaluation of the approved closeout documentation referenced in Table 5-1 and inspection of the associated sites, remedial actions specifically declared in the 300-FF-1 ROD (EPA 1996) have been completed. Contaminated soil was excavated and disposed at the ERDF, clean backfill was placed, and backfilled soil was revegetated. Except for the sites that met cleanup objectives for unrestricted land use (618-4 Burial Ground, 618-5 Burial Ground, and Landfill 1A), institutional controls are required to ensure that unanticipated changes in land use do not occur that could result in unacceptable exposures to residual soil contamination (Figure 6-1). Additional institutional controls are required to prevent human use or exposure to groundwater in the 300-FF-5 OU because groundwater contamination remains at concentrations that exceed action levels. When combined with these institutional controls, it is believed that the completed remedial actions for the 300-FF-1 OU will be protective of groundwater based on leaching studies that were performed and the conceptual site model. As identified in Section 1.2, residual contamination in the deep vadose zone soil will be addressed as part of the 300-FF-5 groundwater OU.

The DOE is responsible for establishing and maintaining land use and access restrictions until cleanup criteria are met. Institutional controls include placing written notification of the remedial action in the facility land-use master plan. The DOE will prohibit any activities that would interfere with the remedial activity without EPA concurrence. In addition, measures acceptable to EPA that are necessary to ensure the continuation of these restrictions will be taken before any transfer or lease of the property. A copy of the notification will be given to any prospective purchaser/transferee before any transfer or lease. The DOE will provide EPA with written verification that these restrictions have been put in place.

Figure 6-1. Institutional Control Requirements.



7.0 OPERATIONS AND MAINTENANCE ACTIVITIES

Post-construction operations and maintenance activities include implementation of institutional controls, continued monitoring of groundwater beneath the OU, and evaluation of protectiveness for ecological receptors. Institutional controls are addressed in Section 6.0.

7.1 GROUNDWATER MONITORING

Groundwater beneath the 300-FF-1 and 300-FF-2 OUs is addressed by the 300-FF-5 OU. Monitoring of groundwater beneath the 300 Area will continue as prescribed by the ROD (EPA 1996) and the *Operation and Maintenance Plan for the 300-FF-5 Operable Unit* (DOE-RL 2002a) until drinking water standards are met or decisions are made to implement more aggressive response actions.

7.2 ECOLOGICAL RISK ASSESSMENT

Risk assessment activities are ongoing to determine the ecological impacts and protectiveness of actions in the 300 Area. Two primary activities include the near-shore environmental surveys and the River Corridor Baseline Risk Assessment (RCBRA).

7.2.1 300 Area Near-Shore Environment Survey

In 2001, the Hanford Site Public Safety and Resource Protection Program and the Washington State Department of Health led a multi-agency study to characterize the near-shore environment of the 300 Area (PNNL 2003). Characterization activities included external radiation surveys and the collection of surface water, biota, and sediment samples. The focus of the biological surveillance was to (1) identify and quantify the degree of contaminant accumulation within various components of the riparian and aquatic ecosystems along the 300 Area shoreline, and (2) identify which biota were best suited to monitor the biological attenuation of contaminants over time. Results of the near-shore survey will be folded into the RCBRA evaluation.

7.2.2 River Corridor Baseline Risk Assessment

The RCBRA project was initiated by the DOE to evaluate protection of ecological receptors under human-health-based actions performed in the 100 Area and 300 Area NPL sites. The 100 Area and 300 Area Component evaluates the risk to ecological receptors from residual concentrations of chemicals and radionuclides at remediated upland waste sites and within the adjacent shoreline riparian and aquatic areas of the 100 and 300 Areas. The Columbia River Component evaluates risk to ecological receptors from Hanford Site releases within the Columbia River from the upstream Hanford Site jurisdictional boundary to the convergence of the Columbia River with the Pacific Ocean near Astoria, Oregon. Results from the RCBRA will be used to evaluate protectiveness of the 300 Area remedial actions.

8.0 PROJECT COST SUMMARY

This section presents a summary of the actual project costs associated with the remedial actions and backfill/regrading operations performed between 1997 and 2004, as addressed in Section 4.0 of this report. All cost data are intended to represent the fully burdened cost for the work performed, including all applicable direct and indirect overhead charges. The total cost of work performed for the sites and activities addressed in this report was more than $63 million (Table 8-1). Unit rates for work performed (remedial action and waste disposal) ranged from $53/U.S. ton to $876/U.S. ton (Table 8-2). The following subsections present additional background, breakdown, and discussion of the project costs.

8.1 COST COLLECTION METHOD

All costs in the report were extracted from data accumulated and maintained in Parade® and Cobra® program files. A work breakdown structure code of account (COA) collection system was established early in the project planning process. Actual remedial action project costs were captured by COAs consisting of a six-digit location code and a four-digit activity code as presented in Figure 8-1. Unit rates for transportation/disposal and treatment (stabilization, macroencapsulation) were provided by the ERDF based on its own work breakdown structure and the average ERDF operational costs for all Environmental Restoration Contractor (ERC) projects between 1996 and 2003. Burdened costs for offsite treatment of drummed waste from the 618-4 Burial Ground were based on transportation and treatment subcontracts managed by the ERDF.

8.1.1 Included Costs

Data presented in this summary are intended to include all project and ERDF costs for mobilization activities, excavation and loadout, waste transportation and disposal at the ERDF, and offsite treatment of drummed waste. Backfill, regrading, and revegetation costs are also included in this summary. Costs include fully burdened labor, equipment and materials, and subcontract services.

8.1.2 Excluded Costs

Data presented in this summary exclude up-front costs associated with remedial investigation/feasibility study development, initial project conceptual and detailed designs, RDR/RAWP development, and subcontract package development. All costs associated with the K_d/leach study were captured under cost accounts for the 300-FF-2 OU design and are excluded from the values presented in the report. Litigation costs were also excluded from this cost summary.

Table 8-1. Summary of Remedial Action and Waste Disposal Costs.

Remedial Action and Waste Disposal Summary

OU	Site Name	Site Code	Waste Quantity (U.S. tons)[b]	Remedial Action[a, c]		Waste Treatment/Disposal[a, d]		Total ($K)[a]
				ERC ($K)	Subcontract ($K)	Soil/Debris ($K)	Drums ($K)	
300-FF-2	300-10	30010	1,993	112.1	91.8	60.7	0.0	264.6
300-FF-1	300-44	30044	451	100.1	89.5	13.7	0.0	203.3
300-FF-2	300-45	30045	224	98.2	91.2	6.8	0.0	196.2
300-FF-1	618-4 Burial Ground	G6184	51,597	5,288.5	5,315.7	3,713.6	7,177.0	21,494.8
300-FF-2	618-5 Burial Ground	G6185	50,930	2,417.9	2,864.9	2,346.9	0.0	7,629.7
300-FF-1	Landfill 1A	NDF1A	15,897	714.4	841.2	484.2	0.0	2,039.8
300-FF-1	Landfill 1B	NDF1B	39,302	562.4	441.1	1,197.1	0.0	2,200.6
300-FF-1	Landfill 1D	NDF1D	6,199	578.4	563.2	188.8	0.0	1,330.4
300-FF-1	North Process Pond	NPACS	154,825	1,579.4	1,895.6	4,716.0	0.0	8,191.0
300-FF-1	South Process Pond	SPPAC	256,888	2,593.8	3,441.4	7,824.8	0.0	13,860.0
300-FF-1	Process Trenches	PTACS	37,961	1,066.9	969.5	1,156.3	0.0	3,192.7
300-FF-1	Sanitary Sewer	SPPB1	0	0.0	2.1	0.0	0.0	2.1
300-FF-1	Ash Pits	SPPB2	0	114.3	114.3	0.0	0.0	228.6
300-FF-1	300-FF-1 Backfill	31FX2	79	493.4	1,926.4	2.4	0.0	2,422.2
		Totals	**616,346**	**$15,719.8**	**$18,647.9**	**$21,711.3**	**$7,177.0**	**$63,256.0**

[a] All values represent fully burdened costs, including applicable direct and indirect (G&A) overhead charges.

[b] Waste quantities as weighed on 300 Area project scale.

[c] Remedial Action
ERC- ERC labor, equipment, and materials
subcontract- labor, equipment, and supplies for remedial action, backfill/revegetation, laboratory, and miscellaneous support subcontracts

[d] Waste Treatment/Disposal
Soil/Debris- transportation, treatment (stabilization or macroencapsulation), and disposal at ERDF for bulk soil and debris
Drums- transportation, treatment, and disposal (ERDF and offsite) of DU oxide and DU chips/oil drummed waste

Table 8-2. Summary of Remedial Action and Waste Disposal Unit Rates.

Remedial Action/Waste Disposal Unit Rates

OU	Site Name	Site Code	Site Type	Subcontractor	Excavation Approach	PPE	Duration (months)[c]	Waste Quantity (U.S. tons)[b]	Total Cost ($K)[a]	Unit Cost ($/U.S. ton)
300-FF-2	300-10	30010	surface contamination	Weston	direct load	Level D	1	1,993	264.6	0.133
300-FF-1	300-44	30044	surface contamination	Weston	direct load	Level D	1	451	203.3	0.451
300-FF-2	300-45	30045	surface contamination	Weston	direct load	Level D	1	224	196.2	0.876
300-FF-1	618-4 Burial Ground	G6184	disposal pit	Weston, FE&C	sort, stockpile, load	Level B	16	51,597	21,494.8	0.417
300-FF-2	618-5 Burial Ground	G6185	disposal/burn pit	FE&C	sort, stockpile, load	Graded Level B	11	50,930	7,629.7	0.150
300-FF-1	Landfill 1A	NDF1A	disposal pit	Weston	sort, stockpile, load	Level B	6	15,897	2,039.8	0.128
300-FF-1	Landfill 1B	NDF1B	disposal pit	Weston	sort, stockpile, load	Graded Level B	7	39,302	2,200.6	0.056
300-FF-1	Landfill 1D	NDF1D	disposal/burn pit	Weston	sort, stockpile, load	Level D, Level B	4	6,199	1,330.4	0.215
300-FF-1	North Process Pond	NPACS	effluent disposal	Weston	direct load	Level D	10	154,825	8,191.0	0.053
300-FF-1	South Process Pond	SPPAC	effluent disposal	Weston	direct load	Level D	6	256,888	13,860.0	0.054
300-FF-1	Process Trenches	PTACS	effluent disposal	Weston	direct load	Level D	8	37,961	3,192.7	0.084
300-FF-1	Sanitary Sewer	SPPB1	(no action)	n/a	n/a	Level D	n/a	0	2.1	n/a
300-FF-1	Ash Pits	SPPB2	(no action)	n/a	n/a	Level D	n/a	0	228.6	n/a
300-FF-1	300-FF-1 Backfill	31FX2	n/a	RCI	n/a	Level D	n/a	79	2,422.2	n/a
								616,346	$63,256.0	

[a] All values represent fully burdened costs, including applicable direct and indirect (G&A) overhead charges.
[b] Waste quantities as weighed on 300 Area project scale.
[c] Excavation and loadout durations to nearest month.

Figure 8-1. Remedial Action Code of Account Structure. (4 Pages)

PBS#: RL-0041
HQ/ERC WBS#: 1.4.03.1.2.13
TITLE: Remote Waste Site Zone

Subproject Strategy

Remedial Action Project
CODE OF ACCOUNT STRUCTURE CHART

1.4.03.1.2.13 0041 Remote Waste Site Zone
1.4.03.1.2.13.03 300 Area Environmental Restoration Remedial Action

1.4.03.1.2.13.03.22 P2 300-FF Remedial Action

1.4.03.1.2.13.03.22.01 P21 300-FF-1 Operable Unit

1.4.03.1.2.13.03.22.01.32 P212 300-FF-1 Operable Unit Remediation

1.4.03.1.2.13.03.22.01.32.01 P21201 300-FF-1 VDesign LWS, Landfill

R31FX2 300-FF-1 NON-SITE SPECIFIC
R31FX22200 RADIATION MONITORING

1.4.03.1.2.13.03.22.01.32.02 P21202 300-FF-1 Site Remediation

R30044 300-44 TRENCH
R300442000 MONITORING, SAMPLING, TESTING, AND ANALYSIS
R300448000 SOLIDS COLLECTION AND CONTAINMENT
R30044N6W0 FINAL PROJECT CLOSEOUT REPORT

R31FX2 300-FF-1 NON-SITE SPECIFIC
R31FX211W0 ERC MOBILIZATION
R31FX211W1 SITE PREPARATION
R31FX211X0 SUBCONTRACTOR MOBILIZATION
R31FX211Z0 READINESS ASSESSMENT
R31FX21300 PRECONSTRUCTION SUBMITTALS/IMPLEMENTATION PLANS
R31FX22300 AIR MONITORING AND SAMPLING
R31FX28000 SOLIDS COLLECTION AND CONTAINMENT
R31FX28150 LAUNDRY
R31FX2M130 BACKFILL/COMPACTION
R31FX2M400 REVEGETATION AND PLANTING
R31FX2N000 DEMOBILIZATION
R31FX2N6W0 FINAL PROJECT CLOSEOUT REPORT
R31FX2Y000 DIRECT PROJECT SUPPORT
R31FX2Y110 MANAGEMENT
R31FX2Y120 SUPERVISION
R31FX2Y160 SUBCONTRACTOR PROJECT SUPPORT
R31FX2Y210 CONTRACT ADMINISTRATION
R31FX2Y211 CULTURAL RESOURCES
R31FX2Y220 ADMINISTRATIVE SUPPORT
R31FX2Y450 AUDITS, CORRECTIVE ACTION RESPONSES (CAR'S)
R31FX2Y4A0 FIELD ENGINEERING
R31FX2Y4M0 DESIGN SUPPORT
R31FX2Y510 PURCHASING
R31FX2YCC0 ERC YEAR 2000 COMPLIANCE
R31FX2YF60 SAFETY ENGINEER
R31FX2YF84 SITE EMERGENCY PREPAREDNESS DRILL
R31FX2YFB0 QUALITY PROGRAM
R31FX2YFC0 VOLUNTARY PROTECTION PROGRAM
R31FX2YH10 STAFF/SAFETY MEETINGS/SAFETY COMMITTEE / ON-SITE
R31FX2YH40 GENERAL TRAINING (INSTRUCTOR, COORDINATION & CLASS TIME)
R31FX2YH90 DOE SPECIAL INFORMATION REQUESTS / BUDGET EXERCISES.
R31FX2YN70 BASELINE MANAGEMENT & CHANGE CONTROL
R31FX2YN80 DETAILED WORK PLAN, MAP
R31FX2YN90 PROJECT PLANNING, SCHEDULING & COST CONTROL
R31FX2YNA0 PROJECT ESTIMATES & VALIDATIONS
R31FX2YNF0 AUDITS

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Figure 8-1. Remedial Action Code of Account Structure. (4 Pages)

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TITLE: Remote Waste Site Zone

Subproject Strategy

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RG6184 BURIAL GROUND 618-4

RG618411X0 SUBCONTRACTOR MOBILIZATION
RG61841310 PROJECT DATA QUALITY OBJECTIVES PLANNING AND IMPLEMENTATION
RG618413V0 PREPARE AUDITABLE SAFETY ANALYSIS/FINAL HAZARDOUS CLASSIFICATION REPORT
RG61842000 MONITORING, SAMPLING, TESTING, AND ANALYSIS
RG61842300 AIR MONITORING AND SAMPLING
RG61842600 SOIL\SEDIMENT SAMPLING
RG61842900 LABORATORY CHEMICAL ANALYSIS
RG618429W0 CHEMICAL - MONITORING AND FIELD SCREENING
RG61842AW0 RADIOLOGICAL MONITORING AND FIELD SCREENING
RG61842D00 ON-SITE LABORATORY FACILITIES
RG61842E00 OFF-SITE LABORATORY FACILITIES
RG61842F00 SAMPLING ANALYSIS
RG61842Y00 DATA QUALITY ASSESSMENT/DATA MANAGEMENT
RG61842Y10 MONITORING & FIELD SCREENING - CLOSED 9/30/97 SEE 29W0 OR 2AW0
RG61842Y20 DATA QUALITY ASSESSMENT DQA / DATA MANAGEMENT/CHARACTERIZATION REPORT
RG61848000 SOLIDS COLLECTION AND CONTAINMENT
RG61849W00 SOLID WASTE TREATMENT
RG6184M000 SITE RESTORATION
RG6184M400 REVEGETATION AND PLANTING
RG6184N6W0 FINAL PROJECT CLOSEOUT REPORT
RG6184N6W1 BURIAL GROUND EXCAVATION REPORT

RNDF1A LANDFILL 1A 300-49

RNDF1A11X0 SUBCONTRACTOR MOBILIZATION
RNDF1A2000 MONITORING, SAMPLING, TESTING, AND ANALYSIS
RNDF1A2300 AIR MONITORING AND SAMPLING
RNDF1A2600 SOIL\SEDIMENT SAMPLING
RNDF1A29W0 CHEMICAL - MONITORING AND FIELD SCREENING
RNDF1A2AW0 RADIOLOGICAL MONITORING AND FIELD SCREENING
RNDF1A2D00 ON-SITE LABORATORY FACILITIES
RNDF1A2E00 OFF-SITE LABORATORY FACILITIES
RNDF1A2F00 SAMPLING ANALYSIS
RNDF1A2Y00 DATA QUALITY ASSESSMENT/DATA MANAGEMENT
RNDF1A2Y20 DATA QUALITY ASSESSMENT DQA / DATA MANAGEMENT/CHARACTERIZATION REPORT
RNDF1A8000 SOLIDS COLLECTION AND CONTAINMENT
RNDF1AN6W0 FINAL PROJECT CLOSEOUT REPORT
RNDF1AY211 CULTURAL RESOURCES

RNDF1B 300-50 LANDFILL 1B

RNDF1B11X0 SUBCONTRACTOR MOBILIZATION
RNDF1B2000 MONITORING, SAMPLING, TESTING, AND ANALYSIS
RNDF1B2600 SOIL\SEDIMENT SAMPLING
RNDF1B29W0 CHEMICAL - MONITORING AND FIELD SCREENING
RNDF1B2AW0 RADIOLOGICAL MONITORING AND FIELD SCREENING
RNDF1B2E00 OFF-SITE LABORATORY FACILITIES
RNDF1B2F00 SAMPLING ANALYSIS
RNDF1B2Y00 DATA QUALITY ASSESSMENT/DATA MANAGEMENT
RNDF1B2Y20 DATA QUALITY ASSESSMENT DQA / DATA MANAGEMENT/CHARACTERIZATION REPORT
RNDF1B8000 SOLIDS COLLECTION AND CONTAINMENT
RNDF1BN6W0 FINAL PROJECT CLOSEOUT REPORT

RNDF1D 628-4 LANDFILL 1D

RNDF1D2000 MONITORING, SAMPLING, TESTING, AND ANALYSIS
RNDF1D2600 SOIL\SEDIMENT SAMPLING
RNDF1D29W0 CHEMICAL - MONITORING AND FIELD SCREENING
RNDF1D2AW0 RADIOLOGICAL MONITORING AND FIELD SCREENING
RNDF1D2F00 SAMPLING ANALYSIS
RNDF1D2Y00 DATA QUALITY ASSESSMENT/DATA MANAGEMENT
RNDF1D2Y20 DATA QUALITY ASSESSMENT DQA / DATA MANAGEMENT/CHARACTERIZATION REPORT
RNDF1D8000 SOLIDS COLLECTION AND CONTAINMENT
RNDF1DN6W0 FINAL PROJECT CLOSEOUT REPORT

Figure 8-1. Remedial Action Code of Account Structure. (4 Pages)

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RNPACS NORTH PROCESS PONDS 316-2
- RNPACS2000 MONITORING, SAMPLING, TESTING, AND ANALYSIS
- RNPACS2300 AIR MONITORING AND SAMPLING
- RNPACS2600 SOIL\SEDIMENT SAMPLING
- RNPACS2900 LABORATORY CHEMICAL ANALYSIS
- RNPACS29W0 CHEMICAL - MONITORING AND FIELD SCREENING
- RNPACS2AW0 RADIOLOGICAL MONITORING AND FIELD SCREENING
- RNPACS2D00 ON-SITE LABORATORY FACILITIES
- RNPACS2E00 OFF-SITE LABORATORY FACILITIES
- RNPACS2F00 SAMPLING ANALYSIS
- RNPACS2Y00 DATA QUALITY ASSESSMENT/DATA MANAGEMENT
- RNPACS2Y10 MONITORING & FIELD SCREENING - CLOSED 9/30/97 SEE 29W0 OR 2AW0
- RNPACS2Y20 DATA QUALITY ASSESSMENT DQA / DATA MANAGEMENT/CHARACTERIZATION REPORT
- RNPACS8000 SOLIDS COLLECTION AND CONTAINMENT
- RNPACSM130 BACKFILL/COMPACTION
- RNPACSM400 REVEGETATION AND PLANTING
- RNPACSN6W0 FINAL PROJECT CLOSEOUT REPORT
- RNPACSY211 CULTURAL RESOURCES

RPTACS 300 AREA PROCESS TRENCHES 316-5
- RPTACS2000 MONITORING, SAMPLING, TESTING, AND ANALYSIS
- RPTACS2600 SOIL\SEDIMENT SAMPLING
- RPTACS2900 LABORATORY CHEMICAL ANALYSIS
- RPTACS29W0 CHEMICAL - MONITORING AND FIELD SCREENING
- RPTACS2AW0 RADIOLOGICAL MONITORING AND FIELD SCREENING
- RPTACS2F00 SAMPLING ANALYSIS
- RPTACS2Y00 DATA QUALITY ASSESSMENT/DATA MANAGEMENT
- RPTACS2Y10 MONITORING & FIELD SCREENING - CLOSED 9/30/97 SEE 29W0 OR 2AW0
- RPTACS5470 ENVIRONMENTAL PERMITS/NEPA
- RPTACS8000 SOLIDS COLLECTION AND CONTAINMENT
- RPTACSM130 BACKFILL/COMPACTION
- RPTACSM400 REVEGETATION AND PLANTING
- RPTACSN6W0 FINAL PROJECT CLOSEOUT REPORT
- RPTACSY211 CULTURAL RESOURCES
- RPTACSY221 OPERATING RECORD

RSPPAC SOUTH PROCESS PONDS 316-1
- RSPPAC2300 AIR MONITORING AND SAMPLING
- RSPPAC2600 SOIL\SEDIMENT SAMPLING
- RSPPAC2900 LABORATORY CHEMICAL ANALYSIS
- RSPPAC2AW0 RADIOLOGICAL MONITORING AND FIELD SCREENING
- RSPPAC2D00 ON-SITE LABORATORY FACILITIES
- RSPPAC2E00 OFF-SITE LABORATORY FACILITIES
- RSPPAC2F00 SAMPLING ANALYSIS
- RSPPAC2Y00 DATA QUALITY ASSESSMENT/DATA MANAGEMENT
- RSPPAC2Y10 MONITORING & FIELD SCREENING - CLOSED 9/30/97 SEE 29W0 OR 2AW0
- RSPPAC2Y20 DATA QUALITY ASSESSMENT DQA / DATA MANAGEMENT/CHARACTERIZATION REPORT
- RSPPAC8000 SOLIDS COLLECTION AND CONTAINMENT
- RSPPACM130 BACKFILL/COMPACTION
- RSPPACN6W0 FINAL PROJECT CLOSEOUT REPORT
- RSPPACY211 CULTURAL RESOURCES
- RSPPACY4M0 DESIGN SUPPORT

RSPPB1 SANITARY SEWER TRENCH 300-555
- RSPPB1M130 BACKFILL/COMPACTION

RSPPB2 300 ASH PITS
- RSPPB22900 LABORATORY CHEMICAL ANALYSIS
- RSPPB22F00 SAMPLING ANALYSIS
- RSPPB22Y00 DATA QUALITY ASSESSMENT/DATA MANAGEMENT
- RSPPB22Y10 MONITORING & FIELD SCREENING - CLOSED 9/30/97 SEE 29W0 OR 2AW0
- RSPPB28000 SOLIDS COLLECTION AND CONTAINMENT
- RSPPB2N6W0 FINAL PROJECT CLOSEOUT REPORT

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Figure 8-1. Remedial Action Code of Account Structure. (4 Pages)

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1.4.03.1.2.13.03.22.02 P22 300-FF-2 Operable Unit

1.4.03.1.2.13.03.22.02.32 P222 300-FF-2 Operable Unit Remediation

1.4.03.1.2.13.03.22.02.32.02 P22202 RA Liquid Waste Sites

R30010 300-10 BURIAL TRENCH
R300102000 MONITORING, SAMPLING, TESTING, AND ANALYSIS
R300102F00 SAMPLING ANALYSIS
R300108000 SOLIDS COLLECTION AND CONTAINMENT

R30045 300-45 SURFACE CONTAMINATION AREA
R300452000 MONITORING, SAMPLING, TESTING, AND ANALYSIS
R300458000 SOLIDS COLLECTION AND CONTAINMENT

1.4.03.1.2.13.03.22.02.32.11 P22211L 300-FF-2 Remediation - All Sites

RG6185 BURIAL GROUND 618-5
RG618511X0 SUBCONTRACTOR MOBILIZATION
RG61852000 MONITORING, SAMPLING, TESTING, AND ANALYSIS
RG61852600 SOIL\SEDIMENT SAMPLING
RG618529W0 CHEMICAL - MONITORING AND FIELD SCREENING
RG61852AW0 RADIOLOGICAL MONITORING AND FIELD SCREENING
RG61852E00 OFF-SITE LABORATORY FACILITIES
RG61852F00 SAMPLING ANALYSIS
RG61852Y20 DATA QUALITY ASSESSMENT DQA / DATA MANAGEMENT/CHARACTERIZATION REPORT
RG61858000 SOLIDS COLLECTION AND CONTAINMENT
RG6185M130 BACKFILL/COMPACTION
RG6185N6W0 FINAL PROJECT CLOSEOUT REPORT

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8.2 COST PRESENTATION

For presentation in this report, actual costs were grouped into the following general categories:

- Remedial action
- ERDF waste treatment and disposal
- Drummed waste treatment and disposal.

Additional information on each of the three general categories is provided in the following subsections.

8.2.1 Remedial Action

A summary of remedial action costs is presented in Table 8-3. Remedial action costs are subdivided into ERC and subcontract costs. The ERC costs include labor and other (equipment and materials) elements. The subcontract costs include the two remedial action subcontractors that supported the work (Weston, FE&C), the backfill subcontractor (RCI), commercial laboratories, and other miscellaneous subcontracts (e.g., engineering support, training, cultural resources). The remedial actions and backfill subcontracts were all lump sum, fixed price contracts.

The work breakdown structure for remedial action included site-specific and non site-specific (e.g., project management, engineering, cost control, administration) COAs at the project level. For presentation in this report, remedial action costs captured for non-site-specific COAs were distributed to individual sites based on the year and duration (nearest month) of the work performed.

8.2.2 ERDF Waste Transportation, Treatment, and Disposal

A summary of the ERDF costs is presented in Table 8-4. The ERDF is operated under two major subcontracts for transportation (RCI) and operations (Duratek Federal Services, Inc.), with oversight by the ERC. Separate costs for transportation/disposal, stabilization, and macroencapsulation of soil and debris are presented based on average unit rates of $30.46/U.S. ton, $166/U.S. ton, and $327.41/U.S. ton, respectively. Soil and debris quantities are based on weights measured at the 300 Area remedial action project truck scale. The transportation/ disposal rate accounts for transport of waste from the 300 Area queue to the ERDF.

8.2.3 618-4 Burial Ground Drummed Waste Treatment and Disposal

A summary of the treatment and disposal costs associated with drummed depleted uranium waste from the 618-4 Burial Ground is presented in Table 8-5. Costs for treatment and disposal of drums containing depleted uranium chips immersed in oil are based on a treatment subcontract managed by the ERDF and include the cost of transportation to and from the Oak Ridge, Tennessee facility. Costs for treatment (stabilization) and disposal of drums containing depleted uranium oxide powder are presented based on an average unit rate of $166/U.S. ton.

Table 8-3. Remedial Action Cost Detail.

Remedial Action Cost

OU	Site Name	Site Code	ERC ($K)[a, b]			Subcontract ($K)[a, c]					Total ($K)[a]
			Labor	Other	Subtotal	RA	Backfill/Veg	Lab	Other	Subtotal	
300-FF-2	300-10	30010	108.7	3.4	112.1	81.9	0.0	0.0	9.9	91.8	**203.9**
300-FF-1	300-44	30044	96.7	3.4	100.1	79.6	0.0	0.0	9.9	89.5	**189.6**
300-FF-2	300-45	30045	94.8	3.4	98.2	81.3	0.0	0.0	9.9	91.2	**189.4**
300-FF-1	618-4 Burial Ground	G6184	4,964.2	324.3	5,288.5	4,377.2	0.0	882.3	56.2	5,315.7	**10,604.2**
300-FF-2	618-5 Burial Ground	G6185	2,385.4	32.5	2,417.9	2,450.6	0.0	377.1	37.2	2,864.9	**5,282.8**
300-FF-1	Landfill 1A	NDF1A	688.3	26.1	714.4	730.5	0.0	93.6	17.1	841.2	**1,555.6**
300-FF-1	Landfill 1B	NDF1B	553.1	9.3	562.4	391.9	0.0	32.8	16.4	441.1	**1,003.5**
300-FF-1	Landfill 1D	NDF1D	547.8	30.6	578.4	493.6	0.0	56.3	13.3	563.2	**1,141.6**
300-FF-1	North Process Pond	NPACS	1,557.3	22.1	1,579.4	1,770.3	29.0	46.9	49.4	1,895.6	**3,475.0**
300-FF-1	South Process Pond	SPPAC	2,563.4	30.4	2,593.8	3,250.6	1.2	108.2	81.4	3,441.4	**6,035.2**
300-FF-1	Process Trenches	PTACS	1,045.7	21.2	1,066.9	817.0	24.2	69.8	58.5	969.5	**2,036.4**
300-FF-1	Sanitary Sewer	SPPB1	0.0	0.0	0.0	0.0	2.1	0.0	0.0	2.1	**2.1**
300-FF-1	Ash Pits	SPPB2	106.4	7.9	114.3	86.0	0.0	18.4	9.9	114.3	**228.6**
300-FF-1	FF-1 Backfill/Veg	31FX2	460.1	33.3	493.4	40.1	1,860.6	5.9	19.8	1,926.4	**2,419.8**
		Totals	**15,171.9**	**547.9**	**15,719.8**	**14,650.6**	**1,917.1**	**1,691.3**	**388.9**	**18,647.9**	**34,367.7**

[a] All values represent fully burdened costs, including applicable direct and indirect (G&A) overhead charges.

[b] **ERC Summary**

Labor - ERC project management, field engineering, environmental, safety, radcon, sampling, data management, project controls; includes support to mobilization, excavation and loadout, necessary treatment, disposal, backfill, revegetation, demobilization, and site closeout; excludes project design, subcontract development, work plan development

other - ERC equipment, supplies

[c] **Subcontract Summary**

RA - remedial action subcontractor labor (project management, safety, supervision, craft, admin), equipment, supplies; includes mobilization, excavation and loadout, demobilization

Backfill/Veg - backfill and revegetation subcontractor labor (project management, safety, supervision, craft, admin), equipment, supplies; includes mobilization, earthwork, and demobilization

Lab - Contract laboratory sample analysis and reporting for waste characterization and site closeout; air monitoring

Other - misc. ERC support subcontract costs (engineering support, training, cultural resources)

Table 8-4. ERDF Transportation, Treatment, and Disposal Cost Detail.

ERDF Transportation, Treatment and Disposal (Soil and Debris)

Site	Site Code	Soil & Debris Quantity (us tons) [b]				ERDF Cost ($K) [a]			
		Non-Hazardous Soil/Debris (direct disposal)	Hazardous Soil (stabilization)	Hazardous Debris (macro)	Total	Transportation/ Disposal	Stabilization	Macro	Total
Process Trenches	316-5	37,961	0	0	37,961	1,156.3	0.0	0.0	1,156.3
300-10	300-10	1,993	0	0	1,993	60.7	0.0	0.0	60.7
300-44	300-44	451	0	0	451	13.7	0.0	0.0	13.7
300-45	300-45	224	0	0	224	6.8	0.0	0.0	6.8
North Process Pond	316-2	154,825	0	0	154,825	4,716.0	0.0	0.0	4,716.0
South Process Pond	316-1	256,888	0	0	256,888	7,824.8	0.0	0.0	7,824.8
Landfill 1A	300-49	15,897	0	0	15,897	484.2	0.0	0.0	484.2
Landfill 1B	300-50	39,302	0	0	39,302	1,197.1	0.0	0.0	1,197.1
Landfill 1D	628-4	6,199	0	0	6,199	188.8	0.0	0.0	188.8
618-4 Burial Ground	618-4	35,856	15,220	290	51,366	1,092.2	2,526.5	94.9	3,713.6
618-5 Burial Ground	618-5	45,807	4,496	627	50,930	1,395.3	746.3	205.3	2,346.9
300-F-1 Backfill	n/a	79	0	0	79	2.4	0.0	0.0	2.4
	TOTALS	**595,482**	**19,716**	**917**	**616,115**	**$18,138.4**	**$3,272.9**	**$300.2**	**$21,711.5**

[a] All values represent fully burdened costs, including applicable direct and indirect (G&A) overhead charges.

[b] Waste quantities as weighed on 300 Area project scale.

Table 8-5. 618-4 Burial Ground Drummed Waste Cost Detail.

618-4 Burial Ground Drummed Waste Treatment/Disposal

Waste Stream	Quantity (drums)	Quantity (U.S. tons)	Treatment Location	Treatment Method	Disposal Location	Treatment/Disposal Cost ($K)
DU Chips Oil	520	104	Offsite (Oak Ridge)	solvent wash/grout (DU solids), incineration (oil)	ERDF (DU solids), offsite (oil)	7,155.9
DU Oxide (LDR)	38	11	ERDF	stabilization	ERDF	1.8
DU Oxide (non-LDR)	228	116	ERDF	stabilization (radiological control)	ERDF	19.3
	786	231				$7,177.0

a All values represent fully burdened costs, including applicable direct and indirect (G&A) overhead charges.

8.3 DISCUSSION

Several factors contribute to the unit cost values presented in Table 8-2. The following subsections summarize some of the major factors and trends observed in the cost data presented in this report.

8.3.1 Large Liquid Waste Sites

The lowest unit costs were observed for the larger liquid waste sites such as the North Process Pond, South Process Pond, and 300 APT. Unit costs for these sites ranged from $53 to $84/U.S. ton. The major factors contributing to the lower relative unit cost for these sites include the following:

- Longer excavation/loadout durations (6 to 10 months) that permitted more effective amortization of mobilization and demobilization costs.
- The general absence of anomalous waste. Because contaminant distribution at liquid sites tends to be more uniform and predictable, work was performed in Level D PPE and the subcontractor was allowed to excavate and load waste directly into roll-off containers for transport to the ERDF.
- Excavation and loadout rates were predictable and driven by the heavy equipment and the daily allotment of roll-off containers.

The primary challenge for liquid waste sites is the alignment of subcontractor equipment and personnel resources with the allotment of ERDF roll-off containers provided.

8.3.2 Small Waste Sites

Unit costs for the small soil contamination sites (300-10, 300-44, and 300-45) were among the highest observed, ranging from $133 to $876/U.S. ton. The major factor in the high relative unit cost for these sites was the short excavation/loadout duration, which was a month or less for each site. The distributed non-site-specific ERC charges (e.g., project management, engineering, cost control, administration) were the largest part of the total cost for these small sites. Although work was performed in Level D PPE and direct loadout was allowed for these sites, the subcontractor was also less able to effectively amortize mobilization and demobilization cost.

8.3.3 Burial Grounds and Landfills

Unit costs for the burial grounds and landfills ranged from $56 to $417/U.S. ton. The greatest influence on the unit cost for these sites was the potential to encounter anomalous waste. This potential and the inability to reliably predict where or when anomalous waste would be encountered resulted in the following work controls:

- Use of Level B PPE (supplied air respirators, chemically resistant protective clothing). Use of the Level B PPE increased the potential for heat stress in warm weather conditions and decreased worker productivity. The cost impact for Level B operations was the greatest for Landfill 1D and the 618-4 Burial Ground because they were the first sites excavated with these controls. As experience was gained, a graded approach to Level B operations was developed and implemented that reduced the number of personnel in protective gear and increased productivity.

- Waste sorting and stockpiling. Waste excavated from the burial grounds and landfills had to be sorted to identify and remove anomalies, stockpiled, sampled, and released before the subcontractor was allowed to load the material into roll-off containers for transport to the ERDF. This requirement resulted in double handling of all excavated material, the need for additional personnel (craft labor, radiological control technicians, and samplers), and decreased overall productivity.

- Production rates for the burial grounds and landfills were much less predictable than liquid waste sites. Rather than being driven by equipment and roll-off container allotment, rates were variable depending on the type of material being excavated and amount of anomalous waste encountered. Site-specific factors that influenced the unit cost for the 618-4 Burial Ground and Landfill 1B are addressed in the following subsections.

8.3.3.1 618-4 Burial Ground. Of the burial ground and landfill sites, the 618-4 Burial Ground had the highest unit cost at $417/U.S. ton. Several factors contributed to the high unit cost relative to the other comparable sites. The biggest factor was the discovery of more than 780 drums containing two distinct depleted uranium waste streams. This discovery resulted in the need for specialized drum handling equipment (e.g., cranes), materials (e.g., overpack containers, mineral oil), and work procedures (e.g., drum handling plans). Approximately two-thirds of the drums required offsite treatment at a cost that totaled more than $7 million. In addition, remedial action operations at the 618-4 Burial Ground were performed in two phases under two subcontracts (Weston and FE&C) separated by 4 years. Excavation and sorting operations at the 618-4 Burial Ground were performed using Level B PPE.

8.3.3.2 Landfill 1B. Landfill 1B had the lowest unit cost ($56/U.S. ton) among the burial ground and landfill sites. The primary reason for the low relative unit cost was that most of the site consisted of a shallow excavation (1 m [3 ft] or less) and there was relatively little anomalous waste and debris. With the help of geophysical survey results, a graded approach was implemented where Level B PPE was limited to a few specific areas of the site.

8.4 COMPARISON OF ESTIMATED AND ACTUAL COSTS

Recognizing that the ROM cost estimates provided in the 300-FF-1 ROD (EPA 1996) and summarized in Section 2.0 have not been escalated to reflect present-value dollars, some general conclusions can be made in comparison with the actual costs presented in this report. The actual cost was higher but within the ROM accuracy (+50% to -30%) assumed for the ROM estimate for the process waste site grouping (300 APT, South Process Pond, North Process Pond and Scraping Disposal Area, Ash Pits, Landfill 1A, Landfill 1B, and Landfill 1D). Increases from the estimated costs can be attributed primarily to greater quantities of contaminated soil at the liquid waste sites and implementation of Level B excavation operations at the landfills.

Actual costs for remediation of the 618-4 Burial Ground were substantially higher than the ROM estimate. The primary reasons for increased costs at the 618-4 Burial Ground include implementation of Level B excavation operations and the discovery of more than 780 drums containing depleted uranium waste. As stated in Section 8.3, this resulted in a need for specialized work approaches, equipment, and materials. In addition, substantial offsite treatment costs were incurred for approximately two-thirds of the drums.

8.5 FUTURE USE OF COSTS

Costs presented in this report have not been escalated to reflect present-value dollars. Future users of the cost data should be cautioned that escalation adjustments may be needed to provide meaningful information, depending on the intended use.

9.0 OBSERVATIONS AND LESSONS LEARNED

Remediation of the waste sites addressed in this report provided an opportunity to identify project successes, areas for improvement, and lessons learned. The ERC team, subcontractors, RL, and EPA successfully worked together to adapt to changing and unexpected conditions that were presented during remedial action operations. In doing so, the work was performed safely without any lost-time injuries.

The liquid waste sites and soil contamination sites fit the subcontract structure well, and remedial action operations at those sites were performed efficiently by the project teams, with little adjustment to the work and subcontracting approaches. The primary lesson learned was related to the anomalous waste materials that were encountered at the burial ground/landfill sites and the associated work approaches. The following information addresses specific observations and lessons learned.

- **Contracting Strategy.** Separation of work scope between burial grounds/landfills and liquid waste disposal sites is the most effective contracting strategy. Significant differences exist between the two waste site types with respect to the heavy equipment requirements, the mix of personnel skills needed, excavation approach, safety precautions/PPE, and process monitoring. The separation of work scope could likely be accomplished within a single subcontract or through two discrete subcontracts depending on the specific requirements of the project.

- **Area of Contamination/Staging Pile Areas.** To operate efficiently, sufficient space is needed to stockpile contaminated materials and oversize debris and stage anomalous waste items during the characterization process. If the AOC is too small, the excavation operation can be suffocated by anomalous waste items and/or contaminated materials. With issuance of the 300 Area RDR/RAWP (DOE-RL 2004b) in 2001, the use of staging pile areas in accordance with 40 CFR 264.554 was authorized to address this issue. The staging pile provision authorized stockpiling of bulk soil and debris outside of the AOC prior to loadout. This approach was effective during remedial action operations at the 618-5 Burial Ground.

- **Waste Sorting.** Use of the original grizzly apparatus designed for the 300-FF-1 OU project (nonmechanized, 15-cm [6-in.] grid spacing, with flip top) was an inefficient method for sorting waste material during the excavation process. Based on experience from Landfill 1D, routine use of the grizzly was discontinued prior to the start of waste removal from the 618-4 Burial Ground. Use of alternate sorting methods was subsequently approved by the DOE and EPA and implemented into project documents and subcontracts. In general, the remedial action subcontractor has the flexibility to choose among the approved sorting methods depending on the type of material being excavated.

- **Level B Personal Protective Equipment.** Level B PPE was worn by all personnel working inside the AOC during excavation operations at Landfill 1D and at the 618-4 Burial Ground. A graded approach to Level B operations was implemented progressively at other burial ground/landfill sites to a point where the excavator operator performed a primary sort of material using supplied air in a small exclusion zone at the dig face. Other workers were on standby to enter the Level B exclusion area as needed. Once material had been excavated and intact drums or containers were removed, material was trucked outside of the exclusion zone for final sorting. Workers supporting the final sort were not required to wear respirators for this activity as long as the material had been cleared by industrial hygiene (IH) surveys. This work approach was viewed to be effective and consistent with as low as reasonably achievable principles.

- **Contaminants of Concern.** Establishing COCs based on historical information and characterization is effective for liquid waste sites but less practical for burial ground/landfill sites where waste inventories are often not well known or documented. It is more effective to establish a final COC list for burial ground/landfill sites after excavation is complete and the actual quantity and type of waste encountered can be considered. With issuance of the 300 Area RDR/RAWP and 300 Area SAP documents in 2001, a process was established to add or delete constituents from a preliminary list of COCs based on the actual waste encountered. Concurrence on the *final* list of COCs is obtained the from DOE and EPA prior to implementation of verification sampling.

- **Contaminant Migration.** The conceptual models for burial ground/landfill sites where there is no documented disposal of large quantities of liquid waste typically predict little contaminant migration. This prediction was found to be accurate for the 300 Area sites. Residual soil concentrations were often at or near published site background levels after removal of contaminated soil and debris to native soil. Residual soil concentrations supported future unrestricted land use at three of the waste sites addressed in this report.

- **Spill Reporting.** Waste unearthed during excavation of burial ground/landfill sites is not exempted from the CERCLA Section 103 notification requirements for spill reporting. A wide range of field conditions is typically encountered during excavation of dump sites and/or burial grounds with a high likelihood of unknown materials. A site-specific instruction was implemented for the 300 Area to establish a consistent approach for release to meet the intent of the CERCLA and DOE reporting requirements without unnecessarily inhibiting efficient and cost-effective remedial action operations. Clear reporting eligibility criteria for waste unearthed in the AOC was a key aspect of the 300 Area instruction. To be considered for release reporting, the waste must have originated from within a container (e.g., drum, tank, bottle, piece of process equipment, pipe) and must be spilled/leaked to the ground as a result of new damage to the container caused by the excavation and/or removal process. The eligibility criteria were approved by regulatory and legal staff and have also been used at 100 Area waste sites.

- **Industrial Hygiene.** IH responsibilities were originally split between Bechtel Hanford, Inc., and the subcontractor due to concerns with liability. This practice resulted in independent and duplicative IH support using different equipment. The duplication of effort resulted in higher cost to the project, confusion among project team members at times, and an increase in the number of personnel in the excavation area/exclusion zone. Subsequent agreements were made that assigned all responsibility for IH monitoring to the remedial action subcontractor.

- **BCL Stockpiles.** The original 300-FF-1 remedial action design specified centrally located BCL stockpiles that were not immediately adjacent to the individual waste sites. Project personnel were able to authorize the creation of BCL stockpiles adjacent to the waste sites, thus eliminating additional handling and transport of BCL material by the remedial action subcontractor.

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APPENDIX A

UNPLANNED RELEASE CLOSEOUT SUMMARY

APPENDIX A
UNPLANNED RELEASE CLOSEOUT SUMMARY

During excavation of the waste sites, soil associated with several unplanned waste releases was removed and transported to the Environmental Restoration Disposal Facility (ERDF) for disposal (Table A-1). Specific information related to the nature of each waste site may be found in the Waste Information Data System.

Table A-1. Unplanned Release Closeout Summary. (2 Pages)

Site Code	Waste Description	Release Site	Closeout Document
UPR-300-15	Uranium-bearing acid	316-5	BHI-01164
UPR-300-19	Nitric, sulfuric, and chromic acid, followed by ammonium bifluoride and sodium hydroxide	316-5	BHI-01164
UPR-300-20	Uranium-bearing nitric and sulfuric acid	316-5	BHI-01164
UPR-300-21	Nitric acid	316-5	BHI-01164
UPR-300-22	Nitric and hydrofluoric acid	316-5	BHI-01164
UPR-300-23	Nitric and sulfuric acid	316-5	BHI-01164
UPR-300-24	Nitric and hydrofluoric acid	316-5	BHI-01164
UPR-300-25	Uranium-bearing nitric and sulfuric acid	316-5	BHI-01164
UPR-300-26	50% sodium hydroxide solution	316-5	BHI-01164
UPR-300-27	Uranium-bearing nitric and sulfuric acid	316-5	BHI-01164
UPR-300-28	Hydrofluoric, nitric, and sulfuric acid with copper, uranium, and zirconium in solution	316-5	BHI-01164
UPR-300-29	Hydrofluoric, nitric, sulfuric, and chromic acid with copper, uranium, and zirconium in solution	316-5	BHI-01164
UPR-300-30	Hydrofluoric, nitric, sulfuric, and chromic acid	316-5	BHI-01164
UPR-300-47	38% ethylene glycol solution	316-5	BHI-01164
UPR-300-8	50% sodium hydroxide solution	316-5	BHI-01164
UPR-300-9	Uranium-bearing nitric acid	316-5	BHI-01164
UPR-300-32	Acid waste release from the 333 Building to process sewer	316-1, 316-2	CVP-2003-00002
UPR-300-33	Acid waste release from the 333 Building to process sewer	316-1, 316-2	CVP-2003-00002
UPR-300-34	Acid waste release from the 333 Building to process sewer	316-1, 316-2	CVP-2003-00002
UPR-300-35	Acid waste release from the 333 Building to process sewer	316-1, 316-2	CVP-2003-00002
UPR-300-36	Acid waste release from the 333 Building to process sewer	316-1, 316-2	CVP-2003-00002
UPR-300-37	Acid waste release from the 333 Building to process sewer	316-1, 316-2	CVP-2003-00002

Table A-1. Unplanned Release Closeout Summary. (2 Pages)

Site Code	Waste Description	Release Site	Closeout Document
UPR-300-FF-1	77 small contaminated areas throughout the 300-FF-1 Operable Unit	300-FF-1 OU	CVP-2003-00002
UPR-300-7	Oil from underground day tanks on north side of the 384 Powerhouse	316-2	BHI-01298
UPR-600-15	Discarded uranium fuel elements near the 618-4 Burial Ground	618-4	2004-097[a]

[a]Closed out as a no action site as documented on waste site reclassification form 2004-097.

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