EPA/ROD/R10-01/119
2001

EPA Superfund
Record of Decision:

HANFORD 300-AREA (USDOE)
EPA ID: WA2890090077
OU 03
BENTON COUNTY, WA
04/04/2001

DECLARATION OF THE RECORD OF DECISION

SITE NAME AND LOCATION

USDOE Hanford 300 Area
300-FF-2 Operable Unit
Hanford Site
Benton County, Washington

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected interim remedial actions for portions of the U.S. Department of Energy (DOE) Hanford 300 Area, Hanford Site, Benton County, Washington, which were chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the information contained in the Administrative Record for this site.

The State of Washington concurs with the selected remedy.

ASSESSMENT OF THE SITES

The response action selected in this Interim Action Record of Decision (ROD) is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. Such a release or threat of release may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

The 300-FF-2 Operable Unit is composed of 56 waste sites (listed in Appendix A). These sites fall into the following four general categories: waste sites in the 300 Area Industrial Complex (40 sites); outlying waste sites north and west of the 300 Area Industrial Complex (7 sites); general content burial grounds (7 sites); and transuranic-contaminated burial grounds (2 sites).

The selected remedy in this interim action ROD includes the following components:

- Removal of contaminated soil, structures and associated debris;
- Treatment, as necessary, to meet waste acceptance criteria at an acceptable disposal facility;
- Disposal of contaminated materials at the Hanford Site Environmental Restoration Disposal Facility (ERDF), Waste Isolation Pilot Plant (WIPP) in Carlsbad, New Mexico,

or other disposal facilities approved in advance by the U.S. Environmental Protection Agency (EPA);

- Recontouring and backfilling of excavated areas followed by infiltration control measures (e.g., revegetation);

- Institutional controls to ensure that unanticipated changes in land use do not occur that could result in unacceptable exposures to residual contamination;

- Ongoing groundwater and ecological monitoring to ensure effectiveness of the remedial actions and to support the final Record of Decision and five-year remedy reviews; and

- Regulatory framework for a "Plug-In" or "Analogous Sites" approach for accelerating future remediation decisions.

The reasonably anticipated future land use for the 300 Area and surrounding vicinity is industrial and the 300-FF-2 cleanup will result in protection of human health and the environment based on the exposure assumptions contained in the 300 Area industrial use scenario.[1] Other land uses may also be appropriate for noncontaminated portions of the 300 Area National Priorities List (NPL) site.

The procedures used to implement the multi-year work effort required by this ROD will be outlined and documented in more detail in the Remedial Design/Remedial Action (RD/RA) workplan, a primary document under the Tri-Party Agreement (TPA), subject to EPA approval. It is anticipated that the RD/RA workplan process will be implemented in a phased approach, with the RD/RA workplan to be submitted to EPA by June 30, 2002. This document will identify the plan and schedule for submittal of subsequent workplans.[2] Once initiated, substantial continuous physical on-site remedial action shall be maintained until all of the cleanup work is completed. A detailed schedule and cleanup plan for implementing this ROD will be submitted to EPA for approval by June 30, 2002, for inclusion in the RD/RA workplan and in support of TPA Milestones M-16-03A and M-16-00B. This schedule will include specific commitments regarding the Decontamination and Decommissioning (D&D) of facilities and aboveground structures necessary to complete the cleanup of underlying waste sites in the 300 Area Complex and the remediation plans for the 618-10 and 618-11 Burial Grounds. The detailed schedule and cleanup plan for implementing this ROD shall be consistent with the current TPA milestone to complete all 300 Area remedial actions by September 30, 2018 (TPA Milestone M-16-00).

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[1] Residual human health risks after meeting remedial action objectives (RAOs) are based on an industrial land use scenario for soils. Potential site risks from contaminated soils, structures, and debris with respect to metals and organics are reduced from greater than 10^{-2} to approximately 1×10^{-5}. Site risks from contaminated soils, structures, and debris with respect to radionuclides are reduced from greater than 10^{-2} to approximately 10^{-4} (approximate risk equivalent to 15 mrem/year dose above background).

[2] The RD/RA workplan may be submitted before June 30, 2002, without the plan and schedule for submittal of subsequent workplans, however such plan and schedule must be submitted on June 30, 2002, (pursuant to TPA milestone M-16-03A) and upon approval by EPA, will be incorporated into the RD/RA workplan.

It has been estimated that approximately 150 buildings and structures need to first be removed to expose the 40 soil contamination areas within the 300 Area Industrial Complex that need to be cleaned up pursuant to this ROD. Decontamination and Decommissioning (D&D) of facilities in the 300 Area must be carefully coordinated with the soil cleanup process pursuant to this ROD. When buildings are demolished and foundations removed, soil contamination areas that were previously "capped" by building foundations or paved areas will be exposed to natural precipitation, thus providing a potential pathway to groundwater and the river. These exposed areas will also pose a direct contact/direct exposure threat to both human and ecological receptors. Although RD/RA workplan implementation and Tri-Party Agreement Milestone commitment dates have not yet been established for the removal of buildings and structures in the 300 Area that overlie contaminated waste sites, these projects are to be completed in a manner that supports soil cleanup and final closeout for the 300-FF-2 Operable Unit by the M-16-00 Milestone date of September 30, 2018. It is anticipated that the removal of buildings, structures, or facilities will be authorized and performed through the CERCLA Removal Action process, consistent with the guidelines established in the May 22, 1995, joint EPA/DOE "Policy on Decommissioning Department of Energy Facilities Under CERCLA." The D&D activities will be evaluated in Engineering Evaluation/Cost Analysis (EE/CA) documents and authorized in CERCLA Action Memoranda. As an alternative approach, D&D activities can be evaluated using the Limited Field Investigation/Focused Feasibility Study approach to support a subsequent Record of Decision to authorize the removal of buildings and aboveground structures. An additional $663 million (not within the scope of this remedial action) is estimated to be required to remove materials and structures from the 300 Area to facilitate the cleanup of contaminated soil and debris (Source: 300 Area Accelerated Closure Plan, June 2000).

STATUTORY DETERMINATIONS

The selected remedy specified for this interim action is protective of human health and the environment; complies with Federal and state requirements that are legally applicable, or are relevant and appropriate to this interim action; and is cost-effective.

Treatment technologies will be employed to address some principal threat waste as part of the selected remedy. Principal threat waste in the 300-FF-2 Operable Unit falls into two general categories: 1) drummed waste (liquid or non-liquid) that is both highly mobile and/or highly toxic; and 2) non-liquid, highly radioactive soil and debris. It is anticipated that all liquid waste will undergo treatment prior to final disposal. Radiologically contaminated soil and debris will not be treated prior to disposal in ERDF (unless soil or debris require treatment to meet Resource Conservation and Recovery Act [RCRA] Land Disposal Restrictions or ERDF Waste Acceptance Criteria) because cost-effective methods to reduce the toxicity, mobility, or volume of radiological constituents at these concentrations have not been identified. Therefore, the selected remedy is utilizing treatment to the maximum extent practicable and resulting in the treatment of some principal threat wastes, and is satisfying the statutory preference for treatment as a principal element of the remedy.

Because this remedy will result in hazardous substances, pollutants, and/or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted to ensure that the remedy is protective of human health and the environment every 5 years after the commencement of the remedial action. Review of this remedy will be ongoing as the Tri-Parties continue to develop final remedial measures for the 300 Area National Priorities List site.

The preamble to the NCP states that when noncontiguous facilities are reasonably close to one another and wastes at these sites are compatible for a selected treatment or disposal approach, CERCLA Section 104(d)(4) allows the lead agency to treat these related facilities as one site for response purposes and, therefore, allows the lead agency to manage waste transferred between such noncontiguous facilities without having to obtain a permit. The 300 Area sites addressed by this interim action ROD and ERDF are reasonably close to one another, and the wastes are compatible for the selected disposal approach. Therefore, the sites are considered to be a single site for response purposes.

DATA CERTIFICATION CHECKLIST

The following information is included in the *Decision Summary* of this ROD. Additional information can be found in the Administrative Record file for this site.

- Contaminants of concern (COCs) and their respective concentrations. Contaminants of concern for the individual waste sites associated with this operable unit can be found in Appendix A. Due to the scope of this action, contaminant concentrations are not included in this ROD. Available site characterization data can be found in the *Limited Field Investigation for the 300-FF-2 Operable Unit* (DOE/RL-96-42), which can be found in the Administrative Record. However, the contaminants of concern and their respective concentrations have been included for one waste site in Section VII (Table 2) to illustrate how the baseline risk assessment was performed.

- Baseline risk represented by the COCs (see Section VII, Table 3). Due to limited data, a qualitative baseline risk assessment was performed to support this interim action decision. This procedure is consistent with the *Hanford Site Past Practice Strategy* (DOE/RL-91-40, March 1992). A comprehensive quantitative baseline risk assessment will be performed to support the final 300-FF-2 ROD with data gathered from implementing the Remove, Treat, and Dispose (RTD) remedy and ongoing environmental monitoring.

- Cleanup levels established for COCs and the basis for the levels (see Section VIII, Tables 5 and 6).

- How source materials constituting principal threats are addressed (see Section XI and Section XIII, "Preference for Treatment as a Principal Element").

- Current and reasonably anticipated future land and current and potential future beneficial uses of groundwater used in the qualitative risk assessment and ROD (see Sections VI and VIII).

- Potential land and groundwater use that will be available at the site as a result of the selected remedy (see Section XII, "Expected Outcomes of the Selected Remedy").

- Estimated capital, annual operation and maintenance (O&M), and total present value costs; discount rate; and the number of years over which the remedy cost estimates are projected (see Section XII, "Cost Estimate for the Selected Remedy" and Tables 8, 9, and 10).

- Key factor(s) that led to selecting the remedy (i.e., describe how the selected remedy provides the best balance of trade-offs with respect to the balancing and modifying criteria, highlighting criteria key to the decision) (see Sections XII and XIII).

Signature sheet for the Record of Decision for the USDOE Hanford 300-FF-2 Operable Unit Interim Remedial Actions between the United States Department of Energy and the United States Environmental Protection Agency, with concurrence by the Washington State Department of Ecology.

Michael H Schlender (for) 4/5/01

Keith A. Klein
Manager
Richland Operations Office

Date

Signature sheet for the Record of Decision for the USDOE Hanford 300-FF-2 Operable Unit Interim Remedial Actions between the United States Department of Energy and the United States Environmental Protection Agency, with concurrence by the Washington State Department of Ecology.

Charles E. Findley
Acting Regional Administrator, Region 10
United States Environmental Protection Agency

4-4-01
Date

Signature sheet for the Record of Decision for the USDOE Hanford 300-FF-2 Operable Unit Interim Remedial Actions between the United States Department of Energy and the United States Environmental Protection Agency, with concurrence by the Washington State Department of Ecology.

Michael Wilson
Program Manager, Nuclear Waste Program
Washington State Department of Ecology

4/5/01
Date

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DECISION SUMMARY

I. SITE NAME, LOCATION, AND DESCRIPTION

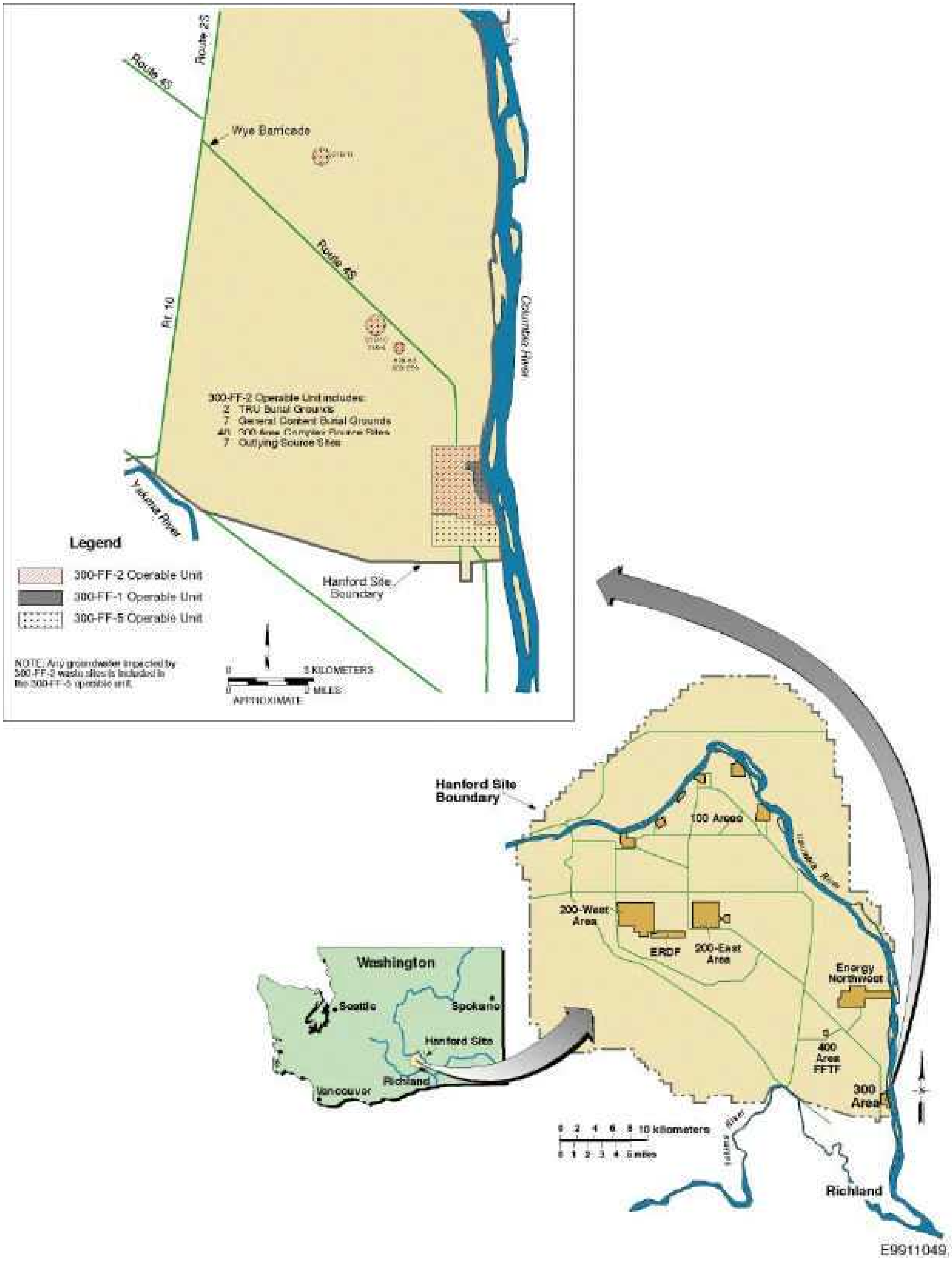
The U.S. Department of Energy's Hanford Site is a 586-square-mile (1,517-km^2) Federal Facility located in southeastern Washington along the Columbia River (see Figure 1). It is situated north and west of the cities of Richland, Kennewick, and Pasco, an area commonly known as the Tri-Cities. The region includes the incorporated cities of Richland, Pasco, and Kennewick (Tri-Cities), as well as surrounding communities in Benton, Franklin, and Grant counties. The Hanford Site was established during World War II, as part of the Manhattan Project, to produce plutonium for nuclear weapons. Hanford Site operations began in 1943.

The 300 Area, which encompasses approximately 0.52 sq mi (1.35 sq km), is adjacent to the Columbia River and approximately 1 mi (1.6 km) north of the Richland city limits. The 300 Area is generally level, with a steep embankment dropping to the river. 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 have expanded over the years. The 300 Area contains a number of support facilities and other facilities necessary for research and development, environmental restoration, decontamination, and decommissioning. Approximately 150 buildings and structures are scheduled for decontamination and decommissioning (D&D) in the next decade. A number of facilities with ongoing missions will remain in the 300 Area for some time. Operations in the 300 Area created both liquid and solid wastes. Prior to 1994, liquid wastes were discharged to a series of unlined ponds and process trenches just north of the 300 Area. Prior to 1973, a series of unlined disposal sites, called burial grounds, were used for solid wastes and debris generated by 300 Area operations. These burial grounds were located just north and west of the 300 Area Complex and some contain drummed liquid wastes.

II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

The Hanford Site was listed on the National Priorities List (NPL) in November 1989 under the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) as amended by the *Superfund Amendments and Reauthorization Act of 1986* (SARA). The Hanford Site was divided and listed as four NPL Sites: the 100 Area, the 200 Area, the 300 Area, and the 1100 Area. Each of these areas was further divided into operable units, which are groupings of individual waste units based primarily on geographic area and common waste sources.

Figure 1. Map of the Hanford Site and the 300 Area Operable Units



In anticipation of the NPL listing, the U.S. Department of Energy (DOE), the U.S. Environmental Protection Agency (EPA), and the Washington State Department of Ecology (Ecology) entered into the *Hanford Federal Facility Agreement and Consent Order* (known as the Tri-Party Agreement) in May 1989. This agreement established a procedural framework and schedule for developing, implementing, and monitoring remedial response actions at Hanford. The agreement also addresses *Resource Conservation and Recovery Act* (RCRA) compliance and permitting.

The 300 Area NPL site consists of the following operable units: 300-FF-1, 300-FF-2 and 300-FF-5 (see Figure 2). The 300-FF-1 and 300-FF-2 Operable Units address contaminated soils, structures, debris, and burial grounds. The 300-FF-5 Operable Unit addresses the groundwater beneath 300-FF-1 and 300-FF-2.

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

The Tri-Parties developed a Community Relations Plan (CRP) in April 1990 as part of the overall Hanford Site restoration process. The CRP was designed to promote public awareness of the investigations and public involvement in the decision-making process. The CRP summarizes known concerns based on community interviews. Since it was originally written, several public meetings have been held and numerous fact sheets have been distributed in an effort to keep the public informed about Hanford cleanup issues. The CRP was updated in 1993 and in 1996 to enhance public involvement.

The *Proposed Plan for 300-FF-2 Operable Unit* and the *Focused Feasibility Study for the 300-FF-2 Operable Unit* (300-FF-2 FFS) were made available to the public in both the Administrative Record and the Information Repositories maintained at the locations listed below on July 3, 2000.

ADMINISTRATIVE RECORD (Contains all project documents)

U.S. Department of Energy
Richland Operations Office
Administrative Record Center
2440 Stevens Center
Richland, Washington 99352

INFORMATION REPOSITORIES (Contain limited documentation)

University of Washington
Suzzallo Library
Government Publications Room
Seattle, Washington 98195

Gonzaga University
Foley Center
E. 502 Boone
Spokane, Washington 99258

Portland State University
Branford Price Millar Library
Science and Engineering Floor
SW Harrison and Park
Portland, Oregon 97207

DOE Richland Public Reading Room
Washington State University, Tri-Cities
100 Sprout Road, Room 101L
Richland, Washington 99352

The notice of the availability of these documents was published in the *Tri-City Herald* on July 2, 2000. A 60-day public comment period was held from July 3 to September 5, 2000. All submitted written comments can be found in the Administrative Record. Responses to the public comments received during the public comment period are included in the Responsiveness Summary (Appendix B) and were considered during the development of this ROD. EPA received no requests for a public meeting for the 300-FF-2 Proposed Plan. Other public involvement activities included:

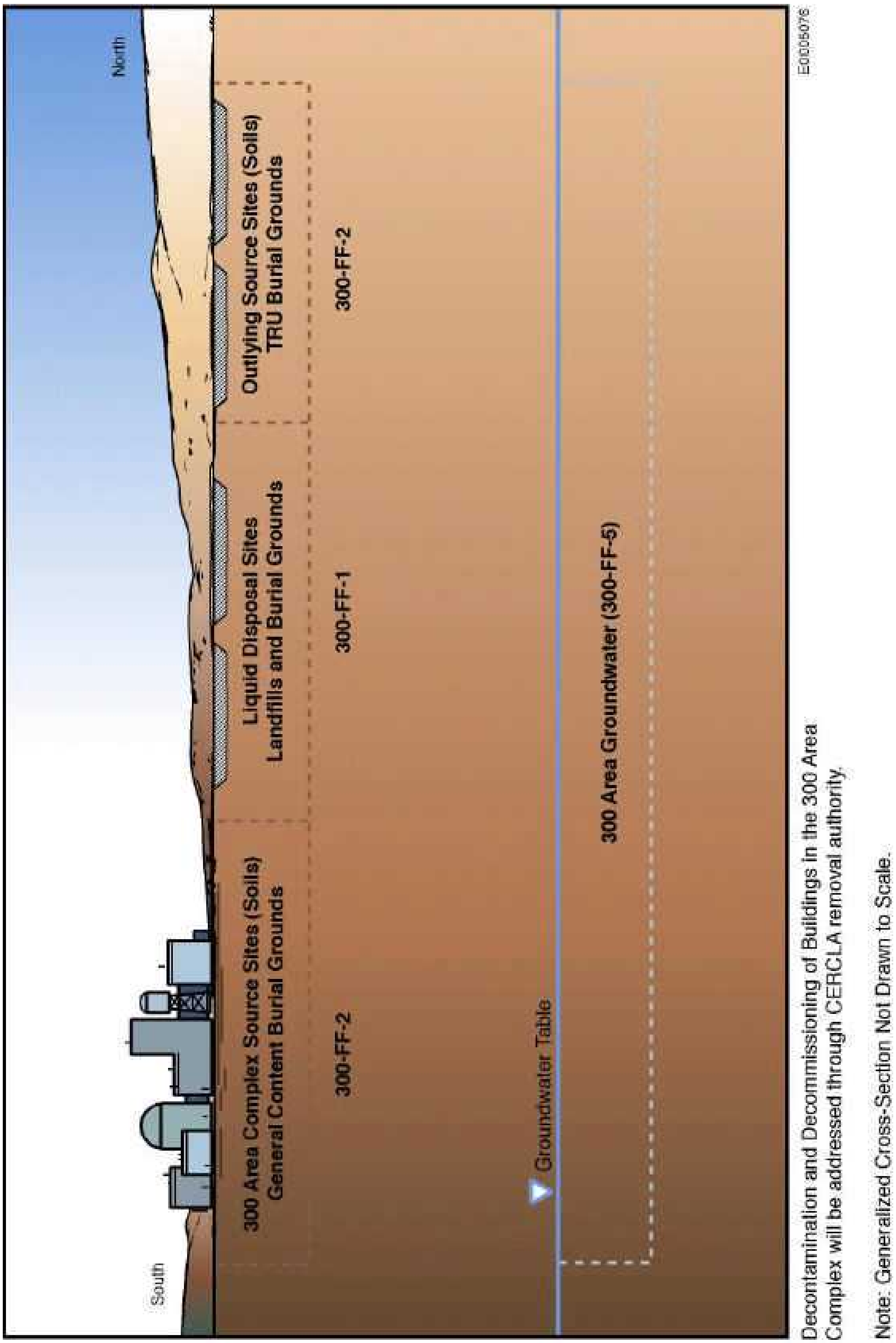
- A fact sheet, which explained the proposed action and informed the public that they could request a public meeting, was mailed to approximately 2,000 people.

- An article appeared in the bi-monthly newsletter, the *Hanford Update*, detailing the start of the public comment period (The *Hanford Update* is mailed to over 4,000 people).

- The Proposed Plan was made available to members of the Hanford Advisory Board (HAB), and a site tour was provided at the request of the HAB Environmental Restoration Committee on July 11, 2000.

- A public meeting was held on June 15, 2000, in Hood River, Oregon, to discuss the proposed cleanup action for the 100 Area Burial Grounds. A portion of this meeting was also dedicated to presenting the proposed cleanup action for the 300-FF-2 Operable Unit.

Figure 2. General Relationship of the 300-FF-2 Operable Unit Waste Site Groups



IV. SCOPE AND ROLE OF OPERABLE UNIT

Scope and Role of Operable Unit within Overall Strategy for cleaning up the Hanford Site

The Hanford Site is composed of four National Priority List (NPL) Sites which contain approximately 75 operable units (OUs) that have undergone, are undergoing, or will undergo remediation under CERCLA or RCRA corrective action authority. Cleanup actions in the 1100 Area and North Slope have been completed. Soil and groundwater cleanup in the 100 Area is currently underway. Several groundwater treatment systems are in operation in the 200 Area. In addition, assessment work has begun in the 200 Area soil sites to identify appropriate cleanup actions. Finally, soil remediation in parts of the 300 Area is currently underway.

Scope and Role of Operable Unit Within Overall Strategy for Cleaning up the 300 Area

The 300-FF-2 Operable Unit is one of three operable units associated with cleanup of the 300 Area NPL site. Cleanup actions for 300-FF-1 and 300-FF-5 are underway in accordance with an associated ROD. The relationship of 300-FF-2 with the other 300 Area operable units and area activities is presented in the following subsections and depicted in Figure 2.

300-FF-1 Operable Unit

The 300-FF-1 Operable Unit covers an area of approximately 117 acres (47.4 ha) and contains many of the current and past 300 Area liquid waste disposal units. The scope of 300-FF-1 includes: the major 300 Area liquid/process waste disposal sites, the 618-4 Burial Ground, and three small landfills. The 300-FF-1 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 suspected to be the primary source of groundwater contamination addressed in the scope of 300-FF-5.

A ROD for 300-FF-1 was approved in July 1996 (*Record of Decision for the 300-FF-1 and 300-FF-5 Operable Units*). 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 are based on a reasonably anticipated future industrial land use. Institutional controls were required as part of the remedy because the cleanup did not result in conditions that would permit unrestricted use and unlimited exposure.

Full-scale remediation of the 300-FF-1 Operable Unit began in July 1997. Through June 2000, these actions have resulted in the excavation and disposal of more than 530,000 tons of contaminated soil and debris to the ERDF and the completion of cleanup at seven waste sites (see Table 1).

Table 1. Summary of 300-FF-1 Progress as of August 2000			
Year	**Amount of Material Moved to ERDF (US Tons)**	**Amount of Material Moved to ERDF (Loose Cubic Yards)**	**Actual Expenditures**
FY97	30,000 tons	18,927 LCY	$ 2.5 million
FY98	117,000 tons	73,815 LCY	$ 6.1 million
FY99	232,000 tons	146,369 LCY	$ 5.9 million
FY00	155,000 tons	97,790 LCY	$ 4.4 million
TOTAL	**534,000 tons**	**336,901 LCY**	**$ 18.9 million**

In December 1999, EPA issued an Explanation of Significant Difference (ESD) to the ROD for 300-FF-1 to grant a site-specific treatability variance for a small quantity of soil and debris (925 cubic meters) in one 300-FF-1 waste site (Landfill 1D) so that it could be removed from the 300 Area and disposed of in ERDF. The soils met the criteria for a RCRA Land Disposal Restriction (LDR) treatability variance under 40 CFR 268.44(h), and 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.

300-FF-5 Operable Unit

The 300-FF-5 Operable Unit consists of contaminated groundwater beneath the 300-FF-1 and 300-FF-2 Operable Units (an area of approximately 1.6 square miles, or 1025 acres). Based on information that was available at the time when the 300-FF-5 ROD was developed, the following conclusions were made.

- Uranium was the primary contaminant of concern in 300 Area groundwater, although smaller amounts of Trichloroethene (TCE) and 1,2-Dichloroethene (DCE) were also detected above action levels.
- 300-FF-1 liquid disposal sites were a primary source of the groundwater contamination.
- Elevated uranium concentrations in groundwater were estimated to reach proposed drinking water standards in 3 to 10 years from late 1993.
- TCE levels were declining below action levels at the time, and DCE was expected to remain in the unconfined aquifer above action levels for “an undetermined period of time.” Both compounds were localized.
- Two groundwater plumes are entering the 300 Area from other parts of the Hanford Site. A tritium plume is entering from the north and a TCE plume is entering from the southwest.

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 ROD assumes 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. 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 (O&M) plan for 300-FF-5 defined three primary activities to accomplish these goals: (1) groundwater monitoring, (2) near-shore river monitoring, and (3) posting warning signs.

An ESD to the 300-FF-5 ROD was developed by EPA in June 2000. The ESD expands the scope of 300-FF-5 to include groundwater beneath all 300-FF-2 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 requires an update to the O&M 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.

300-FF-2 Operable Unit

The 300-FF-2 Operable Unit is the third and final operable unit associated with cleanup of the 300 Area NPL site. It is an interim source control action. The 300-FF-2 Operable Unit is composed of 56 waste sites (listed in Appendix A). These sites fall into four general categories: waste sites in the 300 Area Industrial Complex (40 sites); outlying waste sites north and west of the 300 Area Industrial Complex (7 sites); general content burial grounds (7 sites); and transuranic-contaminated burial grounds (2 sites).

V. SITE CHARACTERISTICS

<u>Physical Characteristics of the 300-FF-2 Operable Unit</u>

The topography of Hanford Site in the vicinity of the 300-FF-2 Operable Unit can be described as a gently undulating, low-profile plain. Elevations range from approximately 168 m (550 ft) above mean sea level near the 400 Area to approximately 119 m (390 ft) above mean sea level along the Columbia River near the 300 Area.

Local Geology

The Hanford Site is located in the Pasco Basin, a sediment-filled topographic and structural basin situated in the northern portion of the Columbia Plateau. The Hanford Site is dominated by the low-relief plains of the Central Plains physiographic region and anticlinal ridges of the Yakima Folds physiographic region. The Pasco Basin is bounded on the north by the Saddle Mountains anticline; on the west by the Umtanum Ridge, Yakima Ridge, and Rattlesnake Hills anticlines; and on the south by the Rattlesnake Mountain anticline. The Palouse Slope, a west-dipping monocline, bounds the Pasco Basin on the east. The Pasco Basin is divided into the Wahluke and Cold Creek synclines, which are separated by the Gable Mountain anticline, the eastern extension of the Umtanum Ridge. The sediments within the Pasco Basin are underlain by the Miocene-age Columbia River Basalt Group, a thick sequence of flood basalts that covers a large area in eastern Washington, western Idaho, and northeastern Oregon.

The uppermost member of the Columbia River basalts present in the 300 Area is the Ice Harbor Member of the Saddle Mountains Basalt group. Suprabasalt strata in the 300 Area consist of the 29- to 44-m thick (95- to 145-ft thick) Ringold Formation, the 24- to 35-m (80- to 115-ft) thick Hanford formation, and a thin veneer of surficial deposits. Sediments from the upper strata of the Ringold Formation within and near the 300 Area are characterized by complex interstratified beds and lenses of sand and gravel. Ringold Formation deposits are generally better cemented, calcified, and sorted than those from the Hanford formation. Ringold strata typically contain a lower percentage of angular basaltic detritus than do Hanford formation deposits.

Soil Characteristics

Regional soil in the Hanford Site area is highly permeable with few clearly defined horizons. The major soil types identified in the 300 Area include Rupert sand, Ephrata sandy loam, and Burbank loamy sand. Rupert sand is the dominant soil type in the area and is characterized as a moderately deep soil that developed in coarse, sandy glaciofluvial deposits mantled by windblown sand. Relief is typically characterized as hummocky terraces and dune-like ridges. Ephratra sandy loam is a medium-textured soil underlain by gravel. Burbank loamy sand consists of excessively drained, coarse-textured soil underlain by gravel. These soils developed in gravelly and stony alluvial deposits that are mantled with mixed alluvium and windblown sand.

Local Hydrogeology

The unconfined aquifer beneath the 300 Area is composed of two hydrogeologically distinct formations: the Hanford and the Ringold formations. The Hanford formation is dominated by pebble to boulder gravels with sandy dominated facies present locally. Excluding eolian deposits, the vadose zone is composed of the Hanford sands and gravels. The open framework structure of this formation yields very high hydraulic conductivities ranging between 3,600 m/day (12,000 ft/day) to 10,000 m/day (32,800 ft/day). The formation generally has a high porosity and drains rapidly. Though groundwater mounding beneath operating ditches and ponds was observed in the past, no such mounding is known to exist today. Saturated Hanford formation underlies the 300 Area and varies between 1.5 to 7.6 m (5 to 25 ft) in thickness. The saturated Hanford formation generally thickens near the Columbia River and thins to the west. The partially indurated Ringold Formation underlies the Hanford formation and completely contains the unconfined aquifer on the western edge of the operable unit. There is evidence of several erosional lows in the top of the Ringold Formation that generally extend from west to east across the formation. The Ringold Formation has much lower conductivities, ranging from 50 m/day (160 ft/day) to 150 m/day (500 ft/day).

The uppermost confined aquifer occurs in the lower sand and gravel units of the Ringold Formation and is separated from the unconfined system by the Ringold lower mud unit. An upward gradient exists between the confined and the unconfined aquifers, indicating that the mud unit is locally extensive.

Flow in the unconfined system is generally toward the Columbia River, and groundwater eventually discharges to the river through springs and seeps in the river bottom and riverbank. However, river stage strongly influences both groundwater flow and contaminant exchange rates between the aquifer and the river. This effect is most pronounced near the river, but is also observed throughout the operable unit. Gradient reversals, causing flow to move from the river into the 300-FF-5 Operable Unit, are common and are facilitated by the high transmissivities measured in the Hanford formation. Daily river stage variations of 1 to 3 ft are common, and seasonal (long-term) changes of 4 ft have been observed.

The groundwater flow system has a significant impact on the contaminant distribution observed in the aquifer. Higher groundwater pore velocities, associated with the saturated Hanford formation found along the river, will quickly flush and naturally dilute contamination introduced into the aquifer and facilitate its remediation. Groundwater concentrations of contaminants whose movement is only slightly chemically retarded will decrease with time once potential sources are removed or contained.

The depth to the groundwater table varies throughout the 300-FF-2 Operable Unit, depending on the location of the waste site relative to the Columbia River. Depths range from approximately 20 feet below grade for 300-FF-2 waste sites near the river to as much as 60 feet below grade for 300-FF-2 waste sites located further west.

Surface Water

The Columbia River is the second largest river in North America and is the dominant surface-water body on the Hanford Site. The existence of the Hanford Site has precluded development of this section of river for irrigation and power, and the Hanford Reach (the free-flowing section of the Columbia River beginning at Priest Rapids Dam and ending just north of 300-FF-1) has been designated a National Monument pursuant to a June 9, 2000, Presidential Proclamation under the 1906 Antiquities Act. Washington State has classified the stretch of the Columbia River from Grand Coulee to the Washington-Oregon border, which includes the Hanford Reach, as Class A, “Excellent.” Class A waters are to be suitable for essentially all uses, including raw drinking water, recreation, and wildlife habitat.

The Columbia River has many uses, including production of hydroelectric power, extensive irrigation in the Mid-Columbia Basin, and as a transportation corridor for barges. The river and islands also serve as habitat for a variety of fish and birds. Several communities along the Columbia River rely on the river for drinking water. In addition, the Columbia River is used extensively for recreation, including fishing, hunting, boating, sailboarding, waterskiing, diving, and swimming.

Meteorology

The Hanford Site is characterized by a low annual rainfall of approximately 16 cm/yr (6.3 in/yr). The summer months are typically hot and dry, and winters are moderately cold. Predominant wind directions from west-northwest to northwest average 10 to 12 km/hr (6 to 7 mi/hr) in the winter and 13 to 17 km/hr (8 to 10 mi/hr) during the summer. Predominant wind directions may be different in various areas of the site as influenced by ridges and river valleys. Windblown dust accompanies strong winds on the Hanford Site.

Ecology

General wildlife monitoring on a Hanford Site-wide basis is reported in annual Hanford Site environmental reports. Additional related information that is applicable to the ecological characteristics of 300-FF-2 may be found in Appendix E of the FFS.

Flora: The 300-FF-2 Operable Unit is characterized as an arid-to-semiarid, shrub-steppe vegetation zone. The natural climax community is the big sagebrush/bitterbrush/Sandberg's bluegrass association. The dominant nonriparian flora species on disturbed waste sites within the operable unit include cheatgrass, Russian thistle, and rabbitbrush. Additional information can be found in Appendix E of the FFS.

Fauna: Reptiles observed in the 300-FF-2 Operable Unit vicinity include western yellow-bellied racers, gopher snakes, and a few species of lizards. Fifty-three species of birds were documented during winter and summer surveys, including ring-billed and California gulls, bank swallows, Forster's terns, Canada geese, and a variety of ducks and fish-eating fowl. Approximately 40 species of mammals have been identified on the Hanford Site. The most abundant small mammals captured in the 300-FF-5 Operable Unit riparian zone studies were the house mouse and the Great Basin pocket mouse. A total of 44 fish species have been identified in the Columbia River near the 300 Area. A complete list of all Federal- and Washington State-designated threatened and endangered species that may be associated with 300-FF-2 can be found in the FFS.

Sensitive Areas: Critical habitats, or habitats of concern, are administrative designations as defined in the *Hanford Site Biological Resources Management Plan* (BRMaP). While no critical habitats as defined by the BRMaP are located in the 300-FF-2 Operable Unit, specific actions will be prescribed to reduce or prevent injury to sensitive environments (e.g., native plant communities). Before initiating remedial action work, project-specific ecological resource reviews will be conducted to determine the presence or absence of species or habitats of concern. If ecological resources of concern are identified, mitigation actions will be evaluated to avoid, minimize, or compensate for impacts. These requirements will be documented in more detail in the 300-FF-2 Remedial Design/Remedial Action (RD/RA) workplan. Sensitive environments in the 300-FF-2 Operable Unit are similar or identical to those identified for the 300-FF-1 and

300-FF-5 Operable Units. These sensitive environments include mature sagebrush/bitterbrush/ Sandberg's bluegrass communities.

Cultural Resources

Late prehistoric material is prevalent throughout the 300 Area, especially adjacent to the Columbia River. Several cultural resource surveys have been conducted within and around the 300 Area. These surface surveys have been limited in scope and represent only a portion of the operable unit area. Five sites with prehistoric components, five sites with historic components, and one site containing both historic and prehistoric components are known to be located within the operable unit area. Soil excavation associated with implementing the Remove, Treat, Dispose remedy would occur in extensively disturbed areas, so the likelihood of encountering cultural resources during the remedial action would be low. However, if archeological resources are discovered during project activities, the procedures documented in the *Hanford Cultural Resource Management Plan* would be followed (these requirements will be documented in the 300-FF-2 RD/RA workplan). These procedures require that work in the vicinity of the discovery must stop until a Cultural Resource Specialist has been notified; the significance of the find is assessed; the Tribes are notified; and, if necessary, a mitigation plan is developed in consultation with the Tribes, the Washington State Historic Preservation Office, and, if participating, the Advisory Council on Historic Preservation. In the event that human remains were to be encountered, the provisions of Section 10.4 of the implementing regulations for the *Native American Graves Protection and Repatriation Act of 1990* (43 CFR 10) would be followed (these requirements will be documented in the 300-FF-2 RD/RA workplan). These regulations require that activity in the area of discovery cease immediately, reasonable efforts must be made to protect the discovery, notice of discovery must be given to the appropriate Tribes, and a period of 30 days must be set aside following notification for negotiations regarding appropriate disposition.

Nature and Extent of Contamination in the 300-FF-2 Operable Unit

The 300-FF-2 Operable Unit addresses radioactively- and/or chemically-contaminated soil, buried waste, and belowground structures (e.g., pipelines and concrete) at sites within the 300 Area Industrial Complex and in the general vicinity of the 300 Area Industrial Complex. Waste sites that are included in the scope of the 300-FF-2 Operable Unit were identified through a categorization process that was developed and implemented by the Tri-Parties. The categorization process resulted in identification of 56 waste sites[3] that require remedial action under CERCLA (see Appendix A). These sites fall into four general categories: waste sites in the 300 Area Industrial Complex (40 sites); outlying waste sites north and west of the 300 Area Industrial Complex (7 sites); general content burial grounds (7 sites); and transuranic-contaminated burial grounds (2 sites). See Figure 3.

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[3] The term "waste site" is a general term used to describe a discrete geographic area that could contain contaminated soil, debris, or material above cleanup levels. Waste site boundaries generally conform to the boundaries of engineered structures (such as trenches, pipelines, or burial grounds) or the location of documented spills or unplanned releases. However, the true boundary of the waste site (i.e., the area requiring cleanup) is determined by EPA based on the areal extent of contamination associated with the engineered structure or release.

300 Area Complex Source Sites (40 Sites)

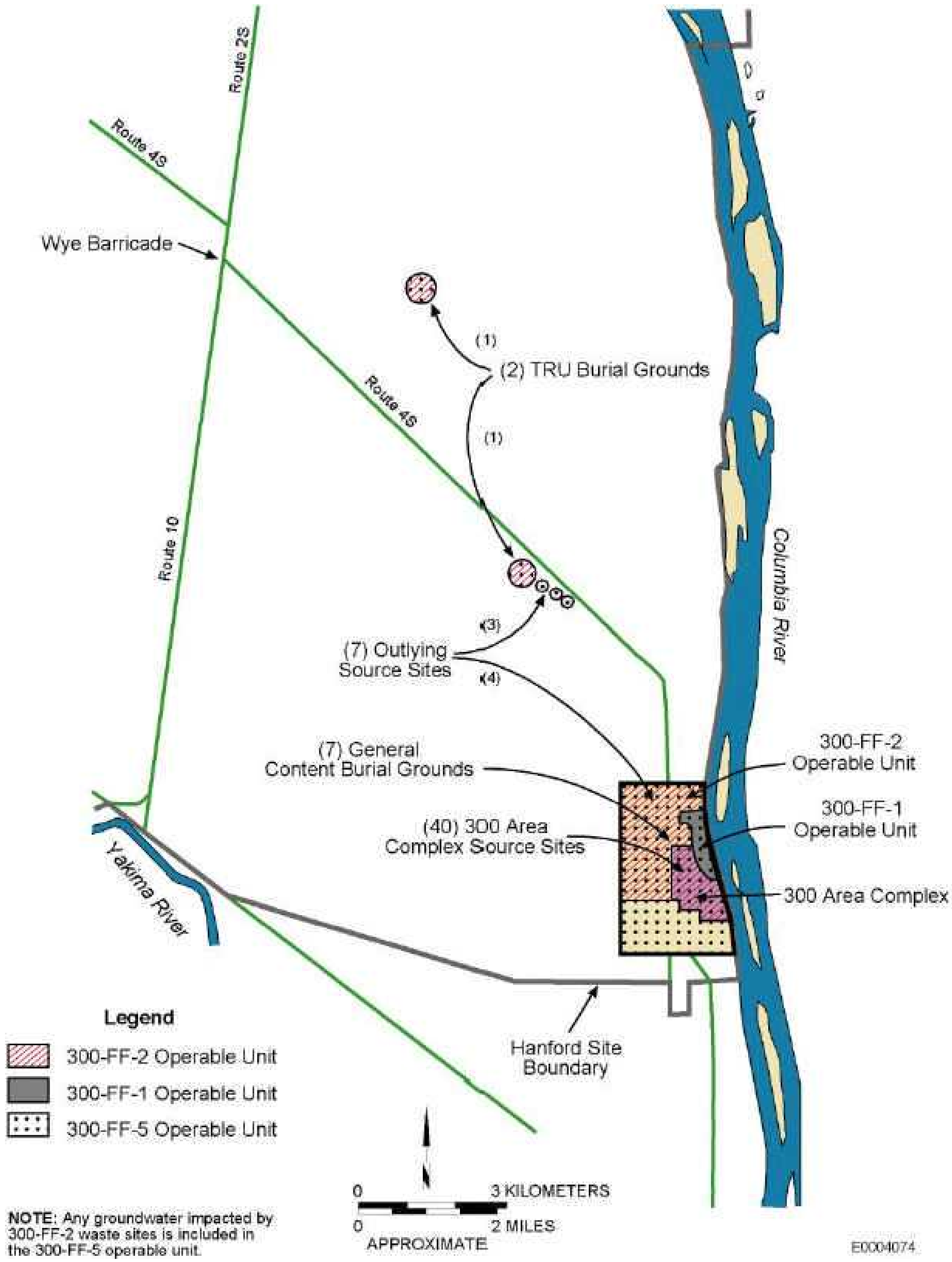
The source sites within the 300 Area Complex include trenches, storage areas, process plants, process sewers, french drains, and unplanned releases. Characteristics of the 300 Area Complex source sites are summarized as follows:

- It has been estimated that approximately 150 buildings and structures need to be removed to expose the 40 soil contamination areas that need to be cleaned up pursuant to this ROD. An additional $663 million (not within the scope of this remedial action) is estimated to be required to remove materials and structures from the 300 Area to facilitate the cleanup of contaminated soil and debris. Most 300 Area Complex sites lie beneath existing facilities and/or paved areas and are directly impacted by current operations and/or future decontamination and decommissioning (D&D) activities. Within the complex, boundaries of contamination are not well defined, and sites often overlap each other. Implementation of 300-FF-2 remedial actions will require integration with ongoing use of the 300 Area, transition, and demolition. The D&D activities will be evaluated in Engineering Evaluation/Cost Analysis (EE/CA) documents and authorized in CERCLA Action Memoranda (i.e., CERCLA removal authority). As an alternative approach, D&D activities can be evaluated using the Limited Field Investigation/Focused Feasibility Study approach to support a subsequent Record of Decision to authorize the removal of buildings and aboveground structures.

- Five sites within the 300 Area Complex consist of underground sewer systems/piping. The 300 Area Radioactive Liquid Waste Sewer (300 RLWS), the 300 Area Retired Radioactive Liquid Waste Sewer (300 RRLWS), and the 309 Holdup Tank Outfall Pipeline (300-257) are abandoned systems. The 300 Area Process Sewer (300-15) and 300 Area Retention Process Sewer (300-214) are active sewer systems. Together, these sites include more than 52 km (32 mi) of underground piping that interconnects 300 Area facilities and runs through the building interiors. Many leaks and unplanned releases associated with the sewer systems have been documented. The volume of liquids that leaked from the systems and potential future impacts to the groundwater and the Columbia River are unknown.

- Several 300 Area Complex source sites involve coordination of CERCLA and RCRA regulatory authorities. These sites include the 300 Area Waste Acid Treatment System (specifically, waste sites UPR-300-38 and 300-224), the 303-K Contaminated Waste Storage area (specifically, waste site 300-251), the 303-M Uranium Oxide Facility (303-M UOF), the 340 Complex, and the 324 Building (300-25). As necessary, separate RCRA closure documents will be developed after completing remedial actions under CERCLA.

Figure 3. Overview of the 300-FF-2 Operable Unit Waste Site Groups



A complete list of the source sites within the 300 Area Complex is presented in Appendix A.

Outlying Source Sites (7 sites)

The outlying source sites include trenches, cribs, dumping areas, storage areas, and unplanned releases. The 316-4 Crib is an outlying source site and the only 300-FF-2 source waste site that has been shown to impact groundwater. Groundwater monitoring results suggest that the uranium contamination is localized. Contaminated groundwater beneath the 316-4 Crib will be addressed as part of the 300-FF-5 Operable Unit. A complete list of the outlying source sites is presented in Appendix A.

General Content Burial Grounds (7 sites)

The general content burial grounds operated from the mid-1940s to mid-1970s to support 300 Area fuel fabrication and laboratory activities. They received a broad spectrum of chemical and radiological waste as well as solid waste and debris. The 300 Area burial grounds are difficult to characterize due to their heterogeneous nature, and quantitative characterization data are generally not available. Records documenting the inventory for many of the 300 Area burial ground sites are poor, especially for sites that operated in the 1940s and 1950s. Some of the known attributes for the general content burial grounds are highlighted as follows:

- All of the general content burial ground sites have an existing cover of soil with vegetation or asphalt.
- None of the general content burial grounds currently appear to be impacting groundwater.
- The 618-1 Burial Ground is located in the north end of the 300 Area Complex under 3 small storage buildings (303M, 334A, and 334), a concrete pad, and gravel area.
- The 618-5 Burial Ground is located adjacent to several 300-FF-1 waste sites that have been excavated and removed. It is also located within 100 m (350 ft) of the Columbia River.
- Historical records indicate that the 618-7 Burial Ground contains “hundreds” of drums of zircaloy chips from the fuel fabrication and machining processes. Zircaloy is composed of zirconium, tin, iron, chromium, and nickel. Under the right conditions, spontaneous heating can occur during the handling of finely divided zirconium scrap. Prior to burial, the chips were placed in 113.5-L (30-gal) iron drums and covered with water to mitigate their pyrophoric attribute. No records were kept to identify the exact quantity or location of the drums, and their integrity is unknown.
- A portion of the 618-8 Burial Ground is located under an actively used parking lot in the north end of the 300 Area Complex, just outside of the complex fenceline.

- The 618-13 Burial Ground was a single-use site for the disposal of uranium-contaminated soil and is actually a small, above-grade mound of soil.

A complete list of the general content burial grounds is provided in Appendix A.

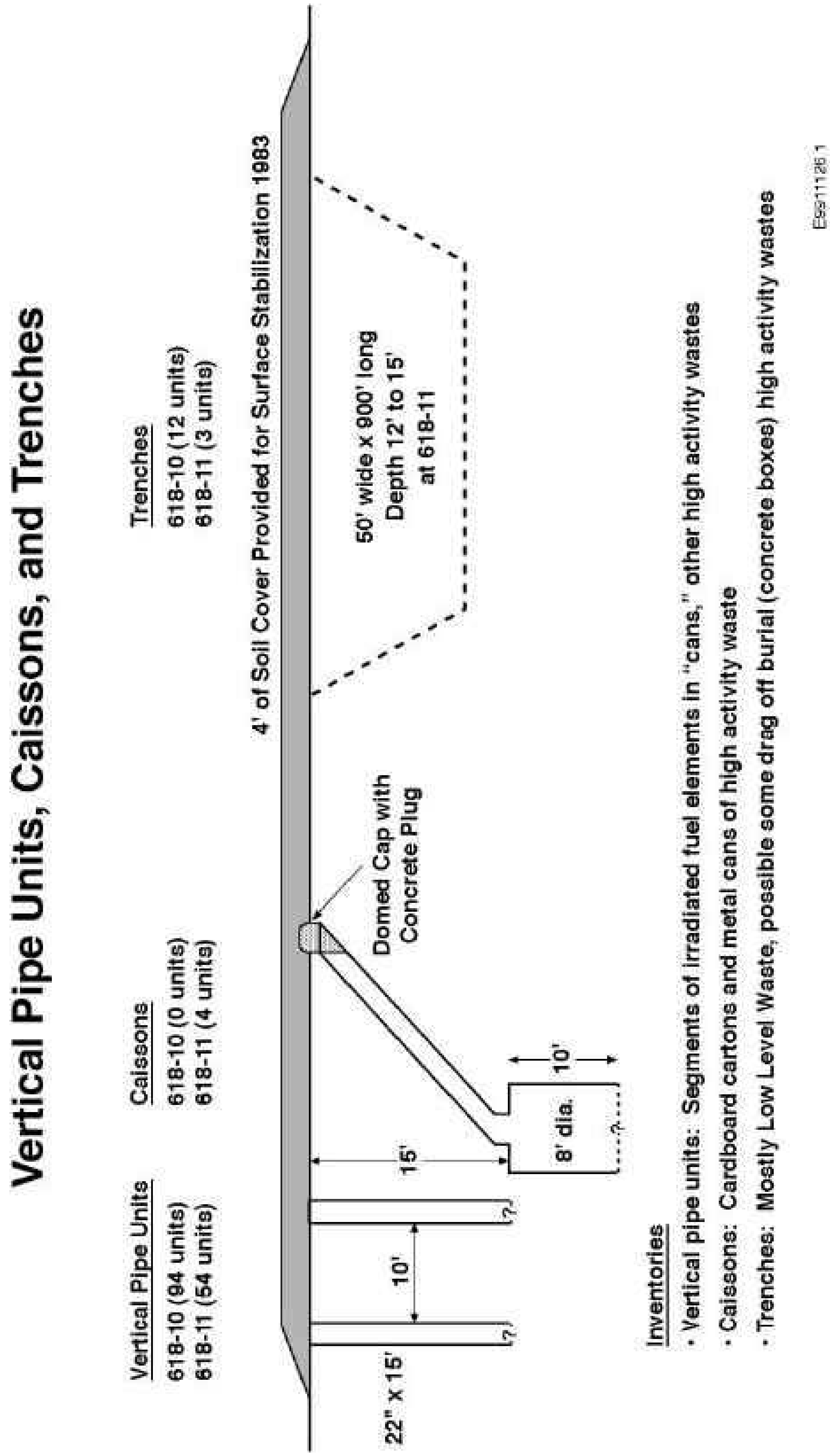
Transuranic-Contaminated Burial Grounds (2 sites)

Transuranic (TRU)-contaminated waste was first identified by the U.S. Atomic Energy Commission (AEC) as a separate category of radioactive waste in 1970, and was later defined by AEC in 1973 as waste containing greater than 10 nCi/g of alpha-emitting TRU radionuclides. This waste was deemed to warrant more stringent handling and disposal considerations than low-level waste (LLW) due to the hazards associated with the increased concentrations of long-lived alpha-emitting radionuclides. Before 1970, such waste was handled in a manner similar to LLW and was generally disposed of by shallow land burial or other similar disposal techniques. The U.S. Department of Energy (DOE) revised the definition of TRU-contaminated waste in 1984, increasing the lower limit of alpha-emitting TRU radionuclides with half-lives greater than 20 years from 10 to 100 nCi/g.

During the plutonium production years, Hanford's 300 Area was tasked with fuels fabrication along with fuel research, testing, and examination. In 1953, the 300 Area laboratories began fuel examination and testing of irradiated fuel rods from the 100 Area production reactors. This type of laboratory analysis created highly radioactive wastes, some of which were sent to the 618-10 and 618-11 Burial Grounds for disposal in vertical pipe units and caissons. Vertical pipe units were constructed of five bottomless 55-gallon drums welded together to form a column and buried vertically (Figure 4). A specially designed truck and flatbed trailer equipped with casks was able to be positioned over the drum or caisson opening and waste remotely deposited into the ground. When filled, or if the dose rate became too high, the unit was capped with concrete and work was moved to another unit. Waste packages would often break open when dropped into the vertical pipe units. Frequent surface contamination occurred from the reflux of airborne particles during waste drops. As a result, three to five large diameter caissons with offset chutes were installed at the 618-11 Burial Ground to help contain contamination and reduce exposure during disposal activities (Figure 4). These vertical pipe units and caissons are unique in the DOE Complex. Less than a dozen caissons were used in a similar manner in the 200 Area. The vertical pipe units were used exclusively in the 618-10 and 618-11 Burial Grounds.

Available records for the 618-10 and 618-11 Burial Grounds indicate that the radionuclide beta/gamma activity was generally divided into three categories for waste disposal: <10 Ci/ft^3 (low-activity), 10 to 1,000 Ci/ft^3 (moderate-activity), and above 1,000 Ci/ft^3 (high-activity). The low-activity wastes were primarily disposed in trenches, while the moderate and high-activity wastes were disposed in vertical pipe units and caissons. Some of the moderate and high-activity wastes were disposed to trenches in concrete/lead-shielded drums. For purposes of the 300-FF-2 FFS, and being consistent with terms in use today, the portion of the TRU-contaminated waste assumed to have dose rates exceeding 200 mrem per hour on contact are considered to be remote handled TRU (RHTRU). Because of the timing associated with

Figure 4. Cross-Section of Disposal Units in the 618-10 and 618-11 Burial Grounds



RHTRU, whereas only 10 percent of the waste disposed to the vertical pipe units in the 618-10 Burial Ground are considered RHTRU. Materials with dose rates less than 200 mrem per hour on contact were generally TRU-contaminated waste consisting of large waste items, waste items in boxes (non-drum containers), and liquid wastes in drums, that were disposed in the burial ground trenches. This waste is called contact-handled (CH) TRU. For the 618-11 Burial Ground, 10 percent of the wastes disposed to the trenches is considered as CHTRU, with the remaining material considered as low-level mixed waste (LLMW). At the 618-10 Burial Ground, 90 percent of the waste disposed to the vertical pipe units and 100 percent of the wastes disposed to the trenches is considered to be LLMW.

The 618-10 and 618-11 Burial Grounds operated between 1954 and 1967 and share the same general characteristics of the general content burial grounds. Some of the specific characteristics of the 618-10 and 618-11 Burial Grounds include:

- Both of the burial grounds have an existing cover that consists of soil with vegetation.

- The 618-11 Burial Ground contains pre-1970 transuranic-contaminated waste buried in pipe units, caissons, and trenches. The reported quantity of plutonium or other transuranic elements in the 618-11 Burial Ground is 5 to 10 kg (11 to 22 lb) dispersed throughout the waste site. The burial ground trenches also contain high-activity waste. The 618-11 Burial Ground is located adjacent to an active commercial nuclear facility that is expected to operate for the next 50 years. In 1987, alternatives for remediation of the waste site were reviewed by the public under the National Environmental Policy Act (NEPA) process in the *Final Environmental Impact Statement, Disposal of Hanford Defense High-Level, Transuranic, and Tank Wastes* (DOE/EIS-0113). The alternative selected in the 1988 NEPA ROD (53 FR 12449) was to proceed with removal and processing of waste from the 618-11 Burial Ground based on its location outside of the 200 Area plateau, and a DOE desire to consolidate transuranic-contaminated waste to the 200 Area plateau.

- The 618-10 Burial Ground also contains pre-1970 transuranic-contaminated waste buried in vertical pipe units and trenches (no caissons). The total quantity of plutonium or other transuranic elements within the 618-10 Burial Ground is estimated to be much less than the 618-11 Burial Ground (1 to 2 kg, or 2 to 4 lb) dispersed throughout the waste site. In addition to a small amount of transuranic-contaminated waste, records indicate that the 618-10 Burial Ground trenches also contain high-activity waste and buried drums of oil. During stabilization activities at the 618-10 Burial Ground in 1983, a noticeable puddle of oil appeared from beneath the soil surface after heavy equipment drove over a portion of the waste site, indicating a potential loss of drum integrity.

- In January 1999, levels of tritium that greatly exceeded concentrations indicative of the sitewide tritium plume were identified in a well immediately downgradient of the 618-11 Burial Ground. Another round of sampling in January 2000 revealed a tritium concentration 400 times the drinking water standard (8.1 million pCi/L) in the same well. A multi-phase groundwater investigation was immediately launched. Phase 1 (February 2000) involved sampling 22 groundwater wells in a 3-5 mile radius of the burial ground.

Phase 2 (October 2000) involved resampling 10 wells and installing two temporary groundwater sampling points and a series of soil-gas sampling points (to monitor tritium releases in the vadose zone). The results of the analysis identify the 618-11 Burial Ground as the primary source of the groundwater plume and suggest that the extent of the plume is highly localized. The groundwater investigation is still ongoing, and any active groundwater responses will be authorized through an amendment to the 300-FF-5 Record of Decision (which addresses groundwater beneath the 300-FF-1 and 300-FF-2 Operable Units). DOE is also evaluating options for interim measures that can be taken to address the source of the plume in the burial ground before the Remove, Treat, Dispose remedy selected in this ROD can be implemented.

A cross-section of the engineered structures associated with the transuranic-contaminated burial grounds (e.g., pipe units, caissons, and trenches) is depicted in Figure 4. A summary of the 618-10 and 618-11 Burial Grounds is provided in Appendix A.

VI. CURRENT AND POTENTIAL FUTURE LAND AND RESOURCE USES

Current Land Use

The 300 Area Complex is currently an active industrial area. Some of the specific activities in the 300 Area Complex include active laboratories, research and development, waste disposal facilities, D&D activities, and other miscellaneous operations.

The outlying areas of 300-FF-2 include most of the burial grounds and outlying source sites. Most of these areas are not being actively used for any purpose. Although they are within the Hanford site boundary and subject to access restrictions, all of the 300-FF-2 waste sites are located outside the Hanford site security checkpoint at the Wye Barricade on Route 2.

It should be noted that the natural habitat of the 300 Area Industrial Complex has been highly disturbed by past industrial/waste management operations, and complete ecological communities represented by common food webs are not present. However, areas adjacent to the industrial complex are subject to sparse and transient use by wildlife. Outlying areas in the 300-FF-2 Operable Unit have a similar habitat to other parts of the Columbia River corridor.

Reasonably Anticipated Future Land Use

The reasonably anticipated future land use for the 300 Area Industrial Complex, the areas adjacent to the 300 Area Industrial Complex to the north and west, and the outlying sites/burial grounds 5-8 miles north of the 300 Area Industrial Complex is “industrial.” This assumption is consistent with the relevant land use planning documents. These include:

- The *Final Report of the Hanford Future Site Uses Working Group* (December 1992) described the cleanup objective for the 300 Area (both the industrial complex and surrounding vicinity) as ‘restricted status for industrial use’ under both “*Cleanup Scenario A: Cleanup for Economic Development, Wildlife*” and “*Cleanup Scenario B:*

Cleanup for Agriculture and Native American Uses Outside the 300 Area," as explained in the report.

- The *Hanford Comprehensive Land-Use Plan Environmental Impact Statement* (HCP EIS) (September 1999) and ROD (64 Federal Register 61615) includes all sites in the 300-FF-2 Operable Unit (including outlying sites and burial grounds) in an "industrial" land use designation to support "new DOE missions or economic development."

- The *City of Richland's Comprehensive Land Use Plan* identifies the 300 Area (as well as areas North and South of the 300 Area) as an "Urban Growth Area" pursuant to Washington's Growth Management Act. Land uses identified in the plan include "industrial" and "business/research park."

- Benton County's *Draft Hanford Land Use Plan* (Spring 2000) identifies all sites in the 300-FF-2 Operable Unit (including outlying sites and burial grounds) as either being in the City of Richland's "Urban Growth Area" or in a land use zone defined by Benton County as "industrial – heavy." Within the Urban Growth Area, the County defers land use planning and land use designations to the City of Richland, unless there is a marked disagreement. In this case there is not. The *Draft Hanford Land Use Plan* will be incorporated into the *Benton County Comprehensive Plan* as Chapter 13 when the plan is updated in Spring 2001.

While none of these documents can formally zone the 300-FF-2 Operable Unit as "industrial," the plans document what a working group comprised of Hanford stakeholders, DOE, and local land use planning authorities expect in the way of future land use and are sufficient to conclude that "industrial" or "general urban uses other than residential," are reasonably anticipated future land uses for the areas covered by the 300-FF-2 Operable Unit. This means that institutional controls must be a required part of the remedy in order to ensure that land uses are limited to those defined in the 300 Area industrial use exposure scenario. Any changes to the land use that are inconsistent with the land use assumptions upon which the ROD is based will be evaluated regularly and used in support of the CERCLA five-year review. (NOTE: Other land uses may also be appropriate as long as institutional controls limit human activities to those described in the 300 Area industrial use exposure scenario.)

Current Ground/Surface Water Uses

The Columbia River is used as a source of drinking water, industrial process water, and crop irrigation. It is also used for a variety of recreational activities, including fishing, hunting, boating, water skiing, and swimming. Water intakes in the vicinity of the 300-FF-2 Operable Unit include the following:

- The 300 Area process and drinking water intake (on standby as of December 1998), located just downstream of the 316-1 South Process Pond

- The City of Richland drinking water intake located approximately 3.25 km (2.75 mi) south (downstream) of the 300 Area.

Irrigation intakes include the Battelle Farm Operations intake, an intake to supply water to farmland west of the 1100-EM-1 Operable Unit, and the Washington State University intake. Energy Northwest also maintains an intake approximately 8 km (5 mi) north (upstream) of the 300 Area. The Energy Northwest intake provides makeup water for coolant at the Washington Nuclear Plant No. 2 (WNP-2) facility.

Groundwater in the immediate vicinity of the 300 Area is used by the Pacific Northwest National Laboratory Life Science Laboratory, located in the 331 Building. The life science research activities entail the continuous use of well 399-4-12 to supply water to the fisheries laboratory. Additionally, the City of Richland supplements its municipal water system during the summer months with 14 wells around 2 recharge ponds filled with Columbia River water located approximately 5 km (3 mi) south of the 300-FF-2 Operable Unit. No other wells in the 300 Area appear to be used for anything other than groundwater monitoring. Under the Federal and state groundwater classification strategy, the 300 Area groundwater is considered a potential source of drinking water. This classification is based on physical characteristics of the groundwater prior to contamination, and not on actual or projected-use scenarios.

Adjacent to the 618-11 Burial Ground site, the Energy Northwest facility (WNP-2) utilizes groundwater from wells 699-13-1A and 699-13-1B (unconfined aquifer) to provide makeup water for the reactor secondary cooling system. In addition, wells ENW-32 and 699-13-1C (confined aquifer) are backup drinking water supply wells for the WNP-2 facility. Well ENW-31 (confined aquifer) is a drinking water well for the WNP-1 facility.

Potential Future Ground/Surface Water Uses

The groundwater in the 300 Area is considered to be a potential future drinking water source, and therefore source control actions must be protective of groundwater quality. Surface water uses are not expected to change from current uses in the future.

VII. SUMMARY OF SITE RISKS

In the Superfund process, potential risks to human health and the environment are evaluated to determine whether significant risks exist due to site contaminants. Two types of potential human health effects due to contact with site contaminants are evaluated at Superfund sites. The first is the potential increase in cancer risks. This potential increase is expressed exponentially as 1×10^{-4}, 1×10^{-5}, 1×10^{-6} (one in ten thousand, one in one hundred thousand, one in a million, respectively). The chance of an individual's developing cancer from all other (non-site-related) causes has been estimated to be about 2,500 people in a population of 10,000. One additional extra cancer in a population of 10,000 *may* be expected to occur as a result of exposure to site contaminants at a 1×10^{-4} increased cancer risk. For the second type of potential human health effect, non-carcinogenic health impacts, a hazard index is calculated. A hazard index greater than or equal to 1.0 may pose a potential adverse human health risk.

A modified risk assessment approach was adopted in accordance with the *Hanford Past-Practice Strategy* (DOE/RL-91-40, March 1992). This approach limits the pre-remediation studies (e.g., remedial investigations), so that more resources can be allocated to the cleanup of waste sites. A conceptual site model was developed and potential risks to human health and ecological receptors were evaluated in qualitative risk assessments for individual 300-FF-2 waste sites.

<u>Conceptual Site Model</u>

A generic conceptual site model for 300-FF-2 was developed to illustrate how contaminants are transported between media (e.g., solid waste material, soil, biota, groundwater, surface water, air) and to identify exposure pathways of concern to human and ecological receptors. Contaminants were initially released to the surface and/or subsurface soil via disposal practices, spills, and/or unplanned releases. The contaminants either remained in place or were transported to other media by wind erosion, volatilization into soil or air, or infiltration of liquids through the soil column to the groundwater and Columbia River.

The primary exposure pathway for humans is direct contact with chemicals or direct exposure to radionuclides from solid waste material and contaminated soil. Ingestion of soil and inhalation of windblown dust are secondary pathways based on the industrial land-use assumption. Groundwater is not considered a potential exposure pathway in the industrial exposure scenario; however, groundwater is considered to be a potential future drinking water source that must be restored to drinking water standards in a reasonable time frame as established in the 300-FF-5 ROD. Other potential exposure pathways are relatively inconsequential in this scenario.

The primary exposure routes for ecological receptors at 300-FF-2 waste sites include direct exposure to contaminated soil, groundwater, or river water; plant uptake of contaminants from the soil through physical/biological processes; and consumption of contaminated plants and animals by various animal species. Plant exposure is a function of the species, root depth, physical nature of the contamination, and concentration/distribution of contaminants in the soil.

<u>Human Health Risk</u>

Estimates of the risk to human receptors from radionuclides were calculated using the RESidual RADioactivity (RESRAD) dose assessment model. Human health risks due to chemical contaminants were evaluated using the equations presented in the *Hanford Site Risk Assessment Methodology* (HSRAM). The input parameters for the RESRAD model and the HSRAM equations are presented in the 300-FF-2 FFS.

The reasonable maximum exposure (RME) scenario evaluated for 300-FF-2 waste sites is the industrial scenario. The RME scenario makes the following key assumptions:

- Adult workers are the potential receptor.

- Direct exposure of onsite workers to residual contamination to a depth of 4.6 m (15 ft) is presumed to occur.[4]

- The period of analysis for evaluation of site risks and groundwater protection is 1000 years.

- The exposure pathways for calculating risks from radionuclides are: 1) direct exposure to radiation; 2) ingestion of soil containing residual contamination; and 3) inhalation of particles in the air from residual contamination.

- The key assumptions that affect the direct exposure risk evaluation are: 1) The depth of cover/clean fill over residual contamination (none is assumed for the 300 Area), and 2) the time spent on the former waste site location, both indoors and outdoors (approximately 1500 hours/year inside a building and 500 hours/year outdoors). Other parameters affect the modeling results, but are not as significant as these two items.

- The exposure pathway for calculating risks from chemicals is the ingestion of contaminated soil.

- The key assumptions that affect the evaluation of direct contact risks associated with chemical contaminants are the soil ingestion rate and the frequency of contact.

- It is assumed that drinking water is not obtained from groundwater sources and that food products are not grown on the site. However, groundwater is considered to be a potential future drinking water source that must be restored to drinking water standards in a reasonable time frame as established in the 300-FF-5 ROD.

Based on risk assessment results for analogous sites[5], the contaminants in 300-FF-2 soil providing the highest contribution to potential increased human health risks include heavy metals (lead and uranium) and various radionuclides, including: cobalt-60, plutonium-238, uranium-234, uranium-235, and uranium-238. Environmental media and waste material contaminated by these constituents include soil, metallic waste, concrete, containerized materials, and miscellaneous debris. Depth of contamination varies. Analogous site characterization data and a sample risk calculation for one waste site, the 618-1 Burial Ground, are presented in Table 2. Baseline risk summaries associated with the RME scenario at 300-FF-2 waste sites are presented in Table 3.

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[4] "For soil cleanup levels based on human exposure via direct contact, the point of compliance shall be established in the soils throughout the site from the ground surface to fifteen feet below the ground surface. This represents a reasonable estimate of the depth of soil that could be excavated and distributed at the soil surface as a result of site development activities." (WAC 173-340-740(6)(c))

[5] Based on historical information, process knowledge, and previous studies, waste constituents that may appear in the various 300-FF-2 waste sites were grouped into categories of chemical and radiological contaminants of concern. This analysis was supplemented with site characterization data from analogous sites in the 300 Area to estimate baseline carcinogenic risks posed by individual waste sites in 300-FF-2. Hence, there is a high degree of uncertainty in these risk calculations.

Table 2. Industrial Risk Due to Radionuclide Concentrations at the 618-1 Burial Ground and Soil Cleanup Levels			
Radionuclide Contaminants	**618-1 Radionuclide Concentrations**[a]	**RME Risk**[b]	**Soil Cleanup Levels**[c]
Americium-241	112 pCi/g	3.4×10^{-5}	210 pCi/g
Plutonium-238	18 pCi/g	3.4×10^{-6}	155 pCi/g
Plutonium-239	351 pCi/g	7.4×10^{-5}	245 pCi/g
Plutonium-240	83 pCi/g	1.9×10^{-5}	245 pCi/g
Uranium-234	2103 pCi/g	1.8×10^{-4}	—[d]
Uranium-235	194 pCi/g	2.4×10^{-4}	—[d]
Uranium-238	2103 pCi/g	7.5×10^{-4}	—[d]
Total		1.3×10^{-3}	

[a]Concentrations (activities) of radionuclides were determined using information developed from analogous site data as discussed in Section VII of this ROD and Appendix D of the *Focused Feasibility Study for the 300-FF-2 Operable Unit.*
[b]Reasonable Maximum Exposure (RME) risk is based on industrial exposure assumptions and radionuclide exposure only. Additional carcinogenic risk and non-carcinogenic health impacts may also exist at waste sites. Cleanup verification packages will document actual contaminant concentrations and total residual risk at individual waste sites when cleanup activity is complete.
[c]Soil cleanup levels for radionuclides are discussed in Section VIII of this ROD and in Appendix F of the *Focused Feasibility Study for the 300-FF-2 Operable Unit.*
[d]Cleanup levels for uranium isotopes are based on achieving a total uranium concentration of 350 pCi/g.

Table 3. Human Health Risk Presented by 300-FF-2 Operable Unit Waste Sites. (2 Pages)		
Waste Site Name	**Waste Site Description**	**Predicted Risk (RME)[a]**
Source Sites Within 300 Area Complex (40 Sites)		
300 RLWS	300 Area Radioactive Liquid Waste Sewer	$1.3x10^{-3}$
300 RRLWS	300 Area Retired Radioactive Liquid Waste Sewer System	$3x10^{-3}$
300-4	Uranium-contaminated soil at the DOE 351 Substation	$5x10^{-4}$
300-5	Soil at site of former underground gasoline tank	NA
300-11	Soil at site of former underground gasoline tank	NA
300-15	Leakage from corroded process sewer pipe	$3x10^{-3}$
300-16	Uranium-contaminated soil near the 314 Building	$1.3x10^{-3}$
300-24	Uranium-contaminated soil at the 314 Building	$1.3x10^{-3}$
300-28	Uranium-contaminated soil along Ginko Street	$1.3x10^{-3}$
300-29	Contaminated berm at the 305-B Chemical Waste Storage Building	$5x10^{-4}$
300-33	Uranium-contaminated soil at the 306W Building	$5x10^{-4}$
300-34	Soil contaminated by process sewer leak	$1.3x10^{-3}$
300-40	Leakage from corroded vitrified clay sewer pipe	$1.3x10^{-3}$
300-43	Uranium-contaminated soil around the 304 Building	$5x10^{-4}$
300-46	Uranium and chemical wastes at the 3706 Building	$5x10^{-4}$
300-48	Thorium and chemical wastes around the 3732 Building	$5x10^{-4}$
300-214	300 Area Retention Process Sewer	$1.3x10^{-3}$
300-224	Uranium-contaminated soils and waste acid treatment system	$1.3x10^{-3}$
300-251	Unplanned release outside the 303-K Building	$>1x10^{-4}$
300-255	309 Tank Farm contaminated soil	$5x10^{-4}$
300-256	306E Fabrication and Testing Laboratory releases	$>1x10^{-4}$
300-257	309 Holdup Tank outfall pipeline	$>1x10^{-4}$
300-258	Abandoned pipe trench between the 334 Tank Farm and 306E	$5x10^{-4}$
300-259	Contaminated soil east of the 618-1 Burial Ground	$5x10^{-4}$
300-260	Contaminated soil west of the 313 Building	$1.5x10^{-4}$
300-262	Contaminated soil west of South Process Pond	$5x10^{-4}$
303-M SA	Uranium-contaminated concrete pad at the 303-M Building	$>1x10^{-4}$
303-M UOF	Former 303-M Uranium Oxide Facility; decontaminated	$>1x10^{-4}$
313 ESSP	Uranium-contaminated concrete pad at the 313 Building	$5x10^{-4}$
340 Complex	340 Radioactive Liquid Waste Handling Facility	$5x10^{-4}$
UPR-300-4	Uranium contamination beneath and south of the 321 Building	$5x10^{-4}$
UPR-300-10	Pipeline leak beneath the 325 Building	$1.3x10^{-3}$
UPR-300-12	Pipeline leak beneath the 325-A Building	$1.3x10^{-3}$
UPR-300-17	Uranium release to asphalt area southwest of the 333 Building	$>1x10^{-4}$
UPR-300-38	Unplanned releases to soil beneath the 313 Building	$7x10^{-4}$
UPR-300-39	Sodium hydroxide leak in the 311 Tank Farm	$>1x10^{-4}$
UPR-300-40	Pipeline leak between the 311 Tank Farm and 303-F Building	$>1x10^{-4}$
UPR-300-45	Uranium-bearing acid spill at the 303-F Building	$>1x10^{-4}$
UPR-300-46	Uranium-contaminated soil north of the 333 Building	$3x10^{-4}$
UPR-300-48	Drain line leak at the 325 Building basement topsy pit	$>1x10^{-4}$

Table 3. Human Health Risk Presented by 300-FF-2 Operable Unit Waste Sites. (2 Pages)		
Waste Site Name	**Waste Site Description**	**Predicted Risk (RME)[a]**
Outlying Source Sites (7 sites)		
300 VTS	300 Area vitrification test site	$>1x10^{-4}$
300-8	Uranium-contaminated aluminum shavings	$>1x10^{-4}$
300-18	Uranium-contaminated soil and solid waste	$5x10^{-4}$
316-4	Crib at 618-10 Burial Ground, received uranium and hexone	$3x10^{-3}$
600-47	Dumping area north of the 300-FF-1 OU	$>1x10^{-4}$
600-63	300-N Lysimeter Facility	$>1x10^{-4}$
600-259	Inactive Lysimeter Site East End	$>1x10^{-4}$
General Content Burial Grounds (7 sites)		
618-1	Radioactive solid waste and chemical spills	$1.3x10^{-3}$
618-2	Uranium-bearing equipment	$3x10^{-4}$
618-3	Uranium-contaminated waste from building remodeling	$5x10^{-4}$
618-5	Uranium-bearing trash and equipment	$5x10^{-4}$
618-7	Drums of pyrophoric zircaloy chips in water, with uranium and beryllium	$>1x10^{-2}$
618-8	Uranium-contaminated soil under a parking lot	$1.3x10^{-3}$
618-13	Contaminated soil mound from the 303 Building perimeter	$3x10^{-4}$
Transuranic-Contaminated Burial Grounds (2 sites)		
618-10	Transuranic-contaminated waste in trenches and pipe units	$>1x10^{-2}$
618-11	Transuranic-contaminated waste in trenches, pipe units, and caissons	$>1x10^{-2}$

NA = not applicable (***Model Toxics Control Act*** [MTCA] Method B cleanup criteria apply to petroleum hydrocarbons)
RME = reasonable maximum exposure
[a] Listed values are based on limited data and a modified risk assessment approach adopted in accordance with the *Hanford Past-Practice Strategy* (DOE/RL-91-40). Uncertainties exist with contaminants identified for individual waste sites and with the associated contaminant concentrations.

Under the industrial scenario, each of the general content burial grounds and source waste sites are projected to present a risk greater than 10^{-4}. The 618-7 Burial Ground and the two transuranic-contaminated burial grounds (618-10 and 618-11) each present a risk greater than 10^{-2}. Maximum total incremental risk due to radionuclides in the industrial scenario is greater than 10^{-2}.

Ecological Risk

Potential impacts to ecological receptors from 300 Area contamination were evaluated in ecological investigation reports performed in support of the 300-FF-1 and 300-FF-5 Record of Decision, which was approved in 1996. Information on biota and habitats collected for 300-FF-1 and 300-FF-5 is considered analogous to 300-FF-2 due to the close proximity of the operable units. Additional related information and summaries of these past studies can be found in Appendix E of the 300-FF-2 Focused Feasibility Study.

The Columbia River Comprehensive Impact Assessment (CRCIA), completed in 1998, provided a comprehensive screening assessment of Hanford's major human health and ecological impacts with input from Tribes, stakeholder groups, and the public. CRCIA evaluated potential ecological impacts on 52 plant and animal species, both terrestrial and aquatic, for the entire Hanford Site. This analysis included species that have recently been listed under the Endangered Species Act and Migratory Bird Treaty Act (e.g., three salmonid species recently listed for the Upper Columbia River: *Oncorhynchus mykiss*, *O. tshawytscha*, and *Salvelinus confluentus*). CRCIA findings have been considered and evaluated as part of the 300-FF-2 remedial investigation.

Past 300 Area ecological risk evaluations have used the Great Basin pocket mouse as a representative of terrestrial species that have the greatest potential for exposure to contaminated materials from 300 Area waste sites. This is still considered to be an appropriate assumption because it is a relatively common animal and has a home range comparable in size to many of the waste sites. Available remedial investigation results and comparisons of 300 Area waste sites were utilized to estimate risks for the Great Basin pocket mouse as the representative of terrestrial species. An environmental hazard quotient (EHQ) exceeded 1.0 for some of the unremediated 300-FF-2 waste sites, indicating that *individual mice* (not mouse populations) were at risk. Based on the assumptions that were used (e.g., receptors live on/in waste site, uniform contamination, all food contaminated, no dilution from uncontaminated food, and complete retention of contaminants), the estimate of ecological risk was considered to be conservative. Exposure to contaminants for animals that feed on mice was predicted to be low due to the large foraging area of a predator relative to the size of a waste site.

Risk to aquatic organisms was estimated as part of the investigations conducted for the 300-FF-5 groundwater operable unit. Based on the investigations, the predicted radiological dose to aquatic organisms was less than 1 rad/day. The analysis was conservative (e.g., no dilution of the groundwater by the river was considered) and subject to uncertainty in uptake rate, receptor size/weight, and use frequency.

In summary, most of the 300-FF-2 waste sites are located in areas that have been highly disturbed by industrial/waste management operations and would be unable to support complete ecological communities represented by common food webs. Ecological impacts are isolated and are not expected to be tied to an exposure scenario that would result in an adverse impact to a wildlife receptor. Post-cleanup ecological monitoring will be used to verify these assumptions.

Risk Uncertainties

In general, the assessment of risk for 300-FF-2 is based on a limited data set. Uncertainties are associated with both the contaminants identified for each waste site and the concentrations of the contaminants. The results of sampling at analogous sites may not be representative of conditions at 300-FF-2 waste sites or the historical data may not accurately represent current conditions. Because the samples may not be completely representative of site-specific conditions, the qualitative evaluations of risks may be underestimated or overestimated.

Basis for Action

Risks from contaminated soil and debris were identified at levels that exceed the EPA risk threshold and may, therefore, pose a potential threat to human health. The NCP requires that the overall incremental cancer risk at a site not exceed the range of 10^{-6} to 10^{-4}. For systemic toxicants or noncarcinogenic contaminants, acceptable exposure levels shall represent concentration levels to which the human population, including sensitive subgroups, may be exposed without adverse effect during a lifetime or part of a lifetime, incorporating an adequate margin of safety. These criteria are exceeded for the 56 wastes sites identified in Appendix A of this ROD. Hence, the Tri-Parties believe that the response action selected in this Record of Decision is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. Such a release, or threat of release, may present an imminent and substantial endangerment to public health, welfare, or the environment.

VIII. REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) for 300-FF-2 were developed based on protection of human health given the reasonably anticipated future land use and the conceptual site model, protection of the environment, protection of groundwater as a potential future drinking water source (as established in the 300-FF-5 ROD), protection of the Columbia River, applicable or relevant and appropriate requirements (ARARs), and worker safety. The RAOs developed for 300-FF-2 (Table 4) are consistent with those developed in 300-FF-1.

Residual Risks Post-Achievement of RAOs: Residual human health risks after meeting RAOs are based on an industrial land use scenario for soils. Potential site risks from contaminated soils, structures, and debris with respect to metals and organics are reduced from greater than 10^{-2} to approximately 1×10^{-5}. Site risks from contaminated soils, structures, and debris with respect to radionuclides are reduced from greater than 10^{-2} to approximately 10^{-4} (approximate risk equivalent to 15 mrem/year dose above background).

Remediation Time Frame: The procedures used to implement the multi-year work effort required by this ROD will be outlined and documented in more detail in the Remedial Design/Remedial Action (RD/RA) workplan, a primary document under the Tri-Party Agreement (TPA) subject to Environmental Protection Agency (EPA) approval. It is anticipated that the RD/RA workplan process will be implemented in a phased approach, with the RD/RA workplan to be submitted to EPA by June 30, 2002. This document will identify the plan and schedule for submittal of subsequent workplans.[6] Once initiated, substantial continuous physical on-site remedial action shall be maintained until all of the cleanup work is completed. A detailed schedule and cleanup plan for implementing this ROD will be submitted to EPA for approval by June 30, 2002, for inclusion in the RD/RA workplan and in support of TPA Milestones M-16-03A and M-16-00B. This schedule will include specific commitments regarding the Decontamination and Decommissioning (D&D) of facilities and aboveground structures necessary to complete the cleanup of underlying waste sites in the 300 Area Complex and the remediation plans for the 618-10 and 618-11 Burial Grounds. The detailed schedule and cleanup plan for implementing this ROD shall be consistent with the current TPA milestone to complete all 300 Area remedial actions by September 30, 2018 (TPA Milestone M-16-00).

Cleanup Levels for the 300-FF-2 Operable Unit

Based on historical 300 Area operations and characterization information, a comprehensive list of potential contaminants was identified for 300-FF-2. A set of contaminant specific cleanup levels was developed so that the remedial action objectives specified in Table 4 can be more easily implemented. To do this, a generic waste site profile had to be created in order to run the necessary computer models. Although cleanup levels were developed for each of the COPCs, it should be emphasized that these contaminants will not necessarily be found at

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[6] The RD/RA workplan may be submitted before June 30, 2002, without the plan and schedule for submittal of subsequent workplans, however such plan and schedule must be submitted on June 30, 2002, (pursuant to TPA milestone M-16-03A) and upon approval by EPA, will be incorporated into the RD/RA workplan.

each waste site. Some of the COPCs may not be found at any of the waste sites. The cleanup levels are presented in Tables 5 and 6. Cleanup levels were developed independently for each contaminant of concern for each of the three pathways of concern (direct contact/direct exposure, protection of groundwater, and protection of the Columbia River). For mobile contaminants that pose a threat to groundwater and the Columbia River, the most restrictive cleanup level was selected. For contaminants that are not mobile, and hence do not pose a threat to groundwater or the Columbia River, direct contact/direct exposure cleanup levels protective of human health under the industrial exposure scenario were selected. These concentrations are starting points, and more restrictive cleanup levels may be required (e.g., cumulative risk from multiple contaminants, protection of specific ecological receptors, protection of groundwater, and/or protection of the Columbia River). In addition, contaminant-specific cleanup levels may differ for individual waste sites based on site-specific conditions. Changes to contaminant-specific cleanup levels may be required, and final cleanup levels must be approved by EPA. Documentation of RAO achievement will be made in cleanup verification packages on an individual waste site basis. A complete discussion of the technical approach used to develop these cleanup levels can be found in Appendix F of the 300-FF-2 FFS.

In addition, the generic waste site profile used to develop cleanup levels assumed no ecological receptor populations were being impacted by individual waste sites. While this may be an appropriate general assumption for the 300 Area Complex area, areas adjacent to the industrial complex are subject to sparse and transient use by wildlife and outlying areas share the same habitat characteristics as other parts of the Columbia River corridor. Therefore, additional efforts must be made to demonstrate this is the case for sites outside the fenceline of the 300 Area complex. The results of pre-remediation cultural and ecological waste site surveys may be adequate to address baseline site conditions (i.e., confirm the presence or absence of sensitive plant or animal species).   In some limited cases, soil cleanup levels may have to be adjusted further to be protective of terrestrial plants and animals depending on the location of the individual waste site, the nature of the surrounding habitat, the contaminants of concern, and the presence of sensitive receptors. Specific procedures for implementing these surveys, modifying cleanup levels if appropriate, and documenting results in cleanup verification packages (CVPs) will be outlined in the RD/RA workplan.

<u>Justification for Use of Industrial Cleanup Standards</u>

A number of key factors support the Tri-Parties determination that it is appropriate to use industrial cleanup standards for the 300-FF-2 Operable Unit. These include:

- The reasonably anticipated future land use is industrial pursuant to EPA policy and guidance (see discussion in Section VI)

- The area meets the criteria of “traditional industrial use,” as provided in WAC 173-340-745, because it has the following characteristics:

    a) Humans do not live on the site, and the reasonable maximum exposure scenario is based on an adult employee located on an industrial property;

b) Access to the property by the general public is generally not allowed. When permitted, it is highly limited and controlled.

c) Food is not grown or raised on the property.

d) Industrial operations generally involve the storage of chemicals, noise, odors, and truck traffic.

e) Industrial properties are generally covered by buildings and structures, paved parking lots, paved access roads and material storage areas, and other surface barriers to contaminated soil and debris.

f) Industrial properties generally contain support facilities that are intended to serve the industrial facility employees and not the general public.

- Institutional controls are required as part of the selected remedy to ensure that these land use characteristics are maintained in the future. Institutional controls required before and during cleanup activity, as well as those required after the cleanup is complete, are specified in Section XII (2)(b) of this ROD. The land use restrictions required as part of this ROD after the cleanup is completed must be enforceable and must continue, independent of who the property owner is (e.g., proprietary controls such as property easements and covenants).

- Hazardous substances remaining at the site after the remedial action will not pose a threat to human health or the environment at the site or in adjacent nonindustrial areas. Site-specific cleanup verification reports and continued environmental monitoring (also required as part of the selected remedy) will gather the data necessary to evaluate and document this in a final comprehensive risk assessment that will be required to support the final 300-FF-2 Record of Decision.

- Any changes to the land use that are inconsistent with the land use assumptions upon which the ROD is based will be evaluated regularly and used in support of the CERCLA five-year review.

Table 4. 300-FF-2 Operable Unit Remedial Action Objectives.	
Item	**Description**
RAO 1	Prevent or reduce risk to human health, ecological receptors, and natural resources associated with exposure to wastes or soil contaminated above ARARs or risk-based criteria. For radionuclides, this RAO means prevention or reduction of risks from exposure to waste or contaminated soil that exceed the CERCLA cumulative excess cancer risk range of 10^{-4} to 10^{-6}.[a] For chemicals, this RAO means prevention or reduction of risk from direct contact with waste or contaminated soil that exceed the MTCA cumulative excess cancer risk goal of 10^{-5} and/or a hazard index of 1.[b]
RAO 2	Prevent migration of contaminants through the soil column to groundwater and the Columbia River such that concentrations reaching groundwater and the river do not exceed maximum contaminant levels (MCLs)/non-zero maximum contaminant level goals (MCLGs) under the Federal Safe Drinking Water Act (40 CFR 141)[c] and/or State of Washington drinking water standards (WAC 246-290), ambient water quality criteria (AWQC) for protection of freshwater aquatic organisms under the Federal Clean Water Act (40 CFR 131) and/or State of Washington surface water quality standards (WAC 173-201A), and the MTCA groundwater cleanup standards (WAC 173-340-720).
RAO 3	Prevent or reduce occupational health risks to workers performing remedial action.
RAO 4	Minimize the general disruption of cultural resources and wildlife habitat, and prevent adverse impacts to cultural resources and threatened or endangered species.
RAO 5	Ensure that appropriate institutional controls and monitoring requirements are in place to protect future users at a remediated site.

[a] The Tri-Parties have chosen 15 mrem/yr above background over a period of 1,000 years after final remediation for a maximally exposed individual to address this RAO. Meeting this objective will also be protective of ecological receptors based on criteria specifying that dose rates shall not exceed 0.1 rad/day for terrestrial organisms and 1.0 rad/day for aquatic organisms and terrestrial plants.

[b] Direct contact values may have to be adjusted further to be protective of terrestrial plants and animals depending on the location of the individual waste site and the nature of the surrounding habitat.

[c] For most radionuclides, MCLs correspond to a cumulative dose of 4 mrem/yr.

Table 5. Summary of Soil Cleanup Levels for Chemical Constituents				
Constituent	**Direct Contact[a] (mg/kg)**	**Groundwater Protection[b] (mg/kg)**	**River Protection[c] (mg/kg)**	**Selected Cleanup Level[d] (mg/kg)**
Acetone	350,000	80	NA[f]	80
Benzene	4,530	0.151	0.24	0.151
Carbon tetrachloride	1,010	0.0337	0.05	0.0337
Chloroform	21,500	0.717	1.14	0.717
Ethylene glycol	>1,000,000[e]	3,200	NA[f]	3,200
Methanol	>1,000,000[e]	400	NA[f]	400
Methyl ethyl ketone	>1,000,000[e]	480	NA[f]	480
Methyl isobutyl ketone	280,000	64	NA[f]	64
PCBs	17.0	NA[g]	NA[g]	17.0
Petroleum hydrocarbons	NA[f]	200	NA[f]	200
Tetrachloroethylene	2,570	0.0858	0.16	0.0858
Toluene	700,000	100	1,360	100
1,1,1-trichloroethane	>1,000,000[e]	20	83,400	20
Trichloroethylene	11,900	0.398	0.54	0.398
Xylene	>1,000,000[e]	1,000	NA[f]	1,000
Aluminum	NA[f]	11,800	11,800	11,800
Antimony	1,400	NA[g]	NA[g]	1,400
Arsenic	219	NA[g]	NA[g]	219
Barium	245,000	NA[g]	NA[g]	245,000
Beryllium	30.5	NA[g]	NA[g]	30.5
Cadmium	3,500	NA[g]	NA[g]	3,500
Chromium (III)	>1,000,000[e]	NA[g]	NA[g]	>1,000,000[e]
Chromium (VI)	17,500	8	2	2
Copper	130,000	NA[g]	NA[g]	130,000
Lead	1,000	NA[g]	NA[g]	1,000[h]
Manganese	490,000	NA[g]	NA[g]	490,000
Nickel	70,000	NA[g]	NA[g]	70,000
Strontium	>1,000,000[e]	NA[g]	NA[f]	>1,000,000[e]
Tin	>1,000,000[e]	NA[g]	NA[f]	>1,000,000[e]
Uranium	505[i]	505[j]	505[j]	505[j]
Vanadium	24,500	NA[g]	NA[f]	24,500
Zinc	>1,000,000[e]	NA[g]	NA[g]	>1,000,000[e]
Chloride	NA[f]	25,000	46,000	25,000
Fluoride	210,000	104.7	NA[f]	104.7
Nitrate (as N)	>1,000,000[e]	1,000	2,000	1,000
Nitrite	350,000	160	NA[f]	160
Sulfate	NA[f]	25,000	NA[f]	25,000
Sulfide	NA[f]	NA[f]	0.4	0.4

NOTE: Shaded areas represent the pathway driver for the selected cleanup level. Changes to the cleanup levels based on site-specific information (e.g., size of the waste site, nature and extent of contamination in the soil column, presence of multiple contaminants) may be required. Final cleanup levels must be approved by EPA prior to backfilling excavated waste sites.

[a] **Direct Contact** values represent soil concentrations that are protective of human receptors from direct contact with contaminated waste/soil. Listed MTCA C cleanup standards for industrial soil apply to the top 4.6 m (15 ft) (WAC 173-340-745). Direct contact values may have to be adjusted further to be protective of terrestrial plants and animals depending on the location of the individual waste site and the nature of the surrounding habitat.

[b] **Groundwater Protection** values represent soil concentrations that will be protective of groundwater. Values are equal to 100 times the groundwater cleanup standard (WAC 173-340-745), unless otherwise noted.

[c] **River Protection** values represent soil concentrations that will not cause applicable river cleanup standards to be exceeded as contaminants migrate through the soil column to groundwater, and from groundwater to the river. Listed values are equal to 100 times the applicable river cleanup standard multiplied by a dilution attenuation factor (DAF) of 2, unless otherwise noted.

[d] Listed values apply to the top 4.6 m (15 ft) and represent the most restrictive cleanup level derived from evaluation of the direct exposure, groundwater, and river pathways. Below 4.6 m (15 ft), alternate cleanup levels may be required to meet the RAOs based on verification of the generic site profile during remedial actions.

[e] Direct contact soil cleanup levels calculated using MTCA Method C can result in values > pure material (e.g., > 1 million parts per million).

[f] NA=Not Applicable. No published cleanup standard identified for constituent and pathway.

[g] NA=Not Applicable. RESRAD model predicts constituent will not reach groundwater within 1,000 years based on a generic site profile.

[h] Anomalous lead concentrations will be assessed at the time of waste site closeout to verify protection of groundwater and river pathways.

[i] Based on the isotopic distribution of uranium in the 300 Area and a cleanup level of 350 pCi/g for radioisotopes (Table 5), the corresponding uranium concentration would be 505 mg/kg. Attainment of both values will be verified as part of site closure.

[j] A leach test/Kd study will be performed prior to implementation of remedial actions to verify the soil cleanup level is protective of groundwater and river pathways.

Table 6. Summary of Soil Cleanup Levels for Radionuclides.				
Constituent	**Direct Exposure[a] (pCi/g)**	**Groundwater Protection[b] (pCi/g)**	**River Protection[c] (pCi/g)**	**Selected Cleanup Level [d] (pCi/g)**
Americium-241	210	NA[e]	NA[e]	210
Cesium-137	25	NA[e]	NA[e]	25
Cobalt-60	5.2	NA[e]	NA[e]	5.2
Europium-152	12	NA[e]	NA[e]	12
Europium-154	11	NA[e]	NA[e]	11
Europium-155	518	NA[e]	NA[e]	518
Plutonium-238	155	NA[e]	NA[e]	155
Plutonium-239/240	245	NA[e]	NA[e]	245
Radium-226	7.9	NA[e]	NA[e]	7.9
Ruthenium-106	96	NA[f]	NA[f]	96
Strontium-90	2,500	NA[e]	NA[e]	2,500
Technetium-99	410,000	46.8	93.6	46.8
Thorium-232	4.8	NA[e]	NA[e]	4.8
Tritium (H-3)	471	6,932,000	13,864,000	471
Uranium (Total)	350[h]	350[g]	350[g]	350[g]

NOTE: Shaded areas represent the pathway driver for the selected cleanup level. Changes to the cleanup levels based on site-specific information (e.g., size of the waste site, nature and extent of contamination in the soil column, presence of multiple contaminants) may be required. Final cleanup levels must be approved by EPA prior to backfilling excavated waste sites.

[a] **Direct Exposure** values represent soil activities for individual radionuclides that would meet the RAO for cumulative risk (i.e., 10^{-4} to 10^{-6} risk under an industrial scenario) from exposure to contaminated waste/soil. Values will be lower for multiple radionuclides to achieve the same risk endpoint. Listed values are calculated by RESRAD and apply to the top 4.6 m (15 ft).

[b] **Groundwater Protection** values represent soil concentrations that will be protective of groundwater. Listed values are calculated by RESRAD based on the applicable groundwater cleanup standard.

[c] **River Protection** values represent soil concentrations that will not cause applicable river cleanup standards to be exceeded as contaminants migrate through the soil column to groundwater, and from groundwater to the river. Listed values are calculated by RESRAD based on the applicable river cleanup standard.

[d] Listed values apply to the top 4.6 m (15 ft) and represent the most restrictive cleanup level derived from evaluation of the direct exposure, groundwater, and river pathways. Below 4.6 m (15 ft), alternate cleanup levels may be required to meet the RAOs based on verification of the generic site profile during remedial actions.

[e] NA = Not Applicable. RESRAD model predicts constituent will not reach groundwater within 1,000 years based on a generic site profile.

[f] NA = Not Applicable. No published cleanup standard identified for constituent and pathway.

[g] A leach test / Kd study will be performed prior to implementation of remedial actions to verify the soil cleanup level is protective of groundwater and river pathways.

[h] Listed value is equal to a 15 mrem/yr dose based on the isotopic distribution of uranium-234, -235, and -238 in the 300 Area.

IX. DESCRIPTION OF ALTERNATIVES

Remedial technologies were identified and evaluated in the 300-FF-2 FFS based on their ability to reduce potential risks to human health and the environment from 300-FF-2 waste sites. Collective experience gained from previous studies and evaluation of cleanup methods at the Hanford Site was used to identify technologies that would be carried forward as remedial alternatives to address the 300-FF-2 RAOs. Four remedial alternatives were identified for detailed and comparative analyses. These were:

- No Action (Alternative 1)
- Remove/Treat/Dispose (RTD) (Alternative 2)
- Modified Containment (Alternative 3)
- Containment (Alternative 4)

The No Action and RTD alternatives apply to each of the 300-FF-2 waste site groups. The Modified Containment alternative applies only to 300 Area Complex source sites. The Containment alternative applies only to the general content burial grounds and transuranic-contaminated burial grounds. The Containment alternative was not evaluated for the 7 outlying source sites based on the effectiveness, implementability, and cost of such small-scale containment/institutional controls systems. Alternatives and associated cost estimates are summarized for each waste site group in Table 8.

With the exception of the No Action baseline, the remaining alternatives (i.e., the RTD, Modified Containment, and Containment alternatives) consist of common elements to achieve the 300-FF-2 RAOs. The common elements include a response action, institutional controls, and integration with the 300-FF-5 groundwater monitoring program. Together, the common elements constitute a remedial alternative. The common elements for the 300-FF-2 remedial action alternatives are summarized in Table 7.

Alternative 1 - No Action

The NCP requires that a "No Action" alternative be evaluated to establish a baseline for comparison with other remedial alternatives. No legal restrictions, access controls, or active remedial measures would be applied to the sites. Under this alternative, it is presumed that the DOE would relinquish control of the sites without easements/covenants or access control. No action implies "walking away from the site" and allowing the wastes to remain in their current configuration, affected only by natural processes. The No Action alternative was evaluated for all of the 300-FF-2 waste site groups.

Table 7. Common Elements of the RTD, Modified Containment, and Containment Alternatives.	
Element	**Description**
Response Action	The response action is the primary element of the remedial action alternative. Response actions determined to be appropriate for the 300-FF-2 OU include RTD, modified containment, and containment. The RTD response action involves complete source removal, treatment as necessary, and disposal at an engineered facility such as the ERDF. A modified containment response action for source sites within the 300 Area Complex consists of simple asphalt or concrete cover systems. For burial grounds, the containment response action is identified as an engineered multi-layered surface barrier. Containment was not considered as a response action for the 300-FF-2 OU outlying source sites based on past experience with the Hanford Site 100 Areas for sites of comparable size and suspected contaminants.
Institutional Controls	Institutional controls are an integral part of the RTD, modified containment, and containment response actions. These controls would be required during and after an RTD response action to ensure that future land use remains consistent with the industrial scenario. For containment alternatives, more robust institutional controls would be required to ensure that barriers are properly maintained. Methods of precluding unintentional trespassing and controlling access to waste sites could include signs, entry control, excavation permits, artificial or natural barriers, and active surveillance. Legal restrictions on the use of land and groundwater would be imposed through enforceable land covenants. The legal restrictions would be effective if control of a site is transferred from DOE to another party.
Groundwater Monitoring	The groundwater monitoring integration element of both the RTD and containment response actions would require a periodic reevaluation of the 300-FF-5 O&M plan that authorizes groundwater monitoring requirements for the 300 Area. Additional site characterization data will be gathered as a result of implementing any of the response actions, especially RTD. Consequently, ongoing groundwater monitoring requirements will have to be reevaluated to ensure that contaminants of concern that may have been released from source sites and burial grounds are adequately addressed. More active groundwater response measures may be necessary as well. Any modifications to the groundwater monitoring program or remedial actions will be authorized under 300-FF-5.

Alternative 2 - Remove/Treat/Dispose Alternative

The RTD alternative applies to all of the 300-FF-2 Operable Unit waste site groups. Under the RTD alternative, contaminated soil and/or debris above cleanup levels would be removed from the site, treated as necessary to meet disposal facility requirements, and sent to an engineered disposal facility such as the Environmental Restoration Disposal Facility (ERDF) in the 200 Area or other facility approved by EPA in advance. The RTD alternative assumes an excavation depth sufficient to meet all RAOs, including direct exposure, protection of groundwater, and protection of the Columbia River. The RTD alternative involves significant waste handling during the excavation, treatment, and processing of waste materials. An observational approach, which allows waste characterization, designation, and treatment to occur as excavation proceeds, would generally be used to guide the cleanup operation. Application of water and/or crusting agents would be used for dust control.

The RAOs for protection of groundwater and the Columbia River must be met through the entire soil column from the surface to groundwater. The RAO for direct exposure applies only to the upper part of the soil column, which is defined as the top 4.6 m (15 ft) of soil below the surrounding grade or the bottom of the engineered structure (e.g., burial ground trench, caisson, pipe unit), whichever is deeper. This represents a reasonable estimate of the depth of soil that could be excavated and distributed at the soil surface as a result of site development activities. (See RME exposure scenario described in Section VII of this ROD and WAC 173-340-740(6)(c).) It is anticipated that all of the RAOs would be achieved at depths of less than 4.6 m (15 ft) at many of the 300-FF-2 waste sites because records indicate that the contamination is shallow, and available characterization data suggests that migration of contaminants through the soil column has not occurred. These assumptions would be verified with site-specific information.

If residual contamination exceeding cleanup standards is found below 4.6 m (15 ft), the extent of remediation may require reevaluation by the Tri-Parties. A decision to continue excavation would depend on the nature and form of contaminated material, implementability, cost, volume, and impacts to ecological and cultural resources. Alternatives to continued excavation could include institutional controls, continued monitoring, evaluation of other response actions (e.g., subsurface barriers), or waivers from cleanup standards. Any decisions to leave contaminants in place that exceed cleanup standards below 4.6 m (15 ft) will be made by the Tri-Parties and will require public comment depending on the nature of the waste.

Contaminated debris and soil would be transported to an engineered facility, such as the ERDF, for disposal. Waste may require treatment, if necessary, to meet waste acceptance criteria at the disposal facility. Clean overburden soil would be stockpiled at the site and used as backfill when site remediation is completed. As needed, additional backfill would be obtained from borrow pits located on the Hanford Site.

Remediated areas would be graded to match local area contours and revegetated, paved, or provided with a gravel cover to support industrial land use. Institutional controls would be implemented as described previously in Table 7. Groundwater monitoring would be performed as part of the 300-FF-5 Operable Unit.

Special considerations for the 300 Area Complex source sites, general content burial grounds, and transuranic-contaminated burial grounds are presented in the text that follows.

- **300 Area Complex Source Sites**. For source sites located near and under structures (i.e., buildings, utility corridors, and pipelines) that are currently being used in the 300 Area Complex, implementation of the RTD alternative will be implemented after the structures are removed.

- **General Content Burial Grounds**. To ensure worker safety during implementation of a RTD alternative, the general content burial grounds may require more conservative precautions (e.g., higher levels of protective clothing and equipment) than for typical source waste sites. Suspect or "unknown" materials would be isolated or mechanically separated from other debris during excavation activities.   Multiple handling of the waste would be required to retrieve, sort, sample (as needed), stage, potentially treat, package, transport, and finally dispose of the waste.

- **Transuranic-Contaminated Burial Grounds**. The same precautions that were identified for the general content burial grounds would also apply for the transuranic-contaminated burial grounds. In addition, there is a high degree of uncertainty associated with the amount of transuranic-contaminated waste that is buried at the 618-10 and 618-11 Burial Grounds and with the logistics of implementing an RTD response action. One scenario would include use of a large, moveable containment structure during operations at the transuranic-contaminated burial grounds to help control worker exposure and release of fugitive dust emissions. Remote handling of waste in caissons and vertical pipe units may require the use of robotics or other means. Because of the uncertainties and the magnitude of research and development that must be undertaken, implementation of the RTD alternative would not be anticipated before 2010. After a period of storage at the Hanford Site, transuranic-contaminated waste removed from the 618-10 and 618-11 Burial Grounds would ultimately be transported to the WIPP for disposal. Low-level or mixed waste would be sent to an engineered facility, such as the ERDF, for disposal.

<u>Alternative 3 - Modified Containment Alternative</u>

The Modified Containment alternative applies only to source sites within the 300 Area Complex where active industrial use is occurring and will continue to occur in the near future. This alternative would support industrial use of the area through maintenance, replacement, or construction of simple cover systems to prevent direct exposure of contaminants during industrial use of the site. The Modified Containment alternative would also enhance groundwater protection by minimizing infiltration and controlling runoff in contaminated areas.

Typical industrial materials (e.g., asphalt or concrete) would provide the ground cover depending on the contaminants present and intended use of the area. Institutional controls would be implemented as described previously (Table 7), and maintenance of vegetative or man-made covers would be required to control infiltration. Groundwater monitoring would be performed as part of 300-FF-5.

Alternative 4 - Containment Alternative

The Containment alternative applies only to the 300-FF-2 transuranic-contaminated burial grounds and general content burial grounds. It would involve construction of an engineered surface barrier to prevent unintentional human and biotic intrusion into burial ground waste, to minimize potential human and biotic exposure and to control potential contaminant migration by preventing water infiltration. Application of water would be used to control dust generated from materials used for barrier construction.

Once constructed, the barrier surfaces (including side slopes) would be vegetated to control soil erosion and promote moisture evapotranspiration. Maintenance would include regular inspections and weed control. A moisture monitoring system would be installed to ensure that water is not infiltrating through the engineered barrier and into the burial ground waste. Institutional controls would be implemented as described in previously in Table 7. Groundwater monitoring would be performed as part of 300-FF-5.

Special considerations for the general content burial grounds and the transuranic-contaminated burial grounds are presented in the text that follows.

- **General Content Burial Grounds**. The engineered surface barrier would be a 1.70-m (5.6-ft)-thick multi-layer cap designed to provide protection against water infiltration and biotic intrusion for 500 years (RCRA Subtitle C compliant barrier).

- **Transuranic-Contaminated Burial Grounds**. A more robust engineered surface barrier (the "Hanford Barrier," which is also compliant with RCRA subtitle C) would be used for the 618-10 and 618-11 Burial Grounds because of the nature of the waste and the length of time it will have to be isolated. The Hanford Barrier is composed of nine layers of durable material with a combined thickness of 4.5 m (14.7 ft). Barrier materials would be obtained from locations on the Hanford Site or from nearby communities. The barrier is designed to remain functional for a period of 1,000 years and to provide the maximum practicable degree on contaminant and hydrologic protection considering the long-term variations in the Hanford Site climate.

Table 8. Cost Estimate Comparison for the 300-FF-2 Operable Unit.						
Site Group	**Number of Sites**	**Alternative**	**Capital ($ million)**	**Total O&M ($ million)[a,b]**	**Total Undiscounted Cost ($ million)[c]**	**Total Present Value ($ million)[a]**
300 Area Complex	40	Alternative 1 - No Action baseline.	0	0	0	0
		Alternative 2 - RTD. Removal, treatment as necessary, disposal at engineered facility such as the ERDF. Implementation of institutional controls and ground-water monitoring.	70.7	2.5	148.9	73.2
		Alternative 3 - Modified Containment. Maintenance or replacement of existing simple cover systems (e.g., soil, gravel, asphalt and concrete). Implementation of institutional controls and groundwater monitoring.	1	21.1	652.2	22.1
Outlying Sites	7	Alternative 1 - No Action baseline.	0	0	0	0
		Alternative 2 - RTD. Removal, treatment as necessary, disposal at engineered facility such as the ERDF. Implementation of institutional controls and groundwater monitoring.	14.8	0.4	27.2	15.2
General Content Burial Grounds	7	Alternative 1 - No Action baseline.	0	0	0	0
		Alternative 2 - RTD. Removal, treatment as necessary, disposal at engineered facility such as the ERDF. Implementation of institutional controls and groundwater monitoring.	52.4	1.5	99.5	53.9
		Alternative 4 - Containment. Construction of an engineered surface barrier. Implementation of institutional controls and groundwater monitoring.	15.8	7.7	252.5	23.5
Transuranic-Contaminated Burial Grounds	2	Alternative 1 - No Action baseline.	0	0	0	0
		Alternative 2 - RTD. Removal, treatment as necessary, disposal at engineered facility such as the ERDF. Implementation of institutional controls and groundwater monitoring.	367.4	2.1	434.7	369.5
		Alternative 4 - Containment. Construction of an engineered surface barrier. Implementation of institutional controls and groundwater monitoring.	29.8	2.5	103.4	32.3
				TOTAL COST OF RTD ALTERNATIVE	**$710.3**	**$511.8**
				TOTAL COST OF CONTAINMENT ALTERNATIVE	**$1,008.1**	**$77.9**

NOTE: All costs estimated with an accuracy of –30% to +50% with the exception of the RTD alternative for transuranic-contaminated burial grounds. Due to uncertainties associated with excavation and processing of transuranic-contaminated waste, the cost for these burial grounds is considered to be rough order of magnitude (e.g., approximately 80% of the estimate is based on price quotes for drummed waste disposal obtained from DOE waste management sources).

[a] Present-value costs based on a 2.9% real discount rate (OMB Circular A-94, Appendix C) and a 1000-year period of analysis. [NOTE: This project duration was used to bound the estimate. Actual duration will exceed 1000 years.]

[b] Total O&M is the total present-value cost of annual and periodic operations and maintenance expenditures for a 1000-year period of analysis.

[c] Total undiscounted costs are 1999 dollars for a 1000-year period of analysis.

X. SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

The following evaluation of remedial alternatives summarizes each alternative in relation to each of the nine CERCLA criteria. The first two criteria, overall protection and compliance with ARARs, are defined under CERCLA as "threshold criteria." Threshold criteria must be met by an alternative to be eligible for selection. The next five criteria are defined as "primary balancing criteria." These criteria are used to weigh major trade-offs among alternatives. The last two criteria, State and community acceptance, are defined as "modifying criteria." In the final comparison of alternatives to select a remedy, modifying criteria are of equal importance to the balancing criteria.

The evaluation is organized around the four categories of 300-FF-2 waste sites.

<u>300 Area Complex Source Sites</u>

The No Action, RTD, and Modified Containment alternatives were evaluated for the 300 Area Complex source sites, where industrial use is occurring and is anticipated to continue for at least 50 years. All other remedial technologies were screened out, as documented in the 300-FF-2 FFS.

- **Overall Protection of Human Health and the Environment**. The RTD and Modified Containment alternatives would adequately protect human health and the environment by removing contaminants and/or eliminating exposure pathways at the applicable source sites. The RTD alternative would provide protection by removal, treatment (as necessary), and disposal of contaminated waste and debris in an engineered facility such as the ERDF. Simple surface covers (e.g., asphalt or concrete) would be maintained, replaced, and/or constructed for the Modified Containment alternative to prevent direct contact exposure to contaminants from industrial activities at source sites within the 300 Area Complex. The Modified Containment alternative would require maintenance and a greater degree of institutional controls to ensure that the simple covers remained protective. Groundwater monitoring would be performed as part of the 300-FF-5 Operable Unit. The No Action alternative would fail to provide adequate protection because of the potential risks posed by waste site contaminants. Consequently, the No Action alternative cannot be considered for selection and is eliminated from discussion under the remaining evaluation criteria.

- **Compliance with Applicable or Relevant and Appropriate Requirements**. The RTD and Modified Containment alternatives would both comply with their respective ARARs from Federal and state laws.

- **Long-Term Effectiveness and Permanence**. The RTD alternative would provide a greater degree of long-term effectiveness and permanence than the Modified Containment alternative. With the RTD alternative, contaminated soil and debris would be removed, treated as necessary, and disposed of at the ERDF to meet the RAOs. Uncertainties associated with the volume of waste that leaked from the 300 Area sewer systems and potential future impacts to groundwater and the Columbia River would be addressed with implementation of the RTD alternative. Consequently, less in the way of institutional controls would be required for the 300 Area Complex source sites after completion of the cleanup action. The Modified Containment alternative would provide long-term protection by preventing exposure and enhancing control of contaminant migration via simple surface covers (e.g., asphalt or concrete), but would rely on effective maintenance and more robust institutional controls to ensure continued protectiveness. Long- term protection of groundwater and surface water resources may be difficult to ensure as long as waste remains in place.

- **Reduction of Toxicity, Mobility, or Volume Through Treatment.** The RTD alternative may include some treatment to meet regulatory standards for land disposal and/or ERDF waste acceptance criteria. For source sites within the 300 Area Complex, the Modified Containment alternative would not involve waste treatment. Therefore, the RTD alternative would likely have a greater degree of treatment than the modified containment alternative, but the exact amount cannot be quantified.

- **Short-Term Effectiveness.** The Modified Containment alternative would provide a greater degree of short-term effectiveness than the RTD alternative. A potential for accidents or short-term exposure, primarily to site workers, could exist with excavation of contaminated soil/debris and transportation to the ERDF (or an offsite facility as necessary) using the RTD alternative. Control of dust during excavation and trucking operations would be required to reduce the amount of contaminated material migration to potential receptors. In addition, the RTD alternative could result in short-term impacts at borrow sites that would be used for backfill material.

  Outside of the risks associated with a construction operation, the Modified Containment alternative would present minimal short-term threats because it would not involve excavating, handling, or transporting of any contaminated material. Due to its dependence on current and future industrial activities or D&D activities inside of the 300 Area Complex, the RTD alternative would take much longer to implement than the Modified Containment alternative, which could be implemented immediately. Because existing institutional controls to prevent workers from exposure to contaminants would continue within the 300 Area Complex prior to implementation of the RTD alternative, there would be no difference between these alternatives in the time required to achieve the desired state of protectiveness.

- **Implementability.** When compared to the Modified Containment alternative, the RTD alternative would be more complicated to implement because of ongoing industrial use of the 300 Area Complex and safety requirements associated with excavating, handling, transporting, and disposing large volumes of contaminated soil and debris. Maintenance, replacement, and/or construction of simple surface covers under the Modified Containment alternative would be easier to implement. Much of the needed cover is already in place within the 300 Area Complex, as are the associated institutional controls and groundwater monitoring programs that would be necessary under the Modified Containment alternative. When needed, cover materials are readily available from local suppliers. Contaminated waste would not be handled during the implementation process. Both alternatives are considered reliable cleanup methods.

- **Cost.** The total present-value cost of implementing the RTD and Modified Containment alternatives at source sites within the 300 Area Complex is estimated to be $73.2 million and $22.1 million, respectively. The total undiscounted cost of implementing the RTD and Modified Containment alternatives in 1999 dollars is estimated to be $148.9 and $652.2 million, respectively. See Table 8 for a 300-FF-2 cost estimate comparison.

- **State Acceptance.** The State of Washington supports Remove/Treat/Dispose as the preferred alternative.

- **Community Acceptance.** In general, comments received on the Proposed Plan were supportive of the Remove/Treat/Dispose alternative. Some concerns were voiced regarding land use assumptions, the protectiveness of cleanup levels with regard to groundwater quality and ecological receptors, and the integration of source control actions with groundwater actions in the 300 Area. A number of clarifications to the selected remedy have been made in the ROD as a result of public comments submitted on the Proposed Plan, however, there were no significant changes made to the remedy as it was originally described in the Proposed Plan.

Outlying Source Sites

The RTD and No Action alternatives were evaluated for the 300-FF-2 OU outlying source sites. The Containment alternative was not evaluated for the 7 outlying source sites based on the effectiveness, implementability, and cost of such small-scale containment/institutional controls systems.

- **Overall Protection of Human Health and the Environment.** The RTD alternative would adequately protect human health and the environment by removing contaminants and/or eliminating exposure pathways at the applicable source sites. The RTD alternative would provide protection by removal, treatment (as necessary), and disposal of contaminated waste and debris in an engineered facility such as the ERDF. Implementation of groundwater monitoring and institutional controls would be required to ensure continued overall protection. The No Action alternative would fail to provide adequate protection because of the potential risks posed by waste site contaminants. Consequently, the No Action alternative cannot be considered for selection and is eliminated from discussion under the remaining evaluation criteria.

- **Compliance with Applicable or Relevant and Appropriate Requirements.** The RTD alternative would comply with the ARARs from Federal and state laws.

- **Long-Term Effectiveness and Permanence.** The RTD alternative would provide a high degree of long-term effectiveness and permanence by removing contaminated soil and debris from the site, treatment as necessary, and disposal at an engineered facility such as the ERDF. The RTD alternative would require less in the way of long-term restrictions for the sites after remediation was completed.

- **Reduction of Toxicity, Mobility, or Volume through Treatment.** The RTD alternative may include some treatment to meet regulatory standards for land disposal and/or ERDF waste acceptance criteria. The amount of waste requiring treatment under the RTD alternative is unknown.

- **Short-Term Effectiveness.** A potential for accidents or short-term exposure, primarily to site workers, could exist with excavation of contaminated soil/debris and transportation to the ERDF (or an offsite facility as necessary) using the RTD alternative. Control of dust during excavation and trucking operations would be required to reduce the amount of contaminated material migration to potential receptors. Short-term impacts could be realized at borrow sites that would be the source of backfill materials. The RTD alternative could be implemented immediately.

- **Implementability.** The RTD alternative would be relatively easy to implement for the miscellaneous outlying sites and is considered to be a reliable cleanup method.

- **Cost.** The total present-value cost of implementing the RTD alternative at the outlying source sites is estimated to be $15.2 million. The total undiscounted cost of implementing the RTD alternative in 1999 dollars is estimated to be $27.2 million. See Table 8 for a 300-FF-2 cost estimate comparison.

- **State Acceptance.** The State of Washington supports Remove/Treat/Dispose as the preferred alternative.

- **Community Acceptance.** In general, comments received on the Proposed Plan were supportive of the Remove/Treat/Dispose alternative. Some concerns were voiced regarding land use assumptions, the protectiveness of cleanup levels with regard to groundwater quality and ecological receptors, and the integration of source control actions with groundwater actions in the 300 Area. A number of clarifications to the selected remedy have been made in the ROD as a result of public comments submitted on the Proposed Plan; however, there were no significant changes made to the remedy as it was originally described in the Proposed Plan.

<u>General Content Burial Grounds</u>

The No Action, RTD, and Containment alternatives were evaluated for all but one of the 300-FF-2 OU general content burial grounds. The Containment alternative was not applicable for the 618-13 Burial Ground, because it is a mound of soil. Other remedial technologies were screened out, as documented in the 300-FF-2 FFS.

- **Overall Protection of Human Health and the Environment.** The RTD and Containment alternatives would adequately protect human health and the environment by removing contaminants and/or eliminating exposure pathways at the burial grounds. The

RTD alternative would provide protection by removal, treatment (as necessary), and disposal of contaminated waste and debris in an engineered facility such as the ERDF. An engineered cap would be constructed in the Containment alternative to prevent direct contact exposure to contaminants in the burial grounds and control migration to groundwater. Long-term maintenance and monitoring would be required under the Containment alternative to ensure that the cap remained protective. The No Action alternative would fail to provide adequate protection because of the potential risks posed by waste site contaminants. Consequently, the No Action alternative cannot be considered for selection and is eliminated from discussion under the remaining evaluation criteria.

- **Compliance with Applicable or Relevant and Appropriate Requirements.** The RTD and Containment alternatives would both comply with ARARs from Federal and state laws.

- **Long-Term Effectiveness and Permanence.** The RTD alternative would provide a greater degree of long-term effectiveness and permanence than the Containment alternative. Under the RTD alternative, contaminated soil and debris would be removed to the original depth of the engineered structure. Other than land use restrictions to ensure continued industrial use of the area (if contaminants are left in place above unrestricted land use cleanup levels), further controls would not be necessary to ensure long-term protectiveness. The excavated material would be disposed at an engineered facility such as the ERDF. The Containment alternative would prevent direct exposure and contaminant migration through construction of an engineered cap, but maintenance and a greater degree of institutional controls would be required to ensure effectiveness and permanence. Long-term protection of groundwater and surface water resources may be difficult to ensure as long as waste remains in place.

- **Reduction of Toxicity, Mobility, or Volume through Treatment.** The RTD alternative may include some treatment to meet regulatory standards for land disposal and/or ERDF waste acceptance criteria. The Containment alternative does not involve waste treatment. Therefore, the RTD alternative would likely have a greater degree of treatment than the containment alternative, but the exact amount cannot be quantified.

- **Short-Term Effectiveness.** Short-term effectiveness would be greater with the Containment alternative than with the RTD alternative. A potential for accidents or short-term exposure, primarily to site workers, could exist with excavation of contaminated soil/debris and transportation to the ERDF (or an offsite facility as necessary) using the RTD alternative. The potential for finding unknown waste and multiple handling that is necessary for segregation and treatment would further increase worker risk and safety issues. Control of dust during excavation and trucking operations would be required to reduce the amount of contaminated material migration to potential receptors.

  Outside of the risks associated with a construction operation, the Containment alternative would present minimal short-term threats because it does not involve excavating, handling, or transporting any contaminated material. When compared to Containment, it would likely take longer for the RTD alternative to achieve the desired protectiveness based on lower production rates associated with the increased worker risks and higher costs. The Containment alternative would have a reduced short-term impact on cultural and ecological resources at the waste sites because of the shorter duration for remedial action, but could have short-term cultural and ecological impacts at sites where barrier materials are obtained.

- **Implementability.** When compared to the Containment alternative, the RTD alternative would be more complicated to implement because of the difficulties and safety requirements associated with excavating, handling, transporting, and disposing large volumes of contaminated equipment, soft wastes (e.g., boxes and bags), and soil, and because of inherent unknowns in the general content burial grounds. These tasks, combined with the necessity for workers to wear highly protective work clothing and equipment, would result in lower worker productivity. However, removal is a proven and reliable method to achieve protectiveness. Construction of an engineered surface barrier under the Containment alternative would be easier to implement. Materials for barriers are readily available on or near the Hanford Site, and contaminated waste would not be handled. Containment is a proven technology for landfills where buried waste is left in place, however additional site characterization and engineering studies would have to be performed to ensure that cap subsidence would not jeopardize the integrity of the remedy over time.

- **Cost.** The total present-value cost of implementing the RTD and Containment alternatives at these burial grounds is estimated to be $53.9 million and $23.5 million, respectively. The total undiscounted cost of implementing the RTD and Containment alternatives in 1999 dollars is estimated to be $99.5 and $252.5 million, respectively. The cost estimate for the Containment alternative excludes the 618-13 Burial Ground for which containment is not applicable (i.e., the "inverted" burial ground is a mound). See Table 8 for a 300-FF-2 cost estimate comparison.

- **State Acceptance.** The State of Washington supports Remove/Treat/Dispose as the preferred alternative.

- **Community Acceptance.** In general, comments received on the Proposed Plan were supportive of the Remove/Treat/Dispose alternative. Some concerns were voiced regarding land use assumptions, the protectiveness of cleanup levels with regard to groundwater quality and ecological receptors, and the integration of source control actions with groundwater actions in the 300 Area. A number of clarifications to the selected remedy have been made in the ROD as a result of public comments submitted on the Proposed Plan, however, there were no significant changes made to the remedy as it was originally described in the Proposed Plan.

Transuranic-Contaminated Burial Grounds

The No Action, RTD, and Containment alternatives were evaluated for the 618-10 and 618-11 Burial Grounds. Other remedial technologies were screened out, as documented in the 300-FF-2 FFS.

- **Overall Protection of Human Health and the Environment.** The RTD and Containment alternatives would adequately protect human health and the environment by removing contaminants and/or eliminating exposure pathways at the burial grounds. The RTD alternative would provide protection by removal, treatment (as necessary to permit land disposal), and disposal of contaminated waste and debris in an engineered facility such as the ERDF or WIPP. An engineered cap would be constructed in the Containment alternative to prevent direct contact exposure to contaminants in the burial grounds and control migration to groundwater. Long-term maintenance and monitoring would be required under the Containment alternative to ensure that the cap remained protective. Because of the tritium-contaminated groundwater downgradient from the 618-11 Burial Ground and observation of oil at the 618-10 Burial Ground, additional investigation may be warranted to ensure that the Containment alternative would effectively eliminate contaminant migration to groundwater. The No Action alternative would fail to provide adequate protection because of the potential risks posed by the waste site contaminants. Consequently, the No Action alternative cannot be considered for selection and is eliminated from discussion under the remaining evaluation criteria.

- **Compliance with Applicable or Relevant and Appropriate Requirements.** It is anticipated that the RTD and Containment alternatives would both comply with ARARs from Federal and state laws. For the RTD alternative, a containment structure could be constructed and remote-handling methods could be used to comply with radiation exposure and air emission standards.

- **Long-Term Effectiveness and Permanence.** The RTD alternative would provide a greater degree of long-term effectiveness and permanence than the Containment alternative. Under the RTD alternative, contaminated soil and debris would be removed to the original depth of the engineered structure. Other than land use restrictions to ensure continued industrial use of the area (if contaminants are left in place above unrestricted land-use cleanup levels), further controls would not be necessary to ensure long-term protectiveness. The excavated material would be disposed at engineered facilities such as the ERDF and WIPP. The Containment alternative would prevent direct exposure and contaminant migration through construction of an engineered cap, but maintenance and a greater degree of institutional controls would be required in perpetuity to ensure effectiveness and permanence given the known presence of long-lived transuranic constituents. Long-term protection of groundwater and surface water resources may be difficult to ensure as long as waste remains in place.

- **Reduction of Toxicity, Mobility, or Volume through Treatment.** The RTD alternative may include some treatment to meet regulatory standards for land disposal and/or ERDF and WIPP waste acceptance criteria. The Containment alternative would not involve waste treatment. Therefore, the RTD alternative would likely have a greater degree of treatment than the containment alternative, but the exact amount cannot be quantified.

- **Short-Term Effectiveness.** Short-term effectiveness would be greater with the Containment alternative than with the RTD alternative. Due to the lack of proven retrieval technologies for transuranic-contaminated waste, the short-term consequences of these actions cannot be defined. A potential for accidents or short-term exposure, primarily to workers at the sites and at the commercial nuclear facility adjacent to the 618-11 Burial Ground, could exist with excavation of contaminated soil/debris and transportation to the ERDF or WIPP using the RTD alternative. The potential for finding unknown waste and multiple handling that is necessary for segregation and treatment would further increase worker risk and safety issues. Control of dust during excavation and trucking operations would be required to reduce the amount of contaminated material migration to potential receptors.

  Outside of the risks associated with a construction operation, the Containment alternative would present minimal short-term threats because it would not involve excavating, handling, or transporting any contaminated material. The Containment alternative would have reduced short-term impacts on cultural and ecological resources at the waste sites because of the shorter duration for remedial action, but could have short-term cultural and ecological impacts at sites where barrier materials are obtained.

- **Implementability.** The RTD alternative would be more complicated to implement than the Containment alternative because of inherent unknowns with burial grounds and because of the difficulties and safety requirements associated with excavating, handling, transporting, and disposing of transuranic-contaminated waste. The excavation and subsequent management of transuranic-contaminated waste will present challenges and require complex technologies to ensure protection of workers and the public during remediation. Excavation, retrieval, characterization, treatment, packaging, and transportation technologies for transuranic-contaminated waste have yet to be fully developed at DOE-managed sites across the country. Within the past several years, the issues associated with transuranic-contaminated waste have been recognized and are now being addressed on a larger scale. The program is still relatively new, and no definitive solutions have been established other than to identify the WIPP as a final disposal site. At the Hanford Site, retrieval and treatment of this type of waste will be addressed as part of the Tri-Party Agreement M-91 milestone series. Construction of an engineered surface barrier under the Containment alternative would be easier to implement. Materials for barriers are readily available on or near the Hanford Site, and contaminated waste would not be handled. Containment is a proven technology that is used at landfills where buried waste is left in place. However, there are implementation issues associated with construction of a heavy cap over burial grounds that have large void spaces (e.g., oil was observed at the 618-10 Burial Ground after heavy equipment work on the surface).

- **Cost.** The total present-value cost of implementing the RTD and Containment alternatives at these burial grounds is estimated to be $369.5 million and $32.3 million, respectively. The total undiscounted cost of implementing the RTD and Containment alternatives in 1999 dollars is estimated to be $434.7 and $103.4 million, respectively. It should be noted that approximately 80% of the cost estimate is based on price quotes from DOE waste management sources for the disposal of each drum of transuranic-contaminated waste. Historical records and information on the quantity and type of materials that were disposed at these burial grounds are incomplete, published as estimates, and often contradictory between documents. In addition, the price quotes for packaging, treatment, and disposal of remote handled-TRU at WIPP are not based on real experience. Consequently, there is a high level of uncertainty associated with the cited cost estimates. See Table 8 for a 300-FF-2 cost estimate comparison.

- **State Acceptance.** The State of Washington supports Remove/Treat/Dispose as the preferred alternative.
- **Community Acceptance.** In general, comments received on the Proposed Plan were supportive of the Remove/Treat/Dispose alternative. Some concerns were voiced regarding land use assumptions, the protectiveness of cleanup levels with regard to groundwater quality and ecological receptors, and the integration of source control actions with groundwater actions in the 300 Area. A number of clarifications to the selected remedy have been made in the ROD as a result of public comments submitted on the Proposed Plan, however, there were no significant changes made to the remedy as it was originally described in the Proposed Plan.

XI. PRINCIPAL THREAT WASTES

The NCP establishes an expectation that EPA will use treatment to address the "principal threats" posed by a site wherever practicable (NCP Section 300.430(a)(1)(iii)(A)). "Principal threat" wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained, or would present a significant risk to human health or the environment should exposure occur. A "source material" is material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contamination to groundwater, surface water or air, or acts as a source for direct exposure. Although no "threshold level" of risk has been established to identify principal threat waste, a general rule of thumb is to consider as a principal threat those source materials with toxicity and mobility characteristics that combine to pose a potential risk several orders of magnitude greater than the risk level that is acceptable for the current or reasonably anticipated future land use, given realistic exposure scenarios. Remedies which involve treatment of principal threat wastes likely will satisfy the statutory preference for treatment as a principal element, although this will not necessarily be true in all cases.

Principal threat waste in the 300-FF-2 Operable Unit falls into two general categories: 1) drummed waste (liquid or non-liquid) that is both highly mobile and/or highly toxic; and 2) non-liquid, highly radioactive soil and debris. Treatment technologies would be employed to address some principal threat wastes as part of the RTD alternative. It is anticipated that all liquid waste will undergo treatment prior to final disposal. Radiologically contaminated soil and debris will not be treated prior to disposal in ERDF (unless soil or debris require treatment to meet RCRA Land Disposal Restrictions or ERDF Waste Acceptance Criteria) because cost-effective methods to reduce the toxicity, mobility, or volume of radiological constituents at these concentrations have not been identified. Therefore, the RTD alternative utilizes treatment to the maximum extent practicable and results in the treatment of some principal threat wastes. The Containment and No Action alternatives would not involve treatment of any kind. Therefore, principal threat waste would remain at the waste site in its current form.

XII. SELECTED REMEDY

This ROD presents the selected interim remedial action for portions of the U.S. Department of Energy (DOE) Hanford 300 Area, Hanford Site, Benton County, Washington, which were chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the information contained in the Administrative Record for this site.

SECTION 1: SUMMARY OF RATIONALE FOR THE SELECTED REMEDY

The Tri-Parties have selected the remove, treat as necessary, and dispose (RTD) cleanup approach as the remedy for all four categories of waste sites contained in the 300-FF-2 Operable Unit. This was also the Preferred Alternative identified in the Proposed Plan. It is the most appropriate remedial alternative because:

- The alternative satisfies the CERCLA threshold criteria and represents the best balance of tradeoffs with respect to the CERCLA balancing and modifying criteria. (See discussion in Section X.)

- The alternative satisfies the statutory requirements as outlined by section 121 of CERCLA. (See discussion in Section XIII.)

Other benefits that the selected remedy provides include:

- The alternative is consistent with the overall cleanup approach for the 300 Area at Hanford, as embodied in the Tri-Party Agreement and past cleanup decisions in the 300 Area (i.e., remove contaminated materials from the Columbia River corridor, treat them as necessary, and dispose of them in an appropriate long-term waste management facility).

- The alternative is the most protective and effective long-term solution to the large number and areal extent of waste sites addressed by this ROD (i.e., this remedy will not result in a multitude of caps that would require maintenance and institutional controls in perpetuity and would always pose a potential threat to groundwater and river water quality).

- The alternative meets the values expressed by the community and Hanford stakeholders to remove hazardous materials from the Columbia River shoreline areas and to restore the Columbia River corridor to productive uses.

SECTION 2: DETAILED DESCRIPTION OF THE SELECTED REMEDY

The procedures used to implement the multi-year work effort required by this ROD will be outlined and documented in more detail in the Remedial Design/Remedial Action (RD/RA) workplan, a primary document under the Tri-Party Agreement (TPA) subject to Environmental Protection Agency (EPA) approval. It is anticipated that the RD/RA workplan process will be implemented in a phased approach, with the RD/RA workplan to be submitted to EPA by June 30, 2002. This document will identify the plan and schedule for submittal of subsequent workplans.[7] Once initiated, substantial continuous physical on-site remedial action shall be maintained until all of the cleanup work is completed. A detailed schedule and cleanup plan for implementing this ROD will be submitted to EPA for approval by June 30, 2002, for inclusion in the RD/RA workplan and in support of TPA Milestones M-16-03A and M-16-00B. This schedule will include specific commitments regarding the Decontamination and Decommissioning (D&D) of facilities and aboveground structures necessary to complete the cleanup of underlying waste sites in the 300 Area Complex and the remediation plans for the 618-10 and 618-11 Burial Grounds. The detailed schedule and cleanup plan for implementing this ROD shall be consistent with the current TPA milestone to complete all 300 Area remedial actions by September 30, 2018 (TPA Milestone M-16-00).

The selected remedy for all waste sites contained in the 300-FF-2 Operable Unit includes the following activities.

a) Remove/Treat/Disposal (RTD) Component of the Selected Remedy

1) Per the Tri-Party Agreement, DOE shall submit the Remedial Design Report, Remedial Action Work Plan, and Sampling and Analysis Plan as primary documents for EPA approval prior to the initiation of each phase of remediation work.

2) Removal of any buildings, structures, or facilities that overlie waste sites contained within the scope of the ROD will be performed in advance of soil excavation projects. In addition, the data gathered during the Decontamination and Decommissioning (D&D) process will be used to guide the design of the soil excavation projects (e.g., location of subsurface floor drains and potential soil contamination areas will be identified for the soil remediation phase of the cleanup process). This activity must be performed first, but is not within the scope of this ROD. It is anticipated that the removal of buildings, structures, or facilities will be authorized and performed through the CERCLA Removal Action process, consistent with the guidelines established in the May 22, 1995, joint EPA/DOE "Policy on Decommissioning Department of Energy Facilities Under CERCLA." The D&D activities will be evaluated in Engineering Evaluation/Cost Analysis (EE/CA) documents and authorized in CERCLA Action Memoranda. As an alternative approach, D&D activities can be evaluated using the Limited Field Investigation/Focused Feasibility Study approach to support a subsequent Record of Decision to authorize the removal of buildings and aboveground structures. D&D

[7] The RD/RA workplan may be submitted before June 30, 2002, without the plan and schedule for submittal of subsequent workplans, however such plan and schedule must be submitted on June 30, 2002, (pursuant to TPA milestone M-16-03A) and upon approval by EPA, will be incorporated into the RD/RA workplan.

activity will be performed in accordance with EPA-approved Removal Action Workplans or RD/RA workplans, depending on the cleanup authorization route selected.

3) Removal and stockpiling of soil that is below the cleanup levels. Appropriate sampling activities will be performed to verify acceptance of the material for backfill. (See Tables 5 and 6 for soil cleanup levels.)

4) Excavation and transportation of contaminated soils, structures, and debris to the Environmental Restoration Disposal Facility (ERDF), or other facility approved in advance by EPA, for disposal. Excavation activities shall follow standard construction practices for excavation and transportation of hazardous materials, and shall follow ALARA practices for remediation workers. Dust suppression during excavation, transportation, and disposal are required, as necessary.

5) Treatment, as necessary to meet ERDF (or other facility approved by EPA) waste acceptance criteria, will typically be performed in the 300 Area or at ERDF prior to disposal. In general, the treatment technologies envisioned for these waste materials are macroencapsulation and microencapsulation, although other options may also be appropriate. In the event that some materials cannot be disposed of at the ERDF and require disposal at an offsite facility, such an offsite facility must be in compliance with EPA's Offsite Rule (40 CFR 300.440) concerning offsite disposal of wastes.

6) Transuranic (TRU)-contaminated waste removed from burial grounds (or other 300-FF-2 TRU sources) will be disposed at the Waste Isolation Pilot Plant (WIPP) in Carlsbad, NM. Appropriate characterization, packaging, and processing will be performed to meet WIPP waste acceptance criteria and DOT regulations regarding transportation of TRU-contaminated waste. This activity is planned to take place at the Waste Receiving and Processing Facility (WRAP) for contact-handled TRU (CH-TRU) and at the M-91 facility for remote-handled TRU (RH-TRU). If an RH-TRU facility is not constructed pursuant to the M-91 milestone, one will have to be built to support this remedial action. Appropriate engineering studies and technology development activities will be performed in preparation for the exhumation of TRU-contaminated burial grounds. Exhumation is not anticipated to begin until sometime after 2010. However, these projects shall be completed by the M-16-00 Tri-Party Agreement Milestone date of September 30, 2018.

In the meantime, access restrictions, maintenance of existing cover systems, and environmental monitoring will be continued at the two burial ground sites to ensure interim safety of the burial grounds and protection of the public and environment. [8]

7) An observational approach will be used during the remediation process. The observational approach uses information from historical process operations, analogous sites, and limited field investigations to develop a conceptual model of the waste site. This model is then used to plan the remedial action. The cleanup approach can be modified in the field in accordance with the approved RD/RA workplan based on real-time site characterization data gathered during the remediation process.

8) The measurement of soil contaminant levels during remediation will primarily rely on field screening methods. Limited confirmation sampling of field screen measurements will be undertaken to correlate and validate the field screening. Once field screening activities have indicated that cleanup levels have been achieved, a more extensive confirmation sampling program will be undertaken that routinely achieves higher levels of quality assurance and quality control that will support the issuance of a cleanup verification report for the waste site.

9) The extent of remediation of the waste sites will be as follows:

   a) Burial grounds, landfills, trenches, or other structures that contain contaminated debris or other waste material will be exhumed to the original depth of the structure (i.e., until native soil is reached). Vertical pipe units and caissons will be removed and disposed. Contaminated debris will be disposed. Soil contaminated above cleanup levels will be disposed. Soil below cleanup levels (e.g., uncontaminated berms between trenches) may be left in place or stockpiled and later used as backfill material. The extent of excavation beyond the boundaries of the original engineered structure (lateral or vertical) will be

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[8] The excavation and subsequent management of transuranic-contaminated waste will present challenges and require complex technologies to ensure protection of workers and the public during remediation. Excavation, retrieval, characterization, treatment, packaging, and transportation technologies for transuranic-contaminated waste have yet to be fully developed at DOE-managed sites across the country. Within the past several years, the issues associated with transuranic-contaminated waste have been recognized and are now being addressed on a larger scale. The program is still relatively new, and no definitive solutions have been established other than to identify the WIPP as a final disposal site. At the Hanford Site, retrieval and treatment of this type of waste will be addressed as part of the Tri-Party Agreement M-91 milestone series.

Due to these complexities, remediation of the 618-10 and 618-11 Burial Grounds is not anticipated to begin until sometime after 2010. The excavation, retrieval, characterization, treatment, packaging, and transportation technologies established through development efforts at the Hanford Site and other DOE-managed sites will be used to help prepare remediation plans for the 618-10 and 618-11 Burial Grounds. In the meantime, access restrictions, maintenance of existing cover systems, and environmental monitoring will be continued at the two burial ground sites to ensure interim safety of the burial grounds and protection of the public and environment.

In the future, the Tri-Parties will review the 618-10 and 618-11 Burial Ground remediation plans using the information obtained through technology development efforts. If new information suggests a change to the remedy selected for these two burial grounds, the remedy change would be documented in an amendment to the ROD. The process of issuing a ROD amendment would require public involvement.

determined based on the depth of the contaminated soil. (See criteria below to determine extent of excavation required to meet RAOs.)

b) Engineered structures that contained or received spills of hazardous substances, pollutants, or contaminants (such as foundations, pads, pipelines, radioactive waste sewer systems, and building drainage systems) will be removed (unless verified as uncontaminated through sampling). The extent of soil excavation will be determined based on the depth of the contaminated soil below surrounding grade. (See criteria below to determine extent of excavation required to meet RAOs.)

c) For all other waste sites, the extent of contaminated soil, debris, and engineered structure excavation will be as follows:

- In the top 15 feet of the soil column, soil must meet cleanup levels protective of direct contact/direct exposure to human and ecological receptors, groundwater quality, and Columbia River water quality (see Tables 5 and 6).[9] The top 15 feet of the soil profile will be determined based on an assessment of the surrounding grade and the depth of the original engineered structure. Soil mounding does not count in the soil profile.

- At depths greater than 15 feet, soil must meet cleanup levels protective of groundwater quality and Columbia River water quality (i.e., direct contact/direct exposure levels do not apply) (see Tables 5 and 6).

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[9] For <u>chemicals</u>, acceptable residual concentrations are based on an evaluation of contaminant mobility and MTCA Method C industrial cleanup standards for soil. If the contaminant is not mobile in the soil column given post-cleanup site conditions, the direct contact cleanup level is the applicable cleanup standard. Direct contact values may have to be adjusted further to be protective of terrestrial plants and animals depending on the location of the individual waste site and the nature of the surrounding habitat. If the contaminant is mobile, residual soil concentration levels must not result in an exceedence of Federal or State drinking water standards (for protection of groundwater), MTCA Method B groundwater standards, or Federal and State surface water quality criteria (for protection of the Columbia River), whichever is more stringent. Cleanup levels may have to be adjusted further to be protective of aquatic plants and animals depending on the nature of the contaminant and the ecological receptor. Changes to contaminant-specific cleanup levels may be required, and final cleanup levels must be approved by EPA.

For <u>radionuclides</u>, acceptable residual concentrations are based on an evaluation of contaminant mobility and radionuclide concentrations that achieve the EPA CERCLA risk range of 10^{-4} to 10^{-6} increased cancer risk potential (as an operational practice, the Tri-Parties have interpreted compliance with this requirement to mean that the total dose for all radionuclides shall not exceed 15 mrem/year above Hanford site background for 1000 years following the remediation for the individual who receives a reasonable maximum exposure [RME]). If the contaminant is not mobile in the soil column given post-cleanup site conditions, the direct exposure cleanup level is the applicable cleanup standard. Meeting this objective will also be protective of ecological receptors based on criteria specifying that dose rates shall not exceed 0.1 rad/day for terrestrial organisms and 1.0 rad/day for terrestrial plants. If the contaminant is mobile, residual soil concentration levels must not result in an exceedence of Federal or State drinking water standards (for protection of groundwater), MTCA Method B groundwater standards, or Federal and State surface water quality criteria (for protection of the Columbia River), whichever is more stringent. Cleanup levels may have to be adjusted further to be protective of aquatic plants and animals depending on the nature of the contaminant and the ecological receptor. Changes to contaminant-specific cleanup levels may be required, and final cleanup levels must be approved by EPA.

- The cleanup level of 350 pCi/g for uranium (total of all isotopes) must be met throughout the entire soil column in order to achieve the remedial action objectives specified in this ROD. If this requirement changes, appropriate remedy selection change documentation (e.g., ESD or ROD amendment) and public involvement procedures will be required.

- There may be some limited circumstances where contaminated soil, debris, or engineered structures above cleanup standards may be left in place below a depth of 15 feet. Factors such as nature and form of contaminated material, implementability, cost, volume, and impacts to ecological and cultural resources may be used to evaluate the extent of excavation at depths greater than 15 feet. It is anticipated that these exceptions will only be necessary under very limited circumstances. Appropriate remedy selection change documentation (e.g., ESD or ROD amendment based on the nature of the exception) and public involvement procedures will be required. Regardless of these factors, protection of groundwater and the Columbia River must be achieved for any contamination left below 15 feet (i.e., alternative remedial measures must be evaluated).

10) Once a site has been demonstrated to have achieved all RAOs[10] using post-cleanup site conditions (not generic site profiles) and the key modeling assumptions that describe the industrial land use scenario (which can be found in Section XII (4) of this ROD), and has obtained EPA approval on the cleanup verification package, it will be backfilled with clean materials (i.e., clean fill material from a borrow pit or material that has been determined to be below cleanup levels). The remediated area will then be regraded to match local area contours.

11) Infiltration control (e.g., revegetation, asphalt, concrete) is required as part of this remedy or soil cleanup levels must be reevaluated and modified using different evapotranspiration coefficients (i.e., gravel does not prevent infiltration through residual contamination). The driver for this requirement is protection of groundwater from residual contaminant concentrations. Any revegetation plans should be developed with input from affected stakeholders (such as Natural Resource Trustees). Infiltration control measures other than revegetation will be considered for the 300-FF-2 industrial complex area given the potential future land use. For outlying waste sites and burial grounds,

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[10] Cleanup of the 300 Area must be protective of ecological receptors. The generic waste site profile used to develop cleanup levels assumed no ecological receptor populations were being impacted by individual waste sites. While this may be an appropriate general assumption for the 300 Area Complex area, areas adjacent to the industrial complex are subject to sparse and transient use by wildlife and outlying areas share the same habitat characteristics as other parts of the Columbia River corridor. Therefore, additional efforts must be made to demonstrate this is the case for sites outside the fenceline of the 300 Area Complex. The results of pre-remediation cultural and ecological waste site surveys may be adequate to address baseline site conditions (i.e., confirm the presence or absence of sensitive plant or animal species). In some limited cases, soil cleanup levels may have to be adjusted further to be protective of terrestrial plants and animals depending on the location of the individual waste site, the nature of the surrounding habitat, the contaminants of concern, and the presence of sensitive receptors. Specific procedures for implementing these surveys, modifying cleanup levels if appropriate, and documenting results in CVPs will be outlined in the RD/RA workplan.

revegetation efforts shall also attempt to establish a viable habitat at the remediated areas and will emphasize the use of native plants and seed stock. Revegetation plans cannot rely on irrigation water for sustained growth. Infiltration control plans shall be established as part of the RD/RA workplan process. A plan for long-term maintenance of infiltration controls after waste site closeout will be established in the institutional controls plan.

12) The remedy will be implemented in a manner that is compliant with all Applicable or Relevant and Appropriate Requirements (see Section XII).

Additional Requirements for RTD of Waste Sites within the 300 Area Industrial Complex

It has been estimated that approximately 150 buildings and structures need to first be removed to expose the 40 soil contamination areas that need to be cleaned up pursuant to this ROD. An additional $663 million (not within the scope of this remedial action) is estimated to be required to remove materials and structures from the 300 Area to facilitate the cleanup of contaminated soil and debris. Decontamination and Decommissioning (D&D) of facilities in the 300 Area must be carefully coordinated with the soil cleanup process pursuant to this ROD. When buildings are demolished and foundations removed, soil contamination areas that were previously “capped” by building foundations or paved areas will be exposed, thus providing a potential threat to groundwater and river water quality, as well as direct contact/direct exposure threats. Although RD/RA workplan implementation and Tri-Party Agreement Milestone commitment dates have not yet been established for the removal of buildings and structures in the 300 Area that overlie contaminated waste sites, these projects are to be completed in a manner that supports soil cleanup and final closeout for the 300-FF-2 Operable Unit by the M-16-00 Milestone date of September 30, 2018. Because there may be a time lag between facility D&D and soil cleanup, this ROD requires the following (which must be addressed in the RD/RA workplan):

- Waste sites that are uncovered as a result of D&D activity will require dust suppression and water infiltration control measures for the interim period between D&D and soil remediation. Waste sites requiring these controls will be determined based on the protocols established in the 300-FF-2 Sampling and Analysis Plan or the Removal Action Workplan. In addition, enhanced access controls and signs will also be required during this period to warn people of hazards that have been exposed. All controls will be maintained until appropriate soil cleanup work is completed. Soil cleanup must be initiated in a timely manner (i.e., no more than 12-months from the completion of the D&D activity), or written justification must be provided to EPA and approved. This justification shall include a schedule and budget plan that supports a path forward.

- Provisions for identifying new waste sites in the 300 Area Industrial Complex must be included in the Removal Action workplan for D&D activity and sampling protocols must be established in the 300-FF-2 Sampling and Analysis plan. Waste sites that are discovered during D&D activity will be treated as “candidate sites” that must be characterized and may be “plugged-in” to the RTD remedy as part of the 300-FF-2 ROD.

b) Institutional Control Component of the Selected Remedy

Institutional controls are non-engineering instruments, such as administrative and/or legal controls, that are designed to prevent exposure to contamination by limiting land or resource use. Cleanup in the 300 Area is based on the assumption that land and groundwater use will be restricted, until contaminant concentrations conducive of unlimited use and unrestricted exposure are achieved (e.g., drinking water standards for groundwater). Human exposure to residual contamination must be limited to those levels calculated to be protective under the industrial exposure scenario. In addition, certain activities will be prohibited to ensure that the groundwater and Columbia River water quality are protected as well. Hence, institutional controls are an integral part of the selected remedy.

The following institutional controls are required as part of this remedial action. These requirements clarify the institutional controls that must be met for former waste site locations within the boundary of the 300 Area NPL site. A plan for implementing these requirements shall be submitted by DOE in a site-wide Institutional Controls plan (as required by the "100 Area Burial Ground ROD," September 2000). Pursuant to the 100 Area Burial Ground ROD, the site-wide implementation plan must be submitted to EPA and Ecology as a primary document under the Tri-Party Agreement by July 2001.

Institutional Controls required at current time and during cleanup activity:

1) DOE shall control access to the waste sites addressed in the scope of this ROD until cleanup is complete. Visitors entering any uncovered waste site areas are required to be escorted at all times.

2) DOE shall prohibit well drilling in any waste site areas, except for monitoring or remediation wells authorized in EPA approved documents. Groundwater use is prohibited, except for limited research purposes and monitoring and treatment authorized in EPA approved documents. These restrictions apply until groundwater cleanup objectives (as established in the 300-FF-5 ROD) have been achieved.

3) DOE shall control all intrusive work in any waste site areas addressed by this ROD.

4) DOE shall post and maintain warning signs along the Columbia River shoreline which caution river users of potential hazards from 300 Area waste sites and spring discharges.

5) DOE shall post and maintain warning signs along access roads which caution site visitors and workers of potential hazards from 300 Area waste sites.

6) DOE shall report trespass incidents to the Benton County Sheriff's Office for investigation and evaluation of possible prosecution.

Institutional Controls required after cleanup is complete:

1) DOE shall ensure that former waste site locations are restricted to industrial use only, consistent with the exposure assumptions used in establishing risk-based cleanup levels for radionuclides and the use of MTCA Method C industrial cleanup levels for chemicals. A surveillance program shall be maintained to document that risk or ARAR-based

cleanup levels (and the exposure durations upon which they are based) are not exceeded. This includes restricting access to former waste site locations for sensitive human receptors (e.g., children). This will not be required if remediation work results in soil concentrations that would permit unrestricted use and unlimited exposure.

2) DOE shall prevent the use of groundwater as a drinking water source as long as contaminant concentrations are above drinking water levels.

3) DOE shall limit access to and use of the water from seeps and springs along the Columbia River shoreline as long as concentrations in the discharge water exceed drinking water standards.

4) DOE shall maintain groundwater and Columbia River protection standards including:

   a) Infiltration controls (e.g., revegetation, asphalt, concrete) must be maintained as part of this remedy or remedial action goals/soil cleanup levels must be reevaluated and modified using different evapotranspiration coefficients (i.e., gravel does not prevent infiltration through residual contamination) pursuant to procedures established in the EPA approved RD/RA workplan.

   b) No irrigation will be permitted for agriculture or landscaping on former waste site locations.

   c) These infiltration control measures and irrigation restrictions shall be maintained unless (or until) it can be demonstrated that there will be no negative impact on groundwater or river water quality from residual contamination at former waste site locations.

5) DOE shall control the removal of soil or debris from former waste site locations in the 300 Area NPL site. Soil or debris from former waste site locations can only be removed for other uses if concentrations meet cleanup levels that are based on an unrestricted use exposure scenario. Additional soil or debris can be removed from former waste site locations if they are being sent to a disposal facility approved in advance by EPA.

6) DOE shall limit the removal of soil or debris from former waste site locations where contaminated soils and/or debris remain at depth (i.e., below 15 feet) above direct contact/direct exposure cleanup levels. Any material left at depth above these standards can only be removed from the former waste site location if it is being sent to a disposal facility approved in advance by EPA.

7) DOE shall establish and maintain a records system or database that tracks locations and estimated quantities of residual contamination left in place at waste sites that would preclude unlimited use or unrestricted exposure.

8) DOE shall report the location of residual contamination in deed notices and other informational devices (e.g., a copy of any material documenting the location and quantity of residual contamination will be given to any prospective purchaser/transferee before any transfer or lease). Measures that are necessary to ensure the continuation of land use restrictions or other institutional controls (e.g., proprietary controls such as property easements or covenants), will be taken before any transfer or lease of the property.

Institutional control requirements may be modified in the future as part of the final response action after the interim cleanup action is completed.

c) Environmental Monitoring Component of the Selected Remedy

- Groundwater monitoring beneath the 300-FF-2 Operable Unit is required by the 300-FF-5 Record of Decision. Specific monitoring requirements are outlined in the Operations and Maintenance (O&M) plan for the 300-FF-5 Operable Unit. Any information on the nature and extent of contamination gathered during implementation of the RTD remedy shall be routinely factored into updated groundwater monitoring plans to ensure that the appropriate contaminants of concern are evaluated in the appropriate locations.
- This remedial action will take many years to implement and will leave residual contamination at former waste site locations. Although these residual concentrations will be protective of human health and the environment, continued environmental monitoring is required to ensure that there are no unacceptable impacts to ecological receptors. This post-CVP monitoring is also required to provide the information necessary for the comprehensive risk assessment that will be performed in support of the final 300-FF-2 ROD. These requirements shall be added to the Operations and Maintenance (O&M) plan for the 300-FF-5 Operable Unit or the RD/RA workplan for the 300-FF-2 Operable Unit (both of which are primary documents under the Tri-Party Agreement and require EPA approval). The Tri-Parties can modify these environmental monitoring or reporting requirements in the future, as necessary.
- Environmental monitoring data will be evaluated regularly and used in support of CERCLA five-year reviews to ensure that the selected remedy is being implemented in a manner that is protective of both human health and the environment.

d) Five-Year Review Component of the Selected Remedy

- Because hazardous substances, pollutants, or contaminants will continue to be present at former waste site locations above levels that allow for unrestricted use and unlimited exposure, a CERCLA five-year review will be required. Regular environmental monitoring data will be reviewed pursuant to the requirements established in this ROD and the 300-FF-5 O&M Plan to ensure that protection of human health and the environment is achieved and maintained. Any changes to the land use that are inconsistent with the land use assumptions upon which the ROD is based will be evaluated regularly and used in support of the CERCLA five-year review. A five-year review will not be required for waste sites where post-cleanup site conditions allow for unrestricted use and unlimited exposure.

e) Plug-In Approach Component of the Selected Remedy (For "Candidate Sites" and "Newly Discovered Sites")

This ROD also provides a regulatory framework for a "Plug-In" or "Analogous Sites" approach for additional sites. This approach allows additional waste sites to be cleaned up under this ROD under certain conditions. The plug-in approach requires that when "candidate" or "newly discovered" waste sites fit the "300-FF-2 site profile" and when the contaminant concentrations at that site exceed those required to meet the remedial action objectives established in this ROD, RTD is the selected remedy for these sites and cleanup work for these sites will be added to the schedule required under TPA Milestone M-16-00B.

The 300-FF-2 site profile is based on the site characteristics contained in the focused feasibility study. These characteristics are defined by the following:

- Types of contaminants
- Types of contaminated environmental media
- Types of contaminated waste material

“Newly discovered sites” within the boundaries of the 300-FF-2 Operable Unit may be identified after the ROD is signed (e.g., soil contamination areas that have not yet been identified under 300 Area facilities). Where these newly discovered sites are determined by the Tri-Parties to fit the site profile and to require remedial action based on the cleanup levels required to meet the remedial action objectives in this ROD, use of the Remove, Treat, Dispose remedy is also anticipated.

Twenty-four “candidate sites” consistent with the 300-FF-2 site profile have been identified, but additional site characterization data is required to evaluate the basis for action. This site characterization effort is required by this ROD and shall be performed pursuant to the protocols that will be established in an appropriate sampling and analysis plan (which shall be a primary document under the TPA that requires EPA approval). If further site characterization indicates that remedial action is needed, the waste sites will be plugged into the RTD remedy. A complete list of the candidate sites and identification of their locations is provided in Appendix A.

The Tri-Parties will notify the public regarding the decision to plug in newly discovered waste sites through the periodic publication of ESDs to the 300-FF-2 ROD and/or fact sheets. Minor additions to the 300-FF-2 waste site list can be managed through memoranda issued by EPA to the Operable Unit file maintained in the Administrative Record.

SECTION 3: COST ESTIMATE FOR THE SELECTED REMEDY

Tables 9 and 10 summarize the cost estimates for the selected remedy.

Uncertainty in Cost Estimates

The information in these cost estimate summary tables are based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Major changes may be documented in the form of a memorandum in the Administrative Record file, an ESD, or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

Impact of Discount Rate on Long-Term Projects

Present value analysis is the standard methodology for evaluating costs of cleanup actions which occur over different time frames. In calculating present value costs, a discount factor is used to account for the time value of money. Based on the present value analysis, the RTD alternative is more expensive to perform as opposed to the containment alternative ($511.8 million vs. $77.9 million, respectively). This cost difference is partially due to the effect of the discount rate on the total present value cost estimate. If the effect of the discount rate is removed, annual costs can be summed over the total duration of the project in a manner that reflects the ongoing and perpetual nature of long-term operations and maintenance care associated with the containment option, unadjusted for the time value of money. When this analysis is performed, the total non-discounted cost of the RTD alternative ($710.3 million in 1999 dollars) is less than the total non-discounted cost of the containment scenario ($1,008.1 million in 1999 dollars). (See Table 8.) This is due to the fact that numerous caps would need to be maintained and periodically replaced in perpetuity to ensure that protection of human health and the environment is achieved. It should be noted that there is a significant amount of uncertainty associated with cost estimates developed at this stage of the cleanup process.

Table 9. Cost Estimate Summary for the Selected Remedy – Remove, Treat, and Disposal (RTD)

Site Group	Number of Sites	RTD Alternative Description	Capital ($ million)	Total O&M ($ million)[a,b]	Total Undiscounted Cost ($ million)[c]	Total Present-Value ($ million)[a]
300 Area Complex	40	Removal, treatment as necessary, disposal at engineered facility such as the ERDF. Implementation of institutional controls and groundwater monitoring.	70.7	2.5	148.9	73.2
Outlying Sites	7	Removal, treatment as necessary, disposal at engineered facility such as the ERDF. Implementation of institutional controls and groundwater monitoring.	14.8	0.4	27.2	15.2
General Content Burial Grounds	7	Removal, treatment as necessary, disposal at engineered facility such as the ERDF. Implementation of institutional controls and groundwater monitoring.	52.4	1.5	99.5	53.9
Transuranic-Contaminated Burial Grounds	2	Removal, treatment as necessary, disposal at engineered facility such as the ERDF or WIPP. Implementation of institutional controls and groundwater monitoring.	367.4	2.1	434.7	369.5[d]
TOTALS	**56**	-	**505.3**	**6.5**	**710.3**	**511.8**

NOTE: All costs estimated with an accuracy of –30% to +50% with exception of the transuranic-contaminated burial grounds. Due to uncertainties associated with excavation and processing of transuranic-contaminated waste, the cost for these burial grounds is considered to be rough order of magnitude.

[a] Present-value costs are based on a 2.9% real discount rate (OMB Circular A-94, Appendix C) and a 1000-year period of analysis. [Note: This duration was used to bound the estimate. Actual duration will exceed 1000 years.]

[b] Total O&M is the total present-value cost of annual and periodic operations and maintenance expenditures for a 1000-year period of analysis.

[c] Total undiscounted costs are 1999 dollars for a 1000-year period of analysis.

[d] Approximately 80% of estimate is based on price quotes for drummed waste disposal obtained from DOE waste management sources.

Table 10. Detailed Cost Estimate Summary for the Selected Remedy – Remove, Treat, and Disposal (RTD)					
Description	**300 Area Complex (40)**	**Outlying Sites (7)**	**General Content Burial Grounds (7)**	**Transuranic-Contaminated Burial Grounds (2)**	**Total**
CAPITAL COSTS					
Mobilization and Preparatory Work	$853,669	$156,701	$263,481	$263,965	$1,537,816
Monitoring, Sampling, Testing, and Analysis	$2,693,886	$501,894	$1,379,363	$1,971,241	$6,546,384
Solids Collection and Containment	$5,315,437	$1,329,076	$11,138,205	$17,205,141	$34,987,859
Drums, Tanks, Structures, and Miscellaneous	$67,132	$14,822	$163,137	$245,986	$491,077
Stabilization, Fixation, Encapsulation	$0	$341,452	$3,751,329	$5,655,253	$9,748,034
Disposal (other than commercial)	$13,990,878	$2,405,543	$10,172,348	$12,123,809	$38,692,578
Site Restoration	$12,886,641	$2,838,819	$1,075,688	$1,872,735	$18,673,883
Demobilization	$471,599	$84,346	$81,647	$24,613	$662,205
Project Construction, Management & Support	$5,074,401	$1,106,208	$2,174,036	$3,310,328	$11,664,973
Subtotal (Construction)	$41,353,644	$8,778,861	$30,199,234	$42,673,071	$123,004,810
Field Overhead	$1,834,936	$437,292	$1,270,395	$1,945,843	$5,488,466
Home Office	$550,480	$131,188	$381,119	$583,753	$1,646,540
Profit	$1,284,459	$306,103	$889,278	$1,362,089	$3,841,929
Bond, B&O Tax	$384,594	$95,241	$243,914	$294,384	$1,018,133
Direct Distributable	$8,377,808	$1,798,632	$6,085,537	$8,645,511	$24,907,488
General and Administration	$1,968,564	$422,631	$1,429,944	$2,031,470	$5,852,609
Contingency	$8,753,454	$1,879,283	$6,358,408	$9,033,171	$26,024,316
Subtotal (Overhead through Contingency)	$23,154,295	$5,070,370	$18,458,595	$23,896,221	$70,579,471
Additional Cost:					
- TRU-Related Cost:	$0	$0	$0		
Excavation of Pipe Units/Caissons				$1,024,942	$1,024,942
TRU-related characterization				$13,667,100	$13,667,100
TRU pkg/shipping/processing (including WRAP and M-91 facility)				$235,479,945	$235,479,945
Transportation and Disposal of TRU at WIPP				$45,372,808	$45,372,808
- ERDF Capital Cost	$6,167,318	$981,563	$3,713,356	$5,308,732	$16,170,969
Total Capital Cost ($ million)	**$70.7**	**$14.8**	**$52.4**	**$367.4**	**$505.3**
OPERATIONS & MAINTENANCE COSTS[a]					
Annual Undiscounted Costs in 1999 ($ million)	$71.7	$11.4	$43.2	$61.7	$187.9
Periodic Undiscounted Outyear Costs in 1999 ($ million)	$6.5	$1.0	$3.9	$5.6	$17.1
Total Undiscounted O&M Costs ($ million)[b]	**$78.2**	**$12.4**	**$47.1**	**$67.3**	**$205.0**
Total Present Value O&M Costs ($ million)[c]	**$2.5**	**$0.4**	**$1.5**	**$2.1**	**$6.5**
TOTAL UNDISCOUNTED COST IN 1999 ($ MILLION) – CAPITAL AND O&M	**$148.9**	**$27.2**	**$99.5**	**$434.7**	**$710.3**
TOTAL PRESENT VALUE ($ MILLION) – CAPITAL AND O&M	**$73.2[d]**	**$15.2**	**$53.9**	**$369.5[e]**	**$511.8[f]**

[a] O&M costs for the RTD remedy are associated with ERDF expansion required to accommodate the estimated volume of wastes that would be generated as a result of the cleanup activity. Annual O&M costs include ERDF cap maintenance and monitoring, and periodic O&M costs involve ERDF cap replacement at 500 years.

[b] Total undiscounted costs are 1999 dollars for a 1000-year period of analysis (actual duration will exceed 1000 years).

[c] Present-value costs based on a 2.9% real discount rate (OMB Circular A-94, Appendix C) and a 1000-year period of analysis (e.g., project duration). This duration was used to bound the estimate. Actual duration will exceed 1000 years.

[d] An additional $663 million (not within the scope of this remedial action) is estimated to be required to remove materials and structures from the 300 Area to facilitate the cleanup of contaminated soil and debris (Source: 300 Area Accelerated Closure Plan, June 2000).

[e] The 618-11 Burial Ground constitutes approximately 90% of the TRU Burial Ground cost estimate.

[f] The 618-10 and 618-11 burial grounds constitute approximately 72% of the total cost estimate for the 300-FF-2 Operable Unit.

SECTION 4: EXPECTED OUTCOMES OF THE SELECTED REMEDY

The 300-FF-2 cleanup will result in protection of human health for the projected future industrial use of these sites.[11] It should be noted that other land uses may also be appropriate for non-contaminated portions of the 300 Area NPL site. Cleanup of the 300 Area must also be protective of ecological receptors as well. This will be demonstrated for individual waste sites or additional remedial measures (e.g., environmental monitoring, addition of clean fill, removal of additional contaminants) may be required.

Key assumptions in the 300 Area industrial land use and exposure scenario that shall be used when demonstrating post-cleanup site conditions are protective of human health:

For radionuclides, the 300 Area industrial use scenario assumes that the exposure pathways for residual contamination will be: 1) direct exposure to radiation; 2) ingestion of soil containing residual contamination; and 3) inhalation of particles in the air from residual contamination. It is assumed that drinking water is not obtained from groundwater sources and food products are not grown on the site.[12] The assumptions used for the 300 Area Industrial Use Scenario are described in Appendix B of the 300-FF-1 RD/RA workplan and Appendix F of the 300-FF-2 Focused Feasibility Study. Major assumptions include:

- Direct exposure route: The scenario assumes an adult worker is located in the area of residual contamination for approximately 1500 hours/year inside a building and 500 hours/year outdoors for a period of 30 years (these correspond to a typical workyear for an adult worker). When the worker is outdoors, it is assumed that clean fill does not provide shielding from residual contamination. Furthermore, it is assumed that indoor exposure to external radiation is 70 percent of the outdoor levels (based on the shielding provided by the building from direct exposure to radiation from residual contaminants in the soil).

- Soil ingestion route: The scenario assumes that a worker ingests 25 grams of contaminated soil each year.

- Inhalation route: The scenario assumes that the air contamination inside a building is 40 percent of the outside air particle concentration (which is assumed to be 0.0002 grams per cubic meter from residual soil contamination).

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[11] Residual human health risks after meeting RAOs are based on an industrial land use scenario for soils. Potential site risks from contaminated soils, structures, and debris with respect to metals and organics are reduced from greater than 10^{-2} to approximately 1×10^{-5}. Site risks from contaminated soils, structures, and debris with respect to radionuclides are reduced from greater than 10^{-2} to approximately 10^{-4} (approximate risk equivalent to 15 mrem/year dose above background).

[12] Although groundwater is not considered a potential exposure pathway in the qualitative risk assessment that supports the basis for remedial action, groundwater is considered to be a potential future drinking water source that must be restored to drinking water standards in a reasonable time frame as established in the 300-FF-5 ROD.

The key modeling parameters that affect the direct exposure cleanup levels for radionuclides are: 1) The depth of cover/clean fill over residual contamination (none is assumed for the 300 Area), and 2) The time spent on the former waste site location, both indoors and outdoors (approximately 1500 hours/year inside a building and 500 hours/year outdoors). Other parameters affect the modeling results, but are not as significant as these two items.

For chemicals, the 300 Area industrial use scenario assumes that the exposure pathway for residual contamination will be from ingestion of contaminated soil (this assumption is based on the Model Toxics Control Act [MTCA]). The soil cleanup levels are calculated using the equations provided in MTCA Method C (WAC 173-340-745), one for carcinogens and one for non-carcinogens. For both carcinogens and non-carcinogens, the calculations assume that an adult weighing 70 kg ingests soil at a rate of 50 mg/day (18.25 grams per year), with a frequency of contact of 40 percent and a gastrointestinal absorption rate of 100 . For carcinogens the calculation is based on achieving a lifetime cancer risk goal of 1 in 100,000 ($1x10^{-5}$) for an exposure duration of 20 years and a lifetime of 75 years. For non-carcinogens, the calculation is based on achieving a hazard quotient of 1.

The parameters for chemical cleanup levels specified in MTCA were also used in the 300 Area industrial exposure scenario. The key modeling parameters that affect the cleanup levels are the soil ingestion rate and the frequency of contact. The 40 percent frequency of contact means that the individual ingests 50 mg/day of contaminated soil for 146 days (i.e., 40 percent of the days in a year).

This Record of Decision also requires that the soil cleanup level used not cause contamination of groundwater above drinking water standards or MTCA Method B cleanup levels (even though groundwater ingestion is not an applicable exposure pathway in this analysis). The key modeling parameters that affect the analysis of groundwater protection are: 1) the hydraulic parameters of the aquifer and contaminant characteristics (e.g., Kd factors and leach rates), 2) the evapotranspiration rate (i.e., evaporation and plant uptake of precipitation), and 3) the amount of water applied for irrigation purposes. The key assumptions in the 300 Area industrial use scenario that affect the groundwater protection determination are: 1) vegetation not requiring irrigation will be grown on the waste site after the cleanup is complete or the waste site will be resurfaced to reduce water infiltration (thus allowing for a higher, 0.91, evapotranspiration coefficient to be used); and 2) no water will be applied to former waste site locations for irrigation purposes. These assumptions can only be modified if it can be demonstrated that there will be no negative impact on groundwater quality from residual contamination at former waste site locations (requires EPA approval in advance).

Finally, it is assumed that: 1) no sensitive human subpopulations (e.g., children) are permitted to come into contact with residual soil or debris contamination from waste sites (i.e., the cleanup levels are based on exposures to adults); 2) the period of analysis for evaluation of site risks and groundwater protection is 1000 years; and 3) direct exposure of onsite workers to residual contamination to a depth of 4.6 m (15 ft) may occur (this represents a reasonable estimate of the depth of soil that could be excavated and distributed at the soil surface as a result of site development activities).

Expected Outcomes of Cleanup:

Consistent with the assumptions described for the 300 Area industrial land use and exposure scenario, the institutional controls required upon completion of this remedial action must ensure that:

- Waste sites cleaned up to standards prescribed in this ROD will be restricted to industrial use only, consistent with the exposure assumptions used in establishing risk-based cleanup levels for radionuclides and the use of MTCA Method C industrial cleanup levels for chemicals. This includes restricting access to former waste site locations for sensitive human receptors (e.g., children). (This will not be required if remediation work results in soil concentrations that would permit unrestricted use and unlimited exposure.)

- Drinking water use is precluded until it can be demonstrated that drinking water standards have been achieved through natural attenuation.

- Access is restricted to seeps and springs along the Columbia River shoreline as long as concentrations in the discharge water exceed drinking water standards.

- Infiltration control mechanisms (e.g., revegetation, asphalt, concrete) are implemented and maintained after the cleanup is complete (or remedial action goals/soil cleanup levels must be reevaluated and modified using different evapotranspiration coefficients). Irrigation is not permitted in order to maintain groundwater protection standards. These infiltration control measures and irrigation restrictions shall be maintained unless (or until) it can be demonstrated that there will be no negative impact on groundwater or river water quality from residual contamination at former waste site locations.

- Soil or debris from former waste site locations can only be removed for other uses if concentrations meet cleanup levels that are based on an unrestricted use exposure scenario. This prohibition does not apply to the removal of additional material for disposal.

The entire 300 Area NPL site is not contaminated. These institutional controls only apply to those areas where waste sites (i.e., soil contamination areas, burial grounds, landfills, etc…) were formerly located and residual soil and debris contamination remains. Other land uses are appropriate for those areas in the NPL site that contain no former waste site locations. In addition, land use restrictions will not be required if remediation work results in soil concentrations that would permit unrestricted use and unlimited exposure.

XIII. STATUTORY DETERMINATIONS

Under CERCLA Section 121, selected remedies must be protective of human health and the environment, comply with ARARs, be cost-effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practical. CERCLA also includes a preference for remedies that employ treatment that significantly and permanently reduces the volume, toxicity, or mobility of hazardous wastes as their principal element and a bias against the off site disposal of untreated wastes. This section discusses how the selected remedy meets these statutory requirements.

<u>Protection of Human Health and the Environment</u>

The selected remedy protects human health and the environment through interim remedial actions to reduce or eliminate risks associated with exposure to contaminated soils, structures, and debris. Implementation of this remedial action will not pose unacceptable short-term risks toward site workers that cannot be mitigated through acceptable remediation practices. Removal of contaminated soil, structures, and debris will prevent exposure under future land use. Institutional controls will prevent exposure to residual contamination. Removal of contaminated soil, structures, and debris will prevent further groundwater and surface water contamination.

The qualitative baseline risk assessment for an industrial exposure scenario associated with radionuclides at waste sites under this interim action estimated excess cancer risks greater than 1×10^{-2}. Remediation of sites will principally occur to remove radioactive contaminated soils, structures, and debris. The incremental residual risks after implementation of this remedy are estimated to be approximately 10^{-4} (industrial land use scenario) for exposure to radionuclides. Inorganics and organics will be remediated to levels at or below MTCA Method C levels (WAC 173-340-745) during the course of implementation of the interim remedial actions. The residual risk from organics and inorganics is expected to be 1×10^{-5} or lower. This will be verified and/or documented in individual waste site cleanup verification packages. In addition, contaminants will be remediated to levels that provide protection of ecological receptors, groundwater (as a potential drinking water source), and the Columbia River.

<u>Compliance with Applicable or Relevant and Appropriate Requirements</u>

The selected remedy will comply with the Federal and State chemical-, location-, and action-specific ARARs listed below. No waiver of any ARAR is being sought. Additional background information on these ARARs can be found in Appendix C of the FFS.

- *Model Toxics Control Act Cleanup Regulations* (MTCA), Chapter 173-340 WAC (as amended January 1996), methods prescribed for the development of cleanup standards are applicable for establishing cleanup levels for soil.

- *Safe Drinking Water Act* (SDWA), 40 CFR 141, maximum contaminant levels (MCLs) and non-zero maximum contaminant level goals (MCLGs) for public drinking water supplies are relevant and appropriate for establishing soil cleanup levels that are protective of groundwater.

- *Clean Water Act*, 40 CFR 131, ambient water quality criteria for protection of aquatic life are relevant and appropriate for establishing soil cleanup levels that are protective of the Columbia River.

- *Water Quality Standards for Waters of the State of Washington*, Chapter 173-201A WAC, are relevant and appropriate for establishing soil cleanup levels that are protective of the Columbia River.

- *Clean Air Act, National Primary and Secondary Ambient Air Quality Standards*, 40 CFR 50, are relevant and appropriate to potential airborne emissions of particulates or lead during excavation, treatment, transportation or disposal of hazardous materials.

- *General Regulation for Air Pollution Sources*, Chapter 173-400-040 WAC, is relevant and appropriate for the control of fugitive emissions that may result during implementation of the remedial action.

- *Controls for New Sources of Toxic Air Pollutants*, Chapter 173-460 WAC, are applicable should a treatment technology that involves air emissions be necessary during the implementation of the remedial action.

- *Clean Air Act, National Emission Standards for Hazardous Air Pollutants*, 40 CFR 61, are applicable to potential airborne emissions of radionuclides and asbestos present in the contaminated soils, structures and debris that will be excavated, treated, transported and disposed.

- *Radiation Protection - Air Emissions*, Chapter 246-247 WAC, are applicable to potential airborne emissions of radionuclides present in the contaminated soils, structures and debris that will be excavated, treated, transported and disposed.

- *Resource Conservation and Recovery Act Subtitle C*, 40 CFR Parts 261, 264, 268, are applicable for the identification, treatment, storage, and land disposal of hazardous wastes encountered during implementation of the remedial action.

- *Dangerous Waste Regulations*, Chapter 173-303 WAC, are applicable for the identification, treatment, storage, and land disposal of hazardous and dangerous wastes encountered during implementation of the remedial action.

- *Toxic Substances Control Act*, 40 CFR 761, is applicable to the management and disposal of remediation waste containing regulated concentrations of polychlorinated biphenyls (PCBs), including specific requirements for PCB remediation waste.

- *U.S. Department of Transportation Requirements for the Transportation of Hazardous Materials,* 49 CFR Parts 100 to 179, will be applicable for the transportation of any wastes.

- *Minimum Standards for Construction and Maintenance of Wells,* Chapter 173-160 WAC, and *Rules and Regulations Governing the Licensing of Well Contractors and Operators,* Chapter 173-162 WAC, are applicable for the location, design, construction, and abandonment of water supply and resource protection wells.

- *Archeological and Historic Preservation Act of 1974,* (16 U.S.C. 469-469c), is applicable in order to recover and preserve artifacts in areas where an action may cause irreparable harm, loss, or destruction of significant artifacts.

- *Archaeological Resources Protection Act of 1979,* 43 CFR Part 7, is applicable in order to secure, for the present and future benefit of the American people, the protection of archaeological resources and sites which are on public lands.

- *Native American Grave Protection and Repatriation Act of 1990,* 43 CFR 10, is applicable for any sites where Native American remains are found and provides requirements for Federal agency responsibilities with regard to these discoveries.

- *National Historic Preservation Act of 1966,* 36 CFR Part 800, is applicable in order to ensure that Federal agencies consider the impacts of their actions on properties that are on or are eligible for the National Register of Historic Places.

- *Endangered Species Act,* 50 CFR Part 200 and 50 CFR 402, is applicable in order to conserve critical habitat upon which endangered or threatened species depend.

- *Migratory Bird Treaty Act,* 50 CFR 10-24, is applicable in order to protect certain ecological receptors.

Cost Effectiveness

The selected remedy provides overall effectiveness proportional to its cost. Overall effectiveness is determined through an evaluation of long-term effectiveness and permanence, reduction in toxicity, mobility, and volume (TMV) through treatment, and short-term effectiveness. Use of ERDF (a capped and double-lined disposal facility with a leachate collection system built to RCRA Subtitle C standards) or WIPP for disposal is more effective and permanent in the long-term than capping individual waste sites in place with no leachate collection systems. In addition, it is easier to ensure that a long-term institutional controls plan monitors and maintains the ERDF facility in a manner that is protective of human health and the environment than it would be to ensure that a multitude of individual caps are being maintained appropriately. In addition, under the RTD alternative, treatment will be performed, as appropriate, to meet waste acceptance criteria at disposal facilities. No treatment would occur under the containment scenario. Finally, the Tri-Parties believe that the RTD remedy can be performed in a manner that is protective of workers, the community, and the environment.

The RTD remedy has been implemented in a very cost-effective manner at Hanford. Use of practices, such as the "Observational Approach," have allowed large volumes of contaminated soil and debris to be excavated and disposed in a cost-effective manner by combining aspects of site characterization and remediation in one step. These types of practices have led to efficiencies that result in extremely cost-effective remediation practices (e.g., it is costing only $60/ton (approximate) to excavate, transport, and dispose of contaminated material at ERDF). It is anticipated that these efficiencies will continue as the RTD remedy is implemented at more waste sites.

<u>Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable</u>

The selected remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for this site.

<u>Preference for Treatment as a Principal Element</u>

The NCP establishes an expectation that EPA will use treatment to address the "principal threats" posed by a site wherever practicable (NCP Section 300.430(a)(1)(iii)(A)). "Principal threat" wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained, or would present a significant risk to human health or the environment should exposure occur. A "source material" is material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contamination to groundwater, surface water or air, or acts as a source for direct exposure. Although no "threshold level" of risk has been established to identify principal threat waste, a general rule of thumb is to consider as a principal threat those source materials with toxicity and mobility characteristics that combine to pose a potential risk several orders of magnitude greater than the risk level that is acceptable for the current or reasonably anticipated future land use, given realistic exposure scenarios. Remedies which involve treatment of principal threat wastes likely will satisfy the statutory preference for treatment as a principal element, although this will not necessarily be true in all cases.

Treatment technologies will be employed to address some principal threat waste as part of the selected remedy. Principal threat waste in the 300-FF-2 Operable Unit falls into two general categories: 1) drummed waste (liquid or non-liquid) that is both highly mobile and/or highly toxic; and 2) non-liquid, highly radioactive soil and debris. It is anticipated that all liquid waste will undergo treatment prior to final disposal. Radiologically contaminated soil and debris will not be treated prior to disposal in ERDF (unless soil or debris require treatment to meet RCRA Land Disposal Restrictions or ERDF Waste Acceptance Criteria) because cost-effective methods to reduce the toxicity, mobility, or volume of radiological constituents at these concentrations have not been identified. Therefore, the selected remedy is utilizing treatment to the maximum extent practicable and resulting in the treatment of some principal threat wastes, and is satisfying the statutory preference for treatment as a principal element of the remedy.

Five-Year Review Requirements

Because this remedy will result in hazardous substances, pollutants, and/or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted to ensure that the remedy continues to provide adequate protection of human health and the environment every five years after the commencement of the remedial action. Review of this remedy will be ongoing as the Tri-Parties continue to develop final remedial measures for the 300 Area National Priorities List site.

Onsite Determination

The preamble to the NCP states that when noncontiguous facilities are reasonably close to one another and wastes at these sites are compatible for a selected treatment or disposal approach, CERCLA Section 104(d)(4) allows the lead agency to treat these related facilities as one site for response purposes and, therefore, allows the lead agency to manage waste transferred between such noncontiguous facilities without having to obtain a permit. The 300 Area sites addressed by this interim action ROD and ERDF are reasonably close to one another, and the wastes are compatible for the selected disposal approach. Therefore, the sites are considered to be a single site for response purposes.

XIV. DOCUMENTATION OF SIGNIFICANT CHANGES

The Tri-Parties reviewed all written and verbal comments submitted during the public comment period. Upon review of these comments, a number of clarifications were made in the description of the selected remedy in this Record of Decision, but it was determined that no significant changes would be made to the selected remedy, as it was originally described in the Proposed Plan. Responses to comments received on the proposed plan can be found in the responsiveness summary in Appendix B.

APPENDIX A

300-FF-2 OPERABLE UNIT WASTE SITE SUMMARY

A summary of the 300-FF-2 Operable Unit (OU) waste sites is presented in this appendix, including information associated with the 300 Area Complex source sites (Table A-1), outlying source sites (Table A-2), general content burial grounds (Table A-3), transuranic-contaminated burial grounds (Table A-4), and candidate sites (Table A-5). Information related to current site knowledge and potential contaminants was compiled from the following resources:

Waste Information Data System (WIDS)

- *300-FF-2 Operable Unit Technical Baseline Report (BHI-00012)*
- *100 and 300 Area Burial Ground Remediation Study (BHI-00768)*
- *Limited Field Investigation Report for the 300-FF-2 Operable Unit (DOE/RL-97-42)*
- *Completion of the 300-FF-2 Operable Unit Waste Site Categorization Task (CCN 067721)*
- *Focused Feasibility Study for the 300-FF-2 Operable Unit (DOE/RL-99-40).*

Estimated present-value costs for the preferred alternatives at the 300-FF-2 OU waste sites were developed in the 300-FF-2 OU focused feasibility study (FFS) and are listed in the appropriate tables of this appendix.The present-value cost for characterization of candidate waste sites to determine if remedial actions are needed was estimated in the 300-FF-2 OU FFS to be $62,500 for each site.

Table A-1. 300-FF-2 Operable Unit Source Sites Within the 300 Area Complex. (12 Pages)

Site Name	Site Type	Current Site Knowledge	Potential Contaminants	Present-Value Cost (millions)
300 RLWS	Radioactive Process Sewer	Operated 1979 – 1998. Inactive. A network of underground, double-encased stainless-steel pipe (encased in reinforced fiberglass or plastic pipe) that connects the 325, 325-A, 324, 326, 327, and 329 Buildings with the 340 Facility Complex (over 854 m [2,800 ft] of pipeline). Designed to transfer radioactive liquid wastes from generating facilities to the 340 Complex. High-activity effluent was sent to the 200 Areas for storage and disposal. Valve boxes VB-1 through VB-15 regulate flow through the system. The 300 Area Radioactive Liquid Waste Sewer (RLWS) was isolated from the 340 Complex and generating facilities on October 1, 1998. Received radioactive waste with small quantities of various chemicals, decontamination solutions, acids, and bases from various 300 Area research and development (R&D) laboratories. Waste was typically derived from groundwater samples, tank waste samples, destructive examination of nuclear fuel, R&D process waste, and waste treatment studies. Waste was sampled at the 340 Complex and subsequently transported to the 200 West Area for storage and disposal. A batch discharge policy requiring written approval was implemented in 1979 to prevent excessive quantities of waste from accumulating in the 340 Complex.	Uranium, acids, bases	$1.58
300 RRLWS	Radioactive Process Sewer	Operated 1954 – 1975. Inactive. Network of two 15.2-cm (6-in.), single-wall, stainless-steel piping and carbon steel buried 3.1 to 6.1 m (10 to 20 ft) below grade (over 1,247 m [4,090 ft] of pipeline). A separate 7.6-cm (3-in.) transfer line was installed in 1960 to connect the 309 Building with the 340 Complex. Retired system was abandoned in place due to low potential for corrosion. The system transferred radioactive liquid waste from fuel fabrication and R&D laboratories, including the 308, 309, 324, 325, 326, 327, and 329 Buildings to the 340 Complex for sampling and disposal. Waste discharged included water and small quantities of chemicals, decontamination solutions, aqueous fuel fabrication solutions, acids, and bases. After retirement, liquids were drained and a cursory rinse of weak sodium hydroxide solution was flushed through the system. The system was closed by cutting the piping where it exited the building and capping the severed ends. Cleanouts that were located were sealed and marked with bronze monuments (11 were marked).	Uranium, mercury, acids, bases	$2.62

Site Name	Site Type	Current Site Knowledge	Potential Contaminants	Present-Value Cost (millions)
300-4	Unplanned Release	The 351 Substation is an active electrical substation that includes the 351-A and 351-B Buildings. The site is surrounded by a fence on three sides and the 305 Building on the southwest. The station was previously operated by the Bonneville Power Administration (BPA). Mineral oil containing PCBs and solvents was used during routine equipment maintenance, but no spills were documented by the BPA. Four capacitors were de-energized and removed in August 1989 because of insulating oil leaks, but there is no evidence that any fluid leaked onto the ground. During initial removal of BPA equipment in October 1990, radioactive yellow-cake uranium was discovered on the below-ground portions of concrete footings. The extent of contamination is unknown and is likely related to 300 Area fuel fabrication activities and not the BPA. Removal of equipment (excluding contaminated footings) was completed in February 1991. The southwest portion of the site is posted with URM signs where the BPA equipment was removed. One large and six small concrete footings are within the URM. The southern part of the 618-8 Burial Ground is under the northeast corner of the substation fenced area.	Uranium; potential PCBs, solvents	$0.18
300-5	Unplanned Release	The site consists of soil contaminated with petroleum products from the 3709A Fueling Facility. The fueling facility included two 1,900-L (500-gal) underground storage tanks used for unleaded gasoline and diesel fuel, and approximately 9.2 m (30 ft) of piping connecting the tanks to the pump island. The system was undergoing permanent closure after a failed tightness test conducted in August 1991. Evidence of the release was identified by the presence of petroleum product odors immediately following removal of the pump island in April 1992. The release was attributed in part to corroded sections of flex piping with multiple pinhole perforations and possible loose pump/pipe fittings. The tanks were subsequently removed. The excavation was lined with plastic to prevent further migration of contaminants and was backfilled with the original soil to protect the building integrity. Part of the site is beneath a paved access driveway on the southeast side of the 3709A Building. A section of the asphalt has been patched where the tanks were removed.	Petroleum products	$0.18
300-11	Unplanned Release	The site consists of releases to the soil that were discovered after the September 1992 removal of an underground gasoline tank (382-1) that had failed a leak test in August 1992. The capacity of the tank was approximately 551 L (145 gal). The contaminated soil was not cleaned up after removal of the failed tank; it was marked with plastic and the excavation was backfilled to grade. Originally, there were three tanks at the location. The other two tanks (382-2 and 382-3) passed leak testing and were removed in 1994. There was no soil contamination that was attributed to these two tanks based on the applicable *Model Toxics Control Act* (MTCA) regulations. The underground tanks were used to store leaded and unleaded gasoline for use by emergency pumps in the 382 Building. The site is currently unmarked and appears as a graveled lot adjacent to the 382 Building.	Petroleum products	$0.15

Table A-1. 300-FF-2 Operable Unit Source Sites Within the 300 Area Complex. (12 Pages)

Site Name	Site Type	Current Site Knowledge	Potential Contaminants	Present-Value Cost (millions)
300-15	Process Sewer	Operated 1943 – present. Active. The site is an underground process sewer extending throughout the 300 Area (over 9.7 km [6 mi] of outside lines and 40.2 km [25 mi] of interior building lines) for the disposal of process waste such as steam condensate, cooling water, and nonregulated liquids. The piping is mostly 20-cm (8-in.) vitrified clay with acid-proof joints. Large portions of the system were relined with cured in-place epoxy during the 1995 Project L-070 system upgrade. The 20-cm (8-in.) pipes feed into larger 46-cm (18-in.) pipes that currently discharge to the Treated Effluent Disposal Facility (TEDF) sump northeast of the 306E Building. Between 1975 and 1995, the system discharged to the 316-5 Process Trenches. The system discharged to the North and South Process Ponds (316-2 and 316-1) before construction of the process trenches in 1975. Past activities from the 313 and 333 Building Fuel Fabrication Facilities contributed chromium, copper, uranium, nitrate, sulfate, fluoride ions, caustics, and degreasing solvents (e.g., perchloroethylene and 1,1,1-trichlorethane) to the system. Photographic processes resulted in discharges of silver to the system. Acetone releases occurred in small quantities when labware was washed. Lead is believed to have entered the process sewer from prior paint shop processes. Administrative controls were established in 1978 to require that end of pipe discharges meet drinking water standards. Additional controls were implemented in 1985 to discontinue discharges from chemical and biological laboratories, fuel fabrication, photographic processing, and maintenance operations. In 1995, discharges to the 316-5 Process Trenches were transferred to the 300 Area TEDF for treatment and discharge to the Columbia River.	Uranium, chromium, copper, lead, nitrate, sulfate, fluoride ions, caustics, perchloroethylene, 1,1,1-trichlorethane, acetone	$16.88
300-16	Unplanned Release	Subsurface contamination was discovered in May 1994 when a damaged power pole was being replaced. When the pole was pulled from the ground, yellow-cake uranium contamination was attached to the subsurface portion of the pole. The site is not marked in the field. There are also two additional occurrences of a similar nature that occurred in 1992 and 1995.	Uranium	Cost is included with 300-15
300-24	Unplanned Release	Soil contamination of 7,000 cpm was identified near the southeast side of the 314 Building in January 1991 during a routine survey of the building exterior. The soil may have become contaminated as a result of operational practices that began at the site in 1945. Acid sludges were collected in a dumpster and allowed to evaporate and/or overflow to the surrounding soil just north of the 314 Building. An oxide burner that spread uranium metal and oxide dust operated on the north side of the 314 Building. Processes at the 314 Building included metal extrusion, uranium scrap recovery, melt plant operations, and research. The area around the building is mostly paved with a few areas of exposed soil. The area is posted with URM signs that also state "Contact Radiological Control Group Prior to Excavating."	Uranium	$0.54

Table A-1. 300-FF-2 Operable Unit Source Sites Within the 300 Area Complex. (12 Pages)

Site Name	Site Type	Current Site Knowledge	Potential Contaminants	Present-Value Cost (millions)
300-28	Unplanned Release	Underground contamination was discovered in the early 1990s during excavation activities associated with installation of a fiber optic phone system. The contamination was confined to soil just below the asphalt surface. Test holes were excavated every 15.3 m (50 ft) along the proposed trench path until no contamination could be found. The contamination appeared to end on the west side of the street intersection west of the 306-W Building. New asphalt is visible where trenches may have been excavated. Underground radiological hazard signs are posted in the general vicinity.	Uranium	$1.05
300-29	Unplanned Release	The site is a U-shaped soil berm that surrounds the east wing of the 305-B Chemical Waste Storage Building. JA Jones subcontractors excavated 76.5 m^3 (100 yd^3) of soil in May 1980 and took it to the JA Jones Pit #1 (600-1) before contaminated blacktop rubble was discovered on the south side of the berm. Work was stopped immediately when contamination was identified and the area was surveyed. All of the remaining contaminated blacktop material was removed from the berm and the area was released from radiation zone status. Excavated material was subsequently surveyed using a radiation monitor.	Uranium	$0.28
300-33	Unplanned Release	The site consists of contaminated soil around and under the 306-W Building. Multiple leaks and fires occurred over the years in and around the 306 Building. The fires occurred in barrels and waste “load luggers” that contained uranium, thorium, heavy metals, and other fuel component scrap. The long-lived contamination settled in building sumps, crevices, and nearby soil. There were also reported spills of slightly enriched uranyl nitrate hexahydrate solutions into the sump. The area around the building is paved and posted as having underground radioactive contamination.	Uranium, thorium, heavy metals, acids	$4.48
300-34	Unplanned Release	The site is a release to the soil that was discovered during excavation and installation of manhole PS-87, a 0.7-m (2.3-ft)-diameter sewer opening with a round metal cover at grade. The contamination was found at a depth of 13.7 m (2 ft). A leak from a cracked portion of the process sewer (300-15) is suspected to be the source of the contaminated soil. The cracked portion had been patched with grout. Contaminated soil was initially stockpiled in drums and was later returned to the excavation at approximately the same location.	Uranium, thorium, heavy metals, acids	Cost is included with 300-15

Table A-1. 300-FF-2 Operable Unit Source Sites Within the 300 Area Complex. (12 Pages)				
Site Name	**Site Type**	**Current Site Knowledge**	**Potential Contaminants**	**Present-Value Cost (millions)**
300-40	Unplanned Release	During removal of the 311 Stillhouse in 1980, it was discovered that the vitrified clay process sewer line was severely corroded. An entire section of the lower half of the pipe between the neutralization pit and the 3712 manhole was missing. It was estimated that 61 m (200 ft) of the pipe was in similar condition. The section of pipe was part of the 300 Area process sewer that collected rain water drainage from the 311 Tank Farm and 303-F floor drains. It also collected effluent from the 311 Stillhouse. As-built drawings for the 1995 300 Area process sewer upgrade show that the process sewer connection was cut and capped beneath the 3712 Building. The site currently appears as an uneven gravel-covered area.	Uranium, thorium, nitric acid, sodium hydroxide, alcohol, trichloroethylene, phosphoric acid, hydrofluorosilicic acid, cutting oil	Cost is included with 300-15
300-43	Unplanned Release	The site consists of contaminated soil around the 304 Building and storage area. The 304 Building and sections of concrete/asphalt around the building are painted grey and posted “fixed Contamination Area.” A row of “Radiologically Controlled Area” signs is present on the south side of the 304 and 303A Buildings. The facility began operations in 1972. Until 1989, the walls of the facility were not sealed to the concrete pad and there were numerous small holes in the wall. During concretion operations, the walls were washed down daily, which may have carried contamination out of the building. In addition, there was no provision to contain the washwater at either of the large door openings. The fenced north pad had no containment system for spills, washwater, or precipitation runoff.	Uranium	$0.17
300-46	Unplanned Release	The site consists of chemical and uranium contamination in and around the 3706 Building that is the result of operations and associated spills. The waste included all components of the bismuth phosphate, REDOX, PUREX, and RECUPLEX processes along with laboratory cleansers, reagents, and drying agents. Mercury deposits from multiple laboratory uses were also prevalent. Additional chemical wastes were products of bioassay and environmental sample analyses, and machining and grinding of metallurgical test samples. Contamination resulted from inadequate containment systems, spills, overflows, vaporization, spreads of radioactive dusts and fines, and other incidents involving the loss of control of radioactive materials. The building was never connected to the RLWS. All nonsanitary waste was discharged to the 300 Area process sewer system. In 1954, the building underwent a major decontamination and remodeling effort and many of the laboratories were converted to offices. Sampling laboratories for fuel fabrication operations continued until they were transferred to the 3720 Building in the mid-1960s. By 1964, the building was used for general services (e.g., mail, duplicating, photographic, drafting, first aid). The building is currently unoccupied and is posted as a “Fixed Contamination Area.” The ground around the building is not posted as a controlled radiological area.	Uranium, plutonium, thorium, beryllium, mercury, sodium thiosulfate, hydroxylamine hydrochloride, barium chloride, barium nitrate, magnesium perchlorate, sodium iodine, sodium carbonate, acetone, boric acid, silver nitrate, arsenic nitrate, zinc nitrate, ammonium chloride, tartaric acid	$2.60

Table A-1. 300-FF-2 Operable Unit Source Sites Within the 300 Area Complex. (12 Pages)

Site Name	Site Type	Current Site Knowledge	Potential Contaminants	Present-Value Cost (millions)
300-48	Unplanned Release	The site consists of soil contamination in and around the remaining foundation for the 3732 Building. The building was constructed in 1949 as an engineering pilot plant for the lead-dip and triple-dip canning processes. Powdered thorium oxide fuel targets for uranium-233 production were fabricated at the facility from 1965 to 1967. In 1968, the program switched to pelletized targets that were canned through 1970. The processes spread fine and particulate contamination throughout the building. Decontamination practices included hosing down the facility floor and walls, which allowed contaminated liquid to be released to the surrounding soil. The building itself was demolished in 1997. Fixed contamination on the foundation structure was painted and the entire structure was then covered with approximately 0.9 m (3 ft) of gravel. Soil in the area is contaminated with thorium oxide and fuel fabrication chemical waste from the processes conducted in the building between 1965 and 1970.	Thorium oxide, uranium, fuel fabrication chemicals	$0.22
300-214	Radioactive process sewer	Operated 1953 – present. Active. The Retention Process Sewer (RPS) is an active system that consists of underground carbon steel and PVC connecting the 300 Area laboratory facilities (308, 324, 326, 327, and 329 Buildings) to the 307 Retention Basins. The system was updated through cleaning and relining as part of Project L-070. Waste discharged to the RPS is nonhazardous, potentially radioactive waste (not to exceed 5,000 pCi/L) from the 300 Area laboratory facilities. Approximately 11.4 million L (3 million gal) flowed through the RPS into the 307 Retention Basins in FY 1998. Waste is sent from the retention basins to the 300 Area TEDF.	Thorium oxide, uranium, fuel fabrication chemicals	$0.55
300-224	Trench	Active. The site is a subsurface concrete pipe trench with either a concrete block or metal plate cover. The trench has several sections that allow piping connections to be made between process operations in the 313, 303-F, 333, and 334-A Buildings and the 311, 333, and 334 Tank Farms. The 333 Building portion of the trench contains piping for the 300 Area waste acid treatment system (WATS) and transfer lines to U-bearing waste acid storage tanks in the 333 West Tank Farm. The trench also contains piping for fresh acids, fresh oil, and waste oil. The 313 Building portion of the trench contained transfer piping for the 300 Area WATS, the 313 Uranium Recovery Operation (URO), for fresh caustic neutralization, for the neutralized acid waste stream, and the neutralized uranium-bearing acid waste. Until 1977, the east side concrete pipe trench drained into a limestone pit (300-246) located over the 618-1 Burial Ground. This end of the pipe trench was sealed in 1975, and a drain was installed to the process sewer. The trench between the 333 and 313 Buildings was constructed with weep holes in the floor to prevent rainwater buildup, and leaks from this section are expected to have contaminated the ground beneath the trench as a result. The west trench has ethylene glycol heating lines for freeze protection.	Uranium, acids (including nitric and sulfuric), caustics, petroleum products, tetrachloroethene (PCE), ethylene glycol, solvents	$0.23

Table A-1. 300-FF-2 Operable Unit Source Sites Within the 300 Area Complex. (12 Pages)				
Site Name	**Site Type**	**Current Site Knowledge**	**Potential Contaminants**	**Present-Value Cost (millions)**
300-251	Unplanned Release	The site consists of uranium contaminated soil within the fenced enclosure around the 303-K Building. The 303-K Building was constructed in 1943 for storage to support uranium fuel production and has since been used for various decontamination activities and storage through 1995. Releases may have occurred during decontamination activities within the facility and/or the storage of materials outside the facility.	Uranium, lead, perchloroethylene, chloroform, ethyl acetate, acids, beryllium/zircaloy-2	$0.20
300-255	Unplanned Release	The site consists of contaminated soil inside the fenced area of the 309 Building Tank Farm. The source of contamination was likely piping related to tanks 309-TW-1, 309-TW-2, and 309-TW-3. The tanks collected liquid waste from the storage basin overflow drain system, the Rupture Loop Annex Cell sump, contaminated floor drains, Loadout Facility drains, exhaust fan pit drains, exhaust fan pit drain, stack and duct drains, and the exhaust air filter drain. Contaminated surface soil (2.5 to 10.2 m [1 to 4 in.]) has been removed from selected areas. The whole soil surface area has been covered with approximately 13 cm (5 in.) of gravel.	Cesium-137, cobalt-241, barium, cadmium, chromium, lead, selenium	$0.19
300-256	Unplanned Release	The site consists of contaminated soil under and around the 306-E Building. The releases are the result of airborne dust and particulate contamination, including uranium, thorium, and the components of the beryllium/zircaloy-2 brazing material. In addition, multiple fires and leaks in barrels and waste "load luggers" containing uranium, thorium, heavy metals, and other fuel component scraps occurred over the years in and around the 306 Building. Multiple drain leaks, piping leaks, and spills including chemicals, cleansers, solvents, reagents, and PCB oils have also occurred. The area around the 306-E Building is paved and posted as having underground radioactive contamination.	Uranium, thorium, heavy metals, chemicals, cleansers, solvents, reagents, PCB oils	$5.68
300-257	Abandoned Pipeline	The site consists of process sewer piping that was originally connected to the 309 Building Rupture Loop Holding Tank and extends to the Columbia River bank. The tank was removed in the late 1970s, and all connections to the RLWS were severed and plugged. Several incoming and outgoing pipes were connected to the tank. Streams from the 309 Building included cooling water from air conditioning chillers and floor drains from the south basement service area. The piping fed into a 91-cm (36-in.) corrugated steel pipe that flowed to the river. No pipeline is visible on the river bank or at the edge of the river. It is assumed that the point of discharge was underwater. The area where the tank was located is now covered with asphalt and is being used as a parking lot.	--	$0.53

Table A-1. 300-FF-2 Operable Unit Source Sites Within the 300 Area Complex. (12 Pages)

Site Name	Site Type	Current Site Knowledge	Potential Contaminants	Present-Value Cost (millions)
300-258	Trench	Operated 1960 – 1975. Inactive. The site consists of an abandoned subsurface concrete pipe trench. The top of the trench is level with the ground surface and is covered with metal plates that are posted "Radioactive Material, Internally Contaminated." The trench is surrounded by asphalt between the 306-E Building and the fence south of the 333 Building. Between the 333 Building fence and the 334 Tank Farm, the trench is surrounded mostly by gravel. It was used to house acid transfer piping. Some of the piping was removed in 1975, but several spurs remain in place.	Uranium, acid and caustic solutions	$0.15
300-259	Unplanned Release	The site is a posted Contamination Area (CA) that encompasses the 618-1 Burial Ground. Partially buried debris were discovered north of the 618-1 Burial Ground marker posts in March 1991. Contaminated leather gloves were removed from the area. Additional areas of soil contamination have been identified on the east side of the 618-1 Burial Ground markers and near the southeast corner of the burial ground. Some soil was removed and contaminated areas were covered with gravel. The CA and the burial ground are covered with gravel.	Uranium	$1.27
300-260	Unplanned Release	Soil samples from the site exceeded regulatory levels for lead and barium. It is possible that slag may have been stockpiled in the area before being sent to a burial ground. Radioactively contaminated black chunks (suspected to be oxidized uranium) were found in holes during upgrades of the electrical utilities in 1994. Contamination was also identified in an underground trench that was excavated at the north edge of the site. The 1994 excavation activities identified multiple areas of soil contamination and contaminated power/telephone poles. In 1996, a decision was made to post the 300 Area perimeter fence as a URM and postings were removed from smaller, individual URM areas. The site is no longer radiologically posted. It is currently surrounded by light posts and yellow rope, but no signs of any kind are present. A small amount of equipment and large wooden boxes are stored in the area.	Uranium, lead, barium	$0.83
300-262	Unplanned Release	The site consists of contaminated soil that was discovered in 1994 while performing excavation activities in support of the V784 Project (utility pipeline). The source of the contamination is unknown and appears to have existed prior to construction of the railroad spur that runs next to the South Process Pond. Following completion of the project, the contaminated soil was put back into the excavation. The site is posted as a URM area.	Uranium	$0.33

Table A-1. 300-FF-2 Operable Unit Source Sites Within the 300 Area Complex. (12 Pages)				
Site Name	**Site Type**	**Current Site Knowledge**	**Potential Contaminants**	**Present-Value Cost (millions)**
303-M SA	Storage Area	Operated 1983 – 1987. Inactive. The storage area is an inactive, 12.7-cm (5-in.)-thick concrete pad with 15-cm (6–in.) curbing that has been painted with a heavy grey paint. Several “fixed radioactive contamination” labels are visible. There is a low-point storm drain that appears to be active. The drain overflows into the process sewer. The area was used to store drums of pyrophoric uranium and zircaloy-2 chips and fines prior to oxidation at the 303-M Facility. The metal turnings were stored under water in 114-L (30-gal) drums prior to treatment. An estimated 127 tons of uranium were treated during operation of the 303-M Facility from 1983 to 1987. Services to the 303-M facility have been disconnected.	Uranium, zirconium	$0.18
303-M UOF	Process Unit	Operated 1983 – 1987. Active. The facility is a reinforced concrete structure containing a highbay area and a one-story extension on the north side. It was used to oxidize pyrophoric uranium metal turnings and zircaloy-2 fines generated during fuel fabrication machining operations in the 333 Building. The turnings were received in 114-L (30-gal) drums filled with water for fire prevention. The metal turnings were removed, screened, hand fed into a shredder, and placed inside a burner chamber for oxidation. Approximately 127 tons of material were processed during operations. Operations ceased in 1987 and all services to the facility have been disconnected. Uranium and excess materials have been removed from the building and surfaces were decontaminated. There is a potential for residual contamination in the process sewer sumps (plugged), ventilation ducts and filter housings, and in process equipment. The site is still covered under the RCRA Part A Permit and is therefore classified as active. RCRA/CERCLA integration site.	Uranium, zirconium	included with 303-M SA
313 ESSP	Storage Pad	Inactive. The site is a concrete pad with an asphalt ramp connecting it to Ginko street. The WATS pipe trench (300-224) passes east-west through the site and is posted as internally contaminated with radioactive material. Two areas of the pad have been painted grey. Signs near the painted areas read “Fixed Contamination – Contamination Under Grey Paint on Ground.” The site was previously used to stage radiological waste from 313 Building operations. During fuel fabrication operations, mixed waste from the 313 centrifuge and uranium waste from the 313 filter press were staged. The site was also used to stage raw material received by rail cars.	Uranium	$0.55

Table A-1. 300-FF-2 Operable Unit Source Sites Within the 300 Area Complex. (12 Pages)				
Site Name	**Site Type**	**Current Site Knowledge**	**Potential Contaminants**	**Present-Value Cost (millions)**
340 Complex	Storage Tank	Inactive. The 340 Complex consists of the 340, 340-A, 340-B, and 3707-F Buildings and two office trailers. Other 340 Complex systems include the 307 Retention Basins, two tanks in an underground vault, six above-ground tanks in 340A, underground transfer pipes, loadout and decontamination equipment, and instrumentation. Before 1963, the complex also included the 316-3 Trenches, which disposed of retention process waste. The complex received radioactive liquid waste from the 300 Area laboratory buildings (324, 325, 326, 327, 329) via the 300 Area RLWS. Waste routed by the RLWS was accumulated in the 307 Retention Basins or in the vault by two 57,000-L (15,000–gal) tanks. Waste meeting criteria was discharged to the process sewer. Waste exceeding discharge criteria was transferred to the 200 Areas by rail car for storage and disposal. In 1978, the vault was decontaminated as part of Project V-677. Solidified waste (sand, organic material from laboratory processes, pump leakage, and high-activity residual contamination) had accumulated on the vault floor from unplanned vault tank overflows. Throughout the operating history, spilled material and leaks were common and several have contributed radionuclides to the soils around the buildings in the complex. RCRA/CERCLA integration site.	Uranium, cesium, strontium, organic and inorganic laboratory chemicals, chromium, manganese, iron, nickel, acids, bases, decontamination solutions	$5.08
UPR-300-4	Unplanned Release	The site represents a number of releases that occurred from 1945 to 1988. The 321 Canyon provided support for 300 Area laboratory programs dedicated to production reactor fuel development. General contamination of the canyon walls, decks, and ground areas around the building is associated with separation pilot plant operations that were tested in the area. Specific events include an explosion of hexone/nitric acid mixture in early 1949. The explosion spread contamination and cracked ceilings and floors. Cleanup processes consisted of repeated water flushings that spread contamination to the surrounding soils. Other events included a May 1957 explosion in a dissolver vessel that contained enriched uranyl nitrate solution, a January 1962 concentrator overpressurization that sprayed uranyl nitrate hexahydrate, and an iodine-131 release during a gas-scrubbing experiment in 1964.	Acids, bases, bismuth, chromium, hexone, mercury, tributyl phosphate, carbon tetrachloride, uranium, plutonium, thorium, strontium, cesium, copper, zinc, trichloroethene, acetone	$10.69
UPR-300-10	Unplanned Release	The site is the result of a leak in the radioactive waste sewer line that served the 325-B hot cells, between the west basement wall of room 32 and the north foundation wall of room 202. The liquid included waste from dissolution of highly radioactive samples/irradiated reactor fuels. The line was subsequently capped and rerouted through the basement of the 325 Building.	Uranium	$0.28

Table A-1. 300-FF-2 Operable Unit Source Sites Within the 300 Area Complex. (12 Pages)

Site Name	Site Type	Current Site Knowledge	Potential Contaminants	Present-Value Cost (millions)
UPR-300-12	Unplanned Release	The site consists of contaminated soil beneath the 325-A Building. A transfer of approximately 15,142 L (4,000 gal) of wastewater from tank WT-1 to the 340 Complex was initiated in 1979. A decrease of 15,142 L (4,000 gal) was observed in tank WT-1, but no waste was received at the 340 Complex. An investigation of the RLWS revealed that an isolation valve on the discharge line was shut, precluding transfer of the waste to the 340 Complex storage tanks. Checks of the system showed that approximately 11,356 L (3,000 gal) could not be accounted for. Decontamination of room 50-A and removal of water collected in the scrubber sump and its overflow tank were initiated to further investigate potential escape paths from room 50-A. A check of the floor integrity suggested that the water flowed down the drain line, through the sump discharge line, into the sump, and then onto the floor where it exited to the soil through existing cracks in the floor. The wastewater contained nitrate ions, promethium-147, fission products, and transuranic nuclides. The total activity was estimated to be 70 Ci of which 95% was promethium-147.	Promethium-147, fission products, transuranic nuclides, nitrate	$0.21
UPR-300-17	Unplanned Release	The site consists of the asphalt area at the southeast corner of the 333 Building. The release occurred when a garbage can containing oily rags, metal shavings (believed to be uranium), and other waste material caught fire. The can was inside a plastic-lined wood burial box that also caught fire. Contamination was identified within a radius of approximately 3 m (10 ft) around the box. According to site personnel, the asphalt in the contaminated area was removed and the area was patched with new asphalt. The asphalt and the concrete at the southeast corner of the building are currently painted grey and labeled "Fixed Contamination Area." There is no indication where the asphalt was replaced in 1979.	Uranium	$0.33
UPR-300-38	Unplanned Release	The site consists of contaminated soil beneath the southern half of the 313 Building from multiple release events. Any discharges to the process sewer may have contributed to the contamination because of a general failure of the line beneath the building. RCRA/CERCLA integration site.	Uranium, acids, tetrachloroethene, sodium hydroxide, chromium	$5.68
UPR-300-39	Unplanned Release	The release occurred when one of two 37,854-L (10,000-gal) sodium hydroxide tanks leaked. A 50% sodium hydroxide solution contaminated soil around the tanks. The two tanks are currently labeled "Empty." The location and extent of the release is not evident in the field. The ground around the tanks is covered by a concrete containment pad/curb surrounded by more concrete and gravel. The area is not marked or labeled. Soil around the tanks still exhibit a high pH.	Sodium hydroxide	$0.15

Table A-1. 300-FF-2 Operable Unit Source Sites Within the 300 Area Complex. (12 Pages)

Site Name	Site Type	Current Site Knowledge	Potential Contaminants	Present-Value Cost (millions)
UPR-300-40	Unplanned Release	Broken drain connections between the pipe trench, the 303-F Building, and the process sewer were discovered in October 1974. The bottom of the trench was severely eroded, indicating that a spill had occurred. The waste consisted of uranium-bearing acid waste containing nitric and sulfuric acid with uranium in solution, and chromic acid with copper and zinc in solution. Evidence of uranium contamination has been found in the soil, but the total volume of spilled material is unknown.	Uranium, nitric acid, sulfuric acid, chromic acid, copper, zinc	$0.28
UPR-300-45	Unplanned Release	The site consists of contaminated soil beneath the transfer piping, adjacent to the 303-F Building. The uranium-bearing acid transfer line runs through the pipe trench from the 333 Building to the valve box at the southeast corner of the 313 Building outside the Uranium Recovery Room. It is a 5-cm (2–in.) stainless steel line that leaves the valve box, runs up the wall of the 313 Building, and enters the building as an overhead line in the 313 Uranium Recovery Room. The release was caused by a leak in the line that was the result of a gasket failure. The leak contained nitric and sulfuric acid with uranium in solution. The leak spilled to the valve box, the pipe trench, and the paved area between the 313 Building and 303-F Building. Soil beneath the leaking gasket was contaminated. Some soil from the release was removed and sent to the low-level burial grounds for disposal.	Uranium, nitric acid, sulfuric acid	$0.28
UPR-300-46	Unplanned Release	The site consists of radioactively contaminated soil that was discovered while excavating a pipe trench north of the 333 Building. The contamination appeared to be confined to a narrow band of soil approximately 2.5 to 5 cm (1 to 2 in.) thick. About one truckload of soil was removed from the site and disposed of as low-level radioactive waste. There is no visual evidence of the release. The area is not marked or posted. Gravel east of the telephone pole along the north perimeter fence appears to be slightly newer than other gravel in the vicinity.	Uranium, nitrate	$0.15
UPR-300-48	Unplanned Release	The site consists of radioactively contaminated soil that was the result of a crack in the process sewer drain pipe elbow. The release was discovered during confirmation of the 325 Building sewer system configuration. The crack allowed liquid to leak to the soil under the basement floor. The soil is protected from precipitation and other runoff by a 15.2-cm (6-in.) foundation floor in the basement of the 325 Building.	Uranium	$0.13
TOTAL PRESENT-VALUE COST FOR RTD ALTERNATIVE AT 300 AREA COMPLEX SOURCE SITES				**$73.2**

Table A-2. 300-FF-2 Operable Unit Outlying Source Sites. (2 Pages)

Site Name	Site Type	Current Site Knowledge	Potential Contaminants	Present-Value Cost (millions)
300 VTS	Process Unit	Operated 1983 – 1986. Inactive. Site was created on undisturbed ground with no relationship to the 618-7 Burial Ground. Area is vegetation free, covered with cobbles, and is surrounded by a fence. The site was used as a field demonstration area for vitrification of soil containing waste simulates, including polychlorinated biphenyls (PCBs) and very low levels of radioactivity. Most of the contaminated soil and equipment have been removed from the site. A mobile trailer that supported testing, various in situ vitrification (ISV) test structures, a terra vit melter structure, storage units, supplies, spare parts, piles of gravel, vitrified material and soil, scaffolding, and a portable toilet are currently housed within the fenced area. There are also empty ethylene glycol drums, and some systems may still contain ethylene glycol.	(Potential) PCBs, ethylene glycol, organics, and radionuclides in soil surrounding ISV melts	$3.28
300-8	Dumping Area	Operated 1962 – 1972. Inactive. Site consists of six irregular-shaped soil contamination areas broken up by areas along roads and railroads that have been cleared of contamination. The site was used to stage scrap metal from the 300 Area. Recycling of aluminum scrap began in 1962. The material was staged until a quantity sufficient for bid proposals was collected. Purchased material was loaded into rail cars using a clam-shell bucket. The process scattered metal shavings over a large area. Some of the metal was contaminated with low levels of uranium and beryllium. Posted as a soil contamination area in 1994.	Uranium, aluminum, beryllium	$3.71
300-18	Dumping Area	Inactive. The site was identified during routine surveillance activities in April 1993. Contaminated metal shavings, nuts and bolts, soil, and concrete were identified. An area approximately 4.6 by 6.1 m (15 by 20 ft) was posted as a soil contamination area. Approximately 0.6 m (2 ft) of clean soil was placed over the site, and it was subsequently re-posted as a URMA.	Uranium	$0.19
316-4	Crib	Operated 1948 – 1956. Inactive. The site consists of two bottomless tanks buried 3 m (10 ft) below grade and resting on gravel strata. The tanks are 0.6 m (2 ft) apart with a stainless steel overflow pipe connecting them just below the top of each tank. A total of 896 kg (1,974 lb) of uranium was discharged to the cribs as uranium-bearing organic wastes from the 321 Building between 1948 and 1954. In 1995, radioactive contamination was identified in groundwater well adjacent to the crib (699-S6-E4A) during improvement activities. Sample results identified hydrocarbons and uranium.	Uranium, hydrocarbons	$0.19

Table A-2. 300-FF-2 Operable Unit Outlying Source Sites. (2 Pages)

Site Name	Site Type	Current Site Knowledge	Potential Contaminants	Present-Value Cost (millions)
600-47	Dumping Area	Inactive. The site consists of several areas of debris and irrigation pipes, four URMAs, and one small SCA. Debris included concrete, brick, cinder block, glass, stainless steel, plastic, tar roofing paper, wire, pipe, bottles, and screen. Most of the debris and contamination was identified during field inspections performed in preparation for installation of the 300 Area Treated Effluent Disposal Facility outfall in 1992. The site was expanded in 1993 to include the four URMAs. Contamination areas have been surface stabilized with 0.6 to 0.9 m (2 to 3 ft) of clean backfill material.	Uranium	$0.66
600-63	Unplanned Release	The Buried Waste Test site was established in 1978 to investigate recharge and migration in Hanford Site soil. Six drainage lysimeters and two weighing lysimeters were installed. Trace amounts of Co-60 and tritium were placed in the lysimeters and monitored. The site is currently enclosed within a chainlink fence and a locked gate. The fenced area is posted with "Restricted Area – Contact PNL Radiological Office" and "Underground Radioactive Material" signs.	Uranium, cobalt-60, tritium, techetium-99	$2.89
600-259	Laboratory	The Special Waste Form Lysimeter was constructed in the summer of 1983 and consists of 10 soil-filled caissons around a central access caisson. The caissons are still in place. Each lysimeter caisson contains one waste form sample that is in direct contact with the soil. Samples of commercial reactor were obtained and solidified in cement, bitumen, or vinyl-ester styrene to create a waste form. Information was collected between 1984 and 1992 regarding the amount and types of contaminants that leached into the soil over time. The Grout Waste Test Facility has been removed and previously consisted of four lysimeters that were installed in 1985. Two of the four lysimeters were never used. Twenty-four waste forms were placed in each lysimeter in layers separated by soil and gravel. Routine monitoring and leachate collection activities were conducted until 1989. In 1991, it was noted that one of the Grout Waste Test Facility caissons was not collecting recharge water. It was speculated that the bottom weld was compromised and that radioactive materials had probably leaked into the underlying sediments over a 3-year period. The Grout Waste Test Facility lysimeters were removed in 1992.	Uranium, cobalt-60, tritium, techetium-99	$2.93
TOTAL PRESENT-VALUE COST FOR RTD ALTERNATIVE AT OUTLYING SOURCE SITES				**$15.22**

Table A-3. 300-FF-2 Operable Unit General Content Burial Grounds. (2 pages)			
Site Name	**Current Site Knowledge**	**Potential Contaminants**	**Present-Value Cost (millions)**
618-1	Operated 1945 – 1951. The site consists of at least two trenches. Most of the burial ground is identified by yellow concrete markers and radiation area chain. There are five other "buried radioactive material" medallions inserted flush with the asphalt pavement along the east side of the 333 Building to mark the western extent of the burial ground. Received waste from the 321 Building, 3741 contaminated machining operation, and 3706 Laboratory. Reports mention burial of a bronze crucible reading 179 mr/hr. Some buried waste may have been dissolved after a nitric acid tank leak in 1965.	Uranium, plutonium, fission products, graphite, nitric acid, sulfuric acid	$ 8.05
618-2	Operated 1951 – 1954. The site consists of three trenches. It is fenced and posted as a URM. Inventory includes waste from fuel fabrication activities and laboratories, including solid metallic uranium oxides in the form of metal cuttings. A 1954 fire destroyed flammable material in the burial ground. Automobile batteries (approximately two dump truck loads) were found on the surface prior to surface stabilization in 1989. They were left in place and covered with 0.6 m (2 ft) of clean backfill material. The site may also contain lead and tin from dip-canning processes.	Uranium, plutonium, fission products, tin, lead	$4.43
618-3	Operated 1954 – 1955. The site consists of one pit. It is fenced and posted as a URM. Inventory includes uranium-contaminated construction debris from the 311 Building and construction/demolition debris from remodeling of the 313, 303-J, and 303-K Buildings. Spotty surface contamination was found in the NW corner in 1983. No corrective action was taken. Site was surface stabilized in 1989.	Uranium	$5.46
618-5	Operated 1945 – 1964. Single, regulated burning pit and storage area for aluminum silicate and bronze crucibles surrounded by two fences. Outer fence is an irregular shape and is posted as a URM. Inner fence is posted as soil contamination. Contains uranium-contaminated trash, uranium-contaminated aluminum silicate, and bronze crucibles with rad levels up to 200 mr/hr.	Uranium, lead, asbestos	$5.8
618-7	Operated 1960 – 1973. Two trenches and one V-shaped pit that are fenced and posted as a URM. Used for disposal of hundreds of drums containing zircaloy chips from the process of machining the ends of zircaloy clad fuel elements at the 321, 3722, and 3732 Buildings. The chips may be contaminated with beryllium and uranium. They were considered pyrophoric and put into 114-L (30–gal) iron drums that were filled with water prior to disposal. No records are available on the exact location and inventory of drums. Other low-level material contaminated with uranium and thorium was also buried at the site.	Uranium, beryllium, thorium, pyrophoric metal	$14.56

Table A-3. 300-FF-2 Operable Unit General Content Burial Grounds. (2 pages)			
Site Name	**Current Site Knowledge**	**Potential Contaminants**	**Present-Value Cost (millions)**
618-8	Operated 1954. A parking lot was constructed over a majority of the site. Brass medallions have been embedded in the asphalt to mark the site. The burial ground was expanded to the north in 1980 as delineated by post and chain and is posted as a URM. It is suspected that the site contains debris from expansion and remodeling of the 313 Building in 1954.	Uranium	$8.86
618-13	Operated 1950. Currently posted as "environmental test site." Previously posted as a radiation zone. Originally a single-use site for disposal of uranium–contaminated soil removed from the 303 Building perimeter in 1950. Covered with 0.6 m (2 ft) of clean soil. Reportedly later served as safety shield for hexone drums stored in buildings west of the mound (prior to burial in the 618-9 Trench). Concrete foundation exists directly west of the mound.	Uranium	$1.5
TOTAL PRESENT-VALUE COST FOR RTD AT GENERAL CONTENT BURIAL GROUNDS			**$53.85**

Table A-4. 300-FF-2 Operable Unit Transuranic-Contaminated Burial Grounds.

Site Name	Current Site Knowledge	Potential Contaminants	Present-Value Cost (millions)
618-10	Operated 1954 – 1963. Site consists of trenches and vertical pipe units. Trenches range in size from 97.5 m (320 ft) long by 21.3 m (70 ft) wide by 7.6 m (25 ft) deep to 15.2 m (50 ft) long by 12.2 m (40 ft) wide by 7.6 m (25 ft) deep. Vertical pipe units are 55.9-cm- (22-in.) diameter by 4.6-m- (15-ft) long waste receptacles (six bottomless 208-L [55-gal] drums welded together). The site perimeter is fenced, marked with concrete markers (3-64-1 through 3-64-8), and posted as a URM. The site was surface stabilized with grasses in 1983 and contains low- to high-activity waste (primarily fission products and some transuranic) from 300 Area. Twelve trenches were used mostly for burial of low-level waste. Some other high-activity waste was placed in concrete-shielded drums and buried in the trenches. Ninety-four of the vertical pipe units were used for disposal of high-activity waste. When full, pipe units were backfilled and topped with concrete. A plutonium-contaminated glovebox was buried at the site in 1960, and miscellaneous contaminated debris was buried at the site following a plutonium nitrate spill in the 305-B Building in 1961. In 1961, a fire occurred that destroyed the flammable material in one of the trenches. During stabilization in 1983, oil puddled on the surface after heavy equipment drove over a portion of Trench 4 near marker 3-64-55. The area was stabilized with the rest of the site.	Uranium, plutonium, fission products, other transuranic constituents, petroleum products.	$38.24
618-11	Operated 1962-1967. Site consists of trenches, vertical pipe units, and caissons. Trenches are 274.3 m (900 ft) long by 15.2 m (50 ft) wide by 4.6 m (15 ft) deep. Vertical pipe units are 55.9-cm- (22-in.) diameter by 4.6-m- (15-ft) long waste receptacles (six bottomless 208-L [55-gal] drums welded together). The caissons are 2.4-m- (8-ft) diameter, 3-m- (10-ft) long corrugated metal pipe. The site perimeter is surrounded by a chain link fence, marked with concrete markers (2-68-1 through 2-68-28), and posted as a URM. The site was surface stabilized with grass in 1983 and contains a variety of low- to high-activity waste (including fission products and plutonium) from the 300 Area. Three trenches were used for contact-handled waste. Remote-handled waste was deposited in vertical pipe units or into the caissons. Fifty of the vertical pipe units were backfilled and topped with concrete when full. Four caissons were buried 4.6 m (15 ft) below grade and connected to the surface by an offset 0.9-m- (3-ft) diameter pipe with a domed cap. There were seven unplanned releases associated with the site. Most occurred during transfer of waste to the selected receptacle.	Uranium, cesium, strontium, curium, cobalt, zirconium metal, plutonium metal, plutonium nitrate, other transuranic constituents, thorium, beryllium, aluminum-lithium, carbon tetrachloride, tritium, sodium-potassium eutectic	$331.3
		TOTAL PRESENT-VALUE COST FOR RTD ALTERNATIVE	**$369.54**

Table A-5. 300-FF-2 Operable Unit Candidate Sites.[a] (6 Pages)				
Site Name	**Location**	**Site Type**	**Current Site Knowledge**	**Potential Contaminants**
300-2	300 Area Complex	Trench	Operated 1965 – 1966. Inactive. In September 1965, a fuel element at the Plutonium Recycle Test Reactor (PRTR) was heated until molten in a process tube burst resulting in a contamination event. The release contaminated the PRTR heavy water moderator with fission products and with light water from the coolant. Most of the contaminated water was pumped to the 340 Building and subsequently trucked to the 200 Areas for disposal. Secondary coolant and other normally contamination-free streams were routed directly to the Columbia River. When contamination was detected in this stream, it was diverted to the ground. Approximately 189,270 L (50,000 gal) of contaminated water with 33 mCi iodine-133, 12 mCi iodine-131, 10 μCi of alpha emitters (calculated as plutonium-239), and 40 μCi of nonvolatile beta emitters were disposed of into the ground during the first 36 hours of the incident. A small number of subsequent pumpings contributed insignificant amounts to the total inventory.	Iodine-131, iodine-133, plutonium-239, other radioactive constituents
300-7	Outlying Site	Burial Ground	Inactive. Small, polygon-shaped rise that extends north and west from the 300 Area North Parking Lot (north edge of parking lot forms south edge of waste site). The site can be seen as a scarred area with surface debris piles in aerial photos. Visible surface debris includes concrete, trash, and cables. Subsurface disturbances have been identified using ground penetrating radar but are unmarked. Some of the disturbed area overlaps the 618-8 Burial Ground. The site is currently covered with natural vegetation.	Uranium, asbestos, miscellaneous debris
300-9	Outlying Site	Burial Ground	Operated 1943 – 1945. Inactive. Inventory is unknown. Process knowledge suggests uranium-contaminated waste from early 300 Area experimental processes.	Uranium
300-22	300 Area Complex	Unplanned Release	The site is a release to the ground that occurred as a result of a parted hose coupling outside of the 309 Building (also known as the Plutonium Recycle Test Reactor [PRTR]). The hose was being used to backflush waste from the B Cell to a waste trailer during decontamination procedures at the building. At the time of the release, an area of ground 6 m by 2 m (20 ft by 8 ft) was roped off and tagged. The top 20 cm (8 in.) of soil was removed and placed in a load lugger for supplemental disposal in a burial ground. The site has been covered with new asphalt that is roped off and restricted from use.	Uranium
300-80	300 Area Complex	French Drain	Inactive. The site is a square concrete structure that is covered by a steel plate marked "Radioactive Material, Internally Contaminated." The site previously received steam condensate discharges. The site is above the surrounding grade, has no drain pipes that enter from the roof, and does not appear to be a stormwater drain. The stream was eliminated in 1995 and rerouted to the process sewer.	Uranium

Table A-5. 300-FF-2 Operable Unit Candidate Sites.[a] (6 Pages)				
Site Name	**Location**	**Site Type**	**Current Site Knowledge**	**Potential Contaminants**
300-109	300 Area Complex	French Drain	Inactive. Surface features resembling a drain north of the 333 Building could not be identified on a site visit. A white PVC pipe emerges laterally from the asphalt in the approximate location described in the miscellaneous streams report. There is a channel cut in the asphalt that runs north to the 300 Area perimeter fence and visual evidence of water runoff in the channel, but no french drain structure is apparent. A drain on the northeast side of the building could feed into a buried french drain.	Uranium
300-110	300 Area Complex	Injection Well	Active. The site is a 40-cm (16-in.) drain with a metal grate that is labeled "Internal Radioactive Contamination" due to its proximity to the 618-1 Burial Ground. The drain has a dirt bottom that is approximately 0.6 m (2 ft) below the surface of the asphalt and an overflow line that drains to the process sewer.	--
300-121	300 Area Comples	French Drain	Inactive. The site is a concrete french drain with a metal cover. The inside is dry and filled with cobbles. There is a single discharge line entering the drain near the bottom. The drain received effluent from floor drains inside the 3621-D Building. This discharge included air compressor condensate from the air compressor system used to engage the air starter motors on the diesel generators located inside the building. Cobbles in the bottom of the drain have an oily discoloration.	Ethylene glycol, petroleum products
300-175	300 Area Complex	French Drain	Inactive. The site is a 36-cm- (14-in.) diameter concrete french drain with a metal cover. The inside is dry and filled with cobbles. There are no steam lines entering the site, and no lines are visible inside the drain. The 3714 Building was originally constructed as a solvent storage facility. It was later converted to an organic chemistry laboratory. The building has been inactive since 1995, and water, steam, and electrical services have all been disconnected. Drawings and observations of the building suggest that a floor drain inside the building may be connected to the french drain outside the building wall.	--
300-263	300 Area Complex	Catch Tank	Inactive. The site consists of a catch tank that was set up to hold contaminated process solutions from the 324 Building that were too hot to send directly to a crib without additional treatment. Hazardous or radioactive waste was never transferred from the 324 Building to the tank. Shortly after the tank was installed, the 340 Complex came on line and the piping system to the tank was bypassed and capped. Waste was subsequently transferred from the 324 Building to the 340 Complex. Rain water is believed to have entered the tank from historical pooling that submerged a flange assembly with several missing cover bolts. The site is physically located within the boundaries of the 316-3 waste site, which may be the source of the contamination.	Uranium, cesium

Table A-5. 300-FF-2 Operable Unit Candidate Sites.[a] (6 Pages)

Site Name	Location	Site Type	Current Site Knowledge	Potential Contaminants
300-265	300 Area Complex	Radioactive Process Sewer	Installed in 1971. Operated 1978 – mid 1980's. Inactive. The site is a 5-cm (2-in.) underground encased stainless steel waste transfer line encased within a 10-cm (4-in.) fiberglass-reinforced epoxy pipe that ran between the 324 and 325 Buildings. Inside the pipeline are two other stainless steel pipes, one is 1-cm (0.4-in.) and the other is 1.9-cm (0.75-in.). The inner pipes were driven through the 5-cm (2-in.) pipe several years after the larger pipe was installed. The depth of the pipeline ranges from 1 to 4 m (3 to 12 ft) underground. The two inner pipes were used to transfer high level waste from spent nuclear fuel processing between buildings.	fission products, transuranic nuclides
300-268	300 Area Complex	Foundation	Operated 1945 – 1956. Inactive. This site is the former location of the 3741 building and is now covered with gravel and cannot be precisely located without geophysical surveys or excavation. The 3741 Building was used to store and prepare samples of irradiated graphite, flux wires, and uranium from the 305 Test Pile. Airborne and floor contamination in and around the facility was an early concern, leading to several modifications to the facility. The building was torn down in 1956. It is not known if the concrete foundation was removed or if surrounding soils were remediated.	Uranium, metals
300-269	300 Area Complex	Foundation	Operated 1972 – 1995. Active. This site is the former location of the 331-A Virology Laboratory. The site is now a rectangular concrete building foundation. Air conditioner units have been installed on the foundation to support adjacent facilities. The building was originally used for biological research on animals to investigate radiation effects from plutonium and other fission products. As part of the requirements associated with demolition of the building the EPA has required that soil sampling be conducted beneath the foundation to demonstrate that contamination has not been released to the soil or groundwater.	Plutonium, other fission products
300-270	300 Area Complex	Unplanned Release	The site is the result of a release of milky colored water that came from a pipe under the loading dock on the east side of the 333 Building that was reported on January 18, 2000. The pipe drains the roof of the 313 Building. The release was on to the surface of the ground, in an area of compacted gravel and soil. Soil collected from the area near the pipe showed elevated levels of lead. Water samples collected were found to be at levels below regulatory limits. The source of the lead contamination is unknown.	Lead

Table A-5. 300-FF-2 Operable Unit Candidate Sites.[a] (6 Pages)

Site Name	Location	Site Type	Current Site Knowledge	Potential Contaminants
316-3	300 Area Complex	Trench	Operated 1953 – 1963. Inactive. The site is the location of two former disposal trenches that ran in an east-west direction and were separated by 6 m (20 ft). Each trench contained a 13-cm (5–in.) vitrified clay pipe that ran the length of the entire unit. Between 1953 and 1963, effluent in the 307 Retention Basins that was below discharge limits was released to these disposal trenches. When the trenches were removed from service in 1963, contaminated sediments were excavated and transported to the 618-10 Burial Ground. The trenches were backfilled with 7,646 m^3 (10,000 yd^3) of uranium-contaminated material scraped from the bottom of the South Process Pond and covered with flyash from the 300 Area Ash Pits. Several 300 Area buildings were constructed on top of the backfilled trenches. Most of the site lies within the 324 Building fenceline.	Uranium
331 LSLDF	300 Area Complex	Drain Field	Operated 1970 – 1974. Inactive. The site consists of an abandoned drain field that was fed by one diversion box and four septic tanks. The waste line has been capped west of the septic tanks, and the system has been connected to the 300 Area sanitary sewer. The unit previously discharged sanitary wastewater from the 331-A and 331-B Buildings, and potentially animal waste, to the soil column. In January 1975, between 25 and 2,500 µCi of plutonium-238 from contaminated soil used in a botanical experiment was washed into the process sewer, and this material may have ended up in the LSLDF.	Sanitary wastewater, animal waste, americium, curium, neptunium, plutonium, uranium, cadmium, chromium, lead
331 LSLT1	300 Area Complex	Drain Field	Operated 1966 – 1969. Inactive. The site is a rectangular leaching trench that has been abandoned and backfilled. There are two trenches. The north trench has been arbitrarily designated as the LSLT1 unit. The trench previously disposed of sanitary waste and animal waste to the soil column. Sanitary waste flowed from the 331-B Septic Tank. Animal waste flowed from the animal waste unloading pit, entered diversion chamber #1, and was subsequently discharged to the leaching trench.	Sanitary wastewater, animal waste, americium, curium, neptunium, plutonium, uranium, cadmium, chromium, lead
331 LSLT2	300 Area Complex	Drain Field	Operated 1966 – 1974. Inactive. The site is a rectangular leaching trench that has been abandoned and backfilled. There are two trenches. The south trench has been arbitrarily designated as the LSLT2 unit. The trench previously disposed of sanitary waste and animal waste to the soil column. Sanitary waste flowed from the 331-B Septic Tank. Animal waste flowed from the animal waste unloading pit, entered diversion chamber #1, and was subsequently discharged to the leaching trench. In 1974, the clean animal sewage was connected to the regular 300 Area Sanitary Sewer System.	Sanitary wastewater, animal waste, americium, curium, neptunium, plutonium, uranium, cadmium, chromium, lead

Table A-5. 300-FF-2 Operable Unit Candidate Sites.[a] (6 Pages)

Site Name	Location	Site Type	Current Site Knowledge	Potential Contaminants
333 ESHWSA	300 Area Complex	Storage Area	Inactive. The site is part of the paved area near the northeast corner of the 333 Building, within the building fenceline. It was used to provide temporary storage for miscellaneous hazardous and/or radioactive waste, including waste oil, cutting lubricants, chemicals, and solvents. The site is now used for storage of miscellaneous nonhazardous materials only. There are several large trash dumpsters currently at this location.	Uranium, petroleum products, solvents
UPR-300-1	300 Area Complex	Unplanned Release	The site was a release to the soil that occurred from a long-duration leak that was discovered in the cast iron transfer line between the 307 Retention Basins and the 340 Building. A transfer of retention waste was stopped when water appeared at the ground surface between the basins and the building. The area of flooding was subsequently excavated, and the bottom half of the transfer line was found to be severely corroded. The corroded section of carbon-steel pipe discharged approximately 900 Ci of short-lived radionuclides (mainly promethium-147 and 10 Ci each of strontium-90 and cesium-137) to the soil column over a period of up to a year. The top 0.6 m (2 ft) of contaminated soil was put into drums and disposed of in a 200 Area burial ground. Further removal of contaminated soil was considered a threat to adjacent structures. The area is currently covered with gravel. There is no apparent sign of subsurface contamination.	Uranium, promethium-147, strontium-90, cesium-137
UPR-300-2	300 Area Complex	Unplanned Release	The site appears to be the result of multiple releases from ongoing decontamination and waste-handling activities beginning in 1954. Several leaks have occurred that contributed significant amounts of radioactivity to the soil around the 340 Building. The contamination extends several feet down adjacent to the south wall of the building, suggesting that the sump overflowed during the tanker truck era. The last known release in the area was found in 1977 when a leaking "T" in the liquid waste line was unearthed. Strontium-90 has been identified in the soil. Surface has been stabilized, but contamination is known to extend several feet into the soil. Contamination is also present on the north side of the building. A HEPA filter was located there, and condensation from the filter enclosure dripped on the ground. Surface soil has since been removed.	Uranium, cesium-137, strontium-90

Table A-5. 300-FF-2 Operable Unit Candidate Sites.[a] (6 Pages)				
Site Name	**Location**	**Site Type**	**Current Site Knowledge**	**Potential Contaminants**
UPR-300-5	300 Area Complex	Unplanned Release	The site is a result of a release that contaminated the storage basin area, the filter vault, the stack base, the truck stall, and the truck ramp outside the 309 Building. The fill line to the 309 Fuel Storage Basin was opened to prevent exposed walls from drying and causing possible airborne contamination. The supply line was inadvertently left open overnight causing water to flow into the overflow drain and back up into the filter pit, the stack base, and the truck stall. The truck ramp sloped below the 309 Building grade and filled with 0.46 m (1.5 ft) of water. The water contained low-level contamination. Contaminated areas were flushed by a fire hose several times to reduce the contamination level and direct residual contamination back into the drain. Contaminated sand and rock were collected and put into drums for disposal. The elevation of the ramp was raised in the mid-1970s and covered with a concrete cap. Currently the ramp is paved with asphalt. No radiological postings or markers are present to identify the location of the release.	Cesium-137, cobalt-60, uranium
UPR-300-11	300 Area Complex	Unplanned Release	During project V-659, contamination was discovered in the soil beneath leaking flanges on a "T" section of the RRLWS south of the 340 Vault. The leak contaminated a column of soil approximately 1.2 m (4 ft) in diameter and 5.5 m (18 ft) long. Five boreholes were dug to characterize the contamination. Radioactivity was found in the three holes nearest the area of concern. At a depth of 7.6 m (25 ft), the contamination spread laterally through an interface between undisturbed soil and backfill. Contaminated soil was excavated by hand to a depth of 2.4 m (8 ft) below grade. Approximately 90% of the contaminated soil was removed. A decision was made not to remove all of the contaminated soil because the plume was close to another contaminated plume (UPR-300-1).	Strontium-90, europium-155, cerium-144, plutonium-239/240, plutonium-238, and americium-241
UPR-600-22	Outlying Site	Unplanned Release	The site consists of a series of small parallel berms that are arranged to form a triangle. The area was contaminated prior to 1972 with particulate fallout from burial activities at the 618-11 Burial Ground. The contamination was subsequently covered by scraping the affected area into "wind rows."	Uranium, cesium, strontium, curium, cobalt, zirconium, plutonium, thorium, beryllium, aluminum-lithium

[a]The estimated present-value cost of characterization at each candidate site is approximately $62,500.

APPENDIX B: RESPONSIVENESS SUMMARY

The public comment period for the 300-FF-2 Proposed Plan was held between July 3 and September 5, 2000 (See section III of this ROD for more information). Comment letters were received from the following individuals and/or organizations:

- Heart of America Northwest
- Columbia Riverkeeper
- Public Employees for Environmental Responsibility (PEER)
- State of Washington Department of Fish and Wildlife
- Two members of the general public

Comments on an earlier draft of the document were submitted by the Nez Perce Tribe and the Confederated Tribes and Bands of the Yakima Nation.

All comments received were considered and are in the Administrative Record file.

In general, comments received voiced support for the preferred alternative of "Remove, Treat, and Dispose" but identified concerns in the following areas:

- Land use assumptions
- Protectiveness of proposed cleanup levels with respect to groundwater
- Protectiveness of proposed cleanup levels with respect to the environment
- Separation of source control operable units from the groundwater operable unit

Many specific comments were identified as well. General comments will be addressed first followed by specific comments.

GENERAL COMMENTS AND RESPONSES

The following information summarizes general areas of concern that were expressed through the comments and provides the associated agency responses.

General Comment 1: The industrial land use assumption is not valid for the 300-FF-2 Operable Unit.

Response GC1: The approach toward assessing and factoring land use assumptions into the remedial actions for the 300-FF-2 Operable Unit are consistent with USEPA's "Land Use in the CERCLA Remedy Selection Process" policy (OSWER Directive No. 9355.7-04). This directive states that "remedial action objectives developed during the RI/FS should reflect the reasonably anticipated future land use or uses." The approach toward the 300-FF-2 Operable Unit has been consistent with this policy. The reasonably anticipated land use of "industrial" for the 300 Area Industrial Complex, the areas adjacent to the 300 Area Industrial Complex to the north and west, and the outlying sites/burial grounds 5-8 miles north of the 300 Area Industrial Complex are consistent with the relevant land use planning documents. These are:

- The Final Report of the Hanford Future Site Uses Working Group (December 1992) described the cleanup objective for the 300 Area (both the industrial complex and surrounding vicinity) as 'restricted status for industrial use' under both "*Cleanup Scenario A: Cleanup for Economic Development, Wildlife*" and "*Cleanup Scenario B: Cleanup for Agriculture and Native American Uses Outside the 300 Area*," as explained in the report.

- The *Hanford Comprehensive Land-Use Plan Environmental Impact Statement* (HCP EIS) (September 1999) and ROD (64 Federal Register 61615) includes all sites in the 300-FF-2 Operable Unit (including outlying sites and burial grounds) in an "industrial" land use designation to support "new DOE missions or economic development."

- The City of Richland's Comprehensive Land Use Plan identifies the 300 Area (as well as areas North and South of the 300 Area) as an "Urban Growth Area" pursuant to Washington's Growth Management Act. Land uses identified in the plan include "industrial" and "business/research park."

- Benton County's Draft Hanford Land Use Plan (Spring 2000) identifies all sites in the 300-FF-2 Operable Unit (including outlying sites and burial grounds) as either being in the City of Richland's "Urban Growth Area" or in a land use zone defined by Benton County as "industrial – heavy." Within the Urban Growth Area, the County defers land use planning and land use designations to the City of Richland, unless there is a marked disagreement. In this case there is not. The Draft Hanford Land Use Plan will be incorporated into the Benton County Comprehensive Plan as Chapter 13 when the plan is updated in Spring 2001.

While none of these documents can formally zone the 300-FF-2 Operable Unit as "industrial," the plans document what a working group comprised of Hanford stakeholders, DOE, and local land use planning authorities expect in the way of future land use and are sufficient for the Tri-Parties to conclude that "industrial" or "general urban uses other than residential," are reasonably anticipated future land uses for the areas covered by the 300-FF-2 Operable Unit. This means that institutional controls must be a required part of the remedy in order to ensure that land uses are limited to those defined in the 300 Area industrial use exposure scenario. Any changes to the land use that are inconsistent with the land use assumptions upon which the ROD is based will be evaluated regularly and used in support of the CERCLA five-year review process. (NOTE: Other land uses may also be appropriate as long as institutional controls limit human activities to those described in the 300 Area industrial use exposure scenario.)

In conclusion, a number of key factors support the Tri-Parties determination that it is appropriate to use industrial cleanup standards for the 300-FF-2 Operable Unit. These include:

- The reasonably anticipated future land use is industrial pursuant to EPA policy and guidance (see discussion in Section VI)

- The area meets the criteria of "traditional industrial use," as provided in WAC 173-340-745, because it has the following characteristics:

a) Humans do not live on the site and the reasonable maximum exposure scenario is based on an adult employee located on an industrial property;
b) Access to the property by the general public is generally not allowed. When permitted, it is highly limited and controlled.
c) Food is not grown or raised on the property.
d) Industrial operations generally involve the storage of chemicals, noise, odors, and truck traffic.
e) Industrial properties are generally covered by buildings and structures, paved parking lots, paved access roads and material storage areas, and other surface barriers to contaminated soil and debris.
f) Industrial properties generally contain support facilities that are intended to serve the industrial facility employees and not the general public.

- Institutional controls are required as part of the selected remedy to ensure that these land use characteristics are maintained in the future. Institutional controls required before and during cleanup activity as well as those required after the cleanup is complete are specified in Section XII (2)(b) of the ROD. The land use restrictions required as part of the ROD after the cleanup is completed must be enforceable and must continue, independent of who is the property owner (e.g., proprietary controls such as property easements and covenants).

- Hazardous substances remaining at the site after the remedial action will not pose a threat to human health or the environment at the site or in adjacent nonindustrial areas. Site-specific cleanup verification reports and continued environmental monitoring (also required as part of the selected remedy) will gather the data necessary to evaluate and document this in a final comprehensive risk assessment that will be required to support the final 300-FF-2 Record of Decision.

- Any changes to the land use that are inconsistent with the land use assumptions upon which the ROD is based will be evaluated regularly and used in support of the CERCLA five-year review process.

General Comment 2: The proposed cleanup levels are not protective of groundwater.

Response GC2: The remedial action objectives (RAOs) require that the soil cleanup levels be protective of human health and the environment (using the industrial exposure scenario), be protective of groundwater, and be protective of the Columbia River. The selected remedy requires that debris or soil contaminated with concentrations above cleanup levels be removed from the area and institutional controls be established to limit human exposure to residual contamination. Cleanup levels were developed independently for each contaminant of concern for each of the three pathways of concern (direct contact/direct exposure, protection of groundwater, and protection of the Columbia River). Cleanup levels protective of groundwater and the Columbia River are based upon the MTCA Method B "100 times rule" or upon MTCA Method A (WAC 173-340-740, 745). For mobile contaminants that pose a threat to groundwater and the Columbia River, the most restrictive cleanup level was selected. For contaminants that are not mobile, and hence do not pose a threat to groundwater or the Columbia River, direct contact/direct exposure cleanup levels protective of human health under the industrial exposure scenario were selected. These concentrations are starting points, and more restrictive cleanup levels may be required to achieve RAOs (e.g., cumulative risk from multiple contaminants, protection of specific ecological receptors, protection of groundwater, and/or protection of the Columbia River). In addition, contaminant-specific cleanup levels may differ for individual waste sites based on site-specific conditions (e.g. size of the waste site, nature and extent of contamination in the soil column). Changes to contaminant-specific cleanup levels may be required and final cleanup levels must be approved by EPA. Documentation of RAO achievement will be made on an individual waste site-basis in cleanup verification packages (CVPs). Documentation that cleanup objectives have been met is provided at the CVP stage when extensive site characterization data is available (i.e., achievement of RAOs can be best assessed with data supplied by the ongoing excavation/cleanup activity). The Tri-Parties believe that this is the most technically sound and cost-effective way to document the results of cleanup activity at the Hanford site. A complete discussion of the technical approach used to develop the 300-FF-2 cleanup levels can be found in Appendix F of the 300-FF-2 FFS.

One contaminant of concern that is being explored further at the current time is uranium. The presence of an existing contaminant plume in the groundwater is making it difficult to conclusively demonstrate that the soil cleanup activity is protective of groundwater. Existing data supports the conclusion that the soil cleanup level being used in the 300-FF-1 cleanup work is achieving the RAOs established in the ROD, including protection of groundwater. However, a more comprehensive assessment of the fate and transport of uranium in the 300 Area is currently being performed (a technical evaluation of the leach potential and Kd properties of soil contaminated with uranium). This additional data may further validate the current cleanup level or indicate that additional measures are required to protect groundwater quality. If any changes are required in the cleanup approach or cleanup level as a result of the analysis, appropriate adjustments will be made to the selected remedy and the public will be notified or given an opportunity to comment on the change through an Explanation of Significant Difference or a ROD amendment, depending on the nature of the change required.

General Comment 3: Biological monitoring and ecological risk characterizations do not support the proposed cleanup approach for the 300 Area.

Response GC3: Potential impacts to ecological receptors from 300 Area contamination were evaluated in ecological investigation reports performed in support of the 300-FF-1 and 300-FF-5 Record of Decision which was approved in 1996. The Tri-Parties believe that the information on biota and habitats collected for the 300-FF-1 and 300-FF-5 Operable Units is analogous to the 300-FF-2 Operable Unit due to the close proximity and similarities of the operable units. A summary of past 300 Area studies which includes conclusions reached can be found in Appendix E of the 300-FF-2 Focused Feasibility Study.

The Columbia River Comprehensive Impact Assessment (CRCIA), completed in 1998, provided a comprehensive screening assessment of Hanford's major human health and ecological impacts with input from Tribes, stakeholder groups, and the public. CRCIA evaluated potential ecological impacts on 52 plant and animal species, both terrestrial and aquatic, for the entire Hanford site. This analysis included species that have recently been listed under the Endangered Species Act and Migratory Bird Treaty Act (e.g., three salmonid species recently listed for the Upper Columbia River: Oncorhynchus mykiss, O. tshawytscha, and Salvelinus confluentus). CRCIA findings have been considered and evaluated as part of the 300-FF-2 remedial investigation.

Past 300 Area ecological risk evaluations have used the Great Basin pocket mouse as a representative of terrestrial species that have the greatest potential for exposure to contaminated materials from 300 Area waste sites. This is still considered to be an appropriate assumption because it is a relatively common animal and has a home range comparable in size to many of the waste sites. Available remedial investigation results and comparisons to other similar waste sites were utilized to estimate risks for the Great Basin pocket mouse as the representative of terrestrial species. An environmental hazard quotient (EHQ) exceeded 1.0 for some of the 300-FF-2 waste sites, indicating that *individual mice* (not mouse populations) were at risk. Based on the assumptions that were used (e.g., receptors live on/in waste site, uniform contamination, all food contaminated, no dilution from uncontaminated food, and complete retention of contaminants), the estimate of ecological risk was considered to be conservative. Exposure to contaminants for animals that feed on mice was predicted to be low due to the large foraging area of a predator relative to the size of a waste site.

Risk to aquatic organisms was estimated as part of the investigations conducted for the 300-FF-5 groundwater Operable Unit. Based on the investigations, the predicted radiological dose to aquatic organisms was less than 1 rad/day. The analysis was conservative (e.g., no dilution of the groundwater by the river was considered) and subject to uncertainty in uptake rate, receptor size/weight, and use frequency.

In summary, most of the 300-FF-2 waste sites are located in areas that have been highly disturbed by industrial/waste management operations and would be unable to support complete ecological communities represented by common food webs. Ecological impacts are isolated and are not expected to be tied to an exposure scenario that would result in an adverse impact to a wildlife receptor. This ROD contains specific provisions for post-cleanup ecological monitoring (see Section XII). This ecological monitoring will be used: 1) to verify the generic site model used to develop cleanup levels (which assumed no ecological receptor populations were being impacted by individual waste sites); 2) to assess the protectiveness of the selected remedy in CERCLA five-year reviews; and 3) to provide the information necessary for the comprehensive risk assessment that will be performed in support of the final ROD for the 300-FF-2 Operable Unit.

General Comment 4: The proposed cleanup levels are not protective of the ecological receptors.

Response GC4: Ecological risk-based cleanup levels were not calculated for radionuclides. The Tri-Parties believe that use of a cleanup standard that is protective of a reasonable maximum exposed individual to 15 mrem/year above background for 1000 years will also be protective of ecological receptors (based on the following criteria: dose rates shall not exceed 0.1 rad/day for terrestrial organisms and 1.0 rad/day for aquatic organisms and terrestrial plants). In addition, in practice the Tri-Parties are finding that the cleanup of non-radioactive chemical contaminants is incidental to the cleanup of radioactive contaminants in soils.

In addition, the generic waste site profile used to develop cleanup levels assumed no ecological receptor populations were being impacted by individual waste sites. While this may be an appropriate general assumption for the 300 Area Complex, areas adjacent to the industrial complex are subject to sparse and transient use by wildlife and outlying areas share the same habitat characteristics as other parts of the Columbia River corridor. Therefore, this ROD specifies that additional efforts must be made to demonstrate this is the case for sites outside the fenceline of the 300 Area Complex (See ROD Section XII(2)(a)(11)). The results of pre-remediation cultural and ecological waste site surveys may be adequate to address baseline site conditions (i.e., confirm the presence or absence of sensitive plant or animal species). Soil cleanup levels may have to be adjusted further, in some limited cases, to be protective of terrestrial plants and animals depending on the location of the individual waste site, the nature of the surrounding habitat, the contaminants of concern, and the presence of sensitive receptors. Specific procedures for implementing these surveys, modifying cleanup levels if appropriate, and documenting results in CVPs will be outlined in the RD/RA workplan.

In addition, soil cleanup levels (for contaminants that are mobile to groundwater and the Columbia River) are established to be protective of aquatic organisms based on Ambient Water Quality Criteria (AWQC) under the Federal Clean Water Act (40 CFR 131) and/or the State of Washington Surface Water Quality Standards (WAC 173-201A), whichever is more protective.

Finally, this ROD contains specific provisions for post-cleanup ecological monitoring (see ROD Section XII(2)(c)). This ecological monitoring will be used: 1) to verify the generic site model used to develop cleanup levels (which assumed no ecological receptor populations were being impacted by individual waste sites); 2) to assess the protectiveness of the selected remedy in CERCLA five-year reviews; and 3) to provide the information necessary for the comprehensive risk assessment that will be performed in support of the final ROD for the 300-FF-2 Operable Unit. Any environmental impacts discovered through this monitoring will be evaluated and analyzed. If any changes are required in the cleanup approach or cleanup levels as a result of the analysis, appropriate remedy selection decision documents will be prepared (i.e., an Explanation of Significant Differences or a ROD amendment).

General Comment 5: It is inappropriate to separate source control actions from groundwater actions in the 300 Area.

Response GC5: The 300 Area National Priorities List site has been separated into three distinct operable units for project management purposes. The 300-FF-1 and 300-FF-2 Operable Units address contaminated soil and debris associated with the 300 Area (including disposal locations in the 600 Area that were associated with operations in the 300 Area). The 300-FF-5 Operable Unit addresses underlying groundwater contamination. A Record of Decision was signed for the 300-FF-1 and 300-FF-5 Operable Units in 1996. The final operable unit to undergo remediation is 300-FF-2.

Segregating sites into operable units is a concept grounded in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP):

> "Operable Unit means a discrete action that comprises an incremental step toward comprehensively addressing site problems. This discrete portion of a remedial response manages migration, or eliminates or mitigates a release, threat of a release, or pathway of exposure. The cleanup of a site can be divided into a number of Operable Units, depending on the complexity of the problems associated with the site. Operable Units may address geographic portions of a site, specific site problems, or initial phases of an action, or may consist of any set of actions performed over time or any actions that are concurrent but located in different parts of a site." (40 CFR 300.5)

Although the source control actions are separated from the groundwater response actions in the 300 Area, they are coordinated and consistent. Remedial action objectives established for the source control actions, including 300-FF-2, specify that groundwater and river protection are also cleanup objectives. Therefore, the soil cleanup levels that are used for source control actions are established to meet groundwater and surface water protection standards. The standards that are used to assess groundwater and river protection are drinking water standards and ambient water quality criteria for the protection of freshwater aquatic organisms, respectively. All groundwater and river monitoring requirements are outlined in the Operation and Maintenance (O&M) Plan for the 300-FF-5 Operable Unit. The O&M plan contains provisions for cross-checks between groundwater monitoring requirements and ongoing source control actions to ensure that appropriate contaminants of concern are evaluated in the appropriate monitoring wells and river sampling locations. The O&M plan will be periodically revised to ensure that it is up-to-date. An update effort is currently underway and should be completed by September 2001.

In addition, this is an interim action. A final action will also be required before the cleanup can be determined to be complete. This final action will require a comprehensive risk assessment that identifies and quantifies the risk posed by any residual contamination at Hanford (both chemical and radiological). This requirement will ensure that appropriate actions have been taken and specify what additional measures need to be taken if they are determined not to be adequate.

Finally, remedy reviews will be required for this action every five years due to the fact that residual contaminant concentrations will not permit unrestricted use or unlimited exposure. Regular monitoring per 300-FF-5 requirements and periodic evaluations of remedy effectiveness per 300-FF-1 and 300-FF-2 requirements will ensure that source control and groundwater response actions are implemented in a coordinated and consistent manner.

SPECIFIC COMMENTS AND RESPONSES

The following information identifies specific comments received on the proposed plan and provides responses. Related comments from different reviewers have been grouped into common categories, beginning with the five general comment categories identified in the previous section. To the extent possible, there was an attempt to minimize the amount of paraphrasing that was done on specific comments that were received. Where appropriate, responses to the specific comments reference the general comment responses from the previous section. In such cases, supplemental information may be provided for further clarification of the general response as it applies to the specific comment. Copies of all of the comment letters may be found in the Administrative Record.

Category A - Land Use

Comment A.1. We must point out that the Reasonable Maximum Exposure Scenario must, as a matter of law, now be changed to unrestricted public access for all operable units of the 300 Area.

Response A.1. See response to General Comment 1.

Comment A.2. The FF-2, FF-1, FF-5, and all related 300 Area decisions must reflect cleanup to the standards of MOTCA (chapter 70.05.D) Method B, unrestricted use cleanup and remediation levels.

Response A.2. See response to General Comment 1. Based on the Tri-Parties position that industrial land use scenario is appropriate, the use of MTCA Method C cleanup levels is appropriate. For mobile contaminants in the 300-FF-2 Operable Unit, soil cleanup levels protective of groundwater and the Columbia River are based upon the MTCA Method B "100 times rule" (WAC 173-340-740) or upon MTCA Method A (WAC 173-340-745).

Comment A.3. No area of the FF-2 Unit (nor any of the 300 Area units) is legally eligible for use of MOTCA Method C industrial land use cleanup level (MOTCA's standards are applicable as an ARAR pursuant to CERCLA).

Response A.3. See response to General Comment 1. Based on the Tri-Parties position that industrial land use scenario is appropriate, the use of MTCA Method C cleanup levels is appropriate.

Comment A.4. Areas outside the fence of the 300 Area have never been eligible to be cleaned up utilizing the MOTCA Method C industrial exposure standard.

Response A.4. See response to General Comment 1. Based on the Tri-Parties position that industrial land use scenario is appropriate, the use of MTCA Method C cleanup levels is appropriate.

Comment A.5. USDOE has failed to provide for notice and public comment specific to the resources and land areas that would be restricted from public use under the use of an alternate reasonable maximum exposure scenario or from the use of site specific risk assessment.

Response A.5. See response to General Comment 1. Public comment and input on future land use assumptions in the 300 Area has been solicited via the Future Site Uses Working Group, the *Final Hanford Comprehensive Land-Use Plan and Environmental Impact Statement*, the *Proposed Plan for the 300-FF-1 and 300-FF-5 Operable Units*, and the *Proposed Plan for the 300-FF-2 Operable Unit.* Public input was sought and utilized in the development of each of these documents. Formal NEPA and CERCLA public involvement procedures were utilized in the development of the *Final Hanford Comprehensive Land-Use Plan and Environmental Impact Statement* and the two Proposed Plans, respectively.

Comment A.6. The Reasonable Maximum Exposure Scenario must be changed to unrestricted public access for all operable units of the 300 Area. The management of the property owner and a major federal agency, the Department of Energy, have both formally proposed unrestricted access to the 300 Area in the future. Unrestricted access is therefore a reasonably foreseeable future use. As a result, the standards of MOTCA, Method B, must apply to the FF-2, FF-1, FF-5, and all related 300 Area decisions.

Response A.6. See response to General Comment 1. Public comment and input on future land use assumptions for the 300 Area has been solicited via the Future Site Uses Working Group, the *Final Hanford Comprehensive Land-Use Plan and Environmental Impact Statement*, the *Proposed Plan for the 300-FF-1 and 300-FF-5 Operable Units*, and the *Proposed Plan for the 300-FF-2 Operable Unit.* The Department of Energy has not formally, or informally, proposed that the 300 Area be utilized for anything other than industrial purposes in the future. Based on this information, the Tri-Parties believe that the reasonably anticipated future land use for this portion of the Hanford site is industrial. Therefore, it is appropriate to use the industrial scenario as the reasonable maximum exposure scenario. If the land use changes in the future, additional cleanup work or institutional controls may be required.

Comment A.7. The proposed plan must not skirt around the laws by classifying lands for future industrial use. Hiding behind an industrial land use classification and associated clean-up standards should not be permitted. Instead, the lands and the water associated with them must be recognized for what they are – home to Native American cultural and religious resources, feeders to the Columbia River, and possible areas of groundwater continuity with Richland's water supplies.

Response A.7. See response to General Comment 1. Public comment and input on future land use assumptions for the 300 Area has been solicited via the Future Site Uses Working Group, the *Final Hanford Comprehensive Land-Use Plan and Environmental Impact Statement*, the *Proposed Plan for the 300-FF-1 and 300-FF-5 Operable Units*, and the *Proposed Plan for the 300-FF-2 Operable Unit*. In addition, although the RME scenario for the 300-FF-2 Operable Unit assumes no human uses of drinking water in the 300 Area, groundwater cleanup objectives for the 300 Area have never changed from the original requirement in the 300-FF-5 Operable Unit (i.e., restoration of the contaminated aquifer to drinking water standards). See response to General Comment 2. Environmental monitoring data (both groundwater and ecological), as required by this ROD, will be evaluated regularly and used in support of CERCLA 5-year reviews to ensure that the selected remedy is being implemented in a manner that is protective of both human health and the environment. A complete risk assessment that evaluates the impact of residual contamination on all human and ecological exposure pathways will also be performed in support of the final ROD for the 300-FF-2 Operable Unit.

Comment A.8. Regulatory agencies are required to consider unrestricted public access as a reasonable foreseeable use and to consider groundwater as a beneficial use. This document has failed to acknowledge these uses or to do the required analysis to show why the use does not, and could not, exist. As a result, the proposed plan is based on a series of flawed assumptions that must be corrected.

Response A.8. The Tri-Parties believe that an industrial land use assumption and industrial cleanup standards are supported as discussed in the response to General Comment 1. In addition, although the RME scenario for the 300-FF-2 Operable Unit assumes no human uses of drinking water in the 300 Area, groundwater cleanup objectives for the 300 Area have never changed from the original requirement in the 300-FF-5 Operable Unit (i.e., restoration of the contaminated aquifer to drinking water standards). See response to General Comment 2.

Comment A.9. Regulators cannot take advantage of possible flexibilities in the law without also complying with the public involvement that is supposed to accompany explorations of such “flexibility” (WAC 173-340-600 (4g)(9g) and proposed WSR 00-16-135). The proposed plan adopts the use of an “alternative reasonable maximum exposure scenario” without providing for public notice and comment specific to the lands, waters, and associated resources that would be eliminated-or restricted-from public use by a reduced clean-up level.

Response A.9. See response to General Comment 1. Public comment and input on future land use assumptions for the 300 Area has been solicited via the Future Site Uses Working Group, the *Final Hanford Comprehensive Land-Use Plan and Environmental Impact Statement*, the *Proposed Plan for the 300-FF-1 and 300-FF-5 Operable Units*, and the *Proposed Plan for the 300-FF-2 Operable Unit*. Public input was sought and utilized in the development of each of these documents. Formal NEPA and CERCLA public involvement procedures were utilized in the development of the *Final Hanford Comprehensive Land-Use Plan and Environmental Impact Statement* and the two Proposed Plans, respectively.

Comment A.10. Classifying the site for future industrial use does not excuse it from applicable MTCA standards and requirements. There is the potential that portions of the 300 Area (including underlying and down gradient vadose zone and groundwater) will be used for other non-industrial uses.

Response A.10. See response to General Comments 1 and 2. The groundwater cleanup objective for the 300 Area is still the same as it was in the 300-FF-5 ROD: Restoration of the contaminated aquifer to drinking water standards.

Comment A.11. Under MTCA, a site does not qualify for Method C soil standards just because it is zoned industrial or planned for future industrial uses. Method C soil cleanup standards may not be applied without evaluating all applicable pathways (WAC 173-340-740 (4)).

Response A.11. The Tri-Parties believe that an industrial land use assumption and industrial cleanup standards are supported as discussed in the response to General Comment 1. In addition, although the RME scenario for the 300-FF-2 Operable Unit assumes no human uses of drinking water in the 300 Area, groundwater cleanup objectives for the 300 Area have never changed from the original requirement in the 300-FF-5 Operable Unit (i.e., restoration of the contaminated aquifer to drinking water standards). See response to General Comment 2. A complete risk assessment that evaluates the impact of residual contamination on all human and ecological exposure pathways will also be performed in support of the final ROD for the 300-FF-2 Operable Unit.

Comment A.12. The term "<u>reasonably anticipated</u>" as applied to the foreseen future industrial use (page 1, column 2, paragraph 2) is not associated with or derived from MTCA or RCRA requirements and thus has no legal bearing. Use of this term further illustrates the fact that applicable MTCA ARARs have not been satisfied by this draft plan and that the future use of the site (and its resources) is uncertain.

Response A.12. The term "reasonably anticipated" is an important term within EPA's CERCLA cleanup guidance. See response to General Comment 1. In addition, compliance with MTCA and all other applicable state and federal cleanup requirements is required in this ROD. The Tri-Parties believe that the cleanup approach described in the ROD is compliant with all ARARs.

Comment A.13. Given the close proximity to the Columbia River and very close to the intake pump for the city of Richland's drinking water source, we find it unconscionable to allow an "industrial clean-up scenario" to be allowed.

Response A.13. See response to General Comment 2. Soil cleanup levels used to achieve the reasonably anticipated future land use of industrial must also be protective of groundwater and river water quality, as defined by drinking water standards and river protection standards. Groundwater monitoring requirements are defined in the Operations and Maintenance Plan for the 300-FF-5 Operable Unit. Ongoing groundwater monitoring is reported annually in the *Hanford Site Environmental Report* published by the Department of Energy Richland Operations Office for each calendar year. Existing and potential impacts to groundwater quality, drinking water sources, and ecological receptors are discussed in this document. To date, drinking water sources and ecological receptors have not been found to be affected by 300 Area waste sites. EPA will continue to evaluate this data in support of CERCLA 5-year reviews. Additional measures may be required based on monitoring data.

Comment A.14. The 300 Area should be cleaned up to "unrestricted use", using the best available technology, removing as much of the source term as possible.

Response A.14. See response to General Comment 1. In practice, 300 Area cleanups performed to date have resulted in the removal of the majority of contamination (i.e., well below industrial cleanup standards). This is due to the limited mobility of the primary contaminant, uranium, in the soil column.

Comment A.15. Cleaning up the 300 Area to an "industrial clean-up scenario" only supports USDOE's wishes for limited clean-up and clearly violates the reason for your agency's existence-"the Environmental Protection Agency." The "industrial clean-up scenario" adds even more insult to injury by violating MTCA, totally ignores the TRUST RESPONSIBILITY to the sovereign nations, and will not be protective of groundwater or all life.

Response A.15: See response to General Comments 1 and 2.

Comment A.16. Ecology staff have repeatedly commented on the applicability of the Model Toxics Control Act (MTCA) in relation to a site's qualification for Method C soil standards. In particular, under MTCA, a site does not necessarily qualify for Method C soil standards even if zoned "industrial" property or planned "industrial".

Response A.16. The Tri-Parties believe that an industrial land use assumption and industrial cleanup standards are supported as discussed in the response to General Comment 1.

Comment A.17. Page 1, 2nd column, 2nd paragraph. The second sentence of the paragraph states: "Remedial alternatives for the 300-FF-2 Operable Unit waste sites were evaluated based on a reasonably anticipated future industrial land-use scenario and criteria prescribed by CERCLA." The term "reasonably anticipated" is not associated with or derived from MTCA or RCRA requirements. To the contrary, the term is in direct conflict with fundamental applicable MTCA requirements.

Response A.17. The Tri-Parties do not believe that the CERCLA land use policy and MTCA land use requirements are fundamentally in conflict. Rather, the Tri-Parties believe that the goals and requirements of both statutes are being met (as described in the response to General Comment 1).

Comment A.18. Columbia Riverkeeper strongly encourages the EPA to adopt the "unrestricted clean-up scenario" for the 300 FF-2-Operable Unit and to clean-up the entire 300 Area to "unrestricted use" because of the close proximity to the Columbia River. If the Tri-Party Agencies want to protect the ecosystem in the future, there is no other alternative other than removing as much waste as possible. We must remember science is just starting to learn about the combined and synergistic effects of these contaminants on life forms. We must consider contaminants from other sources as well as Hanford derived contaminants when we decide how clean is clean for these areas. We must consider the potential biological impacts that may occur for as long as these contaminants remain hazardous.

Response A.18. See responses to General Comments 1, 2, 3, and 4. Environmental monitoring data (both groundwater and ecological), as required by this ROD, will be evaluated regularly and used in support of CERCLA 5-year reviews to ensure that the selected remedy is being implemented in a manner that is protective of both human health and the environment. A complete risk assessment that evaluates the impact of residual contamination on all human and ecological exposure pathways will also be performed in support of the final ROD for the 300-FF-2 Operable Unit.

Category B – Protection of Groundwater

Comment B.1. The evaluation of groundwater contamination has not allowed groundwater impacts from the 300-FF-2 source sites to the Columbia River to be understood (i.e., impacts to groundwater quality, impacts to drinking water sources, impacts to ecological receptors, etc.).

Response B.1. See response to General Comment 2. Groundwater monitoring requirements are defined in the Operations and Maintenance Plan for the 300-FF-5 Operable Unit. Ongoing groundwater monitoring is reported annually in the *Hanford Site Environmental Report* published by the Department of Energy Richland Operations Office for each calendar year. Existing and potential impacts to groundwater quality, drinking water sources, and ecological receptors are discussed in this document. The primary sources of existing groundwater contamination in the 300 Area are known to be the liquid disposal sites in the 300-FF-1 Operable Unit where significant amounts of contaminated liquids were disposed, carrying contaminants to groundwater (namely the 300 Area process trenches, North Process Pond, and South Process Pond). Available data does not indicate that 300-FF-2 waste sites are the primary source of existing groundwater contamination. Regardless, all soil cleanup activity performed in support of 300-FF-1 and 300-FF-2 will utilize soil cleanup levels that will not result in further groundwater degradation.

Comment B.2. An evaluation of the available uranium groundwater contamination data in relation to the 300-FF-5 Operable Unit, after issuance of the interim ROD and in relation to potential 300-FF-2 source sites, does not appear to have been performed. As such, potential impacts have not been evaluated inclusively in the decision process associated with the 300-FF-2 Operable Unit.

Response B.2. A comprehensive evaluation of all groundwater contamination in the 300-FF-5 Operable Unit, including contributions from 300-FF-1 and 300-FF-2 waste sites, was performed in support of the 1996 ROD for the 300-FF-5 Operable Unit. The analysis and supporting data can be found in: *Phase I Remedial Investigation Report for the 300-FF-5 Operable Unit* (DOE/RL-93-21) and *Remedial Investigation/Feasibility Study Report for the 300-FF-5 Operable Unit* (DOE/RL-94-85). Additional groundwater investigations were performed for the outlying 300-FF-2 waste sites that were not in the original scope of the 300-FF-5 Operable Unit (see *Limited Field Investigation Report for the 300-FF-2 Operable Unit*, DOE/RL-96-42). An evaluation of all data was recently performed by the USEPA and summarized in the *USDOE Hanford Site: First Five-Year Review*. These documents and others are available in the Administrative Record.

Comment B.3. RAOs for the 300-FF-2 Operable Unit were stated to have been developed based on the reasonably anticipated industrial future land use, worker safety, and applicable or relevant and appropriate requirements (ARARs). Soil cleanup levels based on only worker safety and protection of ground water **for industrial use** may not provide protection for ground water's highest beneficial use and reasonable maximum exposure for future use (a drinking water source) or protect the river and the associated salmon spawning habitats.

Response B.3. See response to General Comment 2. The groundwater cleanup objective for the 300 Area is still the same as it was in the 300-FF-5 ROD: Restoration of the contaminated aquifer to drinking water standards. For mobile contaminants in the 300-FF-2 Operable Unit, soil cleanup levels protective of groundwater and the Columbia River are based upon the MTCA Method B "100 times rule" (WAC 173-340-740) or upon MTCA Method A (WAC 173-340-745). Drinking water standards are being used as the basis for determining whether or not soil cleanup levels will be protective of groundwater quality because the aquifer is considered to be a potential drinking water source (pursuant to the 300-FF-5 ROD) even though MTCA Method C (WAC 173-340-745) is being used as the basis for direct contact cleanup levels for non-mobile chemicals under the industrial land use scenario and groundwater consumption is not part of the reasonable maximum exposure scenario for 300-FF-2. Finally, salmon have not been observed to be spawning in the vicinity of the 300 Area or immediately downstream from the 300 Area.

Comment B.4. DOE/EPA need to incorporate new scientific information and recent site findings to determine whether or not metals in the soils will be released to ground water within the 1000-year time frame. PRGs protective of ground water for metals must be identified and included in the table. Failure to do so is a failure to protect public health, the Columbia River, and associated fisheries resources. The proposal and FFS do not evaluate ground water impacts from waste and soil for most metals (only direct exposure) because constituents are assumed not to reach ground water within 1000 years. This is a flawed and erroneous assumption.

Response B.4. See response to General Comment 2. Modeling of the potential effect of soil contaminants based on studies by Pacific Northwest Laboratory have determined that soluble salts of metals are not predicted to reach groundwater within 1,000 years under normal conditions of precipitation, runoff, and evapotranspiration of soil moisture in the 300 Area. MTCA Method B has been used to establish soil cleanup values protective of groundwater and the Columbia River for the 300-FF-2 ROD. These levels are applicable to 300-FF-2 contaminants that are likely to be mobilized from soil to groundwater. 300-FF-2 cleanup levels are described in Section VIII of the ROD and Appendix F of the FFS.

Comment B.5. The site profile and associated assumptions must be modified to acknowledge that ground water is already contaminated with releases from the area. The plan's site profile and assumption that constituents will not reach ground water within 1,000 years is not consistent with recent site findings (uranium).

Response B.5. See response to General Comment 2. The primary source of Uranium found in the groundwater of the 300 Area originated from sites in the 300-FF-1 Operable Unit (300 Area process trenches, North Process Pond, and South Process Pond) where significant amounts of contaminated liquids were disposed, carrying contaminants to groundwater.

Comment B.6. Identification of 300 Area sources for contaminants of concern in the ground water is documented in the proposal (see Tables A-1, A-2, and A-3). Deflecting or misleading what is truly happening in the area with the following statements is grossly misleading. "None of the general content burial grounds appear to be currently impacting groundwater (pg. 8, the plan);" and "The 316-4 Crib is an outlying source site and the only 300-FF-2 Operable Unit source waste site that has been shown to impact ground water (Pg. 7, the plan)."

Response B.6. See response to General Comment 2. The statements referenced are correct given their context in the source document. An evaluation of all data was recently performed by the USEPA and summarized in the *USDOE Hanford Site: First Five-Year Review*. It is anticipated that future 5-year reviews will continue to evaluate all groundwater contamination issues in a similar manner.

Comment B.7. The groundwater in the 300 Area does not meet the criteria in MTCA that would eliminate it as a future drinking water source. Washington's groundwater standards are required to be based on the most beneficial use and the reasonable maximum exposure expected to occur now and in the future. The most beneficial uses at many sites is drinking water. Some areas also supply fresh water sources for spawning salmon. Both of these beneficial uses exist, or could potentially exist in the 300 Area considering its proximity to the Columbia River and the City of Richland. Washington State laws assume that this beneficial use exists unless it can be demonstrated otherwise (WAC 173-340-720). The groundwater within the 300 Area does not meet any one of the three criteria in MTCA that would eliminate it as a future source of potable water; therefore, it fails the demonstration. Although it may not be a current source of drinking water, it has not been documented or asserted that it will never be a future source, or connected to a future source-of drinking water or waters associated with critical salmon spawning habitat.

Response B.7. See response to General Comment 2. The groundwater cleanup objective for the 300 Area is still the same as it was in the 300-FF-5 ROD: Restoration of the contaminated aquifer to drinking water standards. For mobile contaminants in the 300-FF-2 Operable Unit, soil cleanup levels protective of groundwater and the Columbia River are based upon the MTCA Method B "100 times rule" (WAC 173-340-740) or upon MTCA Method A (WAC 173-340-745). Drinking water standards are being used as the basis for determining whether or not soil cleanup levels will be protective of groundwater quality because the aquifer is considered to be a potential drinking water source (pursuant to the 300-FF-5 ROD) even though MTCA Method C (WAC 173-340-745) is being used as the basis for direct contact cleanup levels for non-mobile chemicals under the industrial land use scenario and groundwater consumption is not part of the reasonable maximum exposure scenario for 300-FF-2. Finally, salmon have not been observed to be spawning in the vicinity of the 300 Area or immediately downstream from the 300 Area.

Comment B.8. Groundwater contamination emanating from the 300-FF-2 Operable Unit could very likely connect with water pumped from north Richland's drinking water wells. As another example, groundwater contamination currently impacting the Columbia River from the 300 Area could reasonably be anticipated to negatively impact salmon spawning habitat as well as salmonids. Despite these factors, to-date, no investigation (vadose zone, groundwater, or ecological) has been performed to support that draft plan's assumptions regarding the groundwater in the 300-FF-2 Operable Unit area and the cleanup level that is proposed.

Response B.8. See response to General Comment 2. A complete evaluation of all groundwater contamination in the 300-FF-5 Operable Unit, including contributions from 300-FF-1 and 300-FF-2 waste sites, was performed in support of the 1996 ROD for the 300-FF-5 Operable Unit. The analysis and supporting data can be found in: *Phase I Remedial Investigation Report for the 300-FF-5 Operable Unit* (DOE/RL-93-21) and *Remedial Investigation/Feasibility Study Report for the 300-FF-5 Operable Unit* (DOE/RL-94-85). Additional groundwater investigations were performed for the outlying 300-FF-2 waste sites that were not in the original scope of the 300-FF-5 Operable Unit (see *Limited Field Investigation Report for the 300-FF-2 Operable Unit*, DOE/RL-96-42). An evaluation of all data was recently performed by the USEPA and summarized in the *USDOE Hanford Site: First Five-Year Review*. These documents and others are available in the Administrative Record.

In addition, the north Richland Well Field is only operated with a positive groundwater gradient due to its design (i.e., the City fills the existing ponds over the well field from the Columbia River, creating both a natural water filter and a groundwater mound from which it pumps groundwater to augment its water system). When this system is not operated, water is pumped directly from the Columbia River to the water treatment plant. Hence, the influx of natural groundwater into the North Richland Well Field is not likely to occur.

Finally, salmon have not been observed to be spawning in the vicinity of the 300 Area or immediately downstream from the 300 Area.

Comment B.9. There must be further TPA milestones in place to remediate groundwater contamination.

Response B.9. Any 300 Area milestones related to groundwater will be developed in support of the 300-FF-5 Operable Unit (not the 300-FF-2 Operable Unit). DOE is currently required to monitor groundwater in the 300-FF-5 Operable Unit pursuant to the requirements established in the 300-FF-5 O&M plan. This data is regularly reviewed and analyzed to determine if groundwater cleanup objectives are being achieved through the natural attenuation remedy. An active response measure may be required by EPA if aquifer restoration to drinking water standards is not occurring in a reasonable timeframe. Modification of the ROD and establishment of TPA milestones requiring an active response will be done at that point in time, if necessary.

Comment B.10. The remediation effort needs to meet the standards for drinking water use.

Response B.10. See response to General Comment 2. The groundwater cleanup objective for the 300 Area is still the same as it was in the 300-FF-5 ROD: Restoration of the contaminated aquifer to drinking water standards. For mobile contaminants in the 300-FF-2 Operable Unit, soil cleanup levels protective of groundwater and the Columbia River are based upon the MTCA Method B "100 times rule" (WAC 173-340-740) or upon MTCA Method A (WAC 173-340-745). Drinking water standards are being used as the basis for determining whether or not soil cleanup levels will be protective of groundwater quality because the aquifer is considered to be a potential drinking water source (pursuant to the 300-FF-5 ROD) even though MTCA Method C (WAC 173-340-745) is being used as the basis for direct contact cleanup levels for non-mobile chemicals under the industrial land use scenario and groundwater consumption is not part of the reasonable maximum exposure scenario for 300-FF-2.

Comment B.11. Method C soil clean-up standards can not be applied without evaluating all applicable pathways (WAC 173-340-740 (4)). All pathways including groundwater must be assessed. The draft plan considers direct exposure to solid waste and contaminated soils as the primary exposure pathway for humans with ingestion and inhalation as secondary and "others" are considered "incomplete or inconsequential." The exclusion of groundwater must not occur and the piecemeal approach of assessing pathways should not continue.

Response B.11. See response to General Comment 2. The groundwater cleanup objective for the 300 Area is still the same as it was in the 300-FF-5 ROD: Restoration of the contaminated aquifer to drinking water standards. For mobile contaminants in the 300-FF-2 Operable Unit, soil cleanup levels protective of groundwater and the Columbia River are based upon the MTCA Method B "100 times rule" (WAC 173-340-740) or upon MTCA Method A (WAC 173-340-745). Drinking water standards are being used as the basis for determining whether or not soil cleanup levels will be protective of groundwater quality because the aquifer is considered to be a potential drinking water source (pursuant to the 300-FF-5 ROD) even though MTCA Method C (WAC 173-340-745) is being used as the basis for direct contact cleanup levels for non-mobile chemicals under the industrial land use scenario and groundwater consumption is not part of the reasonable maximum exposure scenario for 300-FF-2. In addition, a complete risk assessment that evaluates the impact of residual contamination on all human and ecological exposure pathways will also be performed in support of the final ROD for the 300-FF-2 Operable Unit.

Comment B.12. Even though the property may be zoned industrial or there is currently industrial usage, Method C soil cleanup standards may not be applied without evaluation of all applicable pathways. The potential for leaching of contaminants into groundwater is unaffected by the land use (e.g., industrial). If the groundwater pathway is not evaluated for protection from soil contamination, then Method C for soil regulatory requirements are not met. Soil cleanup standard needs to be based on protection of groundwater, the industrial soil Method C standard would not apply and a soil standard based on protection of groundwater would have to be determined (WAC 173-340-740(4)).

Response B.12. See response to General Comment 2. For mobile contaminants in the 300-FF-2 Operable Unit, soil cleanup levels protective of groundwater and the Columbia River are based upon the MTCA Method B "100 times rule" (WAC 173-340-740) or upon MTCA Method A (WAC 173-340-745). Drinking water standards are being used as the basis for determining whether or not soil cleanup levels will be protective of groundwater quality because the aquifer is considered to be a potential drinking water source (pursuant to the 300-FF-5 ROD) even though MTCA Method C (WAC 173-340-745) is being used as the basis for direct contact cleanup levels for non-mobile chemicals under the industrial land use scenario and groundwater consumption is not part of the reasonable maximum exposure scenario for 300-FF-2. A complete risk assessment that evaluates the impact of residual contamination on all human and ecological exposure pathways will also be performed in support of the final ROD for the 300-FF-2 Operable Unit.

Comment B.13. Industrial cleanup standards may not be applied to industrial properties where hazardous substances remaining at the property after remedial action pose a threat to human health or the environment in adjacent non-industrial areas. Given the proximity of the 300 Area both to the nearby Columbia River and to the shallow groundwater. According to the "Reader File" at Ecology, Ecology staff have communicated a belief that MTCA values protective of groundwater are required unless a detailed justification for use of other values can be found. This justification has not been provided to-date.

Response B.13. See response to General Comment 2. The groundwater cleanup objective for the 300 Area is still the same as it was in the 300-FF-5 ROD: Restoration of the contaminated aquifer to drinking water standards. For mobile contaminants in the 300-FF-2 Operable Unit, soil cleanup levels protective of groundwater and the Columbia River are based upon the MTCA Method B "100 times rule" (WAC 173-340-740) or upon MTCA Method A (WAC 173-340-745). Drinking water standards are being used as the basis for determining whether or not soil cleanup levels will be protective of groundwater quality because the aquifer is considered to be a potential drinking water source (pursuant to the 300-FF-5 ROD) even though MTCA Method C (WAC 173-340-745) is being used as the basis for direct contact cleanup levels for non-mobile chemicals under the industrial land use scenario and groundwater consumption is not part of the reasonable maximum exposure scenario for 300-FF-2.

Comment B.14. It has been recommended that Ecology not allow latitude in selecting a uranium cleanup standard that is not protective of groundwater (i.e., that does not strictly follow the MTCA process). Ecology & EPA should start with the "100X groundwater" value of 10.5 mg/kg and require a demonstration of protectiveness to justify use of a higher cleanup value. Such demonstration requirements are consistent with other MTCA cleanup actions throughout Washington State.

Response B.14. See response to General Comment 2. Modeling of uranium transport from soil to groundwater based on studies by Pacific Northwest Laboratory have determined that soluble salts of uranium are not predicted to reach groundwater within 1,000 years under normal conditions of precipitation, runoff, and evapotranspiration of soil moisture in the 300 Area. Prior technical documents developed in support of the 300-FF-5 ROD and ongoing groundwater monitoring has demonstrated that the primary source of uranium found in the groundwater of the 300-FF-5 Operable Unit originated from sites in the 300-FF-1 Operable Unit (300 Area process trenches, North Process Pond, and South Process Pond) where significant amounts of contaminated liquids were disposed, carrying contaminants to groundwater. The presence of this contaminant plume in the groundwater is making it difficult to conclusively demonstrate that the soil cleanup activity is protective of groundwater. A technical assessment of the fate and transport of uranium in the 300 Area is currently being performed. This additional data will be used to assess the protectiveness of the current cleanup level. Any changes in the selected remedy will undergo appropriate public notice and/or comment procedures based on the nature of the change.

Comment B.15. Table 3(a) indicates the preliminary remediation goal (PRG) for uranium is 505 mg/kg with a provision to perform a leach test prior to implementation of remedial actions to verify soil cleanup level is protective of groundwater and river pathways. Information on Ecology's "Reader File" indicates that Ecology staff have recommended that the PRG for uranium should start with 10.5 mg/kg with a provision to perform a leach test prior to implementation of remedial actions. Specifically, the PRG should start with the "100X groundwater" value of 10.5 mg/kg and require a demonstration of protectiveness to justify use of a higher cleanup value.

Response B.15. See response to General Comment 2 and the Response B.14, above.

Comment B.16. Groundwater in the 300 Area does not meet the criteria in MTCA that eliminates it as a future drinking water source. Groundwater standards shall, by law, be based on the most beneficial use and reasonable maximum exposure expected to occur now and in the future. Considering the half-life of uranium, this is a very long time and we cannot predict what the land use will be in 50 years, let alone 100 years or 500 years. We also must not forget the potential for failure of institutional controls. The most beneficial use at most sites, and certainly in the 300 Area considering its relationship to the Columbia River and Richland, is a source of drinking water unless it can be demonstrated otherwise (WAC 173-340-720).

Response B.16. See response to General Comment 2. The groundwater cleanup objective for the 300 Area is still the same as it was in the 300-FF-5 ROD: Restoration of the contaminated aquifer to drinking water standards. For mobile contaminants in the 300-FF-2 Operable Unit, soil cleanup levels protective of groundwater and the Columbia River are based upon the MTCA Method B "100 times rule" (WAC 173-340-740) or upon MTCA Method A (WAC 173-340-745). Drinking water standards are being used as the basis for determining whether or not soil cleanup levels will be protective of groundwater quality because the aquifer is considered to be a potential drinking water source (pursuant to the 300-FF-5 ROD) even though MTCA Method C (WAC 173-340-745) is being used as the basis for direct contact cleanup levels for non-mobile chemicals under the industrial land use scenario and groundwater consumption is not part of the reasonable maximum exposure scenario for 300-FF-2.

Comment B.17. WAC 173-340-720 presents two major criteria/demonstrations that must be met for groundwater at a site to qualify for an exposure scenario other than the highest beneficial use requiring the highest water quality for drinking and other domestic uses. The groundwater must be demonstrated not to be a current source of drinking water and not be a future source of drinking water. It may be true that the groundwater under the 300-FF-2 Operable Unit does not currently serve as a source of drinking water. To date, USDOE, EPA, or Ecology has failed to demonstrate that the 300 Area groundwater's future highest beneficial use and maximum exposure is not drinking water and that soil and groundwater standards need not be based on this potential future use. In conclusion, the term "reasonably anticipated" is just another way of saying that applicable MTCA ARARs have not been satisfied.

Response B.17. See responses to General Comments 1 and 2 and Response B.7. above.

Category C – Ecological Risk Assessment

Comment C.1. USDOE has failed to meet the burden of demonstrating no offsite impact, especially to the Columbia River ecosystems and endangered species. There has been no ecological risk assessment, and no ecological exposure effects assessment on federally listed salmonid species and migratory birds.

Response C.1. See response to General Comment 3. Available data supports the interim action described in this ROD. Environmental monitoring data (both groundwater and ecological), as required by this ROD, will be evaluated regularly and used in support of CERCLA 5-year reviews to ensure that the selected remedy is being implemented in a manner that is protective of both human health and the environment. A complete risk assessment that evaluates the impact of residual contamination on all human and ecological exposure pathways will also be performed in support of the final ROD for the 300-FF-2 Operable Unit.

Comment C.2. We are unable to support any proposed remedial action due to a lack of biological characterization. Complete characterization needs to occur which must include radiological activity and chemical concentrations of contaminants of concern and that a systematic investigation needs to occur for terrestrial and aquatic receptors, including federally listed species.

Response C.2. See response to General Comment 3. This ROD specifies that additional efforts must be made for outlying 300-FF-2 waste sites, that are not in close proximity to the 300 Area, to document pre-remediation ecological site conditions (i.e., confirm the presence or absence of sensitive plant or animal species). In some limited cases, soil cleanup levels may have to be adjusted further to be protective of terrestrial plants and animals depending on the location of the individual waste site, the nature of the surrounding habitat, the contaminants of concern, and the presence of sensitive receptors. Specific procedures for implementing these surveys, modifying cleanup levels if appropriate, and documenting results in CVPs will be outlined in the RD/RA workplan.

Comment C.3. It is recommended: 1) that USDOE and EPA seek contaminant expertise from NMFS and USFWS for species protected under ESA and the Migratory Bird Treaty Act, 2) that EE/E assessments be designed and deployed as part of the preremedial characterization process, 3) that milestones be developed for the EE/E assessments, and 4) that this proposed plan and feasibility study be re-written to include the appropriate analysis required under the remedial investigation/feasibility study process prescribed under the National Contingency Plan and then reissued for public comment.

Response C.3. See response to General Comment 3 and Specific Comments C1 and C2. Available data supports the interim action described in this ROD. In addition, the

Department of Energy has prepared the "Salmon and Steelhead Threatened and Endangered Species Management Plan," (DOE/RL-2000-27, dated April 2000). This document was the culmination of efforts by the Department of Energy to consult with NMFS, pursuant to ESA. This plan was prepared in response to the 1998 and 1999 listing of Steelhead and spring Chinook Salmon within the Columbia River system in the lower Columbia Basin for protection under the ESA. The Tri-Parties will continue to work with members of the Hanford Natural Resources Trustee Council, to ensure that appropriate expertise is factored into the Hanford cleanup process in a constructive manner.

Comment C.4. There has been NO VALID ASSESSMENT of all the waste sites, the multitude of contaminants and their long term impact on the ecosystem for as long as those contaminants remain hazardous. There has been NO VALID ASSESSMENT of combining the waste sites and their cumulative impact on the ecosystem. There has been NO VALID ASSESSMENT that addresses the combined or synergistic affects on the ecosystem. Therefore, it is impossible for any agency to state that the current clean-up by limited removal will be protective of the ecosystem for as long as those materials remain hazardous.

Response C.4. See response to General Comment 3 and Specific Comments C1 and C2. Available data supports the interim action described in this ROD. Environmental monitoring data (both groundwater and ecological), as required by this ROD, will be evaluated regularly and used in support of CERCLA 5-year reviews to ensure that the selected remedy is being implemented in a manner that is protective of both human health and the environment. A complete risk assessment that evaluates the impact of residual contamination on all human and ecological exposure pathways will also be performed in support of the final ROD for the 300-FF-2 Operable Unit.

Comment C.5. MTCA requires detailed site investigations before clean-up levels are determined. This has not been performed according to MTCA staff experts at the Washington State Department of Ecology. Without adequately characterizing the waste, we can not create a valid assessment of potential impacts or justify an industrial clean-up scenario that is supposed to be protective of the ecosystem.

Response C.5. See response to General Comment 3 and Specific Comment C1. The Tri-Parties have agreed to use the observational approach to cleanup which allows waste characterization, designation, and treatment to occur as excavation proceeds. The observational approach maximizes effective use of funds for cleanup and minimizes the timeframe for remedial action. Available data supports the interim action described in this ROD. A complete risk assessment that evaluates the impact of residual contamination on all human and ecological exposure pathways will also be performed in support of the final ROD for the 300-FF-2 Operable Unit.

Category D – Protection of Ecological Receptors

Comment D.1. Our review focused on disposition of our comments submitted on the draft A documents. Those comments included requests for ecological exposure/effect (EE/E) assessments to be conducted on federally listed salmonid species to establish clean-up levels protective of these species, and for an EE/E assessment on species protected under the Migratory Bird Treaty Act. Unfortunately, these requests were not addressed and remain applicable.

Response D.1. See response to General Comments 3 and 4. Available data supports the interim action described in this ROD. In addition, the Department of Energy has prepared the "Salmon and Steelhead Threatened and Endangered Species Management Plan," (DOE/RL-2000-27, dated April 2000). This document was the culmination of efforts by the Department of Energy to consult with NMFS, pursuant to ESA. This plan was prepared in response to the 1998 and 1999 listing of Steelhead and spring Chinook Salmon within the Columbia River system in the lower Columbia Basin for protection under the ESA. The Tri-Parties will continue to work with members of the Hanford Natural Resources Trustee Council, to ensure that appropriate expertise is factored into the Hanford cleanup process in a constructive manner.

Comment D.2. EPA and USDOE need to consult the National Marine Fisheries Service (NMFS) and the U. S. Fish and Wildlife Service (USFWS) under Section 7 of the ESA on the 300-FF-5 ROD since contaminant levels of uranium are increasing, which could jeopardize the continued existence of listed species (16 U.S.C. Sec.1536(a)(2)). The consultation requirements of section 7 are nondiscretionary and are effective at the time of species' listings regardless of whether critical habitat is designated.

Response D.2. See response to General Comments 3 and 4. The Department of Energy has prepared the "Salmon and Steelhead Threatened and Endangered Species Management Plan," (DOE/RL-2000-27, dated April 2000). This document was the culmination of efforts by the Department of Energy to consult with NMFS, pursuant to ESA. This plan was prepared in response to the 1998 and 1999 listing of Steelhead and spring Chinook Salmon within the Columbia River system in the lower Columbia Basin for protection under the ESA. The Tri-Parties will continue to work with members of the Hanford Natural Resources Trustee Council, to ensure that appropriate expertise is factored into the Hanford cleanup process in a constructive manner.

Comment D.3. To date, little effort and insufficient funds have been directed toward determining effects (injury) to biological resources at the Hanford Site and as a result, the public is left wondering whether remedial actions are truly protective of biological resources.

Response D.3. See response to General Comments 3 and 4. Available data supports the interim action described in this ROD. Environmental monitoring data (both groundwater and ecological), as required by this ROD, will be evaluated regularly and used in support of CERCLA 5-year reviews to ensure that the selected remedy is being implemented in a manner that is protective of both human health and the environment. A complete risk assessment that evaluates the impact of residual contamination on all human and ecological exposure pathways will also be performed in support of the final ROD for the 300-FF-2 Operable Unit.

Comment D.4. Selected remedies that include institutional controls may not be protective of wildlife species. Appropriate biological characterization needs to occur prior to cleanup actions to determine if selected remedial response actions reduce or eliminate contaminant pathway(s) to wildlife. At this time, data remains insufficient to perform a meaningful ecological risk assessment.

Response D.4: See response to General Comments 3 and 4. This ROD specifies that additional efforts must be made for outlying 300-FF-2 waste sites, that are not in close proximity to the 300 Area, to document pre-remediation ecological site conditions (i.e., confirm the presence or absence of sensitive plant or animal species). In some limited cases, soil cleanup levels may have to be adjusted further to be protective of terrestrial plants and animals depending on the location of the individual waste site, the nature of the surrounding habitat, the contaminants of concern, and the presence of sensitive receptors. Specific procedures for implementing these surveys, modifying cleanup levels if appropriate, and documenting results in CVPs will be outlined in the RD/RA workplan.

Environmental monitoring data (both groundwater and ecological), as required by this ROD, will be evaluated regularly and used in support of CERCLA 5-year reviews to ensure that the selected remedy is being implemented in a manner that is protective of both human health and the environment. A complete risk assessment that evaluates the impact of residual contamination on all human and ecological exposure pathways will also be performed in support of the final ROD for the 300-FF-2 Operable Unit.

Comment D.5. We find it odd that EPA is stating that this proposed clean-up will be protective of the environment. When we use the word environment, we consider all life in the entire ecosystem. The "industrial clean-up scenario" limits the amount of exposure to humans, but one must ask how does it limit the ecosystem's exposure to the contaminants? All life that lives in this area is dependent on clean water, clean soil, and clean air. Fish and wildlife cannot adjust their exposure level by some arbitrary time limit set by man.

Response D.5: See response to General Comments 3 and 4. Most of the 300-FF-2 waste sites are located in areas that have been highly disturbed by industrial/waste management operations and would be unable to support complete ecological communities represented by common food webs. Ecological impacts are isolated and are not expected to be tied to an exposure scenario that would result in an adverse impact to a wildlife receptor. This ROD contains specific provisions for post-cleanup ecological monitoring (see Section XII). This ecological monitoring will be used: 1) to verify the generic site model used to develop cleanup levels (which assumed no ecological receptor populations were being impacted by individual waste sites); 2) to assess the protectiveness of the selected remedy in CERCLA five-year reviews; and 3) to provide the information necessary for the comprehensive risk assessment that will be performed in support of the final ROD for the 300-FF-2 Operable Unit.

Comment D.6. When we consider protection of the environment/ecosystem we must assume that drinking water standards will not be protective of all species. MTCA is the first step in assuring protection, but we must go even further if we are to meet our TRUST responsibility to the sovereign nations. We must be able to prove that our current clean-up strategy will be protective of all species. Currently EPA, USDOE or Ecology could not prove that an "industrial clean-up scenario" is protective and can not demonstrate that the contamination in the vadose zone for as long as it remains hazardous will not impact the groundwater, or impact the ecosystem.

Response D.6. See response to General Comments 3 and 4. Environmental monitoring data (both groundwater and ecological), as required by this ROD, will be evaluated regularly and used in support of CERCLA 5-year reviews to ensure that the selected remedy is being implemented in a manner that is protective of both human health and the environment. A complete risk assessment that evaluates the impact of residual contamination on all human and ecological exposure pathways will also be performed in support of the final ROD for the 300-FF-2 Operable Unit.

Category E – Separation of Source and Groundwater Actions

Comment E.1. The Explanation of Significant Differences (ESD) that was issued for the groundwater attached to the 300-FF-2 after the close of the comment period on the draft A documents and the issuance of the Rev. 0 documents clearly circumvents the intent and requirements of the Comprehensive, Environmental Response, Compensation and Liability Act (CERCLA), National Environmental Policy Act (NEPA) and the Endangered Species Act (ESA).

Response E.1. See response to General Comment 5. The ESD was issued concurrently with the 300-FF-2 Proposed Plan because it was an administrative change to the original ROD and it made sense to do it at the same time. EPA policy does not require public comment on such documents because the changes were not significant enough to warrant a ROD amendment. However, in this case, the public was given notice of the availability of the ESD in the Proposed Plan Fact Sheet (page 1) and the Proposed Plan (page 10). No requests were made for the document.

Comment E.2. The issuance of an ESD for the contaminated ground water associated with the 300-FF-2 Operable Unit prior to issuance of these final documents (Rev. 0) appears premature. This decision eliminated public involvement in the remedial decision making process and ignores the intent and statutory requirements of CERCLA, NEPA and ESA.

Response E.2. See response to General Comment 5 and Response E.1 above.

Comment E.3. The public now has no opportunity to comment on the 300-FF-2 associated ground water contamination because no formal public comment period, public meeting, and responsive summary are required when issuing an ESD, according to the OSWER Directive 9355.3-02.

Response E.3. See response to General Comment 5 and Response E.1 above.

Comment E.4. The plan defers groundwater evaluation and remediation to the 300-FF-5 Operable Unit, and as such, does not satisfy applicable MTCA ARARs for justifying the stated “reasonably anticipated” future use scenario.

Response E.4. See response to General Comment 5.

Comment E.5. The plan proposes to defer groundwater cleanup requirements to another decision document (i.e., the 300-FF-5 Operable Unit ROD). The proposed plan provides little justification for its recommendation that groundwater remediation decisions be separated from source site remediation decisions for the 300-FF-2 Operable Unit.

Response E.5. See response to General Comment 5 and Response E.1 above.

Comment E.6. The inclusion of groundwater directly beneath the two TRU Burial Grounds and beneath the seven Outlying Source Sites is not supported by the groundwater contamination investigation/characterization performed for the 300-FF-5 Operable Unit. The 300-FF-5 Operable Unit investigations primarily focused on uranium groundwater contamination near the 300-FF-1 Operable Unit and the 300 Area Complex. The 300-FF-5 Operable Unit investigation is an inadequate investigation and/or characterization on which to base groundwater remedial decisions associated with the two TRU Burial Grounds and the seven Outlying Source Sites.

Response E.6. See response to General Comment 5. A complete evaluation of all groundwater contamination in the 300-FF-5 Operable Unit, including contributions from 300-FF-1 and 300-FF-2 waste sites, was performed in support of the 1996 ROD for the 300-FF-5 Operable Unit. The analysis and supporting data can be found in: *Phase I Remedial Investigation Report for the 300-FF-5 Operable Unit* (DOE/RL-93-21) and *Remedial Investigation/Feasibility Study Report for the 300-FF-5 Operable Unit* (DOE/RL-94-85). Additional groundwater investigations were performed for the outlying 300-FF-2 waste sites that were not in the original scope of the 300-FF-5 Operable Unit (see *Limited Field Investigation Report for the 300-FF-2 Operable Unit*, DOE/RL-96-42). An evaluation of all data was recently performed by the USEPA and summarized in the *USDOE Hanford Site: First Five-Year Review*. These documents and others are available in the Administrative Record.

Comment E.7. The inclusion of groundwater directly beneath the two TRU Burial Grounds and beneath the seven Outlying Source Sites is not supported by the groundwater contamination investigation performed for the 300-FF-5 Operable Unit. The updating of the 300-FF-5 Operable Unit O&M will not achieve the aquifer contamination investigation/characterization that was performed by the 300-FF-5 Focused Feasibility Study.

Response E.7. See response to General Comment 5 and Response E.6 above. The O&M plan update will be designed to address the conceptual site model for groundwater contamination in the 300-FF-5 Operable Unit. The update may include requirements to install additional monitoring wells and perform specific analyses of natural attenuation processes. The O&M plan is a primary document under the TPA and must be approved by EPA.

Comment E.8. Updating the 300-FF-5 Operable Unit O&M plan will only establish monitoring criteria to be performed at certain groundwater monitoring wells. The majority of 300-FF-2 Operable Unit source sites do not have dedicated groundwater monitoring networks and as such, unit-specific groundwater monitoring will not occur.

Response E.8. The O&M plan update will be designed to address the conceptual site model for groundwater contamination in the 300-FF-5 Operable Unit. The update may include requirements to install additional monitoring wells and perform specific analyses of natural attenuation processes. The O&M plan is a primary document under the TPA and must be approved by EPA.

Comment E.9. The proposed plan does not indicate that unit-specific groundwater monitoring for the land-based source sites (i.e., burial grounds, cribs, dump sites, surface impoundments, landfills, waste piles, etc.) will be performed. For example, the 618-10 Burial Ground does not have a dedicated groundwater monitoring network.

Response E.9. See response E.8. above.

Comment E.10. Because groundwater remediation and source site remediation activities have been separated, this approach does not satisfy applicable MTCA requirements or relevant and appropriate RCRA requirements.

Response E.10. See response to General Comment 5. MTCA and RCRA are identified as ARARs for the selected remedy and the Tri-Parties believe that the goals and requirements of both statutes are being met by the selected remedy in the 300-FF-2 ROD.

Comment E.11. The Proposed Plan defers groundwater evaluation and remediation to the 300-FF-5 Operable Unit, and as such, does not satisfy applicable MTCA ARARs for justifying the stated "reasonably anticipated" future use scenario.

Response E.11. See response E.10 above.

Comment E.12. The plan defers groundwater clean-up requirements to 300-FF-5 Operable Unit ROD with almost no justification for separating out the groundwater from the source term. This same strategy of separating out groundwater occurred in the 100 Areas and Columbia Riverkeeper (formerly Columbia River United) objected to this myopic approach to clean-up. Groundwater should not be separated, this approach allows for even more delays in remediating the groundwater and allows for potentially even less clean-up.

Response E.12. See response to General Comments 1 and 5.

Comment E.13. The inclusion of groundwater directly beneath the two TRU Burial Grounds and beneath the seven Outlying Source Sites is not supported by the groundwater contamination investigation/characterization performed for the 300-FF-5 Operable Unit. The 300-FF-5 Operable Unit investigations primarily focused on uranium groundwater contamination near the 300-FF-1 Operable Unit and the 300 Area Complex. The 300-FF-5 Operable Unit investigation is an inadequate investigation and/or characterization on which to base groundwater remedial decisions associated with the two TRU Burial Grounds and the seven Outlying Source Sites.

Response E.13. See response to General Comment 5 and Response E.6 above.

Comment E.14. The inclusion of groundwater directly beneath the two TRU Burial Grounds and beneath the seven Outlying Source Sites is not supported by the groundwater contamination investigation performed for the 300-FF-5 Operable Unit. The updating of the 300-FF-5 Operable Unit O&M will not achieve the aquifer contamination investigation/characterization that was performed by the 300-FF-5 Focused Feasibility Study.
Response E.14. See response to General Comment 5 and Response E.6 above.

Comment E.15. The proposed plan does not indicate that unit-specific groundwater monitoring for the land-based source sites (i.e., burial grounds, cribs, dump sites, surface impoundments, landfills, waste piles, etc.) will be performed. For example, the 618-10 Burial Ground does not have a dedicated groundwater monitoring network. In addition, very little unit-specific source site characterization has been performed for the land-based units.

Response E.15. The O&M plan update will be designed to address the conceptual site model for groundwater contamination in the 300-FF-5 Operable Unit. The update may include requirements to install additional monitoring wells and perform specific analyses of natural attenuation processes. The O&M plan is a primary document under the TPA and must be approved by EPA. Ongoing groundwater monitoring is reported annually in the *Hanford Site Environmental Report* published by the Department of Energy Richland Operations Office for each calendar year.

Comment E.16. Because groundwater remediation and source site remediation activities have been separated, this approach does not satisfy applicable MTCA requirements or relevant and appropriate RCRA requirements.

Response E.16. See Response E.10 above.

Category F – Site Characterization

Comment F.1. Limited unit-specific source unit and/or contamination characterization has been performed on the 300-FF-2 Operable Unit source sites. Uranium leachability studies have not been performed. Defending a clean-up scenario prior to adequate characterization or leachability study is premature and scientifically un-defensible.

Response F.1. See response to General Comment 2.

Comment F.2. Deferring waste characterizations and other actions via the "observational approach" may cut short-term costs but will likely generate a morass of Tri-Party Agreement (TPA) meetings and negotiations that will delay cleanup, escalate costs and deprive the public of its notice and participation rights.

Response F.2. Use of the "Observational Approach" at Hanford has allowed large volumes of contaminated soil and debris to be excavated and disposed in a cost-effective manner by combining aspects of site characterization and remediation in one step. This has led to efficiencies that are resulting in extremely cost-effective remediation practices (e.g., it is costing only $60/ton (approximate) to excavate, transport, and dispose of contaminated material at ERDF). The Tri-Parties have established a process for managing the implementation of the observational approach and it has not caused a delay in the cleanup process to date. The public will be notified of any significant or fundamental changes in the cleanup approach through appropriate CERCLA decision documentation (e.g., ESDs, ROD amendments) all of which are maintained in the Administrative Record. Final sampling data and site-specific excavation summaries are also available through the Administrative Record in Cleanup Verification Packages for individual waste sites.

Category G – Cleanup Levels

Comment G.1. Model Toxics Control Act (MTCA) human-health based risk levels are an applicable regulation at the site and must be applied and incorporated into the cleanup plan. Risk at least as stringent as the 10-5 level is applicable for final cleanup levels. These risk levels are applied throughout the state and at other state lead NPL sites. Making exceptions for Hanford is neither equitable nor adequate.

Response G.1. The methods prescribed by MTCA are being used to establish cleanup objectives for chemical contaminants in this ROD. However, standard MTCA equations do not take into account many pathways associated with radionuclide exposure, including the very significant "external exposure" pathway. To date, the State of Washington has not applied MTCA to radioactive contaminants in soil. A policy development initiative is currently underway. Therefore, remedial action objectives for radionuclides are based on the *National Oil and Hazardous Substances Contingency Plan* (40 CFR 300). The NCP establishes that CERCLA cleanups should generally achieve a level of risk within the 10^{-4} to 10^{-6} carcinogenic risk range based on the reasonable maximum exposure for an individual. Further EPA policy has noted that the upper boundary of the risk range is not a discrete line at 10^{-4} and that a specific risk estimate around 10^{-4} may be considered acceptable, if justified based on site-specific conditions. The goal of remediation is to achieve the 10^{-4} to 10^{-6} risk range, using a dose of 15 mrem/yr above background as an operational guideline to achieve this goal. Demonstration that the 10^{-4} to 10^{-6} residual risk range goal has been achieved will be accomplished through final verification sampling during closeout of a site.

Comment G.2. The plan's stated intent (pg. 17, 1st paragraph) was that the most restrictive value be identified and selected as a PRG protective of all pathways. This intent has not been met. The final preliminary remediation goal values identified for direct exposure or ground water protection are not protective of all pathways for many constituents in the preliminary remediation goals (Tables 3a, 3b, the Plan, pgs. 18-19).

Response G.2. See response to General Comment 2. The groundwater cleanup objective for the 300 Area is still the same as it was in the 300-FF-5 ROD: Restoration of the contaminated aquifer to drinking water standards. For mobile contaminants in the 300-FF-2 Operable Unit, soil cleanup levels protective of groundwater and the Columbia River are based upon the MTCA Method B "100 times rule" (WAC 173-340-740) or upon MTCA Method A (WAC 173-340-745). Drinking water standards are being used as the basis for determining whether or not soil cleanup levels will be protective of groundwater quality because the aquifer is considered to be a potential drinking water source (pursuant to the 300-FF-5 ROD) even though MTCA Method C (WAC 173-340-745) is being used as the basis for direct contact cleanup levels for non-mobile chemicals under the industrial land use scenario and groundwater consumption is not part of the reasonable maximum exposure scenario for 300-FF-2. 300-FF-2 cleanup levels are described in Section VIII of the ROD and Appendix F of the FFS.

Comment G.3. The preliminary remediation goals for direct exposure are not consistent with the Remedial Action Objective-2 (Table 2, pg. 17, the plan) to prevent migration of contaminants through soil column to ground water. For example, the most restrictive value for uranium is not identified and should be. The selected value in the table for uranium (soluble salts) is 505 mg/kg with the following restriction: before implementation of remedial actions, the 505 mg/kg will be verified as protective (will not migrate to the ground water in 1000 years) through leach studies (Table 3(a) footnote j). Uranium has a half-life of 4.47 billion years and **has already** impacted ground water in the 300 Area and 300-FF-2 uranium source sites are **currently** impacting ground water. The 300 Area is close to the Columbia River and the city of Richland. The contaminated groundwater emanating from the 300 Area source sites is hydrologically close to at least one of the city of Richland's municipal drinking water wells. The applicable MTCA Method C soil cleanup value (protective of groundwater) of 10.5 mg/kg must be satisfied.

Response G.3. See response to General Comment 2. Modeling of uranium transport from soil to groundwater, based on studies by Pacific Northwest Laboratory, have determined that soluble salts of uranium are not predicted to reach groundwater within 1,000 years under normal conditions of precipitation, runoff, and evapotranspiration of soil moisture in the 300 Area (i.e., the cleanup level has been demonstrated to be protective of groundwater). Prior technical documents developed in support of the 300-FF-5 ROD and ongoing groundwater monitoring as required by the 300-FF-5 O&M plan has demonstrated that the primary source of uranium found in the groundwater of the 300-FF-5 Operable Unit originated from sites in the 300-FF-1 Operable Unit (300 Area process trenches, North Process Pond, and South Process Pond) where significant amounts of contaminated liquids were disposed, carrying contaminants to groundwater. The remaining 300-FF-2 waste sites are considered to be secondary sources of the uranium plume in the 300 Area. The presence of this contaminant plume in the groundwater is making it difficult to conclusively demonstrate that the soil cleanup activity is protective of groundwater. A more comprehensive assessment of the fate and transport of uranium in the 300 Area is currently being performed. This additional data will validate the current cleanup level (350 pCi/L or 505 mg/kg) or indicate that additional measures are required to protect groundwater quality.

Comment G.4. Under MTCA, impacts to ground water from soil or source sites requires a soil value protective of ground water to be identified. For example, Washington State's protocol dictates that the Method C soil value for uranium in the plan of 10.5 mg/kg (or Method B soil value of 4.80 mg/kg) is the starting value (not 505 mg/kg). A scientifically defensible demonstration is required to justify the protectiveness of using a higher cleanup value not visa versa. This protocol is consistent with other MTCA cleanup actions throughout Washington State. Failing to adopt and implement this protocol leads to uneven justice and ultimately, a violation of MTCA.

Response G.4. See Response G.3.

Comment G.5. The plan needs to acknowledge ground-surface water interactions. Ground water containing contaminants released to surface water needs to meet the surface water standard. If the surface water standard is more restrictive than the ground water standard then the ground water standard must be adjusted downward to meet the more restrictive surface water standard. This possibility is not discussed or accounted for in the plan.

Response G.5. The most restrictive standard, surface water or groundwater, is used to determine soil cleanup levels for mobile contaminants. Details of this nature are discussed in the companion document to the Proposed Plan, the *Focused Feasibility Study for the 300-FF-2 Operable Unit,* DOE/RL-99-40, which is included in the Administrative Record.

Comment G.6. The DOE has spoken of taking down all fences in the 300 area. This can only happen if they clean the site to a residential use standard. I believe that this might be an impossible choice for the cleanup level of the 300 Area.

Response G.6. Institutional controls must be established to restrict human exposure to the parameters described in the industrial land use scenario. DOE is currently in the process of developing a site-wide institutional controls plan, pursuant to the action items contained in "*USDOE Hanford Site: First Five-Year Review*."

<u>Category H – Public Involvement</u>

Comment H.1. Although the "Proposed Plan for the 300-FF-2 Operable Unit" (DOE/RL-99-53, Rev. 0) identifies that groundwater monitoring will be conducted, it does not commit to conducting unit-specific groundwater monitoring for all land-based source sites. Similarly, it does not commit to conducting unit-specific source-site characterization for the land-based units prior to removal activities. As a result, it appears that remediation decisions for the land-based units are being made with little supporting unit-specific characterization information. It appears that some of the characterization will be completed using the proposed "observational approach" (page 21) whereby the waste will be characterized as the cleanup proceeds. This approach effectively excludes the public from any participation in, or scrutiny over, the quality of the waste characterizations and associated clean-up actions.

Response H.1. The *Operations and Maintenance Plan for the 300-FF-5 Operable Unit* describes the objectives and groundwater monitoring requirements for the groundwater beneath the 300-FF-2 Operable Unit. Cleanup Verification Packages for individual waste sites will be available in the Administrative Record. Because this is an Interim ROD, a Final Record of Decision must be written to document completion of the cleanup before the 300 Area NPL site can be closed out, providing additional opportunities for public input and comment.

Comment H.2. It appears that some of the characterization will be completed using the proposed "observational approach" (page 21) whereby the waste will be characterized as the cleanup proceeds. This approach effectively excludes the public from any participation in, or scrutiny over, the quality of the waste characterizations and associated clean-up actions.

Response H.2. The Tri-Parties have established a process for managing the implementation of the observational approach. Minor decisions are made on a regular basis and documented in Unit Manager Meeting minutes, which are available in the Administrative Record. Any significant or fundamental changes in the cleanup approach must have appropriate CERCLA decision documentation (e.g., ESDs, ROD amendments) and must undergo appropriate public involvement procedures. Final sampling data and site-specific excavation summaries are also available in Cleanup Verification Packages for individual waste sites. Finally, because this is an Interim ROD, a Final Record of Decision must be written to document completion of the cleanup before the 300 Area NPL site can be closed out. This will provide an additional opportunity for public input and comment.

Comment H.3. It is vital that the regulatory agencies and USDOE provide the public, Tribes, and natural resource trustees with a comprehensive review opportunity for 300 Area remedial action decisions – rather than a piecemeal decision process (especially in light of a recent mass mailed proposal from USDOE, which seeks support for specific land use and remediation goals for the 300 Area).

Response H.3. Meetings of the Hanford Advisory Board, recurrent public meetings discussing the Hanford Site cleanup, and meetings requested by the public to provide input all provide review opportunities. Because this is an Interim ROD, a Final Record of Decision must be written to document completion of the cleanup before the 300 Area NPL site can be closed out providing additional opportunities for public input and comment.

Comment H.4. Given major proposals for the future of the 300 Area, it is vital that agencies meet their obligation to consider cumulative impacts, and provide the public, Tribes, natural resource trustees, and adjacent local governments a comprehensive review opportunity to review the 300 Area remedial action decisions. The current piecemeal approach has deprived the public of this opportunity.

Response H.4. See Response H.3 above. A complete risk assessment that evaluates the impact of residual contamination on all human and ecological exposure pathways will also be performed in support of the final ROD for the 300-FF-2 Operable Unit.

Category I – Protection of Human Health

Comment I.1. As drafted, the proposed RAO's do not agree with risk numbers used to assess waste units. Any human health risk from waste sites/soil must be evaluated against the more stringent risk value of $1X10^{-5}$. The assessment is not consistent with the proposal and FFS document's upper bound risks. MTCA human-health based risk levels are an Applicable regulation at the site.

Response I.1. The methods prescribed by MTCA are being used to establish cleanup objectives for chemical contaminants in this ROD (i.e., the cleanup will achieve the MTCA risk endpoint of 1×10^{-5}). However, standard MTCA equations do not take into account many pathways associated with radionuclide exposure, including the very significant "external exposure" pathway. To date, the State of Washington has not applied MTCA to radioactive contaminants in soil. A policy development initiative is currently underway. Therefore, remedial action objectives for radionuclides are based on the *National Oil and Hazardous Substances Contingency Plan* (40 CFR 300). The NCP establishes that CERCLA cleanups should generally achieve a level of risk within the 10^{-4} to 10^{-6} carcinogenic risk range based on the reasonable maximum exposure for an individual. Further EPA policy has noted that the upper boundary of the risk range is not a discrete line at 10^{-4} and that a specific risk estimate around 10^{-4} may be considered acceptable, if justified based on site-specific conditions. The goal of remediation is to achieve the 10^{-4} to 10^{-6} risk range, using a dose of 15 mrem/yr above background as an operational guideline to achieve this goal. Demonstration that the 10^{-4} to 10^{-6} residual risk range goal has been achieved will be accomplished through final verification sampling during closeout of a site.

Comment I.2. Risk at least as stringent as the 10^{-5} level is applicable for final cleanup levels. These risk levels are applied throughout the state and at other state lead NPL sites. A ROD with cancer risk levels for workers that do not meet state acceptable risk has no business being created by parties responsible for the clean-up of the 300 area.

Response I.2. See Response I.1 above.

Comment I.3. In Table 2, pg. 17 of the proposed plan, RAO 1 establishes risk base criteria or ARARs for direct exposure to waste or soil and limits for cleanup in the field for chemicals. RAO selected for direct exposure to waste or soil for chemicals are MTCA industrial soil cleanup standards (340-745) with a cumulative risk of 10^{-5}. On Page 13 of the proposed plan, potential risk assessment for waste sites is **in direct disagreement to above** RAO numerical risk for industrial exposure (with restricted ground water use) for chemicals in wastes or soil. "The reasonable maximum exposure scenario evaluated for the 300-FF-2 waste sites is the industrial scenario, which assumes that direct exposure to contaminants could occur with industrial use of the site and that groundwater use is restricted through the use of institutional controls." A four-step process is presented to estimate the likelihood of health problems occurring if no cleanup actions are taken at a given site from chemicals and radionuclides : "Risks associated with the reasonable maximum exposure at the 300-FF-2 Operable Unit waste sites are summarized in Table 1. Under **the industrial scenario** each of the general content burial grounds and source waste sites are projected to present a risk greater than 10^{-4}." Any human health risk from waste sites/soil must be evaluated against the more stringent risk value of $1X10^{-5}$. The assessment is not consistent with the proposal and FFS document's upper bound risks.

Response I.3. The Proposed Plan states that cleanup is justified because existing general content burial grounds and source waste sites are projected to present a risk greater than 10^{-4} under the industrial scenario. Cleanup is projected to remove existing contamination and reduce risk to allow the RAOs to be met.

Category J – Cleanup Schedule/Budget

Comment J.1. There must be regulatory agreement (TPA Milestones) in place which correspond to the order in which cleanup and D&D will be done.

Response J.1. A schedule and plan for completing the cleanup of the 300 Area will be established by June 30, 2002 as part of the M-16-03A TPA Milestone. The scope of the cleanup will involve deactivation, decontamination, and decommissioning of facilities and cleanup of soil waste sites in the 300-FF-2 Operable Unit.

Comment J.2. There should be adequate budget in place to address the needs of long-term monitoring.

Response J.2. The TPA obligates DOE to take all necessary steps to integrate Hanford programs and to obtain timely funding in order to fully meet it's obligations under the TPA and to work with EPA and the Ecology to reach agreement on adjustments in work scope or milestones if funding shortfalls exist. If agreement cannot be reached, EPA and Ecology reserve the right to take appropriate action.

Comment J.3. I want to see realistic points of compliance adhered to in the 300 Area. Only if they are coupled with TPA milestones to drive those goals will we have assurance that cleanup will be met.

Response J.3. A schedule and plan for completing the cleanup of the 300 Area will be established by June 30, 2002 as part of the M-16-03A TPA Milestone. The scope of the cleanup will involve deactivation, decontamination, and decommissioning of facilities and cleanup of soil waste sites in the 300-FF-2 Operable Unit.

Comment J.4. I am not at all sure that managing the site for "outcomes"-end states, is at all realistic right now. It took years to make this mess. Unfortunately waste will need to be managed for years. There is still an enormous need for Science and Technology needs to address the cleanup – especially 618-10 and 618-11. Until we can quantify the volumes and types of waste and address the S&T needs, we cannot bound the budgetary requirements for the mitigation.

Response J.4. The advantage of the observational approach has proven to be the flexibility allowed by characterization as remediation continues to establish waste profiles and determine when cleanup is complete.

Category K - Other

Comment K.1. It will be impossible to remove the 300 Area from the NPL listing unless 618-10 and 11 are remediated.

Response K.1. A partial NPL site deletion for portions of the 300 Area that have been completed will be possible prior to the completion of 618-10 and 618-11 if cleanup objectives have been achieved. Full deletion of the 300 Area NPL site will not be possible until the 618-10 and 618-11 burial grounds have been remediated.

Comment K.2. In past records of decisions, we were told that these were interim ROD's. This document reads like it is not an interim ROD. We need clarification. Is this proposed ROD a final or interim ROD?

Response K.2. As stated, this is an interim Record of Decision. A final ROD will be required for final cleanup of the 300 Area NPL site. A complete risk assessment that evaluates the impact of residual contamination on all human and ecological exposure pathways will also be performed in support of the final ROD for the 300-FF-2 Operable Unit.

Comment K.3. In the proposal, **direct exposure** to solid wastes and contaminated soils is considered **the primary** exposure pathway for humans with ingestion and inhalation as secondary and "other" are considered "incomplete or inconsequential." Ecological receptors primary exposure pathway is from **direct exposure** to contamination, soil, through physical/biological processes. (Pg. 13). The major disconnect of evaluating human health and environment impacts/risk in the context of the direct exposure pathway only and excluding ground water is retained in sections of the document. All pathways must be evaluated concurrently to truly assess threat to human health and the environment as set forth in MTCA. To date, EPA has demonstrated an unwillingness to evaluate all pathways concurrently and this action undermines Washington state laws.

Response K.3. See response to General Comment 2. A complete risk assessment that evaluates the impact of residual contamination on all human and ecological exposure pathways will also be performed in support of the final ROD for the 300-FF-2 Operable Unit.

Comment K.4. The plan states that "Final remedies for the 300-FF02 Operable Unit waste sites will be selected only after review and consideration of all information submitted during the public comment period (page 1, column 2, paragraph 2)." Based on this, the public cannot ascertain whether the resulting Record of Decision (ROD) will be final or interim. The plan must define if the resulting ROD will be final, interim, or some combination of final and interim. In addition, the plan should provide justification for the issuance of a final, interim, and/or a combination of final and interim ROD.

Response K.4. As stated, this is an interim Record of Decision. A final ROD will be required for final cleanup of the 300 Area NPL site. A complete risk assessment that evaluates the impact of residual contamination on all human and ecological exposure pathways will also be performed in support of the final ROD for the 300-FF-2 Operable Unit.