

RECORD OF DECISION

HANFORD 200 AREA

SUPERFUND SITE

200-CW-5 AND 200-PW-1, 200-PW-3, AND 200-PW-6

OPERABLE UNITS

September 2011

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PART I: DECLARATION OF THE RECORD OF DECISION

1.0 Site Name and Location

USDOE Hanford 200 Area

200-CW-5, 200-PW-1, 200-PW-3 and 200-PW-6 Operable Units

Benton County, Washington

CERCLIS ID: #WA 1890090078

2.0 Statement of Basis and Purpose

This decision document presents the Selected Remedy for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units (OUs), which are part of the Hanford Site, 200 Area, in Benton County, Washington.

The selected remedy was 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)*, the *Hanford Federal Facility Agreement and Consent Order* (also known as the Tri-Party Agreement), and, to the extent practicable, the “National Oil and Hazardous Substances Pollution Contingency Plan” (40 *Code of Federal Regulations [CFR] 300*) (National Contingency Plan [NCP]). This decision is based on the Administrative Record file for these operable units.

The State of Washington, through the Washington State Department of Ecology (Ecology), concurs with the selected remedy.

3.0 Assessment of Site

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

4.0 Description of Selected Remedy

4.1 Overall Site Cleanup Strategy

The Central Plateau (200 Area National Priorities List [NPL] site) encompasses approximately 75 mi² near the center of the Hanford Site and contains multiple waste sites, contaminated facilities, and groundwater contamination plumes. To facilitate cleanup, these waste sites, facilities, and groundwater plumes are grouped by geographic areas, process types, or cleanup components into multiple OUs. The Central Plateau has been organized into two areas:

- **The Inner Area** is approximately 10 mi² (26 km²) in the middle of the Central Plateau encompassing the region where chemical processing and waste management activities occurred. Cleanup levels for the Inner Area are expected to be based on industrial land use.
- **The Outer Area** is greater than 65 mi² (168 km²) and includes much of the open area on the Central Plateau where limited processing activity occurred. Cleanup levels in the outer area are expected to be

comparable to those being used for waste sites along the Columbia River (River Corridor), which is currently based on residential land use, except for the 300 Area, which is industrial land use.

This ROD presents the selected final remedial action for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs which are part of the overall soil remediation effort in the Inner Area. The 200-CW-5, 200-PW-1, and 200-PW-6 OUs are located in the 200 West Area and the 200-PW-3 OU is located in the 200 East Area. Groundwater located beneath these OUs in the 200 West Area is being addressed through separate CERCLA processes for the 200-ZP-1 and 200-UP-1 groundwater OUs. The remaining Inner Area waste sites and 200 East groundwater OUs will be addressed under separate CERCLA processes for the appropriate OUs.

4.2 Principal Threat Wastes at the Site

Principal threat waste is defined as 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. They include soils containing significant concentrations of highly toxic materials and surface or subsurface soils containing high concentrations of contaminants that are, or potentially are mobile due to wind entrainment, volatilization, surface runoff, or sub-surface transport.

In these OUs, the soils contaminated with significant concentrations of plutonium or cesium radionuclides are considered principal threat wastes since they are highly toxic contaminants. The NCP Section 300.430(a)(1)(iii)(A) establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable. However, there is no feasible technology to practicably treat radionuclides that will not result in larger volumes, creating greater impracticability for disposal. The amount of waste disposed is a limiting factor since plutonium waste generated at 200-PW-1 and 200-PW-6 waste sites will include transuranic waste, which will be disposed at the Waste Isolation Pilot Plant (WIPP), a half-mile deep repository in southern New Mexico that has limited capacity. The contaminated soils will be packaged appropriately for on-site disposal at the Hanford Site Environmental Restoration Disposal Facility (ERDF) or for off-site disposal at the (WIPP), as appropriate. DOE and EPA have determined that the waste remaining in place will not pose an unacceptable risk to human health or the environment.

4.3 Major Components of the Selected Remedy

The selected remedy for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs addresses soils and subsurface disposal structures, two settling tanks, and associated pipelines contaminated primarily with plutonium and cesium. Also, structures and other debris that must be removed in order to conduct required remediation will be excavated. A brief description of the major components of the selected remedy is provided below.

4.3.1 Removal, Treatment, and Disposal of Contaminated Soil and Debris

Removal, Treatment (as needed) and Disposal (RTD) of soil and debris to the specified depths or specified cleanup levels will be used to address plutonium-contaminated soils and subsurface structures and debris. This consists of: (1) removing a portion of contaminated soil, structures, and debris; (2) treating these removed wastes as required to meet disposal requirements at ERDF, which is located on the Hanford Site, or waste acceptance criteria for off-site disposal at WIPP; and (3) disposal at ERDF or WIPP. The selected pipelines associated with these OUs will also be excavated and disposed at ERDF. Cleanup levels have been selected which are protective of groundwater and the current and reasonably expected future industrial land use. The remedy is summarized further in the bullets below.

- The 200-CW-5 OU, also known as the Z-Ditches, will use the RTD approach to excavate contaminated soils and debris exceeding cleanup levels to a depth of 15 ft below ground surface (bgs) with disposal at ERDF or WIPP, as appropriate.
- Three of the six 200-PW-1 waste sites, also known as the High-Salt Waste Group, will use the RTD approach to excavate contaminated soils and debris located to a minimum of 2 feet below the bottom of the disposal structure (20 ft – 23 ft bgs), with disposal at WIPP or ERDF, as appropriate. After the excavations are filled, an evapotranspiration barrier will be constructed over the remaining waste in these waste sites.
- The 200-PW-6 OU and three of the six 200-PW-1 waste sites, also known as the Low-Salt Waste Group, will use the RTD approach to excavate contaminated soils and debris to a depth of 22 ft to 33 ft bgs, with disposal at ERDF or WIPP, as appropriate. After the excavations are filled, an evapotranspiration barrier will be constructed over remaining waste in these waste sites.

4.3.2 Soil Vapor Extraction

A soil vapor extraction (SVE) system was implemented as an expedited response action to remove and treat carbon tetrachloride contamination in the vadose zone at waste sites in the High-Salt Waste Group. The system has been operating since 1992 and has been effective in removing and treating carbon tetrachloride. SVE is being incorporated into the selected remedy. The system will continue to be used until vadose zone cleanup levels are met.

4.3.3 Soil Covers

Soil covers will be used to provide coverage to a depth of at least 15 feet over cesium-contaminated soils. This consists of enhancing the existing soil cover with additional backfill where necessary to provide a minimum of 15 feet of soil cover at each of the waste sites and then maintaining the soil cover.

- The 200-PW-3 OU, also known as the Cesium-137 Waste Group, will require that three of the five waste sites receive additional backfill to achieve coverage of at least 15 feet depth. Contamination at the other two waste sites is deeper than 15 feet from the ground surface and will not require additional backfill.

4.3.4 Institutional Controls

Institutional controls and long-term monitoring will be required for waste sites in the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs where contamination is left in place and precludes an unrestricted land use. These institutional and land use controls will be required to ensure that activities are consistent with and restricted to the reasonably anticipated future industrial land uses for the Inner Area of the Central Plateau. The Department of Energy (DOE) is responsible for implementing, maintaining, reporting on, and enforcing the institutional and land use controls required under this ROD. Although DOE may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or through other means, DOE shall retain ultimate responsibility for remedy integrity and institutional controls.

5.0 Statutory Determinations

Under CERCLA Section 121 and the NCP Section 300.430(f)(5)(ii), the lead agency must select remedies that are protective of human health and the environment and comply with applicable or relevant and appropriate requirements (ARARs) (unless a statutory waiver is justified), are cost-effective, and use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous

substances, pollutants, or contaminants as a principal element, and a bias against off-site disposal of untreated wastes.

The Selected Remedy for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. The Selected Remedy also utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable. The remedy for these OUs does not satisfy the statutory preference for treatment as a principal element of the remedy because there is no feasible technology to practicably treat radionuclide contamination that will not result in larger volumes, creating greater impracticability for disposal. The amount of waste disposed is a limiting factor since plutonium waste generated at 200-PW-1 and 200-PW-6 waste sites will include transuranic waste, which will be disposed at the WIPP, a half-mile deep repository in southern New Mexico that has limited capacity. The contaminated soils will be packaged appropriately for on-site disposal at ERDF or for off-site disposal at WIPP, as appropriate.

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action (and at 5 year intervals thereafter), in accordance with CERCLA Section 121(c) and NCP Section 300.430(f)(4)(ii), to ensure that the remedy is, or will be, protective of human health and the environment.

6.0 ROD Data Certification Checklist

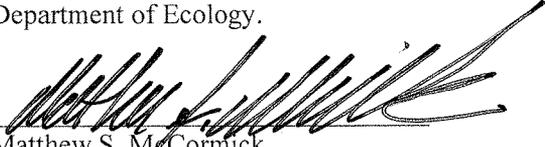
The information outlined in Table 1 is included in the Decision Summary (Part II) of this ROD. Additional information can be found in the Administrative Record for these OUs.

Table 1. 200-CW-5, 200-PW 1, 200-PW-3, and 200-PW-6 OUs ROD Data Certification Checklist

Information	Location in ROD
Contaminants of Concern (COCs) and their respective concentrations	Section 7
Baseline risk represented by the COCs	Section 7
Cleanup levels established for COCs and the basis for these levels	Table 35
How source materials constituting principal threat wastes are addressed	Section 11
Current and reasonably anticipated future land use and current and potential future beneficial uses of groundwater	Section 6
Potential land and groundwater use that will be available at the site as a result of the selected remedy	Section 6
Estimated capital, annual operations and maintenance, and total present value costs, discount rate, and the number of years over which the remedy cost estimates are projected	Section 12.3
Key factors that led to selecting the remedy	Section 12.1

7.0 Authorizing Signatures

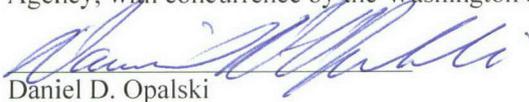
USDOE Signature for the Record of Decision for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs at the USDOE Hanford 200 Area Site. The Record of Decision is selected by the U.S. Department of Energy and the U.S. Environmental Protection Agency, with concurrence by the Washington State Department of Ecology.



Matthew S. McCormick
Manager, Richland Operations Office
U.S. Department of Energy

9/30/2011
Date

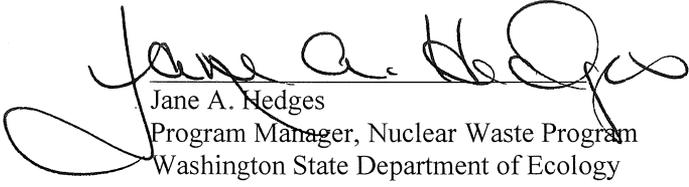
USEPA Signature for the Record of Decision for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs Remedial Action selected by the U.S. Department of Energy and the U.S. Environmental Protection Agency, with concurrence by the Washington State Department of Ecology.



Daniel D. Opalski
Director, Office of Environmental Cleanup, Region 10
U.S. Environmental Protection Agency

9/30/2011
Date

State Signature for the Record of Decision for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs
Remedial Action selected by the U.S. Department of Energy and the U.S. Environmental Protection
Agency, with concurrence by the Washington State Department of Ecology.


Jane A. Hedges
Program Manager, Nuclear Waste Program
Washington State Department of Ecology

10/3/11
Date

PART II: DECISION SUMMARY

This Decision Summary provides an overview of the site characteristics, alternatives evaluated, and the analysis of those alternatives for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs at the Hanford Site. It also identifies the selected remedy for these OUs and explains how the remedy fulfills statutory and regulatory requirements. Although some of the information in the Decision Summary is similar to that in the Declaration, this section discusses the topics in more detail and provides the rationale for the “summary declarations.” This section is based on the information that is available in the Administrative Record for these OUs.

1.0 Site Name, Location, and Brief Description

The U.S. Department of Energy’s (DOE’s) Hanford Site is a 586 mi² (1,527 km²) Federal facility located in southeastern Washington State along the Columbia River. The Hanford Site is situated north and west of the cities of Richland, Kennewick, and Pasco, an area commonly known as the Tri-Cities. This region includes the Tri-Cities and the surrounding communities in Benton, Franklin, and Grant Counties. For administrative purposes, the Hanford Site was divided into four National Priority List (NPL) sites under CERCLA, one of which is the 200 Area. The CERCLA site identification number for the 200 Area is WA 1890090078. The 200 Area is composed of the 200 West Area and 200 East Area as shown in Figure 1. Also referred to as the Central Plateau, the 200 Area is located on an elevated, flat area, where there are no wetlands, perennial streams, or floodplains. 200-CW-5, 200-PW-1, and 200-PW-6 OUs are located in the 200 West Area and the 200-PW-3 OU is located in the 200 East Area.

The DOE is the lead agency for remediation of these OUs. The U.S. Environmental Protection Agency (EPA) is the lead regulatory agency for remediation of these OUs, as identified in Section 5.6 and Appendix C of the *Hanford Federal Facility Agreement and Consent Order*.

The 200 Area contains approximately 800 waste sites and includes waste management facilities and inactive irradiated nuclear fuel reprocessing facilities. The twenty-one waste sites in these OUs are associated with subsurface liquid waste handling and disposal at sites that were engineered and constructed to receive liquid waste and discharge it into the soil beneath the sites. These facilities are primarily the Plutonium Finishing Plant (PFP) and the Plutonium and Uranium Extraction Plant (PUREX). Pipes conveyed the liquid waste from nuclear processing facilities to the waste sites. Table 2 lists the OUs and their respective waste sites as well as the waste groups used to identify the types of waste they received.

2.0 Site History and Enforcement Activities

This section provides background information on past activities at the Hanford Site that have led to the current contamination at the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs. In addition, this section contains information on how CERCLA has been applied to the cleanup of these OUs.

2.1 Site Operational History

From 1943 to 1990, the primary mission of the Hanford site was the production of nuclear materials for national defense. Operations at the Hanford Site included nuclear fuel manufacturing, reactor operations, fuel reprocessing, chemical separation, plutonium and uranium recovery, processing of fission products, and waste partitioning. Large volumes of liquid waste were generated from the processing of plutonium at various processing and finishing plants in the 200 Area. This process wastewater was discharged to waste sites in the 200-PW-1, 200-PW-3, and 200-PW-6 OUs. The processes were intended to recover as much plutonium as possible prior to discharge of the waste liquids, but the waste streams still contained low levels of plutonium and other contaminants.

Figure 1. Hanford Site with Inner and Outer Area

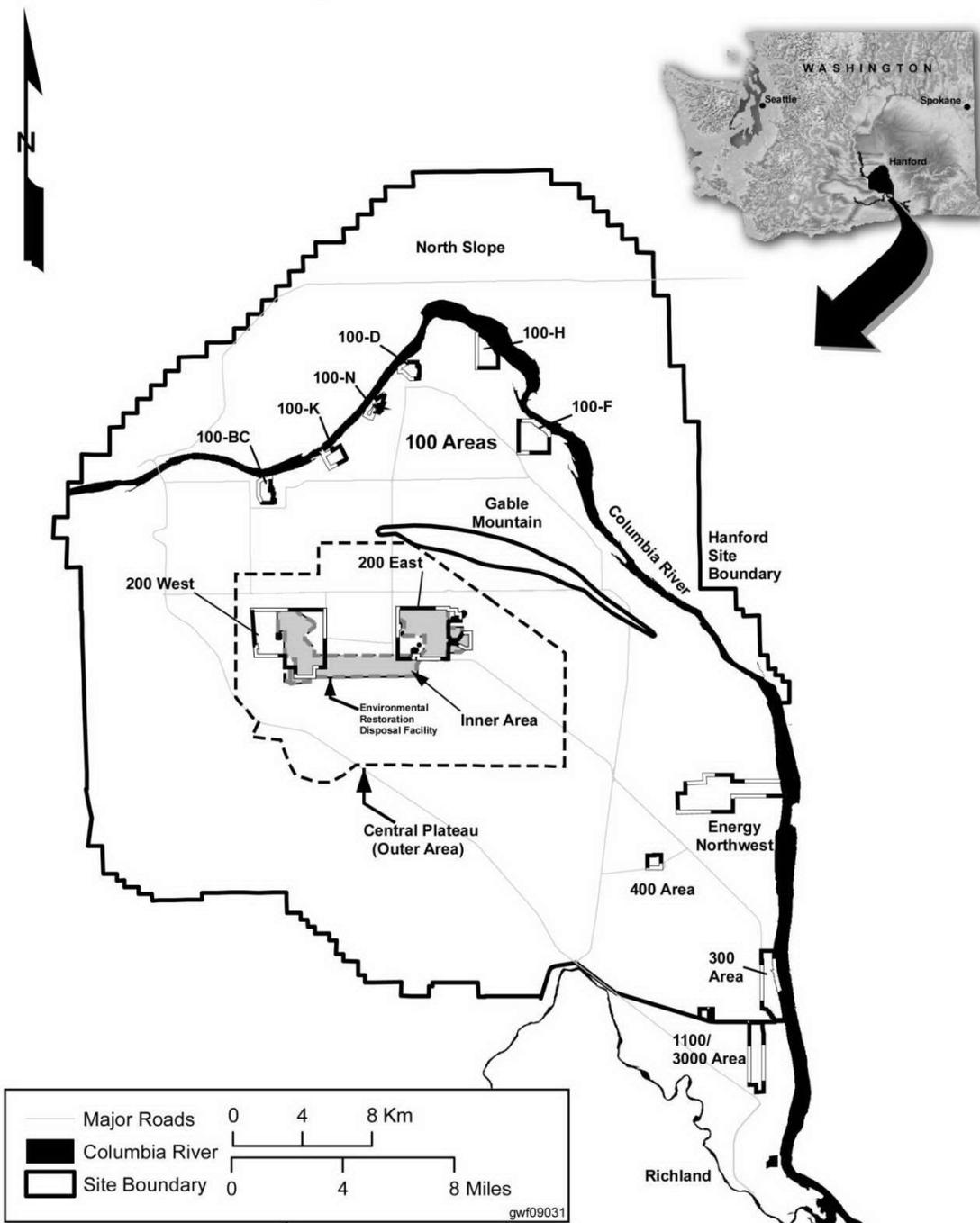


Table 2. Summary of Waste Sites Assigned to Each Waste Group

Operable Unit	Waste Site	Waste Group	Primary Contaminants
200-CW-5	216-Z-1D Ditch, North and South 216-Z-11 Ditch 216-Z-19 Ditch 216-Z-20 Tile Field UPR-200-W-110 Unplanned Release (200-W-207-PL Pipeline)	Z-Ditches	plutonium 239/240, americium-241, cesium-137, radium-226, strontium-90, boron, mercury, PCBs
200-PW-1	216-Z-1A Tile Field 216-Z-9-Trench 216-Z-18 Crib (200-W-174-PL Pipeline) (200-W-206-PL Pipeline)	High-Salt	plutonium 239/240, americium-241, carbon tetrachloride, methylene chloride
200-PW-1 200-PW-6	216-Z-1&2 Crib 216-Z-3 Crib 216-Z-12 Crib 216-Z-5 Crib (200-W-208-PL Pipeline) (200-W-210-PL Pipeline)	Low-Salt	plutonium 239/240, americium-241
200-PW-1 200-PW-6	241-Z-361 Settling Tank 241-Z-8 Settling Tank (200-W-205-PL Pipeline) (200-W-220-PL Pipeline)	Settling Tanks	plutonium 239/240, americium-241
200-PW-3*	216-A-7 Crib 216-A-8 Crib 216-A-24 Crib 216-A-31 Crib UPR-200-E-56 Unplanned Release	Cesium-137	cesium-137
200-PW-6	216-Z-8 French Drain 216-Z-10 Injection/Reverse Well	Other Sites	None Identified

* Pipelines associated with 200-PW-3 are part of another OU.

Cooling water and steam condensate were discharged to the 200-CW-5 OU waste sites. The cooling water and steam condensate systems were designed to isolate those systems from potential contamination sources, but occasionally became contaminated because of minor leaks due to corrosion pinholes or cracks and process upsets. The liquid waste that contained low levels of plutonium and other contaminants discharged to the waste sites in these OUs infiltrated into the ground and contaminated the underlying soil. Over time, this facilitated the accumulation of contaminants to form localized areas of concentrated contamination.

2.2 Previous Investigations, Interim Actions, Enforcement Activities and Operational Activities

In July 1989, the EPA placed the 100, 200, 300, and 1100 Areas of the Hanford Site on the NPL pursuant to CERCLA. In anticipation of the NPL listing, DOE, EPA, and Ecology entered into the *Hanford Federal Facility Agreement and Consent Order*, also known as the Tri-Party Agreement, in May 1989. This agreement established a procedural framework and schedule for developing, implementing, and monitoring CERCLA response actions on the Hanford Site. The agreement also addresses *Resource Conservation and Recovery Act of 1976* (RCRA) compliance and permitting.

Previous investigations include the Remedial Investigations (RI) and Feasibility Studies (FS) for these OUs. The RI and FS findings for the 200-CW-5 OU were published in the following reports:

- 2004: DOE/RL-2003-11, Rev. 0, *Remedial Investigation Report for the 200-CW-5 U Pond/Z-Ditches Cooling Water Group, the 200-CW-2 S Pond and Ditches Cooling Water Group, the 200-CW-4 T Pond and Ditches Cooling Water Group, and the 200-SC-1 Steam Condensate Group Operable Units.*
- 2011: DOE/RL-2004-24, Rev. 0, *Feasibility Study for 200-CW-5 Cooling Water Operable Unit.*

The RI and FS findings for 200-PW-1, 200-PW-3, and 200-PW-6 OUs were published in these reports:

- 2007: DOE/RL-2006-51, Rev. 0, *Remedial Investigation Report for the Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units.*
- 2011: DOE/RL-2007-27, Rev. 0, *Feasibility Study for the Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units.*

Remediation of carbon tetrachloride: Groundwater below the 200 West Area is contaminated with carbon tetrachloride and other contaminants from a variety of sources. A remedy for treating the groundwater below these OUs is being addressed through actions for those four groundwater OUs. The potential for contamination from the soils in the 200-CW-5 and 200-PW-1, 200-PW-3, and 200-PW-6 OUs to migrate to the groundwater and contribute to the existing groundwater contamination was evaluated. Carbon tetrachloride and other volatile contaminants present in the vadose zone were determined to pose a potential threat to groundwater at 200-PW-1 OU, but not at the 200-PW-3, 200-PW-6, or 200-CW-5 OU waste sites.

Since 1992, under an Expedited Response Action for the 200-PW-1 OU, SVE has been used to minimize the migration of carbon tetrachloride and other volatile organic compounds (VOCs) in the vadose zone away from the 216-Z-9 Trench, the 216-Z-1A Tile Field, and the 216-Z-18 Crib. Between April 1991 and September 2009, approximately 81,000 kg (179,000 lb) of carbon tetrachloride were removed by the SVE systems (SGW-44694, *Performance Evaluation Report for Soil Vapor Extraction Operations at the 200-PW-1 Operable Unit Carbon Tetrachloride Site, Fiscal Year 2009*). This potential groundwater threat at the 200-PW-1 OU is being addressed by incorporation of continued use of the existing SVE system in the Selected Remedy.

Previous Operational Activities: Several activities were conducted during operations to mitigate risks posed by the waste sites: (1) some plutonium-contaminated soils were removed, (2) covers were placed over certain waste units, and (3) remedial technologies were tested at certain waste sites. Each of these actions is briefly summarized below.

Removal of plutonium-contaminated soils and tank contents: From 1976 through 1977, 0.3 m (1 ft) of soil containing about 58 kg (128 lb) of plutonium was removed from the bottom of the 216-Z-9 Trench. This action removed roughly half the plutonium mass that had been estimated to be located beneath the trench. In addition, from 1974 through 1975, liquids that could be pumped were removed from the 241-Z-361 and 241-Z-8 Settling Tanks, leaving behind contaminated sludge.

Placement of covers: The Z-Ditches were constructed parallel to one another and operated in sequence; therefore, as one ditch was taken out of service, clean soil from the excavation of the new ditch was used

to backfill the old ditch. Routine stabilization of these sites has been performed to prevent the spread of surface contamination.

Test project for applicability of remedial technology: In 1987, a portion of the 216-Z-12 Crib was vitrified as part of an in situ vitrification (ISV) test project, resulting in the formation of a 408,000 kg (450 ton) block of vitrified contaminated soil.

3.0 Community Participation

This section describes how the public participation requirements of CERCLA and the NCP were met in the remedy selection process.

The Tri-Party agencies developed the *Hanford Site Tri-Party Agreement Public Involvement Community Relations Plan* (CRP) in April 1990 as part of the overall Hanford Site cleanup process. The CRP was designed to promote public awareness of Hanford cleanup activities and investigations and to promote public involvement in the decision-making process. The CRP and its subsequent revisions will serve as the basis for the current and future public involvement efforts for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs.

The DOE worked for several years with cooperating agencies to define land use goals for the Hanford Site. The cooperating agencies and stakeholders included: the National Park Service; Tribal Nations; the States of Washington and Oregon; local, county, and city governments; economic and business development interests; environmental groups; and agricultural interests. A 1992 report, *The Future for Hanford: Uses and Cleanup: The Final Report of the Hanford Future Site Uses Working Group* (Drummond, 1992) was an early product of the efforts to develop land use assumptions. The report recognized that portions of the Central Plateau would be used to some degree for waste management activities for the foreseeable future. Following the report, DOE issued the *Hanford Comprehensive Land Use Plan Environmental Impact Statement* (HCP EIS; DOE/EIS-0222-F) and associated HCP EIS Record of Decision in 1999 (ROD; 64 FR 61615, *Record of Decision: Hanford Comprehensive Land Use Plan Environmental Impact Statement*). The HCP EIS analyzes the potential environmental impacts of alternative land use plans for the Hanford Site and considers the land use implication of ongoing and proposed activities. Under the preferred land use alternative selected in the HCP EIS ROD, the Central Plateau was designated for industrial use, defined as areas suitable and desirable for TSD of hazardous, dangerous, radioactive, and nonradioactive wastes, as well as related activities.

Subsequent to the HCP EIS, the Hanford Advisory Board (HAB) issued HAB Advice #132 (“Exposure Scenarios Task Force on the 200 Area” [HAB 132 2002.T]). The HAB acknowledged that some waste would remain in the core zone of the Central Plateau when cleanup is complete. The goal identified within HAB Advice #132 is that the core zone be as small as possible and not include contaminated areas outside the Central Plateau’s fenced areas. HAB Advice #132 further stated that waste within the core zone should be stored and managed to make it inaccessible to inadvertent intruding humans and biota, and that the DOE should maximize the potential for any beneficial use of the accessible areas of the core zone. The HAB advised that risk scenarios for the waste management areas of the core zone should include a reasonable maximum exposure to a worker/day user and to an intruder.

DOE and EPA sought early input from Tribal Nations and the public on the remedial alternatives for these waste sites through a public workshop held in April 2008. Input was also received through HAB meetings and interactions. The Tribal Nations, the public, and the HAB have been informed of the status of remedial action through regular updates and placement of documents in the Administrative Record. The Tribal Nations were sent formal letters that offered consultation during the public comment period on Proposed Plan.

The RI and FS reports and Proposed Plan for these OUs were made available to the public in July 2011. They can be found in the Administrative Record file located online at www.hanford.gov. These files are also accessible at both the Administrative Record Center and the Public Information Repositories at the locations below:

ADMINISTRATIVE RECORD

U.S. Department of Energy

Administrative Record Center
2440 Stevens Center Place, Room 1101
Richland, WA

PUBLIC INFORMATION REPOSITORIES

(Contains limited documentation, but provides access to the online Administrative Record)

USDOE Public Reading Room

Washington State University, Tri-Cities
Consolidated Information Center, Room 101-L
2770 University Drive
Richland, WA 99352

University of Washington

Suzzallo Library
Government Publications Division
Seattle, WA 98195

Portland State University

Branford Price Millar Library
Science and Engineering Floor
934 SW Harrison
Portland, OR 97205

Gonzaga University

Foley Center
East 502 Boone
Spokane, WA 99258

The following activities were conducted as part of the formal community participation process under CERCLA and the NCP § 300.430(f)(3):

- The notice of availability of the Proposed Plan was published in four regional newspapers (Tri-City Herald, Willamette Week, Hood River News and the Seattle Weekly) on July 5, 2011.
- A public comment period for the Proposed Plan was held from July 5 to August 5, 2011. This public comment period was extended to September 6, 2011 in response to requests from the public for an extension.
- Public meetings to present and solicit comments on the Proposed Plan with a broader community audience were held in: Richland, WA on July 19; Seattle, WA on July 21; Hood River, OR on July 26; and Portland, OR on July 27, 2011.
- Responses to the comments received during the Proposed Plan public comment period are included in the Responsiveness Summary, which is Part III of this ROD.

4.0 Scope and Role of the Response Action

This section describes the overall Hanford Site cleanup strategy, including the planned sequence of actions, the scope of the problems that the actions will address, and the authorities under which the action will be implemented.

4.1 Scope of the Response Action

For administrative purposes, the Hanford Site is divided into four NPL sites under CERCLA, one of which is the 200 Area. The contamination problems in the 200 Area are complex due to the multiple waste sites, contaminated facilities, and groundwater contamination plumes located therein. As a result, these waste sites, facilities, and groundwater plumes are grouped by geographic areas, process types, or cleanup components into several OUs. Each OU or, in this case, grouping of OUs, has its own plan of study and enforceable schedule that will result in a ROD. The OUs have been prioritized for study and scheduled for cleanup in accordance with the Tri-Party Agreement, Part Three, and the *Hanford Federal Facility Agreement and Consent Order Action Plan* (Action Plan).

The 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs are part of the soil remediation effort in the 200 Area, which is composed of the 200 West Area and the 200 East Area. The 200-CW-5, 200-PW-1, and 200-PW-6 OUs are located in the 200 West Area and the 200-PW-3 OU is located in the 200 East Area. Remediation of the vadose zone in the 200-PW-1 OU is being done using SVE under an expedited response action to treat carbon tetrachloride contamination. SVE will be incorporated into the Selected Remedy and will continue until vadose zone cleanup levels are met. Groundwater located beneath these soil waste sites in the 200 West Area is being addressed through two separate CERCLA remedial action decisions. One is the for the 200-ZP-1 OU ROD (2008) and the other is the 200-UP-1OU decision that is currently undergoing the CERCLA remedial action process. The remaining OUs in the 200 Area NPL site will be addressed under separate CERCLA actions. These OUs are listed in Table 3.

4.2 Overall Central Plateau Cleanup Plan

The Central Plateau (200 Area NPL Site) is a complex site. The multiple waste sites, contaminated facilities, and groundwater contamination plumes have been grouped into several OUs as listed in Table 3. Either the CERCLA or CERCLA and RCRA past-practice processes are being followed at these OUs to identify and select remedies that address contaminants of concern (COCs) at each OU.

Table 3. Central Plateau Inner Area OUs

Groundwater OUs	Source OUs	Facilities	Other
200-ZP-1	200-PW-1	200-CU-1	200-DV-1
200-UP-1	200-PW-3	200-CP-1	
200-PO-1	200-PW-6	200-CR-1	
200-BP-5	200-CW-5	200-CB-1	
	200-SW-1		
	200-SW-2		
	200-IS-1		
	200-WA-1		
	200-EA-1		

The sequence and timing of remedy development for these OUs are listed in the Tri-Party Agreement Action Plan. The facility OUs refer to former operating plants and 200-DV-1 refers to contamination in the deep vadose zone primarily around treatment, storage, and disposal (TSD) units. The requirements applicable to these TSD units under the Dangerous Waste Program will be established in the Hanford Dangerous Waste Permit.

5.0 Site Characteristics

The following sections provide information on the Hanford Site and 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OU characteristics, the conceptual site model (CSM), and on the nature and extent of contamination in these OUs.

5.1 Site Overview

The following sections briefly describe the meteorology, topography, and hydrogeologic setting in the vicinity of the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs.

5.1.1 Meteorology

The Hanford Site lies within the semi-arid shrub-steppe Pasco Basin of the Columbia Plateau in south-central Washington State. This area is characterized by low annual rainfall of approximately 17 cm/year (6.8 in/year). Most precipitation occurs during the late autumn and winter, with more than one-half of the annual amount occurring from November through February. Snowfall accounts for about 38 percent of all precipitation from December through February.

The prevailing surface winds on Hanford's Central Plateau are from the northwest, and occur most frequently during the winter and summer. Winds from the southwest also have a high frequency of occurrence on the Central Plateau. Windblown dust accompanies strong winds on the Hanford Site.

Average monthly temperatures range from a low of 31°F (-0.7°C) in January to a high of 76°F (24.7°C) in July. The record maximum temperature, 113°F (45°C) occurred in 2002 while the record minimum temperature, -23°F (-31°C) occurred in 1950. The annual average relative humidity is 55 percent and the annual average dew point temperature is 34°F (1°C).

5.1.2 Topography

The 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OU waste sites are located in the 200 East and 200 West Area of the Hanford Site. The 200 Area is located on a broad, relatively flat area that constitutes a local topographic high commonly referred to as the Central Plateau. The plateau is a giant flood bar (Cold Creek Bar) that was formed during cataclysmic ice-age floods from glacial Lake Missoula. The Cold Creek Bar trends generally east-west, with elevations between 197 and 225 m (647 to 740 ft). The plateau drops off rather steeply to the north and east into a former flood channel that runs east-southeast, with elevation changes of between 15 and 30 m (50 and 100 ft). The plateau gently decreases in elevation to the south into the Cold Creek valley. Most of the 200 West Area and the southern half of the 200 East Area are situated on the Cold Creek Bar, while the northern half of the 200 East Area lies on the edge of a former flood channel. A secondary flood channel running south from the main channel bisects the 200 West Area.

Waste sites in the 200 West Area are situated on a relatively flat area within the secondary flood channel that bisects the 200 West Area. Surface elevations range from approximately 201 to 217 m (660 to 712 ft). Waste site surface elevations in the 200 East Area range from about 189 m (620 ft) in the northern portion to about 220 m (720 ft) in the southern portion. The ground surface in the 200 East Area slopes gently to the northeast.

5.1.3 Geology

The 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OU waste sites are located in the Pasco Basin, one of several structural and topographic basins of the Columbia Plateau. Basalts of the Columbia River Basalt Group and a sequence of suprabasalt sediments underlie the waste sites. From oldest to youngest, the major geologic units of interest are the Elephant Mountain Member of the Saddle Mountains Basalt Formation, the Columbia River Basalt Group, the Ringold Formation, the Cold Creek Unit (CCU), the Hanford formation, and surficial deposits. Figure 2 and

Figure 3 show the stratigraphy of the 200 Area and the major units of interest.

5.1.4 Vadose Zone

The vadose zone is the unsaturated interval between the ground surface and the water table. The vadose zone is approximately 104 m (340 ft) thick in the southern section of the 200 East Area. Sediments in the vadose zone are dominated by the Hanford formation, although the CCU and part of the Ringold Formation are above the water table in the 200 West Area. Because erosion during cataclysmic flooding removed much of the Ringold Formation north of the central part of the 200 East Area, the vadose zone predominantly comprises Hanford formation sediments between this area and Gable Mountain to the north. Basalt also projects above the water table in the northern part of the 200 East Area.

Figure 2. Major Geologic Units of Interest in the 200 Area

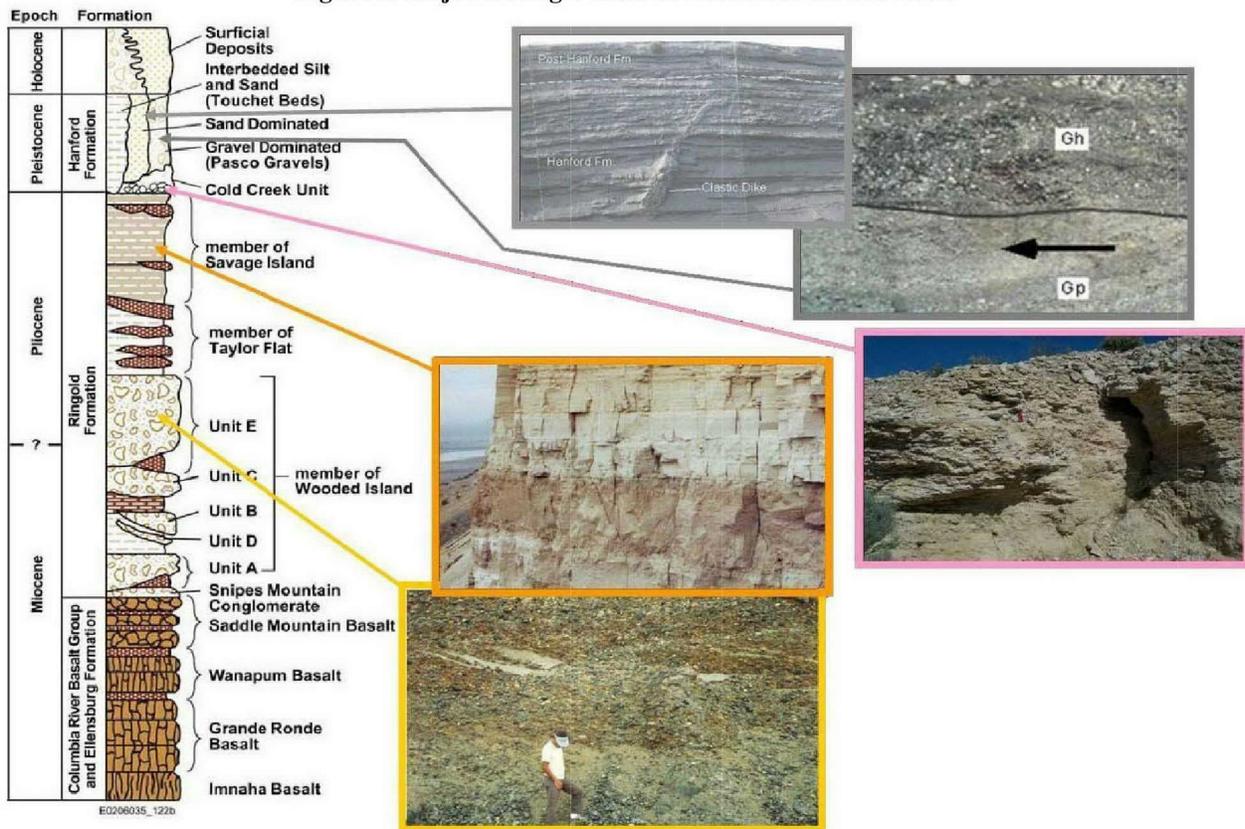
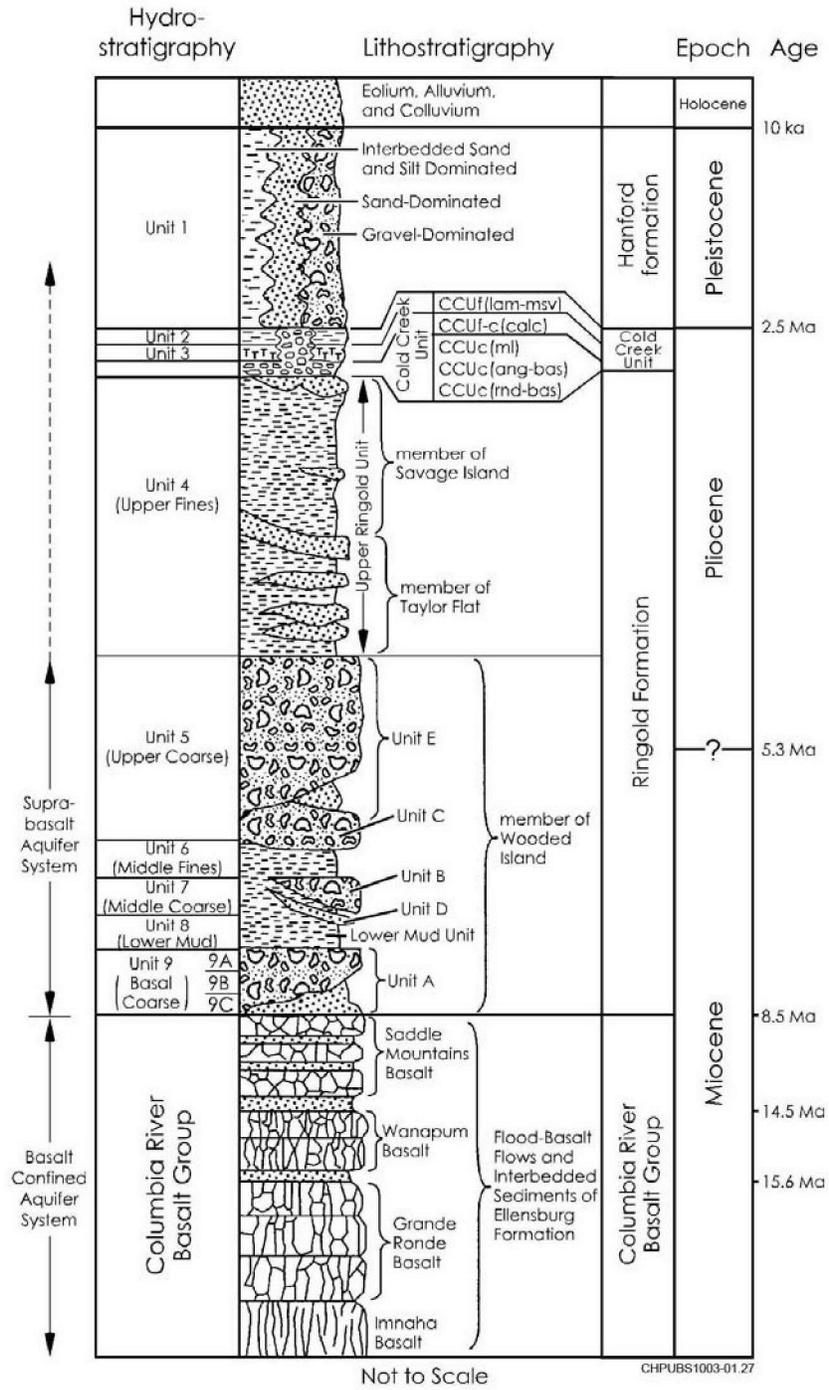


Figure 3. Generalized Stratigraphic Column for the 200 Area



In the 200 West Area, the vadose zone thickness ranges from 40 to 75 m (132 to 246 ft). Sediments in the vadose zone are the Ringold Formation, the CCU, and the Hanford formation. Erosion during cataclysmic flooding removed some of the CCU and the Ringold Formation, especially in the northern part of the 200 West Area.

Historically, and as recently as the early 1990s, perched water has been documented above the CCU at locations in the 200 West Area. While liquid waste facilities were operating, localized areas of saturation or near saturation were created in the soil column. With the reduction of artificial recharge from waste facilities in the 200 Area in 1995, downward flux of liquid in the vadose zone beneath these waste sites has been decreasing.

5.1.5 Groundwater

The top of the unconfined aquifer in the 200 Area occurs within the Ringold Formation, the CCU, or the Hanford formation, depending on location. The base of the unconfined aquifer is the top of the Ringold Formation Unit 8 (lower mud), or the top of the basalt where Unit 8 is absent at the 200 West Area, and the top of the basalt in the 200 East Area. Groundwater in the unconfined aquifer flows from recharge areas where the water table is higher (west of the Hanford Site) to areas where it is lower, near the Columbia River.

Depth to groundwater in the 200 East Area and vicinity ranges from about 54 m (177 ft) near the former B Pond area to about 104 m (340 ft) near the southern boundary of the 200 East Area. The configuration of contaminant groundwater plumes indicates that groundwater flows to the northwest in the northern half of the 200 East Area and to the east/southeast in the southern half of the 200 East Area. Groundwater beneath the 200 West Area occurs primarily in the Ringold Formation. Depth to water varies from about 40.2 m (132 ft) to greater than 75 m (246 ft). In the 200 West Area, groundwater in the unconfined aquifer typically flows from west to east.

Recharge to the unconfined aquifer in the 200 Area is from artificial sources and, less significantly, from natural precipitation. According to estimates, 1.7 trillion L (450 billion gal) of liquid waste, some containing radionuclides and hazardous chemicals, have been released to the ground at the Hanford Site since 1944. Much of this contamination remains in the vadose zone above the water table, but some of the more mobile contaminants have reached groundwater. Most sources of artificial recharge were terminated in 1995. The current artificial recharge is limited to liquid discharges from sanitary sewers, two state-approved land disposal structures (one east of the 200 East Area and one north of the 200 West Area), and 140 small volume, uncontaminated miscellaneous liquid discharge streams.

5.1.6 Ecology

Public access to the Hanford Site has been restricted for more than 50 years. The portion of the Site occupied by DOE's nuclear activities is only a small fraction of the total land area. As a result, much of Hanford is relatively undisturbed and the ecological resources are abundant. However, much of the 200 Area was disturbed by industrial activities and has little vegetative cover.

Undisturbed portions of the 200 Area are characterized by sagebrush/cheatgrass or sagebrush/Sandberg's bluegrass communities. The dominant plants on the Central Plateau are big sagebrush, rabbitbrush, cheatgrass, and Sandberg's bluegrass. Disturbance and active management have either completely denuded or significantly reduced the species more typical of undisturbed sites in the 200 Area at each of the waste sites in the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs.

The shrub and grassland habitat of the Hanford Site supports many groups of terrestrial wildlife. Species may include large animals like Rocky Mountain elk and mule deer; predators such as coyote, bobcat, and

badger; and herbivores including deer mice, harvest mice, ground squirrels, voles, and black-tailed jackrabbits. The most abundant mammal on the Hanford Site is the Great Basin pocket mouse. Many of the rodent species and some predators (badgers) construct burrows on the site. Other non-burrowing animals including cottontails, jackrabbits, snakes, and burrowing owls may use abandoned burrows of other animals.

The largest mammal potentially frequenting these OUs is the mule deer. Mule deer collect around the 200 Area, away from the river, and constitute a grouping named the Central Population. The Rattlesnake Hills herd of elk inhabiting the Hanford Site primarily occupies the Fitzner-Eberhardt Arid Lands Ecology Reserve and private lands adjoining the reserve to the south and west; they are occasionally seen on the Central Plateau.

Common upland game bird species in shrub and grassland habitat include chukar, partridge, California quail, and ring-necked pheasant. There are also several species of hawk that occur in this habitat, although infrequently. There are approximately 17 species of amphibians and reptiles on the Hanford Site. Many species of insects occur throughout habitats on the Hanford Site. Butterflies, grasshoppers, and darkling beetles are among the most conspicuous of the about 1,500 species of insects identified from specimens collected on the Hanford Site.

5.1.7 Cultural Resources

Much of the 200 Area was altered by Hanford Site operations. The Hanford Cultural Resources Laboratory conducted a comprehensive archaeological resources survey of the fenced portions of the 200 Area during 1987 and 1988. The results do not indicate evidence of cultural resources associated with the Native American cultural landscape, early settlers/farming landscape, or archaeological discoveries associated with the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs.

5.2 Conceptual Site Model

A conceptual site model (CSM) documents current and potential future site conditions and illustrates site conditions including contaminant sources, release mechanisms, exposure pathways, migration routes, and potential human and ecological receptors. The illustrated CSM of human exposure under the industrial scenario is shown in Figure 4.

Figure 5 shows the CSM of human exposure under an unrestricted land use scenario. Although an unrestricted land use scenario is not the anticipated land use, the scenario was evaluated for comparison to the industrial land use scenario. Plutonium recovery processes resulted in large amounts of liquid waste being discharged to the soil. The liquid waste infiltrated the soil and, in some cases, reached groundwater. However, only the complete soil exposure pathways are within the scope of this ROD as it only addresses contaminated soil OUs; separate RODs for the groundwater OUs will address the groundwater exposure pathways shown on the CSM figures.

Pathways for current and future receptors were considered based on how the site is currently used and the assumptions about its future industrial use. The term “regular workers” refers to indoor and outdoor workers that are not involved in active soil disturbance and could be exposed to surface soil over longer durations (25 to 70 years). The term “construction workers” refers to outdoor workers that are involved in active soil disturbance (e.g., putting in an underground utility line or constructing a building) and could be exposed to soils at depth for much shorter durations. Under current industrial land use and Hanford site-wide institutional control conditions, only a construction worker has the potential to encounter impacted soil. There are no complete and significant pathways for current regular workers. Exposure routes to groundwater and surface water are incomplete.

Figure 4. Conceptual Site Model of Human Exposure Under an Industrial Scenario

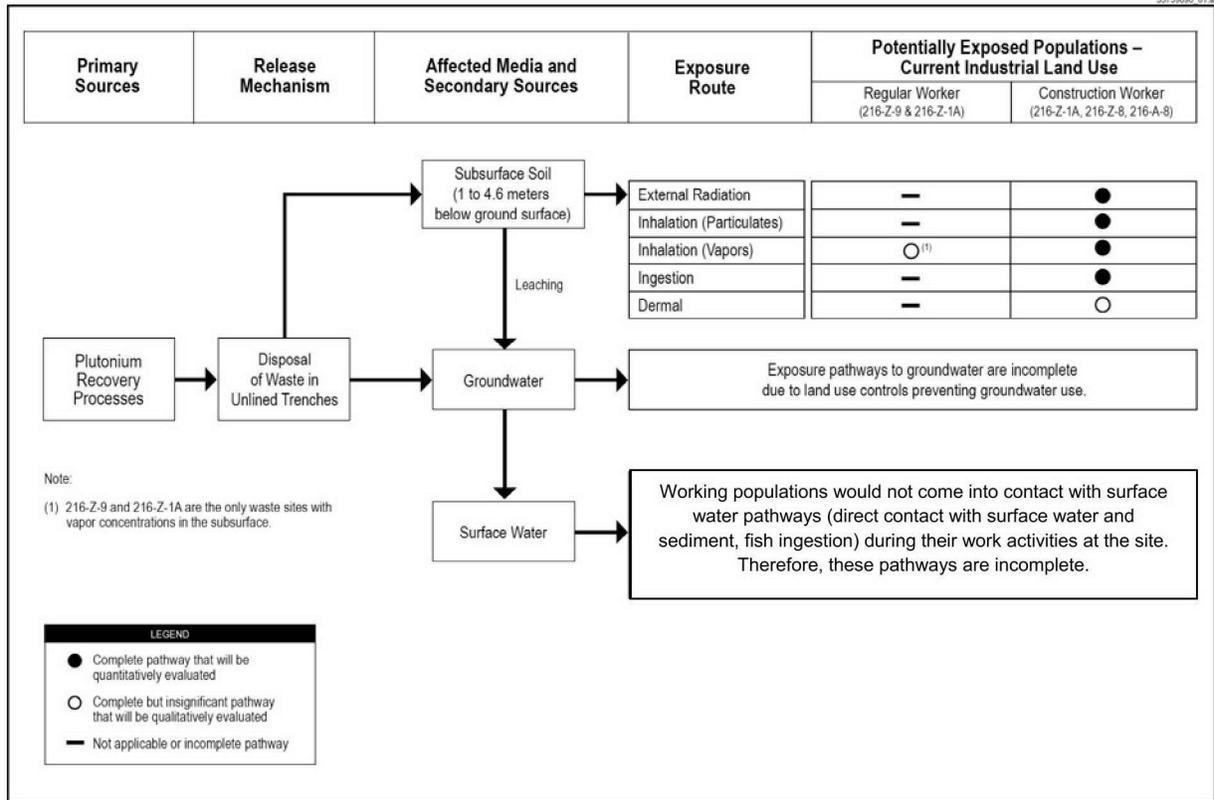
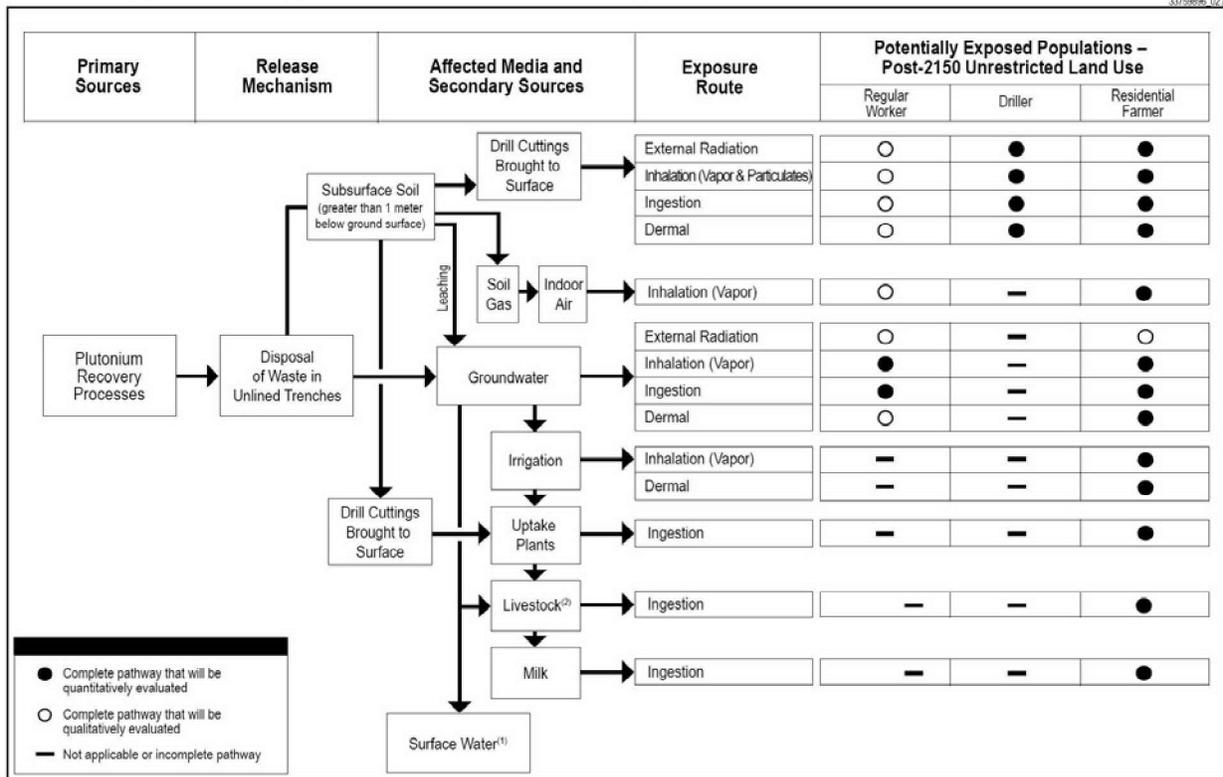


Figure 5. Conceptual Site Model of Human Exposure an Unrestricted Land Use Scenario



An unrestricted land use scenario (to future well drillers and subsistence farmers) was evaluated for comparison to an industrial land use scenario (to construction workers). Under the unrestricted land use scenario, there would be no controls to prevent well drillers from drilling at the waste sites, resulting in a potential exposure to contaminants throughout the entire impacted depth interval, as a well would be drilled to the water table. Current construction workers and future well drillers would have potentially significant exposures through all the direct contact soil pathways (i.e., ingestion, inhalation, dermal contact, and external radiation), as depicted in Figure 4 and Figure 5, for construction workers and well drillers, respectively. The direct soil pathways for future regular industrial workers are identified as potentially complete but insignificant, under the assumption that the drill cuttings would not be spread around a place of business.

The unrestricted land use scenario assumes that exposure to soil occurs when a resident establishes a residence on the waste site and receives an exposure by direct contact with the soil and through the food chain. The direct contact pathway includes potential exposure through external radiation, incidental soil ingestion, dermal contact with soil, and inhalation of ambient vapors and dust particulates. The food chain pathway includes exposure from ingestion of fruits and vegetables grown in a “backyard” garden and consumption of meat (beef and poultry) and milk from livestock raised in a contaminated area. Uptake of contamination into crops and livestock is assumed to occur from contamination present in soil and from groundwater contaminated by migration of contaminants in the soil.

5.3 Operable Unit Overview

This section provides a more detailed description of the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs, the nature and extent of the contamination, and structures associated with the 21 waste sites comprising the four OUs, which are located in the Inner Area. The Inner Area is located in the central portion of the Hanford Site, as shown in Figure 1.

Figure 6 and Figure 7 show the locations of these operable units. The 200-CW-5, 200-PW-1 and 200-PW-6 OUs located in 200 West Area and the 200-PW-3 OU located in 200 East Area are associated with subsurface waste handling and disposal sites that were engineered and constructed to dispose of liquid waste into the soil beneath the sites. Pipes conveyed the liquid waste from nuclear processing facilities to the waste sites. At the cribs, tile field, and French drain, liquid waste was discharged into a layer of gravel that drained into the underlying soil and may have drained laterally as well as downward.

The 200-CW-5 OU in the 200 West Area is associated with waste sites that managed cooling water and steam condensate from the PFP. The 200-CW-5 OU consists primarily of shallow, open ditches, called Z-Ditches, which were used for liquid waste disposal; as one ditch was taken out of service, soils excavated for its successor trench were used to backfill the older trench. These ditches are constructed along parallel routes.

5.4 Sampling Strategy

Five representative soil sites located in the 200-PW-1, 200-PW-3, and 200-PW-6 OUs were sampled. The soil sites were the 216-A-8 Crib, 216-Z-1A Tile Field, 216-Z-8 French Drain, 216-Z-9 Trench, and 216-Z-10 Injection/Reverse Well. The Remedial Investigation (RI) identified these soil sites as representative of the waste sites in these three OUs. RI activities for these OUs were conducted primarily from 1999 to 2007. Characterization activities also took place to define the nature and extent of carbon tetrachloride contamination around the 200-PW-1 waste sites. To gather additional information about the contamination at the 216-A-Crib and 216-Z-9 Trench, characterization activities included drilling vadose zone boreholes, subsurface soil and soil-vapor sampling, and borehole and nearby well geophysical logging.

Figure 6. Location of the 200-CW-5, 200-PW-1, and 200-PW-6 OUs Waste Sites in the 200 West Area

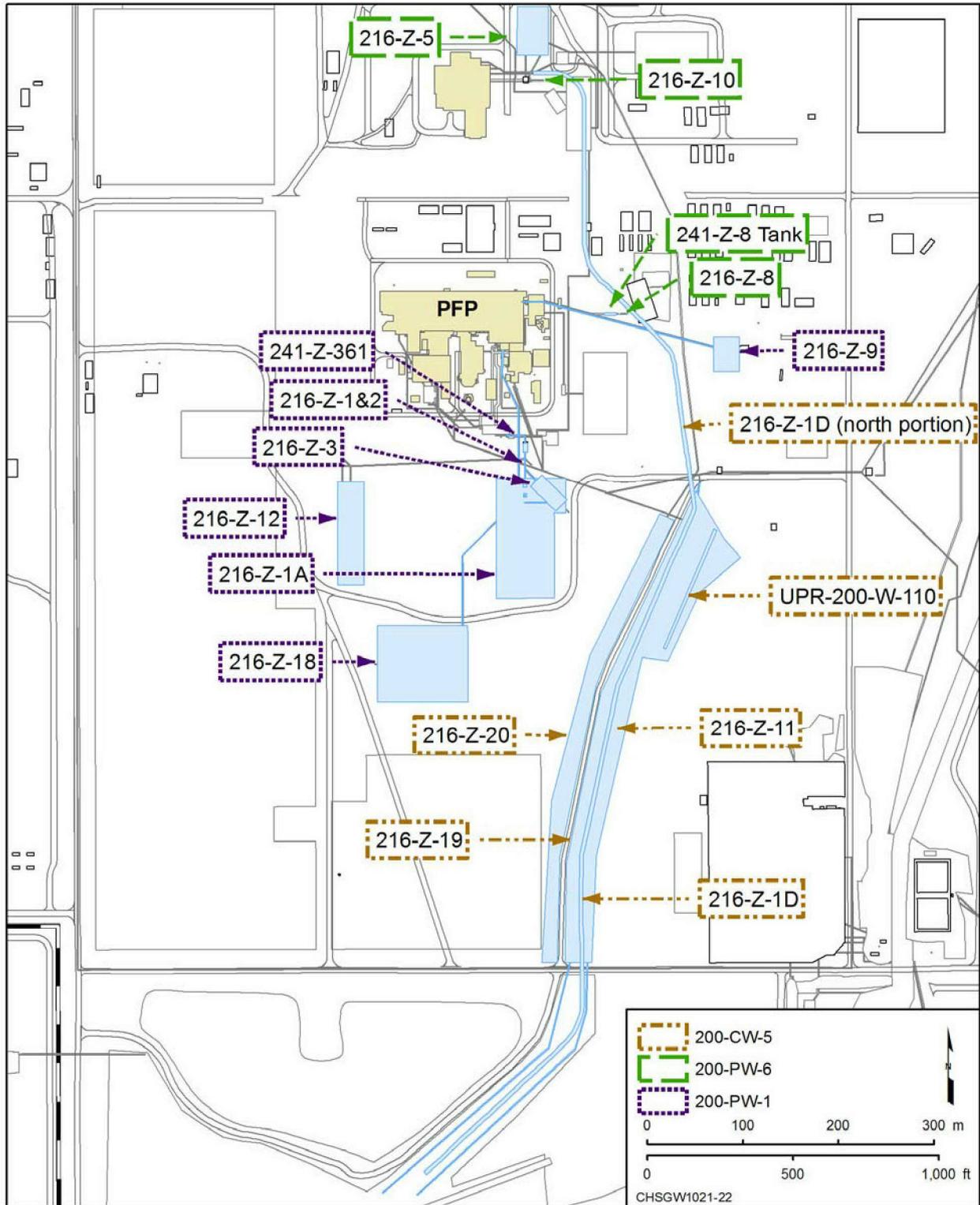
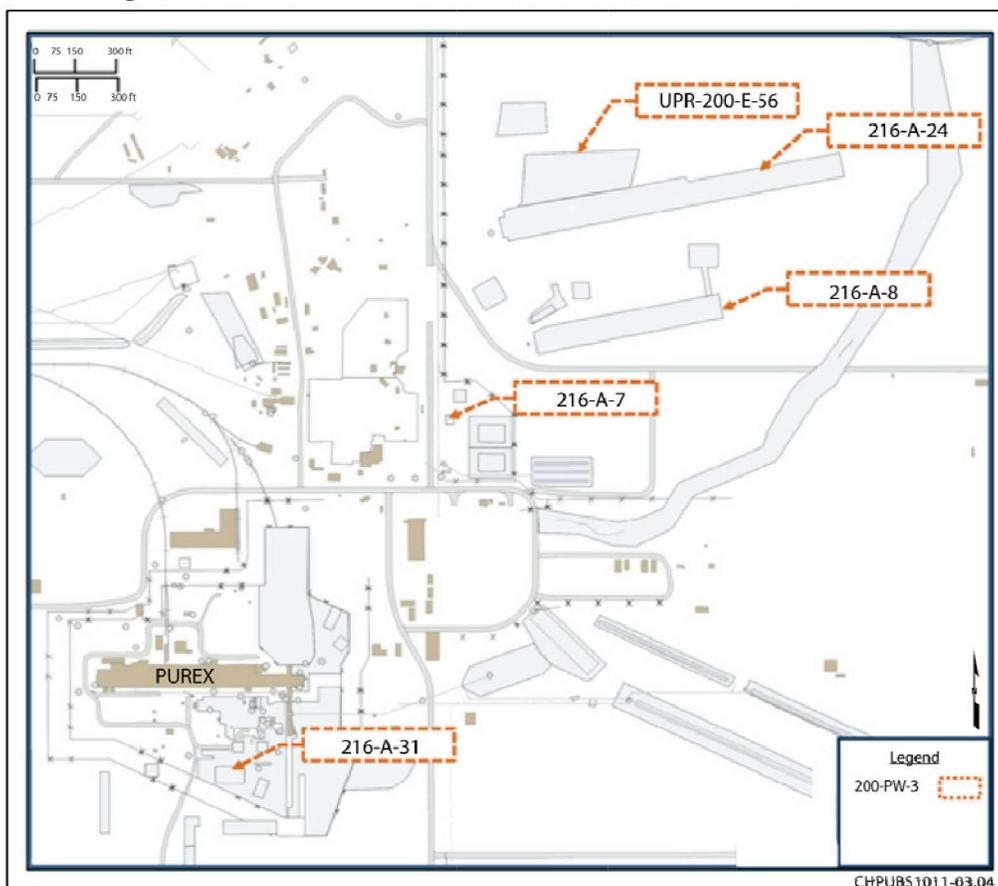


Figure 7. Location of the 200-PW-3 OU Waste Sites in the 200 East Area



The RI activities for the 200-CW-5 OU were conducted in 2002. The 200-CW-5 RI focused on characterization of the 216-Z-11 Ditch, which was identified as a 200-CW-5 OU representative waste site. The RI began with soil probe investigations to optimize placement of a single borehole at the highest anticipated contamination area of the 216-Z-11 Ditch to add to existing historical characterization activities. Soil probes were placed at transects along the 216-Z-11 Ditch and ground-penetrating radar was used to identify the location of the backfilled and parallel 216-Z-1D and 216-Z-19 Ditches for inclusion in the investigation.

5.5 Sources of Contamination

Large volumes of liquid waste were generated from the processing of plutonium at various processing and finishing plants in the 200 West and 200 East Areas of the Central Plateau. Process waste waters were discharged to the 200-PW-1, 200-PW-3, and 200-PW-6 OU waste sites. The processes were intended to recover as much plutonium as possible prior to discharge of the waste liquids, but the waste streams still contained low levels of plutonium, and other contaminants.

Cooling water and steam condensate were discharged to the 200-CW-5 OU waste sites. The cooling water and steam condensate systems were designed to isolate those systems from potential contamination sources, but occasionally became contaminated because of minor leaks due to corrosion pinholes or cracks and process upsets. The process and cooling waters discharged to the 200-CW-5 OU waste sites were disposed of to the ground surface or to the shallow subsurface through ditches or the 216-Z-20 Tile Field, as part of normal operations.

The liquid waste that contained low levels of plutonium and other contaminants discharged to the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OU waste sites infiltrated into the ground, contaminating the underlying soil. Most soil contamination associated with these 200-PW-1, 200-PW-3 and 200-PW-6 OU waste sites is located beneath the bottom of the waste sites.

The COCs for soils in 200-PW-1, and 200-PW-6 are: americium-241 and plutonium-239/240; carbon tetrachloride and methylene chloride were also identified as COCs for protection of groundwater for 200-PW-1. The COCs for soils in 200-CW-5 are: americium-241, plutonium-239/240, cesium-137, radium-226, strontium-90, PCBs, boron, and mercury. The COC for soils in 200-PW-3 is cesium-137.

5.6 Nature and Extent of Contamination

The following subsections discuss the nature and extent of contamination in these OUs.

5.6.1 200-PW-1 Waste Sites

The following sections describe the waste sites assigned to the 200-PW-1 OU. Waste sites that received high-salt wastes are addressed first, and are the 216-Z-9 Trench, the 216-Z-1A Tile Field, and the 216-Z-18 Crib. These are followed by the waste sites that received low-salt waste, which are the 216-Z-12 Crib, the 216-Z-1 Crib, the 216-Z-2 Crib, and the 216-Z-3 Crib. This is followed by a discussion of the 241-Z-361 Settling Tank.

216-Z-9 Trench

The 216-Z-9 Trench is about 213 m (700 ft) east of the 234-5Z Building in the 200 West Area of the Hanford Site. The surface elevation at the site is approximately 202 m (664 ft). Groundwater is approximately 69 m (226 ft) below ground surface (bgs) based on a 2008 well measurement.

The 216-Z-9 Trench consists of a 6.1 m (20 ft) deep open excavation with a 36.5 by 27.4 m (120 by 90 ft) concrete cover. The walls of the trench slope inward and downward to the 18 by 9 m (60 by 30 ft) floor space, which has a slight slope to the south. The underside of the concrete cover was paved with acid-resistant brick/tiles. The cover of the trench is supported by six concrete columns. More than 4 million liters (1,000,000 gals) of plutonium/organic rich process wastes were discharged to the trench between 1955 and 1962.

When the 216-Z-9 Trench was retired in 1962, it had received approximately 50 to 150 kg (110 to 330 lb) of plutonium. Mining took place at the 216-Z-9 Trench in 1976 and 1977 to remove plutonium. The upper 0.3 m (1 ft) of soil was removed from the floor of the trench. The mining operation removed an estimated 58 kg (128 lb) of plutonium. Based on data acquired during the mining operation, an estimated 38 to 48 kg (84 to 106 lb) of plutonium remains in the 216-Z-9 Trench. The 6.4 m (21 ft) deep open space beneath the concrete cover over the 216-Z-9 Trench remains void of soil and contains only the mining equipment.

Based on historical data, the highest concentrations of plutonium and americium are located at the trench floor and generally decrease with depth below the floor. For most of the radionuclides detected above background levels in soil samples (Np-237, plutonium-238 [Pu-238], Ra-226, Ra-228, Sr-90, Tc-99, Th-232, U-234, and U-235), the highest concentrations were at a depth of 14 m (46 ft) bgs or deeper. Radioactive contamination in soil samples (predominantly Am-241 and Pu-239/240) was detected to a maximum depth of 37.2 m (122 ft) bgs.

Soil vapor samples collected from boreholes drilled in the vicinity of the trench revealed carbon tetrachloride at concentrations up to 28,500 ppmv in 1993. Soil samples from boreholes near the 216-Z-9 Trench revealed carbon tetrachloride dense, nonaqueous phase liquid (DNAPL) in soil of up to 380,000 µg/kg from 19.4 to 20.1 m (63.5 to 66 ft bgs). At an adjacent borehole, the maximum carbon tetrachloride

detected in soil was 390,000 µg/kg in the same silt lens. In general, the highest concentrations of contaminants detected in the vadose zone soils have been in fine-grained layers (i.e., silts and the CCU). An SVE system has been operated near the 216-Z-9 Trench as an expedited response action. Between March 1993 and September 2008, approximately 54,608 kg (120,390 lb) of carbon tetrachloride was removed at this location by the SVE system.

At the 216-Z-9 Trench, the discharged effluent volume was greater than soil column pore volume, which indicates the volume of effluent released was sufficient to reach the unconfined aquifer during operation of this waste site. The data, including soil moisture content measurements, indicates that the 216-Z-9 Trench is not a significant current source of groundwater contamination.

Table 4 provides a summary of the maximum concentrations of COCs in soil samples at the 216-Z-9 Trench.

Table 4. Maximum Concentrations of COCs in Soil Samples at the 216-Z-9 Trench

COC	Maximum Concentration	Depth Interval (ft bgs) ^a		Location ^b
		Top	Bottom	
Americium-241	43,478,261 pCi/g	22	22.3	216-Z-9 Trench Floor (1973)
Plutonium-239/240	404,347,826 pCi/g	22	22.3	216-Z-9 Trench Floor (1973)
Carbon Tetrachloride (CCl ₄)	390 mg/kg	64	66	C5336 Borehole ^b
Methylene Chloride	0.14 mg/kg	100	102	299-W15-48 Well

Source:

Remedial Investigation Report for Plutonium/Organic-Rich Process Condensate/ Process Waste Group OU: Includes 200-PW-1, 200-PW-3, and 200-PW-6 OUs; Appendix E – Data Summary Tables for Waste Sites (DOE/RL-2006-51)

a. Most of the soil samples collected from the base of the 216-Z-9 Trench in 1973 were analyzed only for Pu-239 and Am-241.

b. Well 299-W15-48 was drilled at a 32 degree (from vertical) angle underneath the 216-Z-9 Trench. The 299-W15-48 depth intervals provided in this table represent the downhole depths (i.e., not converted to vertical depths).

As reported in DOE/RL-2006-24, *Remedial Investigation Report for the 200-ZP-1 Groundwater Operable Unit*, no radioactive plumes (or contaminants) above maximum contaminant levels (MCLs) have been identified in the groundwater area of the 216-Z-9 Trench. Because the 216-Z-9 Trench received large inventories of carbon tetrachloride and nitrate, it is considered to have been a major contributor in the past of groundwater contamination in the 200 West Area for these two compounds.

216-Z-1A Tile Field

The 216-Z-1A Tile Field is located in the 200 West Area about 153 m (500 ft) south of the 234-5Z Building and immediately south of the 216-Z-1&2 Cribs and is adjacent to the 216-Z-3 Crib. The surface elevation at the site is approximately 205 m (673 ft). Groundwater is approximately 69.6 m (228.3 ft) bgs based on a nearby well measurement in 2008.

The tile field piping is 20 cm (8 in.) diameter vitrified clay pipe placed on a 1.5 m (5 ft) deep gravel bed. The distributor pipe consists of a 79 m (260 ft) long north-south trunk or main pipeline with seven pairs of 21 m (70 ft) laterals spaced at 11 m (35 ft) intervals in a symmetrical herringbone pattern. The main pipeline is a continuous line without perforations. The laterals are divided into 0.3 m (11 in.) long segments. The piping system was overlaid with 15 cm (6 in.) of cobbles and 1.5 m (5 ft) of sand and gravel.

The tile field was used in this configuration from 1949 to 1959. The waste stream discharged to the adjacent 216-Z-1&2 Cribs (1949 to 1952) and the 216-Z-3 Crib (1952 to 1959), overflowed to the tile field, and consisted of neutral to basic (pH 8 to 10) process waste and analytical and development laboratory waste from the Z Plant via the 241-Z-361 Settling Tank. The total volume of waste estimated to have overflowed to the 216-Z-1A Tile Field from 1949 to 1959 was approximately 1 million L (264,172 gal).

The 216-Z-1A Tile Field initially was taken out of service in March 1959 after low concentrations of plutonium were detected in 1958 in the soil at the bottom of a well 46 m (150 ft) deep, and 15 m (50 ft) above the water table, near the 216-Z-3 Crib (Well 299-W18-57, 18 m (60 ft) southwest of 216-Z-3). The 216-Z-1A Tile Field was receiving overflow from the 216-Z-3 Crib during this time, and was taken out of service when the 216-Z-3 Crib was replaced.

In 1964, the 216-Z-1A Tile Field was reactivated to receive plutonium reclamation operation waste liquids directly (i.e., the effluent pipelines from the PRF bypassed the 216-Z-1&2 and 216-Z-3 Cribs). Two groundwater wells (Wells 299-W18-6 and 299-W18-7) were drilled on the west and east sides, respectively, of the tile field to monitor groundwater. From 1964 to 1969, the 216-Z-1A Tile Field was operated as a specific retention facility. The tile field was taken out of service in 1969 when it had received the prescribed liquid waste volume.

From 1964 to 1969, the 216-Z-1A Tile Field received approximately 5.2 million L (1.37 Mgal) of liquid waste from 234-5Z (PFP), the 236-Z PRF, the 242-Z Waste Treatment and Americium Recovery Facility, and miscellaneous laboratory waste. Material discharged to the tile field reportedly included 57 kg (126 lb) of plutonium, 1 kg (2.2 lb) of Am-241, 270,000 kg (594,000 lb) of carbon tetrachloride, and 3,000 kg (6,600 lb) of nitrate. The carbon tetrachloride was discharged to the 216-Z-1A Tile Field in combination with other organics, as a small entrained fraction of process aqueous wastes, and as DNAPL.

The following significant findings are summarized for the 216-Z-1A Tile Field:

- The highest concentrations of radionuclides (Pu-239/240 and Am-241) in sediments are located immediately beneath the tile field, below the distribution pipe.
- The maximum vertical extent of radiological contamination (predominantly Am-241, Pa-233, and Pu-239) detected in soil by borehole geophysical logging, is 37 m (121 ft).
- The maximum vertical extent of radioactive contamination detected above background levels in soil samples (Am-241, Np-237, Pu-239/240, and Pa-233) from the tile field area was 46.8 m (153.5 ft).
- Soil samples from the tile field area revealed a maximum carbon tetrachloride concentration of 6,561 mg/kg in the CCU in 1993.

An SVE system has been operated near the tile field. Between April 1991 and September 2008, approximately 24,772 kg (54,613 lb) of carbon tetrachloride was removed by the SVE system from the combined 216-Z-1A/216-Z-18/216-Z-12 Well Field (SGW-40456).

The 216-Z-1A Tile Field has not been considered to be a past source of groundwater contamination, because the effluent volume discharged at this site was much less than the soil column pore volume. Based on the dispersed carbon tetrachloride vadose zone plume data, there are significant concentrations of carbon tetrachloride in the vadose zone adjacent to this site, so it is possible that this site was a past

source of groundwater contamination, but it is not a significant current source. Table 5 provides a summary of the maximum concentrations of COCs in soil samples at the 216-Z-1A Tile Field.

The total effluent volume (6.2 million L [1.6 Mgal]) discharged to the 216-Z-1A Tile Field over its period of operation is about 12 percent of the estimated soil pore volume.

Table 5. Maximum Concentrations of COCs in Soil Samples at the 216-Z-1A Tile Field

COC	Maximum Concentration	Location	Depth (ft bgs)
Americium-241	2,590,000 pCi/g	299-W18-149 Well	11.2
Plutonium-239/240	38,200,000 pCi/g	299-W18-149 Well	11.2
Carbon Tetrachloride (CCl ₄)	6,561 mg/kg	299-W18-174 Well	127.1

Source:

Remedial Investigation Report for Plutonium/Organic-Rich Process Condensate/ Process Waste Group OU: Includes 200-PW-1, 200-PW-3, and 200-PW-6 OUs; Appendix E – Data Summary Tables for Waste Sites (DOE/RL-2006-51).

Based on the dispersed carbon tetrachloride vadose zone plume data, it is possible this site was a past source of groundwater contamination. However, due to the current unsaturated vadose zone conditions, as well as the operation of the SVE system in the vicinity of the 216-Z-1A Tile Field since 1991, the remaining contaminants in the vadose zone are not considered a significant current source of groundwater contamination.

216-Z-18 Crib

The 216-Z-18 Crib is located in the 200 West Area, southwest of the 216-Z-1A Tile Field and southeast of the 216-Z-12 Crib. The surface elevation at the site is approximately 208.9 m (685.3 ft). Groundwater is approximately 72.8 m (239 ft) bgs based on a nearby well measurement from 2008.

The 216-Z-18 Crib is a below grade inactive liquid waste management unit. The 95 by 79 m (311 by 259 ft) site consists of five separate, parallel, north-south running trenches (Figure 2-5), each 63 m by 3 m (207 ft by 10 ft), and approximately 5.5 m (18 ft) deep. Each crib structure has two 8 cm (3 in.) diameter distribution pipes placed on a 0.3 m (1 ft) thick bed of gravel at 5.2 m (17 ft) bgs, buried under an additional 0.3 m (1 ft) of gravel, covered with a membrane and sand, and backfilled to grade. Waste distributor piping in each trench was fed by the primary steel distribution pipe that bisected each trench. The crib was designed and operated as a specific retention facility.

The 216-Z-18 Crib was used as a replacement for the 216-Z-1A Tile Field, to receive high-salt, acidic (pH 1 to 2.5) aqueous liquid waste and organic liquid waste from the PFP. The waste streams included plutonium recovery waste from the 236-Z PRF and americium recovery waste from the 242-Z Waste Treatment and Americium Recovery Facility. Carbon tetrachloride was received in the aqueous phase liquid and mixed with other organics as a DNAPL. The 216-Z-18 Crib was taken out of service in May 1973 when discharge of contaminated waste streams to the ground from PFP was discontinued as a matter of policy.

The 216-Z-18 Crib received a total of 3,860,000 L (1,020,000 gal) of effluent, constituting approximately 26 percent of the estimated soil pore volume at the site. Material discharged to the crib reportedly included 23 kg (51 lb) of plutonium, 175,000 kg (386,000 lb) of carbon tetrachloride and 500,000 kg (1,102,000 lb) of nitrate. The carbon tetrachloride was discharged to the 216-Z-18 Crib in combination with other organics, as a small entrained fraction of process aqueous wastes, and as DNAPL.

SVE has been in operation at the 216-Z-18 Crib since 1992 as an interim action to remove carbon tetrachloride from the vadose zone soils. Between 1991 and September 2008, the SVE system has removed approximately 24,772 kg (54,613 lb) of carbon tetrachloride.

Wells 299-W18-9 and 299-W18-10 were the only wells that showed contamination above background levels; radiological contamination was identified at about 8 to 17 m (26 to 55 ft) bgs. Pu-239 and Am-241 were identified in Well 299-W18-9 between 7.3 and 20.7 m (24 and 68 ft) bgs, with both showing a maximum of approximately 400,000 pCi/g at about 7.3 m (24 ft) bgs. Am-241 concentrations decreased with depth to 17.4 m (57 ft) bgs, where they increased to 250,000 pCi/g. Concentrations decreased to the tool detection limits below about 20.7 m (68 ft) bgs.

The highest carbon tetrachloride concentration encountered was 1,957 µg/kg in Well 299-W18-249 found at a depth of 44.6 m (146.2 ft). The maximum carbon tetrachloride concentrations in the other two wells were 861 µg/kg in Well 299-W18-96 (43.8 m [143.8 ft]) and 717 µg/kg in Well 299-W18-247 (41.3 m [135.4 ft]). Nitrate was identified in Well 299-W18-96 at 4,400 mg/kg at 25.6 m (84 ft) bgs decreasing to <10 mg/kg at 38.1 m (125 ft) bgs. No significant concentrations of carbon tetrachloride or other volatile organic compounds (VOCs) were identified during soil vapor sampling conducted for the RI or for SVE operations. Shallow (<25 m [82 ft] bgs) soils beneath the crib have not been sampled and analyzed. The high nitrate concentration in the shallowest soil sample from within the crib (4,400 mg/kg at 25.8 m [84.5 ft] bgs in 299-W18-96) indicates the potential for significant residual nitrate contamination at the 216-Z-18 Crib. Based on the presence of carbon tetrachloride and nitrate at the CCU, it is possible this site was a past source of groundwater contamination. Operation of the SVE system in the vicinity of the 216-Z-18 Crib since 1993 has reduced residual carbon tetrachloride mass, making future impacts associated with natural recharge less likely.

In summary, Pu-239 and Am-241 are most concentrated at the base of the crib, but show evidence of past mobility, with lesser concentrations detected at depths of 17.4 and 20.7 m (57 and 68 ft) bgs. Carbon tetrachloride is evident in soils beneath the crib (in the single borehole sampled within the crib perimeter), extending to the CCU. These results are consistent with contaminant distributions at the nearby high-salt waste site, the 216-Z-1A Tile Field, which was replaced by the 216-Z-18 Crib.

216-Z-12 Crib

The 216-Z-12 Crib is located in the 200 West Area, southwest of the 234-5Z Building and northwest of the 216-Z-18 Crib. The surface elevation at the site is approximately 208.3 m (683.6 ft). Groundwater is approximately 72.3 m (237.2 ft) bgs based on nearby well measurement in 2008.

The 216-Z-12 Crib is rectangular, 91 by 6 m (300 by 20 ft) at the bottom, and 5.8 m (19 ft) deep. Waste entered at 4.6 m (15 ft) bgs through a 30 cm (12 in.) diameter, perforated, vitrified clay pipe that ran the length of the crib and rested on a 1.5 m (5 ft) bed of gravel. The pipe was covered with a polyethylene barrier and backfilled to grade. In 1968, a 15 cm (6 in.) diameter steel bypass line was installed 9 m (30 ft) west of and parallel to the original distribution line to bypass 30.5 m (100 ft) of the original line that was plugged.

The 216-Z-12 Crib is a subsurface liquid waste site that was used from 1959 to 1973, as a replacement for the 216-Z-3 Crib, to dispose of PFP liquid process waste and analytical and development laboratory waste from the 234-5Z Building via the 241-Z-361 Settling Tank. The waste was low-salt and neutral to basic (pH 8 to 10) when discharged. In total, the 216-Z-12 Crib received approximately 281,000,000 L (74,240,000 gal) of waste. Material discharged to the crib reportedly included 25.1 kg (55 lb) of plutonium and 900,000 kg (1,980,000 lb) of nitrate. The 216-Z-12 Crib was taken out of service in May

1973 when discharge of contaminated waste streams to the ground from PFP was discontinued as a matter of policy.

A soil vapor survey in 1991 indicated the presence of carbon tetrachloride near the 216-Z-12 Crib, and SVE has been in operation in the vicinity of the 216-Z-12 Crib since 1995 as an interim action to remove carbon tetrachloride from the vadose zone soils. Between 1991 and September 2007, the SVE system has removed approximately 24,772 kg (54,613 lb) of carbon tetrachloride.

Soil sampling was conducted at the 216-Z-12 Crib in 1980 to evaluate the distribution of plutonium and americium. Table 6 lists the maximum Pu-239/240 and Am-241 concentrations for each borehole sampled. The data indicate that (1) the highest concentrations of plutonium and americium are in the sediments immediately below the crib bottom; (2) concentrations decrease rapidly with depth from the crib bottom; and (3) the distributions of plutonium and americium activity are similar. No significant concentrations of plutonium or americium were found at depth. The highest carbon tetrachloride soil vapor concentration measured was 18 ppmv at a depth of 22 m (72.11 ft).

Table 6. Maximum Pu-239/240 and Am-241 Activity in the 216-Z-12 Crib

Well	Well Depth (ft)	Pu-239/240		Am-241	
		Maximum Activity (pCi/g)	Depth (ft bgs)	Maximum Activity (pCi/g)	Depth (ft bgs)
299-W18-152	118	23	112.5	4	25.0
299-W18-153	110	125	21.0	32	21.0
299-W18-154	20	252,000	18.0	196	18.0
299-W18-157	110	0.39	75.0	1	100.0
299-W18-162	30	4,970,000	19.4	965,000	19.4
299-W18-179	40	1,040,000	17.0	432,000	17.0
299-W18-180	40	14	27.0	3	27.0
299-W18-181	135	4,880,000	20.5	952,000	19.3
299-W18-182	40	2,080,000	20.2	1,660,000	20.2
299-W18-183	40	8	25.0	1	25.0
299-W18-184	30	182,000	22.5	122,000	22.5
299-W18-185	40	3,080,000	19.7	874,000	20.3

Source:

Remedial Investigation Report for Plutonium/Organic-Rich Process Condensate/ Process Waste Group OU: Includes 200-PW-1, 200-PW-3, and 200-PW-6 OUs; Appendix E – Data Summary Tables for Waste Sites (DOE/RL-2006-51).

216-Z-1&2 Cribs

The 216-Z-1&2 Cribs are located in the 200 West Area, south of the 234-5Z Building, immediately north of the 216-Z-1A Tile Field, and west of the 216-Z-3 Crib. The 216-Z-1&2 Cribs are separate cribs but operated as one unit. The flow from 216-Z-2 Crib overflowed into 216-Z-1 Crib as part of normal operations. The surface elevation at the site is approximately 207.2 m (679.8 ft). Groundwater is approximately 71.7 m (235.1 ft) bgs, based on a nearby well measurement in 2008.

The 216-Z-1&2 Cribs are open-bottom, 3.7 m (12 ft) square, 4.3 m (14 ft) tall wooden boxes constructed in an excavation that was 4.3 m (14 ft) square at the bottom and 6.4 m (21 ft) deep. To control the intrusion of sand into the structure, open joints in the sides and top were caulked and the upper half of the structure was lagged with 1.9 cm (0.75 in.) plywood. The two cribs, approximately 5.5 m (18 ft) apart,

were connected and fed by a 20 cm (8 in.) diameter SST central pipe with an outlet pipe to the 216-Z-1A Tile Field. The 216-Z-2 Crib overflowed into the 216-Z-1 Crib, which overflowed into the 216-Z-1A Tile Field. Two risers are visible from the surface of each crib. One is a filtered vent; the other is the stick up for a test well (now decommissioned). The 20 cm (8 in.) steel test wells were centered within each crib, installed as part of the original construction. Each extended 6.1 m (20 ft) beyond the base of the timber structure to a total depth of 12.5 m (41 ft) bgs.

The 216-Z-1&2 Cribs operated from 1949 to 1969. From 1949 to 1952, the two cribs received PFP low-salt waste consisting of neutral to basic (pH 8 to 10) process waste and analytical and development laboratory waste from the 234-5Z Building via the 241-Z-361 Settling Tank. The 216-Z-1&2 Cribs were taken out of service in 1952 because the effluent flow rate to the cribs exceeded the infiltration capacity of the cribs, which then overflowed into the 216-Z-1A Tile Field. This low-salt waste stream was discharged to the 216-Z-3 Crib, which replaced the 216-Z-1&2 Cribs, from 1952 to 1959 and to the 216-Z-12 Crib, which replaced the 216-Z-3 Crib, from 1959 to 1973.

The cribs were used for two brief periods in 1966 and 1967 during work on the central distributor pipe in the 216-Z-1A Tile Field; these periods of service were only intended to be for the duration of the 216-Z-1A pipeline maintenance (ARH-2155). During these two periods, the cribs received very small quantities of high-salt waste directly from the PRF in the 236-Z PRF and the 242-Z Waste Treatment and Americium Recovery Facility. Significant volumes of organics were not discharged to these cribs during these short periods of time.

From 1968 to 1969, the cribs received uranium wastes directly from the 236-Z Building. Final use of the cribs to receive uranium waste was concluded in 1969 when the discharge of uranium waste was discontinued. The cribs were administratively retired in 1969 and physically isolated when the inlet piping was cut and blanked.

In total, the two cribs received approximately 33,700,000 L (10,271,000 gal) of effluent: 33,500,000 L between 1949 and 1952 (low-salt wastes), 104,000 L between 1966 and 1967 (high-salt wastes), and 98,000 L between 1968 and 1969 (low-salt wastes). The effluent volume is roughly 13 times the estimated soil pore volume between the base of the cribs and the current water table. An estimate of the discharged inventory includes 7 kg (15 lb) of plutonium and 100,000 kg (220,000 lb) of nitrate.

No data were identified regarding the concentration or distribution of nonradiological contaminants in soils at these two cribs. The quantity of nitrate and the volume of effluent received suggest the site contributed in the past to nitrate contamination in the unconfined aquifer.

In general, the distribution of plutonium and americium in the soils beneath the 216-Z-1&2 Cribs are expected to reflect limited radionuclide mobility, similar to that seen at the more extensively characterized 216-Z-12 Crib. The data indicates the majority of the plutonium and americium contaminant mass is less than 9.4 m (31 ft) bgs, with the highest activities (i.e., >1,000,000 pCi/g) found very near the base of the cribs.

216-Z-3 Crib

The 216-Z-3 Crib is located in the 200 West Area, south of the 234-5Z Building, immediately northeast of the 216-Z-1A Tile Field and adjacent to the 216-Z-1&2 Cribs. The surface elevation at the site is approximately 207.2 m (679.8 ft). Groundwater is approximately 71.7 m (235.1 ft) bgs based on a nearby well measurement in 2008.

The waste distribution system at the 216-Z-3 Crib consists of three corrugated metal culvert sections (6.7 m [22 ft] long, 1.2 m [4 ft] in diameter) laid horizontally, end-to-end, within a gravel-filled

excavation. Each culvert section was perforated with 2.5 cm (1 in.) diameter holes. The culvert sections were placed end-to-end, but it is not clear whether they were physically attached. Wire mesh was welded to both ends of the culvert to limit gravel intrusion. The base of the culverts is about 4.5 m (15 ft) below grade.

The excavation for the 216-Z-3 Crib was 7.6 m (25 ft) deep and, at its base, 1.5 m (5 ft) wide and 21.3 m (70 ft) long. At the base of the excavation, a clam bucket was used to dig two additional holes to a total depth of 13.7 m (45 ft) bgs to allow installation of two 20 cm (8 in.) diameter test wells (now decommissioned). On placement of the test well casings, the two holes were backfilled with sand up to the base of the excavation. These well excavations were likely preferential pathways for infiltrating effluent. Gravel was used to fill the excavation to within 2.4 m (8 ft) of the ground surface. The culvert sections and associated waste feed and overflow lines (20 cm [8 in.] vitrified clay pipe) were incorporated within the gravel. The base of the culverts is 4.5 m (15 ft) below grade, roughly 2.1 m (7 ft) below the top of the gravel. The gravel was covered with two layers of asphalt roofing paper and the trench was backfilled to grade with clean fill. Well 299-W18-67 is in the western half of the crib and Well 299-W18-68 is in the eastern half of the crib. Both wells have been decommissioned. A 1.2 m (4 ft) wide, 1.8 m (6 ft) long, and 10 cm (4 in.) thick concrete slab with penetrating risers is centered over the culvert.

The 216-Z-3 Crib received PFP liquid effluent from 1952 to 1959. The effluent, a low salt waste stream, was neutral to basic (pH 8 to 10) and included process waste as well as analytical and development laboratory wastes. Effluent was routed through a chemical sewer line from 234-5Z to the 241-Z-361 Settling Tank, and distributed through pipeline 200-W-210-PL to the western end of the 216-Z-3 Crib. Overflow from the crib went to the 216-Z-1A Tile Field.

The 216-Z-3 Crib was taken out of service in March 1959 after low concentrations of plutonium were detected in 1958 in the soil at the bottom of a well 46 m (150 ft) deep, and 15 m (50 ft) above the water table, near the crib (Well 299-W18-57, 18 m (60 ft) southwest of 216-Z-3). The 216-Z-3 Crib was taken out of service when the replacement crib, the 216-Z-12 Crib, was placed into service.

The 216-Z-3 Crib received approximately 178,000,000 L (46,992,000 gal) of low-salt waste, which is more than 80 times the estimated soil pore volume between the crib base and the current water table surface. The pore volume within the crib excavation (below the elevation of the overflow line) is roughly 270,762 L (71,528 gal). On average, between 1955 and 1958, the volume of effluent discharged to the 216-Z-3 Crib on a daily basis was approximately 33 percent of the crib pore volume (assumes 30 percent porosity). An estimate of the discharged inventory includes 5.7 kg (12.6 lb) of plutonium and 600,000 kg (1,320,000 lb) of nitrate.

Physical characterization data from radiological logging results from two test wells are summarized in

Table 7. Radionuclides Pu-239/240 and Am-241 were detected from the base of the culvert sections (approximately 4.6 m [15 ft] bgs) to roughly 8.4 m [27.4 ft] bgs), where logging data suggest the presence of fine-grained sediments. The crib floor is 7.6 m (25 ft) bgs. The logged wells are within excavations that extended 6.1 m (20 ft) below the base of the crib floor. The highest concentrations of Pu-239/240 and Am-241 in the western well, Well 299-W18-67, were found at approximately 5.8 m (18.9 ft) bgs. The passive neutron log indicated increased alpha activity between 4.6 and 6.7 m (15 and 22 ft) bgs, with the peak at 5.8 m (19 ft) bgs. In Well 299-W18-68, in the eastern part of the crib, the maximum Am-241 concentration was found at 5.8 m (19.1 ft) bgs, but the maximum Pu-239 concentration was found at 8.3 m (27.1 ft) bgs.

Table 7. Spectral Gamma Logging Results for the 216-Z-3 Crib

Well	Radionuclide	Depths of Detection (ft bgs)	Maximum Concentration (pCi/g)	Depth of Maximum (ft bgs)
299-W18-67	Am-241	16.9-26.4	230,000	18.9
299-W18-67	Pu-241	16.9-26.4	3,300,000	18.9
299-W18-67	Pu-239	15.4-27.4	1,700,000	18.9
299-W18-67	Pu-240	N/A	400,000	N/A
299-W18-68	Am-241	17.1-27.6	90,000	19.1a
299-W18-68	Pu-241	16.1-27.6	473,000	27.1
299-W18-68	Pu-239	15.6-28.1	480,000	27.1
299-W18-68	Pu-240	N/A	100,000	N/A

a. Repeat log data suggest the maximum concentration may be at 8.3 m (27.1 ft) bgs.
N/A = Not available; no data provided in the log data report.

At Well 299-W18-68, the highest responses on the passive neutron log, indicative of alpha activity, were from 4.9 to 6.4 m (16 to 21 ft) bgs, with a secondary peak 7.3 to 8.5 m (24 to 28 ft) bgs. Based on the logging results, all significant plutonium and americium contaminant mass is believed to be located between 4.6 and 5.8 m (15 and 29 ft) bgs, with the majority located between 4.9 and 6.4 m (16 and 21 ft) bgs. This is somewhat different from the distribution seen at the characterized 216-Z-12 Crib, in that much of the plutonium and americium contaminant mass is found at depths shallower than the crib floor. This contaminant distribution suggests even less plutonium and americium mobility than seen at the 216-Z-12 Crib.

Because the effluent volume was more than sufficient to reach groundwater and since there is nitrate contamination in the groundwater beneath this waste site, the site is considered a past source of nitrate contamination in the unconfined aquifer.

241-Z-361 Settling Tank

The 241-Z-361 Settling Tank is located approximately 35 m (115 ft) north of the 216-Z-1A Tile Field in the 200 West Area, within the boundary of the PFP Complex. The surface elevation at the site is approximately 207.2 m (679.8 ft). Groundwater is approximately 72.2 m (236.9 ft) bgs based on a nearby well measurement in 2008.

The surface elevation and hydrogeologic conditions at the 241-Z-361 Settling Tank site are the same as those for the adjacent 216-Z-1A Tile Field.

The 241-Z-361 Settling Tank is an underground, reinforced-concrete structure 8.5 m (28 ft) long and 4.5 m (15 ft) wide, with a 1 cm (3/8 in.) thick steel liner. The tank has inside dimensions of 7.9 by 4.0 m (26 by 13 ft) with 0.3 m (1 ft) thick walls. The bottom slopes, resulting in an internal height variation between 5.2 and 5.5 m (17 and 18 ft). The top is 0.6 m (2 ft) below grade. Two 15 cm (6 in.) diameter SST inlet pipes from the 241-Z Facility enter the settling tank from the north. A single 20 cm (8 in.) diameter SST pipe exits the tank from the south. Several risers are visible above grade.

The tank served as the primary solids settling tank for low-salt liquid waste from the 234-5Z, 236-Z, and 242-Z Buildings from 1949 to 1973. Supernatant effluent in the tank was discharged to the 216-Z-1&2, 216-Z-3, and 216-Z-12 Crib. Prior to discharge to the tank, the effluent was neutralized in the 241-Z sump tanks by adding fly ash, and later sodium hydroxide, to raise the pH to the 8 to 10 range.

The 241-Z-361 Settling Tank was taken out of service in May 1973 when discharge of contaminated waste streams to the ground from PFP was discontinued as a matter of policy.

The following significant findings are summarized for the 241-Z-361 Settling Tank:

- The settling tank currently contains approximately 75 m³ of sludge. The sludge is contaminated with radionuclides (primarily Pu-239), metals, organics, and polychlorinated biphenyls (PCBs).
- Helical piers installed to support tank sampling were surveyed when removed. No radiological contamination was detected.
- The lack of detected radiological contamination on the piers installed beneath the depth of the tank bottom, and the apparent stability in the tank sludge level since 1975, suggests that there has been no leak of tank contents to the soil column.
- All available information indicates the 241-Z-361 Settling Tank has not leaked, so this site is not considered to be a past or current source of groundwater contamination.

A video taken inside of the tank showed that there were cracks in the tank top and some of the reinforcing bar had been damaged (Baxter, 2000). Since waste is currently in the tank, it was not possible to make determinations about the structural integrity of the tank bottom. While the data indicate that this tank has not leaked, the tank structural integrity is such that there is a substantial threat of release to the environment. The kilogram quantity of plutonium in the sludge remaining in this tank presents potential future risks to human health and the environment.

5.6.2 200-PW-3 Waste Sites

The following sections describe the waste sites assigned to the 200-PW-3 OU, in the 200 East Area, and are presented in the following order: 216-A-8 Crib, 216-A-24 Crib, 216-A-7 Crib, 216-A-31 Crib, and UPR-200-E-56.

216-A-8 Crib

The 216-A-8 Crib is located approximately 177 m (580 ft) east of the A Tank Farm in the 200 East Area, at a surface elevation of approximately 198 m (650 ft). Groundwater beneath the 216-A-8 Crib was about 80 m (261.7 ft) bgs in 2005.

The bottom dimensions of the crib are 259 by 6 m (850 by 20 ft). The long axis of the crib trends to the east-northeast. A 61 cm (24 in.) diameter, schedule 20, perforated distribution line extends the length of the crib and rests on a 2 m (6.5 ft) thick layer of rock capped by a 30 cm (12 in.) thick layer of gravel. The gravel fill is mounded over the distribution line. Two layers of Sisalkraft® building paper cover the gravel and prevent overlying native sand backfill from filling the void space. The crib floor was excavated to a uniform elevation of 195 m (639.5 ft). The depth of the excavation varied from 4.9 to 5.8 m (16 to 19 ft.) below the 1955 ground surface. The site was surface stabilized in September 1990 by the addition of 0.6 m (2 ft) of clean fill. Water entered the crib through the 216-A-508 Diversion Box, located due west of the crib. The crib was permanently isolated in April 1995 by filling the 216-A-508 Diversion Box with concrete.

The 216-A-8 Crib was initially taken out of service in May 1958 when the discharged volume was approaching the inventory limit calculated for Sr-90. In January 1966, the 216-A-8 Crib was reactivated when a re-evaluation indicated it had not reached its waste capacity. The crib last received waste in 1985.

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Over its operational life, the 216-A-8 Crib received an estimated 1.15 billion L (303.8 Mgal) of process effluent, which is estimated to be greater than 30 times the pore volume beneath the site. The estimated discharged inventory for the 216-A-8 Crib included 390.8 kg (861 lb) of uranium; 2,410 Ci of Cs-137; 128,600 kg (283,500 lb) of TBP; 55,110 kg (121,500 lb) of NPH; and 24,561 Ci of tritium. No organics were detected.

The following significant findings are summarized for the 216-A-8 Crib:

- The highest radioactive contamination (Cs-137) associated with the crib was within 8 m (25 ft) of the ground surface.
- The maximum depth of radioactive contamination (Cs-137) detected near the crib, by geophysical logging techniques, was 76.5 m (251 ft) bgs. However, the source of the contamination at this depth is not known.
- Radionuclides were detected above background levels in soil samples beneath the 216-A-8 Crib to total depth (80 m [264.5 ft] bgs).

At the 216-A-8 Crib, the discharged effluent volume was greater than the soil column pore volume, which indicates the volume of effluent released was sufficient to reach the unconfined aquifer during operation of this waste site. However, the 216-A-8 Crib is not considered a significant current source of groundwater contamination.

Table 8 provides a summary of the maximum concentrations of COCs in soil samples at the 216-A-8 Crib.

Table 8. Maximum Concentrations of COCs in Soil at the 216-A-8 Crib

COC	Maximum Concentration (pCi/g)	Depth Interval (ft bgs)		Location
		Top	Bottom	
Cesium-137	877,000	19	21.5	C4545 Borehole

Source:

Remedial Investigation Report for Plutonium/Organic-Rich Process Condensate/ Process Waste Group OU: Includes 200-PW-1, 200-PW-3, and 200-PW-6 OUs; Appendix E – Data Summary Tables for Waste Sites (DOE/RL-2006-51).

216-A-24 Crib

The 216-A-24 Crib is located in the 200 East Area, approximately 140 m (460 ft) east of the 241-AN Tank Farm, and north of the 216-A-8 Crib. Surface elevation at the site is approximately 198 m (650 ft). Groundwater is approximately 76 m (249 ft) bgs based on a nearby well measurement in 2008. The 216-A-24 Crib is composed of four inline sections, each 107 m (350 ft) long, and each 1.8 m (6 ft) lower than the previous section and separated from the next by a soil berm. At its base, the crib is 427 m (1,400 ft) long and 6 m (20 ft) wide. Waste was distributed to the crib through a 38 cm (15 in.) diameter corrugated galvanized pipe that is perforated on the bottom half. In each section, the waste distribution line is placed horizontally in the middle of a 1.3 m (4.3 ft) bed of gravel, which is overlain by a polyethylene barrier and enough clean backfill to bring the excavation back to grade. The overlying ground surface dips to the east, such that the distribution line is approximately 1.5 m (5 ft) closer to the surface at the end of the section than it is at the beginning. The base of the waste distribution pipe ranges between 2.7 and 4.3 m (9 and 14 ft) below grade, depending on its location within the section. Eight 20 cm (8 in.) diameter wells on concrete pads are located on this crib. The wells extend from the bottom

of the crib to 0.9 m (3 ft) above grade. In addition, four 38 cm (15 in.) corrugated risers with filter box assemblies extend from the distributor pipe to grade.

The 216-A-24 Crib was constructed to replace the 216-A-8 Crib liquid waste site. It received low-salt, neutral to basic radioactive vapor condensate from the 241-A, 241-AX, 241-AY, and 241-AZ Tank Farms. After the crib was constructed, surface condensers were installed in the tank farms, which greatly reduced the waste volume discharged to the crib. As a result, most of the waste volume was discharged to the first two of the four crib sections. Over its operational life, the 216-A-24 Crib received an estimated 820 million L (216.5 Mgal) of process effluent. The estimated discharged inventory for the 216-A-24 Crib included 65 kg (143 lb) of uranium, 401 Ci of Cs-137, 21,420 kg (47,200 lb) of tributyl phosphate (TBP), 9,192 kg (20,300 lb) of normal paraffin hydrocarbon, and 8,798 Ci of tritium. The 216-A-24 Crib was taken out of service in December 1965 when it had reached its waste capacity. The site was surface stabilized in 1988. The volume of effluent discharged to the site was more than 14 times the soil pore volume between the bottom of the crib and the current water table surface. On the basis of the five wells monitoring the 216-A-24 Crib, measurable movement of radionuclides disposed to the ground was detected in all wells during crib operations. After waste disposal to the crib was terminated, radiation intensity increased in the lower portion of the sediment column in Well 299-E26-7. These data indicate breakthrough to the groundwater could have occurred from the first and second sections of the crib.

The site evaluation was conducted using geophysical logging results from 28 boreholes in and around the crib, and general information about the fate and transport of similar types of waste discharged to the 216-A-8 Crib.

Eighteen boreholes are located within the crib boundary; five of which penetrate the crib floor. Scintillation probe profiles from these wells reflect the waste discharge history. Wells 299-E26-4, 299-E26-5, and 299-E26-6 monitor the first and second sections of the crib. These sections received most of the volume and total beta activity discharged during 1958 and 1959. The profiles from these wells show high radiation intensity from these discharges. After December 1959, the volume and the amount of radioactive effluent sent to the crib were greatly reduced. The condensate was later rerouted to the third and fourth crib sections. Wells E26-2 and E26-3 monitor these sections of the crib and, in 1976, scintillation profiles showed radiation intensity at background levels.

The six boreholes in Table 9 show some level of Cs-137 contamination from ground surface to depths of at least 15.2 m (50 ft), with the highest concentrations being found somewhere between 4.6 and 7.0 m (15 and 23 ft) bgs. All six also showed notably elevated concentrations somewhere in the interval between 9.1 and 15.2 m (30 and 50 ft) bgs, although these concentrations were orders of magnitude lower than the borehole maximums. Logging data indicate the Cs-137 has not spread laterally outside the crib boundaries except as documented at the UPR-200-E-56 site to the north, where relatively minor activity levels (Cs-137 <100 pCi/g) have been detected.

Table 9. Logging Results for Wells of Interest at the 216-A-24 Crib

Location	Maximum Cs-137 Concentration (pCi/g)	Depth of Maximum Concentration (ft bgs)
299-E26-60 Well, head end of Section 1	700,000	17.1
299-E26-74 Well, eastern half of Section 1	1,000,000	16.0
299-E26-71 Well, 11 m (35 ft) north of 299-E26-74 Well	217,000	18.9
299-E26-61 Well, head end of Section 2	180,000	20.2
299-E26-62 Well, head end of Section 3	340	19
299-E26-63 Well, head end of Section 4	16,000	19.2

Source:

Remedial Investigation Report for Plutonium/Organic-Rich Process Condensate/ Process Waste Group OU: Includes 200-PW-1, 200-PW-3, and 200-PW-6 OUs; Appendix E – Data Summary Tables for Waste Sites (DOE/RL-2006-51).

216-A-7 Crib

The 216-A-7 Crib is located in the 200 East Area, approximately 40 m (130 ft) east of the 241-A Tank Farm and 23 m (75 ft) southwest of the 216-A-1 Crib. The surface elevation at the 216-A-7 Crib is approximately 206.4 m (677 ft). Groundwater is approximately 84.4 m (276.9 ft) bgs, based on water level measurements at a nearby well in 2008.

The 216-A-7 Crib was constructed in a 4.9 m (16 ft) deep excavation with a 3 by 3 m (10 by 10 ft) base. Perforated 15 cm (6 in.) vitrified clay pipe was used to distribute discharged liquids within the crib. The base of this piping is about 3.7 m (12 ft) below the current ground surface. Approximately 2.1 m (7 ft) of coarse rock (≥ 7.6 cm [3 in.] diameter) lie between the pipe and the native soils at the base of the excavation, which is about 5.8 m (19 ft) below the current ground surface.

The 216-A-7 Crib received aqueous liquid discharges in 1956 and 1957 and was replaced by the 241-A-302B Catch Tank in 1959. In November 1966, the crib received a one-time discharge of the organic inventory used for a 6-month process test at PUREX. The crib was deactivated in 1966, and isolated by blanking the effluent pipeline. In total, the site received approximately 326,000 L (86,100 gal) of effluent, of which 246,000 L (65,000 gal) was received in 1966.

The 216-A-1 and 216-A-7 Cribs shared a common radiological surface contamination area. In 1992, contaminated surface soil in the vicinity of these two cribs was scraped and consolidated on top of the 216-A-1 and 216-A-7 Cribs. The entire area was then stabilized (covered) with 46 to 61 cm (18 to 24 in.) of uncontaminated backfill, increasing the surface elevation by about 1 m (3 ft).

A 46 m (150 ft) deep dry well (299-E25-54) was installed at the site in 1955 to allow monitoring of radionuclides in the subsurface. It is located within the surface footprint of the crib, but approximately 4.5 m (15 ft) east of the crib base. Cs-137 was detected continuously from 1.9 to 3.1 m (6.3 to 10.4 ft) bgs. The highest activity levels were detected between 2.2 and 2.5 m (7.3 and 8.3 ft) bgs, with a maximum of approximately 600 pCi/g at 2.5 m (8.4 ft) bgs. Uranium-238 was detected at 8 m (28 ft), 10 m (34 ft), and continuously from 11 m (38 ft) to 1 m (42 ft) bgs, with a maximum concentration of about 18 pCi/g at 11 m (39 ft).

216-A-31 Crib

The 216-A-31 Crib is located in the 200 East Area, roughly 125 m (410 ft) south of PUREX and 19 m (61 ft) south of the 216-A-2 Crib. The surface elevation at the 216-A-31 Crib is roughly 217 m (712 ft). Groundwater is approximately 95 m (312 ft) bgs, based on water level measurements at a nearby well measurement in 2008.

The 216-A-31 Crib is 21 by 3 m (70 by 10 ft) at the bottom and 7.3 m (24 ft) deep. A 7.6 cm (3 in.) diameter SST perforated distribution pipe was placed horizontally 6.4 m (21 ft) below grade in the upper portion of a 0.9 m (3 ft) thick bed of gravel. The gravel was covered with polyethylene sheeting and 5 cm (2 in.) of sand, and the crib was backfilled to grade.

The 216-A-31 Crib was a below grade liquid waste site that was used from 1964 to 1966 to dispose of organic, low-salt, neutral to basic liquid waste from the 202-A Building L Cell, via the 241-A-151 Diversion Box. This waste stream had previously been discharged to the 216-A-2 Crib. The inventory discharged to the 216-A-31 Crib is estimated to include 371 Ci of Cs-137, 19,800 kg (43,700 lb) of TBP, and 8,491 kg (18,700 lb) of NPH. The 216-A-31 Crib was taken out of service in November 1966 because the PUREX organic waste was no longer being discharged to the ground.

The effluent volume was between 10,000 L (2,600 gal) and 30,545 L (8,070 gal), which is less than 1 percent of the estimated total soil pore volume between the bottom of the crib and the current water table surface. This ratio indicates that the effluent did not migrate any significant distance below the crib. Because Cs-137 typically sorbs to soil immediately below the release point, concentrations are expected to be highest at 7.3 m (24 ft) bgs. Cesium-137 concentrations are expected to decrease with depth and, due to the small discharge volume, notable concentrations are not expected to extend more than a few meters beyond the crib floor.

UPR-200-E-56 Unplanned Release

The UPR-200-E-56 site is located immediately north of the 216-A-24 Crib in the 200 East Area. The site has a surface elevation of approximately 196 m (643 ft). Groundwater is approximately 74 m (243 ft) bgs, based on nearby a well measurement in 2008.

The site originated as a sloping excavation intended to generate clean borrow material for backfilling around the then new, below grade 241-AN tanks. The final excavation ranged from 1.5 to 6.1 m (5 to 20 ft) deep (estimated), and was 131 m (430 ft) long, and an average of 33.5 m (110 ft) wide. During radiation monitoring performed in June 1979, the excavation was found to be moist and radioactively contaminated. The moisture and contamination appears to be effluent waste from the adjacent 216-A-24 Crib that had seeped laterally over the surface of a 10 cm (4 in.) thick hardpan crust approximately 4.6 m (15 ft) bgs.

Upon discovery of contamination, the pit was refilled with contaminated soil retrieved from the 241-AN tanks location and UPRs associated with the 241-C Tank Farm and the 200 East Area. These soils are expected to have low-level radioactive contamination that is homogeneously distributed as a result of mixing of soils during transfers. The site then was covered with 15 to 20 cm (6 to 8 in.) of clean soil. In 1985, contaminated soil from the 244-A Lift Station (UPR-200-E-100) was disposed at this site and the site was restabilized with 0.6 m (2 ft) of clean soil.

Since this waste site was an unplanned release, neither the volume of effluent that migrated laterally from the 216-A-24 Crib to UPR-200-E-56, nor the associated contaminant inventory is known. The contaminant inventory contained in the soils imported from other sites also is not known.

In 2005 and 2006, spectral gamma geophysical logging was performed on six of the seven wells within the perimeter of UPR-200-E-56. Cesium-137 was the only manmade radionuclide detected. The highest Cs-137 concentrations identified were 80 pCi/g at 3.8 m (12.5 ft) bgs in Well 299-E26-66, and 46 pCi/g at 2.7 m (9 ft) bgs in Well 299-E26-69.

The identified Cs-137 concentrations are more than 61 m (200 ft) above groundwater. The volume of effluent that initially migrated to the site from the 216-A-24 Crib is not known, but residual contaminant distribution suggests it was readily retained within the upper 15 m (50 ft).

5.6.3 200-PW-6 Waste Sites

The following sections describe the waste sites assigned to the 200-PW-6 OU, located in the 200 West Area, and are presented in the following order: 216-Z-8 French Drain, 216-Z-10 Injection/Reverse Well, 241-Z-8 Settling Tank, and 216-Z-5 Crib.

216-Z-8 French Drain

The 216-Z-8 French Drain is located east of the 234-5Z Building, and approximately 94 m (308 ft) northwest of the 216-Z-9 Trench in the 200 West Area. The surface elevation at the site is approximately 205.2 m (673.2 ft). Groundwater is approximately 70.2 m (230.4 ft) bgs based on a nearby well measurement in 2008.

The French drain bottom dimensions form a 1.5 by 1.5 m (5 by 5 ft) square with angled walls. The bottom 0.9 m (3 ft) of the excavation is backfilled with clean, graded gravel. A seal of building paper was laid over the gravel with a 0.9 m (3 ft) diameter hole to match the two sections of a 0.9 m (3 ft) vitrified clay pipeline placed end-to-end over the hole. A concrete collar was poured around the bottom of the clay pipeline, on the top of the building paper. The clay pipeline was filled with gravel and capped with building paper and a wire mesh reinforced-concrete slab to seal the top of the structure. The overflow pipe from the 241-Z-8 Settling Tank entered through the center of the concrete cap of the French drain. Woven wire mesh was placed at the opening of the pipe into the French drain to ensure a void space at the waste inlet. The entire structure was backfilled, resulting in the top of the structure being 2.5 m (8 ft) below grade. Waste overflow entered the gravel-filled excavation at 4.4 m (14 ft) below grade from the 241-Z-8 Settling Tank. The total volume filled with gravel in the French drain was more than 4 m³ (141 ft³). The French drain was designed assuming a net porosity of 30 percent, such that more than 1,000 L (265 gal) of solution could be accommodated. This was sufficient capacity to permit the waste solution to percolate into the sediments beneath the French drain between batch discharges of waste and rinse water from the 241-Z-8 Settling Tank.

The 216-Z-8 French Drain received low-level plutonium contaminated waste from the 234-5Z Building from 1955 to 1962. No organic waste was discharged to the 216-Z-8 French Drain. The waste stream was dilute and neutral, with no fission or activation product content, and was relatively low in both disposal rate and total disposal volume. It is estimated that 9,590 L (2,530 gal) of liquid waste containing an estimated 48.2 g (1.7 oz) of plutonium overflowed from the 241-Z-8 Settling Tank to the 216-Z-8 French Drain by the time it was retired in 1962.

A characterization well (299-W15-202) was drilled in 1980, and soil samples were collected to define the plutonium and americium distribution beneath the 216-Z-8 French Drain (RHO-RE-EV-46P). The well was located less than 1 m (3 ft) south of the 216-Z-8 French Drain, and was drilled to 53.6 m (176 ft) bgs. A maximum value of 457 pCi/g of Am-241 was reported at 6.1 m (20 ft) bgs, near the bottom of the 216-Z-8 French Drain. A maximum Pu-239 value of 4,620 pCi/g was reported at 7.6 m (25 ft) bgs. Results indicate that plutonium and americium were sorbed onto sediments within a few meters beneath the French drain. The data indicates that the nature and extent of contamination are confined to a shallow vadose zone region directly adjacent to the 216-Z-8 French Drain.

216-Z-10 Injection/Reverse Well

The 216-Z-10 Injection/Reverse Well is approximately 30.5 m (100 ft) east of the 231-Z Building in the 200 West Area. The surface elevation at the site is approximately 206.3 m (676.8 ft). Groundwater is approximately 71.3 m (234 ft) bgs based on nearby Well 299-W15-1 on February 27, 2008. Groundwater was approximately 58.8 m (193 ft) bgs at nearby Well 299-W15-1 in 1945.

The 216-Z-10 Injection/Reverse Well was drilled in September 1944. The well was 0.15 m (6 in.) in diameter and constructed of Schedule 40 steel pipe. The drilling log reported depth to bottom at 45.7 m (150 ft) bgs, with a capped flange extending approximately 0.31 m (1 ft) above grade. Three inlet pipes enter the well at 1.5 m (5 ft), 1.8 m (6 ft), and 2.1 m (7 ft) bgs. Historical drawings suggest that a 1.3 cm (0.5 in.) copper tube extends from ground surface to 0.6 m (2 ft) bgs, where it enters the 216-Z-10 Injection/Reverse Well, and may extend to the well bottom. The well was perforated from 36 to 45.7 m (118 to 150 ft) bgs, with a cement plug in the bottom.

The 216-Z-10 Injection/Reverse Well received process and laboratory waste from the 231-Z Building via the 231-Z-151 Sump between February and June 1945. It is estimated that 988,000 L (260,000 gal) of liquid containing up to 50 g (1.6 oz) of plutonium was discharged to the well at approximately 76 L/min (20 gal/min). No other radionuclides were reported to have been released to the 216-Z-10 Injection/Reverse Well. During drilling of nearby Well 299-W15-42, it was estimated the depth to the highest recorded water table in the area of the 216-Z-10 Injection/Reverse Well was 58 m (191 ft) bgs. This suggests the water table did not rise near the 216-Z-10 Injection/Reverse Well perforated interval in later years.

The 216-Z-10 Injection/Reverse Well was taken out of service in June 1945 because the well had been plugged with sludge. In 1947, three monitoring wells (299-W15-59, 299-W15-60, and 299-W15-61) were drilled 4.6 m (15 ft) from the 216-Z-10 Injection/Reverse Well for the collection of characterization soil samples. The wells were drilled to 53.3 m (175 ft) bgs, which was 7.6 m (25 ft) below the bottom of the reverse well.

Characterization soil samples were collected at a minimum frequency of every 1.5 m (5 ft), and every 0.3 m (1 ft) where contamination was suspected to exist. Contamination, specifically plutonium, was not detected in any of the soil samples. In 2005, passive-neutron logging to detect alpha contamination was conducted in these three monitoring wells, and the results confirm that plutonium has not moved 4.6 m (15 ft) laterally from the injection/reverse well toward the soil borings. Cesium-137 was detected near the ground surface and at a few locations near its minimum detection level of approximately 0.2 pCi/g. Any residual radionuclide contamination at the 216-Z-10 Injection/Reverse Well appears to be confined within the 9.1 m (30 ft) diameter lateral circle formed by the three vadose zone wells, and near the vertical perforated zone of the injection/reverse well.

241-Z-8 Settling Tank

The 216-Z-8 Settling Tank is located in the 200 West Area, roughly 61 m (200 ft) east of the 234-5Z Building and 91 m (300 ft) west-northwest of the 216-Z-9 Trench. The surface elevation at the site is approximately 205.2 m (673.2 ft). Groundwater is approximately 70.2 m (230.4 ft) bgs based on a nearby well measurement in 2008.

The 241-Z-8 Settling Tank is a cylindrical tank that is 12.2 m (40 ft) long and 2.4 m (8 ft) in diameter. It is constructed of 0.8 cm (0.31 in.) thick steel or wrought iron plate, and oriented horizontally at about 1.8 m (6 ft) below grade. The tank was fed by two 3.8 cm (1.5 in.) diameter SST pipes that enter the western end of the tank about 15 cm (6 in.) below the tank top. A single pipeline exits the opposite end of the tank, to direct overflow to the 216-Z-8 French Drain, approximately 11 m (36 ft) to the east.

The 241-Z-8 Settling Tank was in service from 1955 to 1962, receiving pH neutral effluent waste from back flushes of the RECUPLEX feed filters. Silica gel was added to the waste stream as a settling agent, and the effluent was flushed to the 241-Z-8 Settling Tank with nitric acid. Overflow from the tank was piped to the 216-Z-8 French Drain. It was 1957 before the volume of effluent discharged to the tank surpassed the tank capacity (58,500 L [15,435 gal]) and liquids might have begun overflowing to the 216-Z-8 French Drain. Physical measurements of the tank contents in 1959 showed the tank had reached its overflow capacity, indicating that waste was overflowing to the 216-Z-8 French Drain.

The 241-Z-8 Settling Tank was taken out of service in June 1962. Based on available records, the tank is assumed to have been filled to overflow capacity when it was taken out of service.

April 1974 surveillance data reported the tank contents as 29,000 L (7,650 gal) of liquids and 1,880 L (500 gal) of sludge. Because the tank was expected to be at capacity, the 27,580 L (7,285 gal) shortfall suggested a tank leak may have occurred, prompting efforts to remove residual tank liquids. Laboratory analysis of samples collected at the time of the surveillance and in May 1974 suggested a residual plutonium inventory of between 8 g and 1,444 g. Liquids present in the tank had a pH of 6.

All pumpable liquid was removed from the tank, and the tank was flushed with 18,800 L (5,000 gal) “fifty percent caustic solution,” leaving approximately 18 cm (7 in.) of sludge, equivalent to 1,880 L (500 gal). A sample of this sludge collected in October 1974 contained a pH of 6.1 and a plutonium concentration of 0.02 g/L. This concentration, averaged across the residual sludge volume, would indicate a residual plutonium inventory of about 38 g. Based on the variability in plutonium concentrations detected in the earlier sludge sampling event, the total plutonium inventory in the residual sludge is estimated to be no more than 1,500 g, and may be less than one-half that amount.

The 241-Z-8 Settling Tank was characterized in 1984 (RHO-RE-EV-46 P) by installation of four wells south of the tank to a depth of 7.6 m (25 ft) bgs (Wells 299-W15-198, 299-W15-199, 299-W15-200, and 299-W15-201). Two sediment samples were collected from each well at 4.6 and 6.1 m (15 and 20 ft) bgs. In addition, four core samples were collected south of the tank from 0 to 30 cm (0 to 12 in.) bgs. The maximum plutonium concentration detected was 44 pCi/g in the sample from 0 to 15 cm (0 to 6 in.) bgs. The investigation identified no significant contamination in the soil column, suggesting that no leak had occurred. Since waste is currently in the tank, it was not possible to make determinations about the structural integrity of the tank bottom. While the data indicate that this tank has not leaked, the tank structural integrity is such that there is a substantial threat of release to the environment. The kilogram quantity of plutonium in the sludge remaining in this tank presents potential future risks to human health and the environment.

216-Z-5 Crib

The 216-Z-5 Crib is in the 200 West Area, approximately 36 m (118 ft) east-northeast of the 231-Z Building. The surface elevation at the site is approximately 207 m (678 ft). Groundwater is approximately 71.3 m (234 ft) bgs based on a nearby well measurement in 2008.

The 216-Z-5 Crib was a liquid waste site that was used from 1945 to 1947 to dispose of 231-Z Building process waste that accumulated in the 231-W-151 Vault. The crib consists of two inline, interconnected 3.8 m (12 ft) square, 1.2 m (4 ft) deep wooden sump boxes that are open at the bottom. Each box was placed at the bottom of a 5.5 m (18 ft) deep rectangular excavation that was approximately 4.3 m (14 ft) square at the base, and then covered with fill to bring the site back to original grade. The two boxes were roughly 20 m (65 ft) apart on center. The crib was oriented north-south and effluent was piped in from the southern end. The crib was deactivated by capping the inlet line from the vault. The site was stabilized (a layer of clean soil added to the ground surface) in 1990. The 216-Z-5 Crib was taken out of service in February 1947 because the soil porosity had been sealed by the sludge in the waste discharged to the crib.

In total, the 216-Z-5 Crib received 31,000,000 L (8,184,000 gal) of effluent. The discharged inventory was estimated to include 340 g (0.75 lb) of plutonium and 100,000 kg (220,000 lb) of nitrate. In 2007, a reevaluation of inventory discharged from the 231-Z Building derived a similar estimate for plutonium and a lower estimate for nitrate.

Eight wells were drilled around the first crib structure in 1947 to assess plutonium distribution in the soils. None penetrated the bottom of the crib structures. Soil analyses indicated only 0.5 g (0.02 oz.) of the plutonium inventory could be accounted for and the remainder of the plutonium discharged to this crib remains directly beneath the crib bottom. Geophysical logging of six of these wells in 2005 supported the results of the 1947 effort, detecting no plutonium or other alpha emitters in the soil column.

The volume of effluent received 31,000,000 L (8,000,000 gal) is approximately 43 times the soil pore volume between the base of the crib and the current water table surface. This suggests mobile waste constituents, such as nitrate, could easily have reached the unconfined aquifer. However, discharges to the soil have been discontinued and significant future impacts are not expected.

Plutonium (and americium from decay of Pu-241) are expected to be sorbed to soils directly under the crib. Based on data from similar sites, most of the contaminant mass is expected to be between 5.5 and 6.7 m (18 and 22 ft) bgs.

5.6.4 200-CW-5 Waste Sites

The 200-CW-5 OU waste sites, also known as the Z-ditches, are the 216-Z-1D Ditch, 216-Z-11 Ditch, 216-Z-19 Ditch, 216-Z-20 Tile Field, and UPR-200-W-110 Unplanned Release.

216-Z-1D Ditch

The 216-Z-1D Ditch operated from 1944 to 1959. It was 1,295 m (4,249 ft) long and 0.6 m (2 ft) deep, with a bottom width of 1.2 m (4 ft), side slopes of 2.5:1, and a minimum grade of 0.05 percent (WHC-EP-0707). Originally, the ditch flowed from a headwall located approximately 60 m (196 ft) east of Building 231-Z. In 1949, after approximately 4 years of operations and as part of Building 234-5Z (Z Plant) construction, the north 526 m (1,725 ft) section of this ditch was abandoned, backfilled, and replaced with process sewer piping that was routed around 234-5Z facility security fencing. A new headwall was constructed approximately 457 m (1,500 ft) downstream where the new pipeline emptied into the remaining south portion of the ditch. The south portion continued to operate until 1959 and had the potential to receive cooling water waste containing constituents associated with the additional processes that occurred at the 231-Z Plutonium Isolation Plant after 1949.

The north portion of the 216-Z-1D Ditch reportedly did not contain significant contamination when it was abandoned in 1949 and, according to data gathered in 1981, is significantly less contaminated than the south portion of the 216-Z-1D Ditch. The coil failures that were a major source of cooling water waste stream contamination in later years had not yet developed, and no reports of process-upset discharges have been identified. Open ditches were routinely surveyed for radiological contamination to control the potential spread of windblown contamination. In 1981, sampling at the north end of the 216-Z-1D Ditch identified a maximum plutonium concentration of less than 70 pCi/g. The early plutonium purification process in the 231-Z Plutonium Isolation Plant that produced the early 216-Z-1D Ditch waste streams was a tightly controlled process due to the high value of the concentrated plutonium product being processed. At that time, process waste streams were segregated with regard to their potential to contain plutonium with major plutonium-containing waste streams being recycled directly back to 224-T Concentration Facility. The cooling water waste streams did not have a recognized potential to contain plutonium. All other secondary waste streams having a potential to contain plutonium were sent to the 231-W-151 Sump where they were analyzed, neutralized, and either recycled back to the 224-T Concentration Facility for

reprocessing, or, if the plutonium was not considered recoverable, disposed to the 216-Z-4 Trench, 216-Z-5 Crib, 216-Z-6 Crib, and/or 216-Z-10 Injection/Reverse Well. Waste containing plutonium was not expected to have been disposed to the 216-Z-1D Ditch.

216-Z-11 Ditch

The 216-Z-11 Ditch operated from 1959 to 1971 and was constructed to replace the 216-Z-1D Ditch after high plutonium contamination was discovered in the portion below the new headwall. As with the other Z-Ditches, it is presumed that the 216-Z-11 Ditch was retired due to evidence of unacceptable levels of surface contamination obtained during operations. The 216-Z-11 Ditch was excavated immediately east of and parallel to the south portion of the 216-Z-1D Ditch and was of similar length (approximately 797 m [2,615 ft] long), width (1.2 m [4 ft] at the bottom), and depth (0.6 m [2 ft] deep). Material excavated for 216-Z-11 Ditch construction was used to backfill the 216-Z-1D Ditch to grade.

216-Z-19 Ditch

In April 1971, the 216-Z-11 Ditch was retired and replaced with the 216-Z-19 Ditch. The 216-Z-19 Ditch was dug west of and parallel to the 216-Z-1D and 216-Z-11 Ditches and operated from 1971 to 1981. Excavation material was used to backfill the 216-Z-11 Ditch to grade. The 216-Z-19 Ditch was similar to that of the previous ditches, except that it was 1.2 m (4 ft) deep.

In 1971, during construction of the 216-Z-19 Ditch, contaminated sediments approximately 130 m (427 ft) from the 216-Z-1D Ditch were inadvertently excavated. Consequently, this portion of the ditch was shifted approximately 10.6 m (35 ft) west. The contaminated sediments were reburied in a trench dug parallel to and east of the 216-Z-11 Ditch, currently designated UPR-200-W-110 Unplanned Release site.

In late March 1976, an accidental release of contamination occurred in the 216-Z-19 Ditch and efforts were made to contain the contaminants in the ditch. A series of three earthen dams were constructed at intervals along the portion of the ditch to raise the ditch water level above the original contaminated water line and to stop contaminated waste water from reaching the 216-U-10 Pond. A water sprinkler system was installed between the lowermost dam and the 216-U-10 Pond to control the spread of windblown contamination by preventing this portion of the ditch from drying out. Thereafter, waste water never reached the pond. In March 1978, the sprinklers were shut down and the dams were removed, but the remaining surface water infiltrated the soil column before reaching the pond. Consequently, from 1976 until 1981 when the 216-Z-19 Ditch ceased receiving effluent, waste stream contaminants were disposed to the soil column. Waste water was diverted from the 216-Z-19 Ditch to the 216-Z-20 Tile Field shortly afterward.

Deactivation and stabilization of the Z-Ditches area began in 1981, following construction of the 216-Z-20 Tile Field as the primary Z Plant waste water disposal facility. The 216-Z-19 Ditch was covered with 0.6 to 1 m (2 to 3 ft) of clean soil. The concrete headwalls, vegetation, and miscellaneous unsalvageable equipment were incorporated into the ditch bottom. At the same time, the previously buried 216-Z-1D and 216-Z-11 ditches received an additional 0.15 to 0.30 m (0.5 to 1.0 ft) of clean fill. The Z-Ditches area likely has 0.30 to 0.6 m (1 to 2 ft) of accumulated stabilizing soil cover over the ditch backfill material. The entire Z-Ditch Complex was reposted as an Underground Radioactive Materials Area.

216-Z-20 Tile Field

The 216-Z-20 Tile Field operated from 1981 to 1995. It was used to dispose of similar effluent that had previously been routed via the ditches to the 216-U-10 Pond. The 216-Z-20 Tile Field is an unlined, subsurface disposal site that is 463 by 3 m (1,519 by 10 ft) at the base of the unit with a depth of 2.9 m (9.5 ft). Three perforated polyvinyl chloride (PVC) pipes run the length of the ditch in a bed of gravel that was backfilled with clean gravel and soil. The 216-Z-20 Tile Field received cooling water, steam

condensate, storm sewer runoff, and/or building and chemical drain waste from Building 234-5Z (Z Plant), 231-Z Plutonium Isolation Plant, Building 291-Z, 232-Z Waste Incinerator Facility, 236-Z Plutonium Reclamation Facility, and 2736-Z Plutonium Storage Building.

The site received effluent volume of 3.8 billion L (1 billion gal) with an effluent volume to soil-pore-volume ratio of 173:1. The estimated site inventory for plutonium is less than 1 g (0.03 oz), and inventories for cesium, americium, and strontium are estimated at 1 Ci or less. A total of 1 Ci of Am-241 and 2 Ci of Pu-239 were released to the crib in 1985 from contamination of process cooling. Further, such releases were prevented by installation of secondary coolant loops.

UPR-200-W-110

UPR-200-W-110 Unplanned Release is a narrow, one-time use disposal trench located immediately east of and parallel to the 216-Z-11 Ditch. This trench was used to dispose of spoils containing 216-Z-1D Ditch sediments and clean backfill material inadvertently excavated from the 216-Z-1D Ditch during 216-Z-19 Ditch construction in 1971. The trench is 129.5 m (425 ft) long and 4.6 m (15 ft) deep. The bottom 2 m (7 ft) of the trench was filled with the spoils material and filled to grade with clean backfill. Consequently, this site contains similar waste constituents as the other Z-Ditches. No inventory is reported for this site. This trench is within the same underground radioactive material zone as the other Z-Ditches.

200-CW-5 OU Nature and Extent of Contamination

Three of the 200-CW-5 waste sites (216-Z-1D (south portion), 216-Z-11, and 216-Z-19 Ditches) were analyzed collectively as one contiguous contamination area. Radionuclides were not detected above screening levels below soil depths of approximately 5.3 m (17.5 ft) bgs. Sampling results show that these waste sites have relatively little chemical contamination and the primary radionuclides are relatively immobile in soil. The highest concentrations are found in the areas that correspond to the ditch bottoms and the interval down to 1 to 1.8 m [3 to 6 ft] below the ditch bottom. Below this interval of high concentrations, plutonium and americium concentrations decrease with depth.

A summary of the maximum concentrations of contaminants in the Z-Ditches in the zone from 0.6 to 5.3 m (2 to 17.5 ft) bgs is shown in Table 10. Radionuclide contamination in the Z-Ditches begins at a depth of about 0.6 m (2 ft) bgs. From 0.6 to 1.2 m (2 to 4 ft) bgs, there are small amounts of Cs-137 and Sr-90 and occasionally significant quantities of Pu-239/240 (40,000 pCi/g found at the 216-Z-11 Ditch in 1981) and Am-241 (9,500 pCi/g found at the 216-Z-19 Ditch in 1979). The highest concentrations of plutonium and americium were reported in the 216-Z-19 Ditch and the 216-Z-1D Ditch from 1.2 to 5.3 m (4 to 17.5 ft) bgs. Cesium-137 also is present at high concentrations (66,000 pCi/g) at this depth. The exception to these results is found at the north end of the 216-Z-1D Ditch where analytical sampling and geophysical logging at two locations show Pu-239/240 and Am-241 at concentrations of less than 100 pCi/g. Concentrations of all contaminants decrease with depth and radionuclide contamination is less than 1 pCi/g below 5.3 m (17.5 ft) bgs. The maximum Pu-239/240 concentration was reported as 13,000,000 pCi/g at the south end of the 216-Z-19 Ditch. However, this concentration is orders of magnitude higher than contaminant levels generally reported for this area and appears to be a localized contamination effect and a statistical outlier.

Table 10. Maximum COC Concentrations in 200-CW-5 Waste Sites

COC	Maximum Concentration	Sample Location (Ditch)	Sample Date	Sample Depth (ft bgs) ^a
Cesium-137	66,000 pCi/g ^b	216-Z-19	1976	7
Americium-241	7,870,000 pCi/g ^c	216-Z-19	1976	7
Strontium-90	216 pCi/g	216-Z-19	3/24/76	7
Plutonium-239	780,000 pCi/g	216-Z-1D	1959	8
Plutonium-239/240	13,000,000 pCi/g	216-Z-19	5/1979	4
Radium-226	5,200 pCi/g	216-Z-19	4/21/76	7
Aroclor 1254	52 mg/kg	216-Z-11	2002	7.5 to 10
Aroclor 1260	78 mg/kg	216-Z-11	2002	7.5 to 10
Boron	24 mg/kg	216-Z-11	2002	7.5 to 10
Mercury	166 mg/kg	216-Z-11	4/24/02	7.5 to 10

a. Sample depths shown are depths bgs at the time of sampling. Contamination now 1 to 0.6 m (2 ft) deeper at locations sampled before 1981 due to addition of stabilization material.

b. Decayed value for Cs-137 was used from 2003 (DOE/RL-2003-11, *Remedial Investigation for the 200-CW-5 U Pond/Z Ditches Cooling Water Group, the 200-CW-2 S Pond and Ditches Cooling Water Group, the 200-CW-4 T Pond and Ditches Cooling Water Group, and the 200-SC-1 Steam Condensate Group Operable Units*). Cesium-137 has a half-life of only 30 years and decayed value was used because concentrations have diminished significantly since sample collection.

c. Americium value shown is the value measured at the time of sample analysis and does not reflect radioactivity decay or Pu-241 ingrowth since then.

d. All nonradiological soil sample results from 2002 RI sampling of Borehole C3808.

bgs= below ground surface

A total of 12 samples were analyzed for Ra-226. Ra-226 was detected at a concentration of 5,200 pCi/g at the 216-Z-19 Ditch. Ra-226 was detected at a concentration of 5,000 pCi/g at the 216-Z-19 Ditch U Pond inlet (Delta). Both of these detections were at an original depth of 2.1 m (7 ft) bgs, and a corrected depth of 9 ft bgs after the 2 ft of stabilized material. The remaining 10 Ra-226 measurements were at concentrations ranging between 0.4 pCi/g and 1.1 pCi/g.

The gross gamma and passive neutron detector logging results showed agreement with the spectral gamma logging data, both of which identified a major zone of contamination at approximately 2.9 m (9.5 ft) bgs.

Am-241 and Pu-239 are present in UPR-200-W-110. The maximum plutonium concentration from a set of 9 boreholes in and around the UPR-200-W-110 site of 3,300 (+/-1,000) pCi/g and Am-241 at 400 pCi/g, were measured in a borehole located near the center and bottom of the trench at 3.8 m (12.5 ft) bgs. Screening data showed less than 1,000 pCi/g at the other UPR boreholes. The screening results confirm the presence of plutonium and americium in UPR-200-W-110, but at lower concentrations than the Z-Ditches because of mixing contaminated sediments with clean backfill during the excavation and reburial activities.

6.0 Current and Potential Future Site and Resource Uses

This section discusses the current and reasonably anticipated future land uses at the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs, as well as the current use and future beneficial groundwater use of the groundwater located beneath these OUs. Land use forms part of the basis for exposure assessment assumptions and risk characterization conclusions.

6.1 Current Land Use

All current land-use activities associated with the Inner Area of the Central Plateau are industrial in nature. The facilities located in the Inner Area processed irradiated fuel from the plutonium-production reactors in the 100 Area. Most of the facilities directly associated with fuel reprocessing are now inactive and awaiting final disposition. The Plutonium Finishing Plant (PFP) is currently being demolished. Several waste management facilities operate in the Central Plateau, including permanent waste disposal facilities such as ERDF, low-level radioactive waste burial grounds, and RCRA-permitted mixed-waste trenches. Construction of the high-level waste treatment facilities in the Central Plateau began in 2002. The 200 East Area is the planned disposal location for the vitrified low-activity tank wastes. Non-Hanford Site DOE organizations and the U.S. Department of the Navy use the 200 East TSD units. In addition, US Ecology, Inc. operates a commercial low-level radioactive waste disposal facility on a 40-ha (100-ac) tract of land at the southwest corner of the 200 East Area that is leased to Washington State.

6.2 Anticipated Future Land Use

The reasonably anticipated future land use for the Inner Area of the Central Plateau is industrial (DOE worker) for at least 50 years and then industrial (DOE or non-DOE worker) thereafter.

The DOE worked for several years with cooperating agencies to define land-use goals for the Hanford Site. The cooperating agencies and stakeholders included the National Park Service, Tribal Nations, the states of Washington and Oregon, local county and city governments, economic and business development interests, environmental groups, and agricultural interests. A 1992 report, *The Future for Hanford: Uses and Cleanup – The Final Report of the Hanford Future Site Uses Working Group*, was an early product of the efforts to develop land-use assumptions. The report recognized that the Central Plateau would be used to some degree for waste management activities for the foreseeable future. Following the report, DOE issued the *Hanford Comprehensive Land-Use Plan Environmental Impact Statement* (HCP EIS [DOE/EIS-0222-F]) and associated HCP EIS ROD (64 FR 61615) in 1999. The HCP EIS presents the potential environmental impacts of alternative land-use plans for Hanford and presents the land-use implication of ongoing and proposed activities. Under the preferred land-use alternative selected in the HCP EIS ROD, the Central Plateau was designated for industrial exclusive use, defined as areas suitable and desirable for TSD of hazardous, dangerous, radioactive, and nonradioactive wastes, as well as related activities.

The Tri-Party agencies have agreed that the reasonably anticipated future land use for the Inner Area of the Central Plateau is industrial land use and includes TSD of hazardous, dangerous, radioactive, and nonradioactive wastes. As long as residual contamination remains above levels that allow for unrestricted use, institutional controls will be required.

6.3 Current Ground and Surface Water Uses

Groundwater below the Central Plateau is currently contaminated and not withdrawn from the aquifer for beneficial use (drinking water or industrial use). An alternate source of water derived from the Columbia River is provided to current industrial workers conducting activities on the Central Plateau.

The Columbia River is the second largest river in the contiguous United States in terms of total flow and is the dominant surface-water body on the Hanford Site. The Columbia River is the principal source of drinking water for the Tri-Cities and the Hanford Site. In addition, the river is used regionally for irrigation and recreation, which includes fishing, hunting, boating, water skiing, diving, and swimming.

6.4 Potential Future Ground and Surface Water Uses

Groundwater located beneath the 200-CW-5, 200-PW-1, and 200-PW-6 OUs is part of the 200-ZP-1 groundwater OU. The NCP establishes the expectation that EPA will return usable ground waters to their beneficial uses wherever practicable and within a reasonable time frame given the particulars of the site (40 CFR § 300.430(a)(1)(iii)(F)). The EPA generally defers to state agency definitions of useable

groundwater provided under the various comprehensive state groundwater protection programs (CSGWPPs) administered by the states across the country.

Based on physical yield and natural water quality, the State of Washington, through its groundwater protection program, has determined that the aquifer setting for the 200-ZP-1 OU meets the Washington Administrative Code (WAC) definition for potable groundwater, and for beneficial use, and has been recognized by the State as a potential source of domestic drinking water. However, it is unlikely that the 200-ZP-1 OU groundwater will be used as a drinking water source in the future because drinking water is provided from a central water treatment facility.

Current uses of the Columbia River are anticipated to continue in the future. The remedial actions for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs will prevent contaminants from reaching the groundwater, which will also protect the Columbia River and its ecological resources from degradation and unacceptable impact caused by migration of contaminants originating from these OUs.

7.0 Summary of Site Risks

This section of the ROD summarizes the site risks associated with the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs, as identified in the baseline risk assessment. This section of the ROD includes information on the human health risk assessment (HHRA) and ecological risk assessment and states the basis for taking action at the site.

7.1 Summary of Human Health Risk Assessment

The human health risk assessments for these waste sites were developed to quantitatively evaluate both the cancer risks and noncancer health hazards from exposure to radionuclides and nonradioactive contaminants present at the waste sites. The baseline risk assessment evaluates risks under current industrial land use conditions, assuming no remedial action was taken, and under unrestricted land use conditions. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the ROD summarizes the results of the baseline risk assessment for these waste sites.

7.1.1 Identification of Contaminants of Concern

The nature and extent of contamination are discussed in Section 5.6 of this ROD. Based on this information and the results of the risk assessment, the COCs for soils in 200-PW-1, and 200-PW-6 are: americium-241 and plutonium-239/240; carbon tetrachloride and methylene chloride were also identified as COCs for protection of groundwater for 200-PW-1. The COCs for soils in 200-CW-5 are: americium-241, plutonium-239/240, cesium-137, radium-226, strontium-90, PCBs, boron, and mercury. The COC for soils in 200-PW-3 are cesium-137.

Two other contaminants at the 200-PW-1 and 200-PW-6 waste sites, technetium-99 and nitrate, were identified as contaminants of interest by the Ecology. DOE and EPA have determined that these contaminants do not pose an unacceptable risk based on fate and transport modeling results and process knowledge of the type of liquid waste discharged at these waste sites. However, at the request of Ecology, additional sampling will be conducted to confirm contaminant levels as part of the remedial design.

7.1.2 Exposure Point Concentrations

Under the industrial scenario, there are no complete and significant pathways for regular workers. For this reason, construction worker pathways were used to calculate exposure point concentrations (EPCs). Construction worker exposure pathways include potentially significant exposures to all the direct-contact soil pathways (i.e., ingestion, inhalation, dermal contact, and external radiation). However, the dermal pathway for soil is insignificant for all contaminants. Construction worker exposure from contact with soil was evaluated for each waste site, except the 216-Z-9 Trench. Contaminated soil at the 216-Z-9 Trench does not begin until below the bottom of the trench (more than 6.1 m [20 ft] bgs), and the trench area is currently capped with a concrete cover. Construction activities are assumed to be limited to the top 15 ft of soil. Therefore, no construction worker exposures are expected at the 216-Z-9 Trench. A summary of EPCs used to estimate the risk at the 200-PW-1, 200-PW-3, and 200-PW-6 OUs for each COC are provided in Table 11.

Table 11. Summary of Soil Exposure Point Concentrations for Current Construction Worker at 200-PW-1, 200-PW-3, and 200-PW-6

COC	EPC	Units	EPC Rationale	Number of Samples
216-Z-1A Tile Field (High Salt)				
Am-241*	2,028,358	pCi/g	95% Chebyshev (Mean, Sd) UCL	17
Pu-239/240	15,509,199	pCi/g	95% Chebyshev (Mean, Sd) UCL	17
Pu-239	12,637,125	pCi/g	Ratio of 4.4:1 (Pu-239:Pu-240)	--
Pu-240	2,872,074	pCi/g	Ratio of 4.4:1 (Pu-239:Pu-240)	--
216-Z-8 French Drain (Other)				
Am-241	457	pCi/g	Maximum, adjusted gamma exceeds maximum	8
Pu-239/240	4,620	pCi/g	Maximum, adjusted gamma exceeds maximum	8
Pu-239	3,764.44	pCi/g	Ratio of 4.4:1 (Pu-239:Pu-240)	--
Pu-240	855.56	pCi/g	Ratio of 4.4:1 (Pu-239:Pu-240)	--
216-A-8 Crib (Cesium Sites)				
Cs-137	877,000	pCi/g	Maximum at depth 5.8 to 6.6 m (19 to 21.5 ft) bgs	Shallowest
Pu-239/240	55.7	pCi/g	Maximum at depth (19 to 21.5) ft bgs	Maximum concentration selected
Pu-239	45.39	pCi/g	Ratio of 4.4:1 (Pu-239:Pu-240)	
Pu-240	10.31	pCi/g	Ratio of 4.4:1 (Pu-239:Pu-240)	
Notes:				
* Americium-241 statistical analysis was done on the historical data set.				
bgs = below ground surface				
COC = contaminant of concern				
EPC = exposure point concentration				
UCL = upper confidence limit				

For the construction worker, exposure is typically to a depth of 4.6 m (15 ft) bgs. However, all of the data were used for 216-Z-8 French Drain because only eight samples are available and the contamination is spread in a relatively small area over the 5m to 11m [16 ft to 35ft]-bgs depth interval of contamination present at this site. In some cases, the ProUCL output recommends use of the maximum concentration rather than a 95 percent upper confidence limit (UCL) where the data sets are small, as was the case with 216-Z-8 French Drain. A 95 percent UCL is a value that, when calculated repeatedly for randomly drawn subsets of site data, equals or exceeds the true mean 95 percent of the time. The 95 percent UCL is not accurate when calculated with limited amounts of data since it can result in a value greater than the highest measured or modeled concentration.

Table 12 is a summary of the EPCs for the 200-CW-5 OU. For the direct contact exposure pathway for soils, EPCs were calculated using concentrations directly measured in soil. For the inhalation route, modeling was performed to estimate nonradiological constituent concentrations in air from particulate or vapor emissions from soil.

Table 12. Summary of Exposure Point Concentrations for COCs at 200-CW-5

	Number of Samples	Number of Detects	Frequency of Detection	Minimum Detected Result (pCi/g)	Maximum Detected Result (pCi/g)	Average Concentration (pCi/g)	EPC (pCi/g)	EPC Basis
Americium-241	286	284	99%	0.014	7.87E+06	30,656	202,640	97.5% KM (Chebyshev) UCL*
Cesium-137	187	184	98%	0.0021	66,041	371	2,571	97.5% KM (Chebyshev) UCL*
Plutonium-239 + Plutonium-239/240	281	279	99%	0.001	7.80E+05	8,257	28,291	97.5% KM (Chebyshev) UCL*
Radium-226	12	12	100%	0.4	5,200	851	5,200	Max. Detect
Strontium-90	30	23	77%	0.28	216	19	95.18	99% KM (Chebyshev) UCL*

7.1.3 Exposure Assessment

The potential pathways for exposure under an industrial land use scenario are depicted in the CSM in Figure 4. An unrestricted land use scenario is depicted in the CSM in

Figure 5. Although an unrestricted land use scenario is not the anticipated land use, the scenario was evaluated for comparison to the industrial land use scenario. More information is available in Appendix A of the *Feasibility Study for the Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units* (DOE/RL-2007-27) and in Section 3 of the *Remedial Investigation Report for the 200-CW-5 U Pond/Z Ditches Cooling Water Group, the 200-CW-2 S Pond and Ditches Cooling Water Group, the 200-CW-4 T Pond and Ditches Cooling Water Group, and the 200-SC-1 Steam Condensate Group Operable Units* (DOE/RL-2003-11). Based on the current and reasonably anticipated future land use, which is industrial use for the Inner Area of the Central Plateau, worker exposures (adults) were identified as a potentially exposed population.

Under industrial land use conditions, two worker populations (regular worker [i.e., no active soil disturbance] and construction worker) could theoretically come into contact with contaminants in impacted soil. DOE and EPA agreed that cleanup values would be based on the most conservative worker exposure scenario, which is based on an industrial worker who would encounter long-term exposure to contamination in soil. The cleanup values are based on a 70 kg (150 lbs) industrial worker who has 250 days of exposure to shallow zone soils over a 25-year exposure duration. The industrial worker scenario assumes the workplace is the key source of contaminant exposure with 6 hours per day spent indoors and 2 hours per day spent outdoors. Potential routes of exposure to soil include direct external exposure, incidental soil ingestion, and inhalation of dust generated from wind or maintenance activities.

Baseline risk assessments are based on the assumption that no remedial action is being taken (e.g., no maintenance, no institutional controls); however, that is not reflective of the current situation at these waste sites where there are ongoing actions. Currently, because soil impacts are to subsurface soil, contact with impacted soil by current regular industrial workers is not occurring. In addition, the existing institutional control programs at the Hanford Site preclude unprotected worker contact (e.g., by current construction workers) with any of the impacted soils at these OUs. Therefore, under current site conditions, there are no complete exposure pathways and thus no significant exposure to impacted soil by industrial workers at the waste sites covered by this ROD.

While land use is anticipated to remain industrial for the foreseeable future, because the radionuclides present in these soils have very long half-lives subsistence farming population was also evaluated for comparison to the industrial land use scenario. Under this scenario, subsistence farmers (adults and children) could theoretically come into contact with contaminants in impacted soil and groundwater. Native American populations (adults and children) were also evaluated for informational purposes and could theoretically come into contact with contaminants in impacted soil and groundwater. Although the Native American risk scenarios were not consistent with the anticipated future land use, they are evaluated to assist interested parties in providing input on the remedial alternatives. Native American scenarios developed specifically by the Yakama Nation and the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) were evaluated and are located in Appendix G of the Feasibility Study (DOE/RL-2007-27).

7.1.4 Toxicity Assessment

The purpose of the toxicity assessment is to weigh the available and relevant evidence regarding the potential for contaminants to cause adverse health effects in exposed individuals and to provide a quantitative estimate of the relationship between the magnitude of exposure and the likelihood of adverse effects (EPA 540/1-89/002).

Cancer Effects

The cancer slope factor (SF) (expressed as $[\text{mg}/\text{kg}\cdot\text{day}]^{-1}$) expresses excess cancer risk as a function of dose. The dose-response model is based on high- to low-dose extrapolation and assumes there is no lower threshold for the initiation of toxic effects. Specifically, cancer effects observed at high doses in laboratory animals or from occupational or epidemiological studies are extrapolated using mathematical models to low doses common to environmental exposures. These models are essentially linear at low doses, so no dose is without some risk of cancer. Table 13 presents the cancer SFs for each of the nonradionuclide COCs at the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs.

Table 13. Carcinogenic Toxicity Criteria for the Nonradionuclide COCs

COC	Oral Cancer: Slope Factor ($\text{mg}/\text{kg}\cdot\text{day}$) ⁻¹	Inhalation Cancer: Slope Factor ($\text{mg}/\text{kg}\cdot\text{day}$) ⁻¹	Tumor Type	EPA Cancer Classification	Reference
Aroclor 1254b	2	--	Liver (rats)	B2	IRIS ^c
Carbon tetrachloride	0.13	0.053	Liver (mice)	B2 ^a	IRIS ^c
Methylene chloride	0.0075	0.0016	Liver (mice)	B2 ^a	IRIS ^c

a. Group B2 = probable human carcinogen (sufficient evidence in animals, inadequate or no evidence in humans)

b. Carcinogenic toxicity information is not published by EPA for Aroclor 1254. However, all aroclors are considered potentially carcinogenic. Cancer risk from Aroclor 1254 is assessed using the oral cancer slope factor for Aroclor 1260.

c. IRIS = Integrated Risk Information System - Online Database (EPA 2007)

The SFs for radionuclides are incremental cancer risks resulting from exposure to radionuclides through inhalation, ingestion, and external exposure pathways. The SFs represent the probability of cancer incidence as a result of unit exposure to a given radionuclide averaged over a lifetime. Table 14 presents the cancer SFs for the radionuclide COCs. These values are from the HEAST (EPA 540/R-97-036) update on April 16, 2001, which is based on Federal Guidance Report No. 13 (EPA 402-R-99-001).

The EPA has classified all radionuclides as known human carcinogens based on epidemiological studies of radiogenic cancers in humans (EPA 402-R-99-001). Cancer SFs for radionuclides are central tendency estimates of the age-averaged increased lifetime cancer risk. This is in contrast to the methodology for nonradionuclide SFs, where upper-bound estimates of cancer potency are often used

Table 14. Radionuclide Toxicity Criteria for COCs^a

Radionuclide COC	Ingestion (Risk/pCi)			Inhalation (Risk/pCi)	External (Risk/yr per pCi/g)
	Soil	Food	Water		
Am-241	2.17E-10	1.34E-10	b	2.81E-08	2.76E-08
Cs-137	4.33E-11	3.7E-11	b	1.19E-11	5.32E-10
Pu-239	2.76E-10	1.74E-10	b	3.33E-08	2.00E-10
Pu-240	2.77E-10	1.74E-10	b	3.33E-08	6.98E-11
Ra-226	7.29E-10	5.14E-10	b	1.15E-08	2.29E-08
Sr-90	9.18E-11	6.88E-11	b	1.05E-10	4.82E-10
Tc-99	7.66E-12	4.00E-12	2.80E-12	1.41E-11	8.14E-11

a. EPA classifies all radionuclides as Group A, known human carcinogens. Values are from EPA's *Health Effects Assessment Summary Tables* (EPA 540/R-97-036), update April 16, 2001, which is based on Federal Guidance Report No. 13 (EPA 402-R-99-001).

b. Radionuclide not evaluated by this pathway.

Non-Cancer Effects

Chronic reference doses (RfDs) are defined as an estimate of a daily exposure level for the human population, including sensitive subpopulations, which are likely to be without appreciable risk of non-cancer effects during a lifetime of exposure (EPA 402-R-99-001). Chronic RfDs are specifically developed to be protective for long-term exposure to a contaminant and are generally used to evaluate the potential non-cancer effects associated with exposure periods of 7 years to a lifetime. The RfDs are expressed as mg/kg-day and are calculated using lifetime average body weight and intake assumptions. Table 15 presents the non-cancer toxicity criteria for nonradionuclide COCs.

The RfD values are derived from experimental data on the no-observed-adverse-effect level (NOAEL) or the lowest-observed-adverse-effect level (LOAEL) in animals or humans. Chronic RfDs, as discussed above, are used in the evaluation of Hanford worker exposures because the long-term exposure (7 years to a lifetime) to relatively low-contaminant concentrations are of greatest concern for that population. However, for the construction worker scenario evaluated in this assessment, EPA guidance (EPA 530-F-02-052) recommends evaluating construction exposures over a 1-year duration. A 1-year timeframe is defined by EPA 540/1-89/002 as a subchronic exposure (i.e., lasting between 2 weeks and 7 years). Chronic RfDs are designed to be protective over a lifetime and reflect the safe dose level for chronic, rather than subchronic, exposures. Therefore, construction worker non-cancer hazards should be evaluated using subchronic RfDs (cancer risks are not affected because all cancer risks are evaluated based on lifetime exposure).

Table 15. Noncarcinogenic Chronic and Subchronic Toxicity Criteria for COCs

Contaminant	Chronic RfD (mg/kg-day)	Toxic Endpoint	Critical Study	Chronic RfD UF ^a	RfD Source	Adjustment from Chronic to Subchronic	Subchronic RfD (mg/kg-day)
Inhalation Exposures							
Carbon tetrachloride	None ^b	--	--	--	--	--	--
Methylene chloride	8.6E-01	Hepatotoxicity	2-year chronic rat	100	HEAST	NC	NC
Oral Exposures							
Aroclor-1254	0.00002	Autoimmune Effects	Chronic Primate	300	IRIS	NC	NC
Boron	0.2	Developmental	Short term developmental Toxicity	66	IRIS	Based on BMDL	NC
Carbon tetrachloride	7.0E-04	Liver lesions	Subchronic rat	1,000	IRIS	Used unadjusted NOAEL; removed UF of 10 for subchronic to chronic. ^c	1.0E-02
Mercury ^d	0.0003	Autoimmune Effects	Subchronic rat	1,000	IRIS	NC	NC
Methylene chloride	6.0E-02	Liver toxicity	Chronic rat	100	IRIS	NC	NC

a. EPA indicates there are generally five areas of uncertainty where an application of a UF may be warranted:

1. Variation between species (applied when extrapolating from animal to human).
2. Variation within species (applied to account for differences in human response and sensitive subpopulations).
3. Use of a subchronic study to evaluate chronic exposure.
4. Use of a LOAEL, rather than a NOAEL.
5. Deficiencies in the database.

b. There is no non-cancer toxicity criteria for this contaminant for this pathway.

c. EPA adjusted the 5-day/week exposure of the NOAEL to a 7-day NOAEL to account for continuous exposure (chronic), rather than subchronic, exposures.

BMDL = Benchmark Dose Methodology Level

IRIS = EPA Integrated Risk Information System (online database) (EPA 2007)

HEAST = Health Effects Assessment Summary Tables

LOAEL = lowest-observed-adverse-effect level

NC = not calculated (subchronic criteria were not derived for these contaminants because these contaminants were not selected as COCs for the subchronic pathways)

NCEA = EPA's National Center for Environmental Assessment

RfD = reference dose

UF = uncertainty factor

In this assessment, subchronic criteria would apply to both well driller and construction worker exposures; however, radionuclides were not evaluated for the well driller since a well driller exposure time is limited to the time it takes to drill a well (approximately 5 days). Subchronic criteria were used to evaluate nonradionuclide contaminants for well drillers. The subchronic criteria were obtained from the following sources:

HEAST: Subchronic criteria from HEAST were used if the chronic RfD has not been updated since 1997 (i.e., the subchronic criteria are based on the same critical study as the chronic criteria).

IRIS: Where the chronic criteria have been updated since 1997 and are in IRIS database, the IRIS file was reviewed. If a UF was used to decrease a chronic value to account for subchronic to chronic exposure, that UF was removed to obtain a subchronic criteria. In addition, if the NOAEL or LOAEL was adjusted from a 5-day exposure to a 7-day exposure, that adjustment was removed to reflect the worker population of concern (see Sections 4.4.2 and 4.4.3 in EPA/630/P-02/002F).

NCEA (EPA's toxicity research arm): Where the source of the chronic criteria is the NCEA (this information is listed on the EPA Region 9 PRG list), the backup documentation that NCEA used to derive the chronic criteria was reviewed to evaluate whether sufficient information was provided to make an adjustment to the chronic value as described above.

7.1.5 Risk Characterization

Human Health Baseline Risk Assessment Results

For carcinogens, risks are generally expressed as the incremental probability of an individual's developing cancer over a lifetime as a result of exposure to the carcinogen. These risks are probabilities that are usually expressed in scientific notation (e.g., 1×10^{-6}). An excess lifetime cancer risk (ELCR) of 1×10^{-6} indicates that an individual experiencing the reasonable maximum exposure estimate has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as the "ELCR" because it would be in addition to the risks of cancer individuals face from other causes such as smoking or exposure to too much sun. The change of an individual's developing cancer from all other causes has been estimated to be as high as one in three. For contaminants that are known or suspected to cause cancer, acceptable exposure levels are generally concentration levels that represent an ELCR range to an individual of one in 1,000,000 (10^{-6}) to one in 10,000 (10^{-4}).

Although unrestricted use is not the anticipated future land use for these waste sites, an unrestricted land use scenario was evaluated for comparison to the industrial land use scenario. The results of this baseline risk assessment indicate that concentrations of radiological contaminants in soil from Z-Ditches (200-CW-5), High-Salt (200-PW-1), Low-Salt (200-PW-1 and 200-PW-6), and Cesium-137 (200-PW-3) Waste Groups pose an unacceptable cancer risk (greater than 10^{-4}) under an unrestricted land use scenario. These estimated baseline human health risks are presented in Concentrations of nonradiological contaminants in soil (metals and PCBs) from the Z-Ditches (200-CW-5) exceed unrestricted land use soil cleanup standards defined in WAC 173-340-740(3)(b). The results from this comparison are presented in Table 17. Risks from PCBs were estimated by comparing the concentration in waste site soil with the cleanup standard defined for the unrestricted land use soil cleanup standards defined in WAC 173-340-740(3)(b).

Table 16.

Concentrations of nonradiological contaminants in soil (metals and PCBs) from the Z-Ditches (200-CW-5) exceed unrestricted land use soil cleanup standards defined in WAC 173-340-740(3)(b). The results from this comparison are presented in Table 17. Risks from PCBs were estimated by comparing the concentration in waste site soil with the cleanup standard defined for the unrestricted land use soil cleanup standards defined in WAC 173-340-740(3)(b).

Table 16. Summary of Baseline Human Health Risks Developed with an Unrestricted Land Use Scenario

Contaminant	ELCR	% Contribution
216-Z-1A Tile Field (High-Salt)		
Americium-241	1.8 in 1,000	~15%
Plutonium-239	8 in 1,000	~67%
Plutonium-240	2.2 in 1,000	~19%
Total ELCR	1.2 in 100	
216-Z-8 French Drain (Other)		
Americium-241	4.0 in 10,000,000	2.8%
Plutonium-238	1.9 in 10,000,000	1.3%
Plutonium-239	1.1 in 100,000	79%
Plutonium-240	2.3 in 1,000,000	17%
Total ELCR	1.4 in 100,000	
216-Z-9 Trench (High-Salt)		
Americium-241	6.5 in 1,000	4.6%
Carbon Tetrachloride	4.8 in 100,000	<1%
Europium-152	2.2 in 10,000	<1%
Neptunium-237	1.6 in 10,000	<1%
Nickel-63	5.9 in 1,000,000	<1%
Plutonium-238	3.9 in 100,000	<1%
Plutonium-239	1.1 in 10	78%
Plutonium-240	2.4 in 100	17%
Protactinium-231	3.1 in 1,000,000	<1%
Radium-226	2.2 in 10,000	<1%
Radium-228	3.2 in 100,000	<1%
Strontium-90	1.1 in 10,000	<1%
Thorium-228	5.8 in 100,000	<1%
Total ELCR	1.4 in 10	
216-A-8 Crib (Cesium-137 Sites)		
Cesium-137	6.5 in 10	~99%
Neptunium-237	3.3 in 1,000,000	<1%
Radium-228	6.6 in 10,000	<1%
Thorium-228	2.8 in 10,000	<1%
Total ELCR	6.5 in 10	
Z-Ditches		
Americium-241	1.2 in 10	14%
Cesium-137	5.0 in 100	5.6%
Plutonium-238	5.2 in 10,000	<1%
Plutonium-239	1.3 in 100	1.5%
Radium-226 ^a	7.1 in 10	79%
Radium-228	4.7 in 100,000	<1%

Contaminant	ELCR	% Contribution
Strontium-90	3.3 in 1,000	<1%
Thorium-228	4.6 in 1,000,000	<1%
Thorium-230	9.8 in 1,000,000	<1%
Thorium-232	1.1 in 10,000	<1%
Uranium-238	1.2 in 1,000,000	<1%
Total ELCR	0.9 in 10	
a. Radium-226 risks at the Z-Ditches are likely overestimated due to uncertainty associated with the maximum concentration sample result which was used to establish the EPC.		

Table 17. Summary of Baseline Human Health Risks: Comparison to WAC 173-340-740(3)(b)

Contaminant	Concentration in Soil	WAC 173-340-740
	(mg/kg)* Z-Ditches	Carcinogen Cleanup Level (mg/kg)
PCBs (Aroclor 1254)	52	0.5
PCBs (Aroclor 1260)	78	0.5

* The concentration in soil used in this assessment is the maximum concentration detected.

The ELCR results for the two Tribal exposure scenarios are similar to the risks presented in Table 18 for the unrestricted land use scenario.

The potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g. lifetime) with a reference dose (RfD) derived for a similar exposure period. An RfD represents a level that an individual may be exposed to that is not expected to cause any deleterious effect. The ratio of exposure to toxicity is called a hazard quotient (HQ). An HQ<1 indicated that a receptor's dose of a single contaminant is less than the RfD, and that toxic carcinogenic effects from that chemical are unlikely. The Hazard Index (HI) is generated by adding the HQs for all chemical(s) of concern that affect the same target organ (e.g. liver) or that act through the same mechanism of action within a medium or across all media to which a given individual may reasonably be exposed. An HI<1 indicates that, based on the sum of all HQs from different contaminants and exposure routes, toxic noncarcinogenic effects from all contaminants are unlikely. An HI>1 indicates that site-related exposures may present a risk to human health. For these waste sites, non-cancer hazards due to chemicals in soil never exceeded an hazard index (HI) of 1.

Baseline Human Health Risk Assessment Results for all Scenarios

Baseline Results for 200-PW-1, 200-PW-3, and 200-PW-6 OUs

Although unrestricted use is not the anticipated future land use for these waste sites, an unrestricted land use scenario was evaluated for comparison to the industrial land use scenario. Volatile or radiological emissions from subsurface soil are insignificant for workers. Under industrial land use conditions, impacted soil is covered by at least 1.8 m (6 ft) of non-impacted soil. In the event that construction workers disturbed soil down to 4.6 m (15 ft) at the High-Salt or Cesium-137 waste sites, they could encounter contamination. Under that unlikely scenario, health risks would exceed 1×10^{-4} . Risks from digging in soil at the 216-Z-8 French Drain were less than 1×10^{-6} . Risks from subsurface soil exposures

at the 216-Z-1A Tile Field (High-Salt sites) were driven by plutonium-239, followed by plutonium-240, then americium-241. Risks from subsurface soil at the 216-A-8 Crib (Cesium-137 sites) are driven by cesium-137. There are no nonradionuclides in soil that are a health concern for construction workers. Construction workers were not evaluated for exposure to subsurface soil at the 216-Z-9 Trench, due to the depth to impacted soil and because the area is covered with a concrete cover; however, if construction workers were to disturb soil beneath the bottom of the trench, construction worker risks would likely exceed 1×10^{-4} . Table 18 summarizes the cancer risks from exposure to contaminants in soil under an industrial land use scenario (current construction worker) and under an unrestricted land use scenario (future well driller and subsistence farmer). Current construction worker risks also represent future construction worker risks since the primary risk drivers are long-lived radionuclides. Non-cancer hazards due to chemicals in soil never exceeded an HI of 1.

Table 18. Summary of Risks from Soil

Radionuclide or Contaminant	Current Construction Worker	Future Well Driller	Future Subsistence Farmer	
	Soil	Soil	Soil	Produce ^a
216-Z-1A Tile Field (High-Salt)				
Am-241	3E-03	3E-06	1E-03	3E-04
Np-237 ^b	--	--	6E-06	6E-07
Pu-239	3E-02	5E-07	1E-03	7E-03
Pu-240	6E-03	1E-07	2E-04	2E-03
Total ^c	4E-02	3E-06	2E-03	9E-03
216-Z-8 French Drain (Other)				
Am-241	1E-07	2E-09	2E-08	2E-07
Pu-238	1E-08	4E-12	7E-09	5E-08
Pu-239	7E-07	7E-10	2E-06	9E-06
Pu-240	1E-07	2E-10	3E-07	2E-06
Total ^c	9E-07	2E-09	3E-06	1E-05
216-Z-9 Trench (High-Salt)				
Ac-227 ^b		--	1E-05	6E-07
Am-241		7E-06	4E-03	8E-04
Eu-152		1E-10	1E-07	3E-11
Ni-63		4E-12	7E-09	2E-06
Np-237		7E-08	2E-04	1E-05
Pa-231 ^b		--	2E-06	1E-06
Pb-210 ^b		--	6E-07	3E-05
Pu-238	Construction worker not evaluated at 216-Z-9	8E-10	2E-06	1E-05
Pu-239		7E-06	2E-02	9E-02
Pu-240		2E-06	3E-03	2E-02
Ra-226		8E-08	2E-04	2E-05
Ra-228		5E-16	3E-13	2E-13
Sr-90		5E-12	5E-09	3E-07
Tc-99		6E-21	1E-18	1E-14
Th-228		1E-15	9E-13	3E-15
Th-230		3E-11	5E-08	2E-07

Radionuclide or Contaminant	Current Construction Worker	Future Well Driller	Future Subsistence Farmer	
	Soil	Soil	Soil	Produce ^a
U-235 ^b		--	8E-07	1E-08
Radionuclide total ^c		2E-05	2E-02	1E-01
Cadmium		1E-12	1E-09	--
Carbon tetrachloride		2E-06	5E-05	1E-03
Chemical total ^c		2E-06	6E-05	1E-03
216-A-8 Crib (Cesium-137 Sites)				
C-14	--	--	6E-16	6E-16
Cs-137	5E-02	7E-06	2E-02	4E-04
Np-237	7E-08	1E-09	3E-06	3E-07
Pu-239	1E-07	1E-11	3E-08	2E-07
Pu-240	2E-08	3E-12	6E-09	4E-08
Ra-228	1E-07	8E-15	6E-12	3E-12
Tc-99	--	--	4E-24	3E-20
Th-228	1E-07	2E-14	2E-11	5E-14
Total ^c	5E-02	7E-06	2E-02	4E-04
Total (500 years) ^c	7E-07	4E-11	2E-06	2E-07
Total (1,000 years) ^c	2.E-07	3E-13	1E-06	9E-08

Notes:

a. Produce grown in impacted soil is the only food chain evaluated for soil.

b. This radionuclide was not on the original COPC list, but is included here because it is a daughter product with risk greater than 1E-7.

c. Totals are calculated using unrounded values.

-- = indicates incomplete pathway or not applicable

Risks from radionuclide soil exposures were modeled up to 1,000 years in the future to evaluate radioactive decay and in growth of daughter products. For the three High-Salt sites, risks are driven by plutonium-239, plutonium-240, and americium-241 (true for all soil scenarios), cumulative risks at future time horizons are not significantly different than current risks. This is due to the fact that the half-lives of the plutonium isotopes are so long. Although at the 216-A-8 Crib where cesium-137 is the risk driver for all soil scenarios, risks are significantly lower at future time horizons due to the relatively short half-life (approximately 30 years) of cesium-137.

An unrestricted land use scenario was evaluated for comparison to the industrial scenario. Under the unrestricted land use scenario, it is assumed humans could encounter groundwater and subsurface soil brought to the surface as drill cuttings from drilling a groundwater well.

In summary, risks from exposure to soils at the 216-Z-8 French Drain are below levels that are a health concern. Risks from soil exposures at the 216-Z-1A Tile Field (High-Salt sites) and 216-A-8 Crib (Cesium-137 sites) are similar and exceed 1×10^{-4} for construction workers and subsistence farmers. Radionuclide risks from soil exposures at the 216-Z-9 Trench were the highest for the four waste sites evaluated, with risks of 2×10^{-5} for well drillers and 1×10^{-1} for subsistence farmers. Plutonium-239 and americium-241, followed by plutonium-240, were the risk drivers in soil for the High-salt sites, and cesium-137 was the risk driver in soil at the 216-A-8 Crib.

Subsistence farmer risks were highest for ingestion of produce, followed by ingestion of soil, ingestion of groundwater, consumption of dairy products, and consumption of beef.

Baseline Results for 200-CW-5 OU

Data evaluated for the Z-Ditches baseline risk assessment considered a subsistence farmer and an industrial worker exposure scenario, assuming no remedial action was taken, and included the sample results from the shallow zone soils (0 to 4.6 m [15 ft] bgs). The baseline risk assessment concluded there was a potential risk to human health and the environment. Table 19 presents a summary of this assessment.

Table 19. 200-CW-5 Waste Site Risk Summary

Risk Element	Z-Ditches
Do the Z-Ditches meet the WAC 173-340-745(5)(b)(iii)(B) Standard Method C industrial soil cleanup levels for chemicals?^a	
Are concentrations less than WAC 173-340-745?	No
Constituents that exceed WAC 173-340-745	Aroclor-1260
Do the Z-Ditches meet the WAC 173-340-740(3)(b) Standard Method B soil cleanup levels for chemicals?^b	
Are concentrations less than WAC 173-340-740?	No
Constituents that exceed WAC 173-340-740	Aroclor-1254, Aroclor-1260
Do the Z-Ditches exceed the EPA upper risk threshold of 10⁻⁴ for radionuclides for the subsistence farmer exposure scenario?^c	
ELCR at 0 year	9.0 × 10 ⁻¹
Primary radionuclides that contribute ELCR, 0 year	Ra-226, Am-241, Cs-137
ELCR at 150 years	9.2 × 10 ⁻¹
Primary radionuclides that contribute ELCR, 150 years	Ra-226, Am-241
ELCR at 1,000 years	4.6 × 10 ⁻¹
Primary radionuclides that contribute ELCR, 1,000 years	Ra-226, Am-241, Pu-239
Do the Z-Ditches exceed the EPA upper risk threshold of 10⁻⁴ for radionuclides for the industrial worker exposure scenario?^d	
ELCR at 0 year	6.1 × 10 ⁻¹
Primary radionuclides that contribute ELCR, 0 year	Pu-239, Ra-226
ELCR at 150 years	5.7 × 10 ⁻¹
Primary radionuclides that contribute ELCR, 150 years	Pu-239, Ra-226
ELCR at 1,000 years	4.7 × 10 ⁻¹
Primary radionuclides that contribute ELCR, 1,000 years	Pu-239, Ra-226
Do the Z-Ditches meet standards for soil concentrations protective of groundwater – chemicals?	
Are groundwater protection standards exceeded based on initial screening?	Yes ^e
Chemicals exceeding WAC 173-340-747(4)	Aroclor-1254, Aroclor-1260
Chemicals predicted to reach groundwater above WAC 173-340-720	None ^f
Groundwater protection required?	No
Do the Z-Ditches meet standards for soil concentrations protective of groundwater – radionuclides?	
Are groundwater protection standards exceeded based on initial screening?	No ^g
Radionuclides predicted to reach groundwater above MCL	None ^f
Groundwater protection required?	No
Do the Z-Ditches meet ecological screening values – chemicals?	

Risk Element	Z-Ditches
Are concentrations less than Table 749-3 values?	No ^h
Constituents that exceed Table 749-3 values	Aroclor-1254, Aroclor-1260, Boron, Mercury
Ecological protection required?	Yes
Do the Z-Ditches meet ecological screening values – radionuclides?	
Are concentrations less than BCGs?	No ⁱ
Constituents that exceed BCGs	Am-241, Cs-137, Pu-239, Pu-239/240, Ra-226, Sr-90
Ecological protection required?	Yes

a. Based on comparison of waste site soil concentrations to WAC 173-340-745(5)(b)(iii)(B), Standard Method C industrial soil cleanup levels, Table B-2 provides comparison results.

b. Based on comparison of waste site soil concentrations to WAC 173-340-740(3)(b), Standard Method B soil cleanup levels. Table B-1 provides comparison results.

c. Based on RESRAD calculation of radiological risk to a subsistence farmer assuming waste site soil contamination extends from the ground surface to 4.6 m (15 ft) bgs. RESRAD input parameters are listed in Table B-7. Calculation results are summarized in Table B-7. Details of the RESRAD evaluation are discussed in Appendix D.

d. Based on RESRAD calculation of radiological risk to an industrial worker assuming waste site soil contamination extends from the ground surface to 4.6 m (15 ft) bgs. Table B-6 lists the RESRAD input parameters. Table B-8 summarizes calculation results.

e. Initial screening based on comparison of waste site soil concentrations to soil concentrations protective of groundwater calculated in accordance with WAC 173-340-747(4), "Deriving Soil Concentrations for Groundwater Protection, Fixed Parameter Three-Phase Partitioning Model." Table B-12 provides comparison results.

f. Based on results of STOMP fate and transport modeling that indicates groundwater protection standards (federal MCLs and state cleanup levels based on WAC 173-340-720 "Groundwater Cleanup Standards") will not be exceeded within 1,000 years. Contaminants modeled with STOMP are listed in Table B-14. Details of the STOMP modeling are discussed in Chapter 4 of DOE/RL-2003-11.

g. Initial screening based on results of RESRAD soil-to-groundwater pathway calculation indicating that no radionuclides in waste site soil would reach groundwater within 1,000 years. RESRAD input parameters are listed in Table B-5. Calculation results are summarized in Table B-13. Subsequent numerical modeling with STOMP (DOE/RL-2003-11 Chapter 4) was performed to confirm the results obtained with RESRAD.

h. Based on comparison of waste site soil concentrations to soil concentrations specified in WAC 173-340-900, "Tables," Table 749-3, "Ecological Indicator Soil Concentrations (mg/kg) for Protection of Terrestrial Plants and Animals." Table B-10 provides comparison results.

i. Based on comparison of waste site soil concentrations to soil concentrations listed in DOE-STD-1153-2002, *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota*, Table 6.4, "Biota Concentration Guides (BCGs) for Water and Soil (in Special Units) for Use in Terrestrial System Evaluations." Table B-11 provides comparison results.

Sources:

ANL, 2007, RESRAD for Windows, Version 6.4.

DOE/RL-2003-11, *Remedial Investigation for the 200-CW-5 U Pond/Z Ditches Cooling Water Group, the 200-CW-2 S Pond and Ditches Cooling Water Group, the 200-CW-4 T Pond and Ditches Cooling Water Group, and the 200-SC-1 Steam Condensate Group Operable Units*.

PNNL-11217, *STOMP: Subsurface Transport Over Multiple Phases: Theory Guide*.

BCG = biota concentration guide

ELCR = excess lifetime cancer risk

EPA = U.S. Environmental Protection Agency

MCL = maximum contaminant level

RESRAD = RESidual RADioactivity (dose model) (ANL 2007)

STOMP = Subsurface Transport Over Multiple Phases (fate and transport model) (PNNL-11217)

7.1.6 Uncertainties

Estimating and evaluating health risk from exposure to environmental contaminants is a complex process with inherent uncertainties. Uncertainty reflects limitations in knowledge, and simplifying assumptions must be made to quantify health risks. Some key areas of uncertainty evaluated in the risk assessment are discussed below.

For construction worker exposure-to-soil calculations, characterization of the top 4.6 m (15 ft) was limited, with few samples representing that depth horizon because the shallower soil has not been

impacted. Therefore, use of exposure concentrations from the deepest soil depth that construction workers would likely encounter has potentially resulted in risks that are biased as high because the majority of a construction worker's exposure would be to the shallower, uncontaminated soil.

In some instances the limited sample size resulted in using the maximum observed concentrations as the EPC. These concentrations likely do not represent concentrations actually present in significant areas of the waste sites. In the case of radium-226 in the Z-Ditches Waste Group, use of this conservative assumption, which likely results an overly high assumed exposure concentration, is compounded by the uncertainty of the sample result itself. In this case, it is suspected to be overestimated by potentially several orders of magnitude due to the interference from other alpha-emitters.

7.2 Summary of Ecological Risk Assessment

A screening-level ecological risk assessment was conducted to identify contaminants, receptors, and exposure pathways that should be considered in the development of remedial alternatives. The feasibility studies for these OUs determined that there are no risks to endangered species. The process for estimating site-related ecological risks includes the following:

- **Problem Formulation**—a qualitative evaluation of contaminant release, migration, and fate; identification of contaminants of potential ecological concern; identification of receptor organisms, exposure pathways, and ecological effects of the contaminants; and selection of endpoints for further study, if warranted.
- **Screening-Level Exposure and Effects Assessment**—a quantitative evaluation of ecological risks involving comparison of exposure point concentrations in soil with ecological benchmark concentrations.
- **Risk Characterization**—estimation of potential adverse ecological effects.

Problem Formulation

Vegetation in the 200 Area is characterized by native shrub steppe, interspersed with large areas of disturbed ground dominated by annual grasses and forbs. The undisturbed portions of the 200 Area are characterized by sagebrush/cheatgrass or sagebrush/Sandberg's bluegrass communities. The dominant plants on the Central Plateau 200 Area are big sagebrush, rabbit brush, cheat grass, and Sandberg's bluegrass. The shrub and grassland habitat of the Hanford Site supports many groups of terrestrial wildlife. Mammals common to the 200 Area, including badgers, Great Basin pocket mice, and deer mice, are known to burrow in soil and can excavate significant amounts of soil as they construct their burrows. Burrowing by these mammals can potentially unearth buried contaminants. Soil macro-invertebrates at the Hanford Site, including darkling beetles and harvester ants, also burrow, and can excavate potentially contaminated soils. In addition, soil macro-invertebrates may be consumed by birds and mammals, which would then potentially receive an exposure.

Many of the waste sites in the 200 Area have been backfilled with clean soil and planted with crested or Siberian wheatgrass to stabilize surface soil, control soil moisture, or displace more invasive deep-rooted species like Russian thistle. In addition, contaminated portions of the 200 Area are actively managed by monitoring, removing deeply rooted vegetation, and controlling burrowing mammals and insects. However, determining if cleanup is needed to protect ecological receptors involved assessing potential ecological risks under baseline conditions. In this case, baseline conditions included the assumptions that the soil covers would no longer be maintained and that other active management methods would no longer be performed.

Initially, the screening-level assessment of ecological risks involved developing the conceptual model of ecological exposure pathways, and comparing that model to site conditions. This comparison was performed to determine if there could potentially be complete exposure pathways from site contaminants to ecological receptors. Any waste sites where contaminants might be present in shallow soil (less than 4.6 m [15 ft]) that is potentially accessible to ecological receptors, have a potential complete ecological exposure pathway. The depth of 4.6 m (15 ft) reflects the standard point of compliance for ecological protection as described in the state of Washington's regulations for cleanup for protection of ecological receptors (WAC 173-340-7490[4][b], "Terrestrial Ecological Evaluation Procedures"). This depth is based on unrestricted use where human activities could bring contamination to the biologically active zone. The physical dimensions of the waste sites and the distribution of soil contaminants detected in them were considered with respect to the biologically active zone. The results from this comparison indicated that potentially complete ecological exposure pathways could be present at several of the waste sites in the High-Salt (200-PW-1), Low-Salt (200-PW-1 and 200-PW-6), Settling Tanks (200-PW-1 and 200-PW-6), Cesium-137 (200-PW-3), and Ditches (200-CW-5) Waste Groups.

Screening-Level Ecological Exposure and Effects Assessment

The next step in the screening-level ecological risk assessment is an evaluation of the potential ecological exposures and effects. The potential ecological exposure pathways that could exist at these waste sites included the potential for the following:

- Accumulation of radionuclides and inorganics by burrowing of invertebrates and animals into contaminated soils.
- Exposures to insect-eating birds and mammals from ingestion of burrowing invertebrates and animals that have accumulated radionuclides and inorganic contaminants.
- Accumulation by deep-rooted plants of contaminants in soils that are subsequently incorporated into surface soil through wind action and rainfall.
- Exposures of wildlife from ingestion of radionuclides and nonradioactive contaminants in contaminated soil that has been exhumed and brought to the surface by burrowing invertebrates and animals.

Ecological risks potentially associated with these exposure pathways were assessed by comparing contaminant concentrations in soil with ecological screening levels. The ecological screening levels for radionuclides were Biota Concentration Guides (BCGs), developed by DOE using international consensus standards for protection of plants and wildlife from exposure to radiation. The ecological screening levels for nonradionuclides were Ecological Indicator Soil Concentrations developed by the state of Washington. Contaminant concentrations within the top 4.6 m (15 ft) of soil at the Z-Ditches were compared with ecological screening levels. Under the current conditions, contaminants were not sampled within the biologically active zone at the High-Salt, Low-Salt, Settling Tanks, and Cesium-137 waste sites, so no comparison with ecological screening levels was performed; however, an evaluation of site information indicates that contaminants could be present within the biologically active zone at these sites. Therefore, for purposes of determining if cleanup action is needed, a more conservative approach was taken by assuming that complete ecological exposure pathways and ecological risks could be present at these waste sites. The comparison of contaminant concentrations in soil at the Z-Ditches with ecological screening levels is presented in Table 20.

7.2.1 Ecological Risk Characterization

The results of the comparison of contaminant concentrations in soil to the ecological screening levels indicate the potential for unacceptable ecological exposures at 200-CW-5 (Z-Ditches), as shown in Table 20. A comparable approach for conservatively addressing the risks at the remaining sites was determined to be appropriate. This analysis provides the basis for action to address ecological risk.

Table 20. Comparison of Contaminant Concentrations in Soil to Ecological Screening Levels (Z-Ditches)

Contaminant	Units	Contaminant Concentration in Soil ^a	Ecological Screening Level ^b
200-CW-5 (Z-Ditches)			
PCBs (Aroclor 1254)	mg/kg	52	0.65
PCBs (Aroclor 1260)	mg/kg	78	0.65
Boron	mg/kg	24	0.5
Mercury	mg/kg	0.66	0.1
Americium-241	pCi/g	202,640	4,000
Cesium-137	pCi/g	2,570	20
Plutonium-239/240	pCi/g	28,291	6,000
Radium-226	pCi/g	5,200	50
Strontium-90	pCi/g	95	20

a. The concentration in soil used in this assessment is the 95% upper confidence limit on the average concentration in waste site soil, which represents an RME or the maximum concentration detected.

b. The ecological screening levels for nonradioactive contaminants are "Ecological Indicator Soil Concentrations for Protection of Terrestrial Plants and Animals," defined in WAC Table 749-3 (WAC 173-340-7493, "Site-Specific Terrestrial Ecological Evaluation Procedures"). The ecological screening levels for radionuclides are BCGs listed in DOE-STD-1153-2202, *A Graded Approach for Evaluation Radiation Doses to Aquatic and Terrestrial Biota*.

7.2.2 Summary of Groundwater Protection Evaluation

The potential migration of contaminants to groundwater was evaluated for the waste groups. For the 200-CW-5 OU (Z-Ditches), the evaluation indicated that there were no contaminants that would migrate through the soil that could affect groundwater above the federal maximum contaminant levels (MCLs) within 1,000 years (fate and transport models were run for 1,000 years). For the remaining OUs, groundwater protection screening values were exceeded for some volatile contaminants. A fate and transport evaluation of volatile and nonvolatile soil contaminants identified that carbon tetrachloride and methylene chloride are the only volatile contaminants that could potentially migrate through the soil and only from the 216-Z-1A Tile Field, 216-Z-9 Trench, and 216-Z-18 Crib (High-Salt waste sites) and impact groundwater above the federal MCLs within 1,000 years. In addition, technetium-99 was the only radionuclide and nitrate was the only nonradioactive contaminant that was retained as potential groundwater contaminants.

7.3 Basis for Action

The response action selected in this Record of Decision (ROD) is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances, pollutants, or contaminants into the environment. Such a release or the threat of release may present an imminent and substantial endangerment to public health, welfare, or the environment. Remedial action is not required at the 216-Z-8 French Drain and the 216-Z-10 Injection/Reverse Well because they have limited contamination and do not pose an unacceptable risk to human health and the environment.

A response action is necessary for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs because of the following conditions:

- The cumulative excess carcinogenic risk from radionuclides to an individual exceeds acceptable 10^{-4} risk levels.
- Without remedial action, contaminants in these OUs would exceed risk threshold values for the anticipated future industrial land use.

8.0 Remedial Action Objectives

This section presents the remedial action objectives (RAOs) for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs. Since the reasonably anticipated future land use is industrial, the industrial worker scenario was considered in developing the RAOs. The RAOs are descriptions of what the remedial action is expected to accomplish. The associated cleanup levels for COCs are provided in Section 12, Table 35.

8.1 Specific Remedial Action Objectives

The RAOs are listed below.

- **RAO 1**—Prevent unacceptable risk to human health and ecological receptors associated with radiological exposure to waste, soil, or debris contaminated above risk-based criteria, by removing the source or eliminating the pathway.
- **RAO 2**—Prevent unacceptable risk to human and ecological receptors associated with nonradiological exposure to waste, soil, or debris contaminated above risk-based criteria by removing the source or eliminating the pathway.
- **RAO 3**—Control the sources of potential groundwater contamination to support the Central Plateau groundwater goal of protecting the beneficial uses of groundwater, including protecting the Columbia River from adverse impacts.

8.2 Basis and Rationale for Remedial Action Objectives

The RAOs are based on the anticipated future industrial land use for these OUs, which are located in the Inner Area of Hanford's Central Plateau. All current land-use activities associated with the Central Plateau are industrial in nature. Several waste management facilities operate in the Central Plateau, including permanent waste disposal facilities such as ERDF, low-level radioactive waste burial grounds, and RCRA-permitted mixed-waste trenches. The current and reasonably anticipated future land use for the Inner Area of the Central Plateau is industrial (DOE worker) for at least 50 years and then industrial (DOE or non-DOE worker) thereafter.

Groundwater located beneath the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs is part of four groundwater OUs (200-ZP-1, 200-UP-1, 200-BP-5 and 200-PO-1 groundwater OUs) and will be remediated through CERCLA actions for those OUs. Groundwater in the Central Plateau is currently contaminated and not withdrawn from the aquifer for beneficial use (drinking water or industrial use). An alternate source of water derived from the Columbia River is provided to current industrial workers conducting activities on the Central Plateau.

Current uses of the Columbia River are anticipated to continue in the future. The remedial action for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs will prevent contaminants from reaching the underlying groundwater, which will also protect the Columbia River and its ecological resources from degradation and unacceptable impact caused by migration of contaminants originating from the OUs covered by this ROD.

8.3 Purpose of Remedial Action Objectives

RAO 1 addresses unacceptable risk to human health and ecological receptors associated with radiological exposure to waste, soil, or debris contaminated above risk-based criteria. Risks are addressed by removing the source or eliminating the pathway.

RAO 1 is satisfied for radiological COCs when the following objectives are met:

- Prevent direct contact exposure to radiological COCs by industrial workers in the top 4.6 m (15 ft) of the waste site that would exceed an ELCR of 1 in 10,000.
- Prevent direct contact exposure to radiological COCs by terrestrial receptors (wildlife, plants, and biota) that would exceed a dose rate of 0.1 rad/day.

With respect to this RAO, the risk drivers are americium-241 and plutonium-239/240 at the 200-PW-1 OU and 200-PW-6 OU waste sites and cesium-137 at the 200-PW-3 OU waste sites. RAO 1 can be achieved by maintaining at least 4.6 m (15 ft) of separation between the ground surface and contaminated soils exceeding the risk-based cleanup levels. Institutional controls are part of the selected remedy and will maintain the integrity of and prohibit activities that could damage or lessen the performance of evapotranspiration caps and soil covers used to achieve this separation. For 200-CW-5, this RAO will be achieved by removing soils that are up to 15 ft bgs that exceed the applicable risk-based cleanup levels.

RAO 2 addresses unacceptable risk to human and ecological receptors associated with nonradiological exposure to wastes or soil contaminated above risk-based criteria. Risks are addressed by removing the source or eliminating the pathway.

RAO 2 is satisfied for nonradiological COCs when the following objectives are met:

- Prevent direct contact exposure to nonradiological COCs in the top 4.6 m (15 ft) of the waste sites that would exceed the WAC 173-340-745(5)(b), Standard Method C industrial soil cleanup based on an ELCR of 1 in 100,000 or an individual hazard quotient (HQ) of 1 or a total hazard index (HI) of 1.
- Prevent direct contact exposure to nonradiological COCs by terrestrial receptors (wildlife, plants, and biota), that would exceed an individual ecological HQ of 1 or a total ecological HI of 1.

RAO 3 addresses protecting the beneficial uses of groundwater, including protecting the Columbia River, from adverse impacts. This is done by controlling the sources of potential groundwater contamination. With respect to this RAO, the risk-drivers at 200-PW-1 are carbon tetrachloride and methylene chloride. Although the remedial investigation determined that technetium-99 and nitrate were within an acceptable risk range, they are considered as contaminants of interest and will be included in associated monitoring plans. The 200-CW-5 OU has no contaminants at levels that would migrate to cause adverse impacts to groundwater.

RAO 3 is satisfied for nonradiological COCs when the soil concentrations are less than WAC 173-340-747 soil concentrations for groundwater protection. RAO 3 is satisfied for radiological COCs when fate and transport modeling demonstrates that soil concentrations would not impact groundwater above MCLs.

Protection of the Columbia River from contaminants in these waste sites is achieved through the groundwater protection objective. There is no surface water in the immediate vicinity of the waste sites that requires a separate remedial action objective.

9.0 Description of Alternatives

This section describes the remedial alternatives developed for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs that were evaluated in their respective feasibility studies (DOE/RL-2004-24 and DOE/RL-2007-27). A total of 21 waste sites are located within these four OUs. The waste sites have been grouped into six waste groups based on the similar process liquid waste type, primary contaminants, and similarities in the distribution of contaminants in the subsurface. Remedial alternatives were considered for each waste group, which resulted in a combination of alternatives for the selected remedy. The remedial alternatives are discussed by waste group, which are the Z-Ditches, High-Salt, Low-Salt, Settling Tanks, Cesium-137, and Other Sites Waste Groups and associated pipelines. The remedial alternatives evaluated are the following:

- No Action Alternative
- Maintain and Enhance Existing Soil Cover
- Engineered Surface Barrier (Barrier Alternative)
- In Situ Vitrification
- Removal, Treatment, and Disposal

These remedial alternatives also include the use of institutional controls, which include non-engineered instruments such as administrative or legal measures to protect human health and the environment from exposure to contamination. Institutional controls may be used as part of a remedy to prevent or limit exposure to hazardous substances, pollutants, or contaminants where waste is left in place and precludes an unrestricted land use. The current implementation, maintenance, and periodic inspection requirements for the current institutional controls at the Hanford Site are described in approved work plans and in the Site-wide Institutional Controls Plan (DOE/RL-2001-41) that was prepared by DOE and approved by EPA and Ecology in 2002. *The Site-wide Institutional Controls Plan* also serves as a reference for the selection of institutional controls in the future.

9.1 Description of Remedy Components

9.1.1 No Action Alternative

This alternative would leave a waste site “as is” (i.e., in its current state). No institutional controls or maintenance would be implemented or continued and no active remedial action would be taken to address potential threats to human health and the environment; therefore, there are no distinguishing protectiveness or implementation features associated with this alternative. The NCP requires consideration of a No Action alternative to provide a baseline to compare against other alternatives (40 CFR 300.430(e)(6)).

9.1.2 Maintain and Enhance Existing Soil Cover (MEESC)

This alternative was only considered for the Cesium-137 Waste Group since it would not be protective if implemented at other waste sites. This alternative would leave all contamination in place at the waste site and include the maintenance of, or enhancement of the soil cover with additional clean fill (as appropriate), to isolate the waste from direct contact exposure.

Treatment/Containment Components

No treatment components are included. This is a containment remedy that would leave all contamination in place. The approximate size of the soil covers over waste sites in the Cesium-137 Waste Group are listed in Table 21.

Table 21 Size of Soil Covers Under MEESC Alternative

Cesium -137 Waste Group	Total Area for Soil Cover ha (ac)
216-A-7	0.08 (0.2)
216-A-8	0.36 (0.9)
216-A-24	0.49 (1.2)
216-A-31	0.08 (0.2)
UPR-200-E-56	1.13 (2.8)
Total	2.14 (5.3)

Institutional Controls

ICs (e.g., land use restrictions) would be used to limit access or intrusion by humans. The DOE is responsible for implementing, maintaining, reporting on, and enforcing institutional and land-use controls. Although DOE may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or through other means, DOE shall retain ultimate responsibility for remedy integrity and institutional controls.

Operations and Maintenance

This alternative requires long-term maintenance of the soil cover to ensure a 15 ft soil thickness remains over the waste sites. This would include long-term environmental surveillance.

9.1.3 Engineered Surface Barrier (Barrier Alternative)

This alternative would leave all contamination in place at the waste site; an engineered surface barrier would be constructed over the waste site to create a minimum of 4.6 m (15 ft) of separation between the contaminated soil and the ground surface. The conventional engineered surface barrier would be modified to include an evapotranspiration barrier layer to limit the natural infiltration of precipitation and to provide an added level of protection to human health and the environment. For waste sites containing long-lived plutonium contamination in 200-PW-1 and 200-PW-6, a physical barrier component would be added into the design to reduce inadvertent access to the contamination. This component would include a layer of coarse, fractured basalt rock. Waste sites constructed with voids would have the voids filled with material that would prevent collapse of the structure.

Treatment/Containment Components

No treatment components are included. This is a containment remedy that would leave all contamination in place. The Barrier alternative provides no treatment for radionuclides, but prevents access to contamination through engineering controls as discussed above.

Institutional Controls

ICs (e.g., land use restrictions) would be used to limit access or intrusion by humans. The DOE is responsible for implementing, maintaining, reporting on, and enforcing institutional and land-use controls. Although DOE may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or through other means, DOE shall retain ultimate responsibility for remedy integrity and institutional controls

Operations and Maintenance

This alternative requires long-term maintenance of the barrier to ensure effectiveness of the barrier and to ensure a 15 ft barrier thickness remains over the waste sites. This would include long-term environmental surveillance.

9.1.4 In Situ Vitrification

In Situ Vitrification was only considered for the High Salt and Low Salt waste groups. This alternative is not applicable to the Cesium-137 waste group. Melting and then solidifying the contaminated soil reduces the volume by about 30 percent because it eliminates the pore space of the soil and gravel. The subsidence area would be backfilled with clean soil fill to match the surrounding grade and then replanted with native vegetation.

Treatment/Containment Components

This alternative would reduce the availability and mobility of radionuclides and hazardous substances by applying an electric current sufficient to melt the soil and turn it into a chemically stable, leach-resistant glass block. A vacuum hood is placed over the treated area during melting to collect off-gasses, which are treated before release.

Institutional Controls

ICs (e.g., land use restrictions) would be used to limit access or intrusion by humans. The DOE is responsible for implementing, maintaining, reporting on, and enforcing institutional and land-use controls. Although DOE may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or through other means, DOE shall retain ultimate responsibility for remedy integrity and institutional controls

Operations and Maintenance

In areas where the glass block would be within 15 ft of the ground surface, a barrier would be placed over the site to break the direct exposure pathway to the block. This barrier would require long-term maintenance and monitoring to measure effectiveness and to ensure a 15 ft barrier thickness remains over the waste sites. This would include long-term environmental surveillance.

9.1.5 Removal, Treatment, and Disposal (RTD)

Conceptually, the RTD process for this alternative consists of five steps:

- Remove and stockpile clean overburden for backfilling.
- Remove contaminated soils and debris and place in waste containers.
- Haul waste containers to assay/screening station and then to the Environmental Restoration and Disposal Facility (ERDF) located onsite at the Hanford Site or to the Waste Isolation Pilot Plant (WIPP) for offsite disposal, as appropriate.
- Backfill excavation with clean fill and compact.
- Construct ET barrier as necessary and replant surface with native vegetation.

Five RTD options were evaluated to accommodate a range of removal objectives for plutonium-contaminated soils from the High-Salt and Low-Salt Waste Groups. Each of these options for removal of contaminated soils includes complete removal of the subsurface waste disposal structures. Only four of the RTD options were retained. Option D was evaluated but was not retained because this option and Option E are similar in the depth of excavation that would be required for remediation for the High-Salt and Low-Salt waste sites.

- Option A—Remove the highest concentrations of contaminants by removing soils at least 0.6 m (2 ft) below the bottom of a waste site. The removal depths for this option range from 20 to 31 feet bgs for the High Salt and Low Salt Waste Group sites. This option was not applicable to the Cesium-137 Waste Group sites.
- Option B—Remove contaminated soils that could result in a direct contact risk to industrial workers and that are less than 4.6 m (15 ft) below the current ground surface. This option only applies to one High-Salt waste site (216-Z-1A Tile Field) and three cesium-137 waste sites (216-A-7 Crib, 216-A-8 Crib, and UPR-200-E-56 Unplanned Release). The removal depths for this option range from 15 to 23 feet bgs.
- Option C—Remove a significant portion of plutonium contamination based on an evaluation of soil contaminant concentration with depth. The removal depths for this option range from 20 to 36 feet bgs.
- Option E—Remove contaminated soils with concentrations resulting in a direct contact risk greater than a 10^{-4} risk level so that long-term ICs at a waste site are not necessary. The removal depths for this option range from 22 to 90 feet bgs.

Treatment/Containment Components

This alternative would remove a portion of the contaminated soil and debris; treat the waste to meet disposal criteria (if necessary); and then dispose of the waste. The approximate size of the ET barriers over waste sites in the High-Salt and Low-Salt Waste Groups are listed in Table 22.

Table 22. Size of ET Barriers over High-Salt and Low-Salt Waste Groups

High-Salt Waste Group	Total Area for ET Barriers ha (ac)
216-Z-1A	0.57 (1.4)
216-Z-9	0.12 (0.3)
216-Z-18	0.74 (1.84)
Total	1.43 (3.54)
Low-Salt Waste Group	
216-Z-1 & 2	0.14 (0.34)
216-Z-3	0.10 (0.25)
216-Z-12	0.23 (0.57)
216-Z-5	0.07 (0.17)
Total	0.54 (1.33)

Institutional Controls

ICs (e.g., land use restrictions) would be used to limit access or intrusion by humans. The DOE is responsible for implementing, maintaining, reporting on, and enforcing institutional and land-use controls. Although DOE may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or through other means, DOE shall retain ultimate responsibility for remedy integrity and institutional controls

Operations and Maintenance

Evapotranspiration barriers would be required over the High Salt waste group. These barriers would require long-term maintenance to maintain the integrity of the remedy and ensure continued protectiveness. This would include long-term environmental surveillance.

9.1.6 Sludge Removal and Tank Stabilization

This alternative was only considered for the Settling Tank Waste Group since it is not applicable to the other waste sites. This alternative would remove, stabilize, and dispose of the sludge from the 241-Z-361 Settling Tank and 241-Z-8 Settling Tank at an approved disposal facility. The tanks would then be grouted for stabilization.

Treatment/Containment Components

This alternative would remove the sludge from the tanks, treat the waste to meet disposal criteria (if necessary), and then dispose of the waste.

Institutional Controls

ICs (e.g., land use restrictions) would be required to limit access or intrusion by humans. The DOE is responsible for implementing, maintaining, reporting on, and enforcing institutional and land-use controls. Although DOE may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or through other means, DOE shall retain ultimate responsibility for remedy integrity and institutional controls

Operations and Maintenance

There are no operations, maintenance, or monitoring requirements required for this alternative.

9.2 Common Elements of Each Alternative

Elements common to most of the above alternatives include the following:

- Institutional controls, long-term monitoring, and maintenance will be required under all alternatives because none of the alternatives meet standards that would allow unrestricted use and unlimited exposure.
- SVE will be required to address contamination from carbon tetrachloride and other VOCs at three of the high-salt waste sites. Continued operation of this system is necessary for protection of groundwater resulting from VOCs at the high-salt waste sites. Continued use of the existing SVE system will be incorporated into the selected remedy.

10.0 Comparative Analysis of Alternatives

This section of the ROD summarizes the comparative analysis of alternatives presented in the respective feasibility studies for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs (DOE/RL-2004-24 and DOE/RL-2007-27). The major objective of the analysis was to evaluate the relative performance of the alternatives with respect to the nine CERCLA evaluation criteria, as described in 40 CFR 300.430(f)(5)(i), so the advantages and disadvantages of each alternative are clearly understood. The nine CERCLA evaluation criteria are as follows:

- Overall protection of human health and the environment
- Compliance with applicable or relevant and appropriate requirements (ARARs)
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost
- State acceptance
- Community acceptance

The first two criteria, overall protection and compliance with ARARs, are defined under CERCLA as “threshold criteria.” Threshold criteria must be met for 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 acceptance and community acceptance, are defined as “modifying criteria.” In the final comparison of alternatives to select a remedy, both balancing criteria and modifying criteria are considered. The criteria were considered for each alternative at each waste group in these OUs which are the Z-Ditches, High-Salt, Low-Salt, Cesium-137, and Settling Tanks Waste Groups. Alternatives for the Other Sites waste group (216-Z-10 Injection/Reverse Well and 216-Z-8 French Drain) were not evaluated because these waste sites have limited contamination and do not pose a risk to human health and the environment. Table 28 through Table 31 at the end of this section show summaries of the comparative analysis.

10.1 Overall Protection of Human Health and the Environment

Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment by considering how risks posed through each exposure pathway are eliminated, reduced, or controlled through treatment, engineering controls, and/or institutional controls.

For the Z-Ditches, four alternatives (RTD, Barrier, a combination of ISV with RTD and a barrier, and a combination alternative of ISV with a barrier) meet the threshold criteria for protection of human health and the environment by eliminating, reducing, or controlling risks posed by the waste sites through removal and/or treatment of contaminated soil, and/or engineering controls. Although each of these four alternatives would provide adequate protection from exposure due to direct contact or soil ingestion/inhalation, perpetual cap maintenance would be required to ensure total protectiveness of each remedy including a barrier. A breach of the cap would potentially expose individuals to contamination and possibly allow migration of contaminants to the groundwater beneath the waste site. The No Action and Maintain and Enhance Existing Soil Cover with ICs alternatives are not protective of human health and the environment and were not retained.

For the High-Salt Waste Group, the Barrier is protective of human health and the environment using evapotranspiration and physical barriers to minimize the potential for exposure to human or environmental receptors. ISV is protective of human health and the environment because it would break the exposure pathway by solidifying the contaminants in a glass block. The RTD alternatives remove contamination to varying depths to minimize the potential for an exposure at the waste sites. Each of these alternatives, except RTD (Option E), will require long-term ICs to maintain protectiveness. The No Action alternative does not meet the threshold criteria, as it is not protective of human health and the environment and was not retained.

For the Low-Salt Waste Group, the Barrier, ISV, and RTD alternatives meet the threshold criteria for protection of human health and the environment. The No Action alternative does not meet the threshold criteria because it is not protective and was not retained.

For the Cesium-137 Waste Group, the Maintain/Enhance Existing Soil Cover (MEESC) and RTD alternatives (Options B and C) meet the threshold criteria for protection of human health and the environment. The No Action alternative does not meet the threshold criteria because it is not protective and was not retained.

For the Settling Tanks, the Sludge Removal and Tank Stabilization option meets the threshold criteria for overall protection of human health and the environment. The No Action alternative does not meet the threshold criteria because it is not protective and was not retained.

10.2 Compliance with Applicable or Relevant and Appropriate Requirements

Section 121(d) of CERCLA and 40 CFR 300.430(f)(1)(ii)(B) require that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate Federal and state requirements, standards, criteria, and limitations, which are collectively referred to as ARARs, unless such ARARs are waived under CERCLA Section 121(d)(4). Compliance with ARARs addresses whether a remedy will meet all of the ARARs or provide a basis for invoking a waiver.

Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than Federal requirements may be applicable. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria or limitations promulgated under Federal environmental or state environmental or facility siting laws that, while not “applicable” to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than Federal requirements may be relevant and appropriate.

All of the alternatives that met the criteria for overall protection of human health and the environment also comply with ARARs. The ARARs are the same for all of the alternatives.

10.3 Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, after RAOs have been met. This criterion includes the consideration of residual risk that will remain onsite following remediation and the adequacy and reliability of controls.

For the Z-Ditches, the RTD alternative provides the greatest long-term effectiveness because contaminants are removed from the ground, treated if necessary, and disposed of in an approved facility. The barrier decreases the mobility of the contaminants and limits contact therewith; however, it requires long-term maintenance to remain effective.

For the High-Salt waste group, the RTD alternatives (Options A, B, and C) ranked moderately well because they remove varying amounts of contaminants from the soil; however, ICs would still be required since waste will be left in place. RTD Option E ranks higher because all contaminated soil would be removed. Because RTD Option A and Option C propose excavation to depths greater than 4.6 m (15 ft) bgs, they would remove any contamination that poses a threat to human health or ecological receptors. By removing these soils, the exposure pathway is interrupted for the industrial worker scenario and ecological receptors.

For the Low-Salt waste group, RTD Option C and Option E rank high for long-term effectiveness because these options would remove all contamination that poses a threat to human health or ecological receptors. The Barrier, ISV, and RTD Option A alternatives leave contamination in place meaning ICs restricting land-use would still be required; therefore, they only rank as performing moderately well.

For the Cesium-137 waste group, the MEESC and RTD alternatives (Options B and C) leave some contamination in place, meaning ICs restricting land-use would still be required; therefore, these options only rank as performing moderately well.

For the Settling Tanks waste group, the alternative evaluated ranks high for long-term effectiveness since the contaminated sludge will be removed and the tanks will be grouted for stabilization.

10.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

The reduction of toxicity, mobility, or volume through treatment criterion assesses the anticipated performance of the treatment technologies that may be included as part of a remedial action.

For the Z-Ditches, the ISV/RTD/Barrier and ISV/Barrier alternatives rank moderately well for reduction in toxicity, mobility, and volume through treatment because they both treat contaminated material (i.e., PCBs) using vitrification to reduce mobility. The barrier decreases the amount of water that infiltrates into the contaminated soil, which potentially reduces the mobility of contaminants. For the ISV/Barrier alternative, the barrier provides additional protection of human health and the environment.

For the High-Salt waste group, the Barrier alternative reduces the amount of water that infiltrates into the subsurface, which may reduce mobility, but it does not reduce contaminant toxicity or volume. ISV captures contaminants in a glass block, reducing volume of the contaminated media and potentially reducing their mobility, but it does not reduce toxicity. The RTD alternatives reduce the amount of contaminated soil in the environment. However, the RTD alternative does not reduce toxicity or volume. Therefore, each alternative ranks as performing moderately well for this criterion.

For the Low-Salt waste group, none of the alternatives are effective in reducing the mobility of plutonium or americium, the primary contaminants, as they are not mobile under existing or anticipated conditions. Therefore, all alternatives are ranked as performing less well for this criterion.

For the Cesium-137 waste group, none of the alternatives are effective in reducing the mobility of cesium, the primary contaminant, as it is not mobile under existing or anticipated conditions. Therefore, all alternatives are ranked as performing less well for this criterion.

For the Settling Tanks waste group, treatment is not a component of sludge removal and tank grouting; therefore, it is ranked as performing less well. However, sludge removed from the tanks will need be packaged to meet waste disposal criteria for the Waste Isolation Pilot Plant (WIPP).

10.5 Short-Term Effectiveness

Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts on human health and the environment that may be posed during construction and implementation of the remedy.

For the Z-Ditches, High-Salt, and Low-Salt waste group, the Barrier alternative ranks highest for short-term effectiveness because it provides lower potential for worker and environmental exposure to contaminants than the RTD alternatives that include excavation of contaminated material, which could potentially result in an exposure. In addition, a Barrier can be constructed in a relatively short period of time compared to that needed to implement ISV or RTD.

For the Cesium-137 waste group, the MEESC alternative ranks highest for short-term effectiveness because it provides lower potential for worker and environmental exposure to contaminants than the RTD alternatives that include excavation of contaminated material, which could potentially result in an exposure.

For the Settling Tanks waste group, the alternative ranks moderately well since the removal of the sludge from the Settling Tanks will require significant contaminated material handling requirements for worker safety and environmental protection.

10.6 Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation, including the availability of services and materials needed to implement the remedy.

For the Z-Ditches, the Barrier alternative ranks high for implementability because it is a proven technology and relatively easy to construct with readily available construction methods and materials. The RTD alternative ranks moderately well because contaminated soils that are excavated must be packaged to meet disposal requirements at the appropriate disposal facility, which will be either ERDF or WIPP. The implementability of ISV is ranked low because of the challenges of applying the technology over a relatively large area.

For the High-Salt waste group, the Barrier alternative ranks high for implementability because it is a proven technology and relatively easy to construct with readily available construction methods and materials. The RTD alternatives rank moderately well because contaminated soils that are excavated must be packaged to meet transportation and WIPP disposal requirements. Wastes that do not qualify as transuranic waste for disposal at WIPP will be disposed of at ERDF. The RTD Option E ranked lowest for implementability because of the challenges of excavating to 27 m (90 ft). The implementability of ISV also ranked lowest because of the challenges of applying the technology below a depth of 7.6 m (25 ft) and over a relatively large area.

For the Low-Salt waste group, the Barrier alternative ranks high for implementability because it is a proven technology and relatively easy to construct with readily available construction methods and materials. The RTD alternatives (Options A, C, and E) all rank moderately well because contaminated soils that are excavated must be packaged to meet transportation and WIPP disposal requirements. The implementability of ISV is ranked low because of the challenges of applying the technology over a relatively large area.

For the Cesium-137 waste group, the MEESC alternative ranks high for implementability because it is relatively easy to construct with readily available construction methods and materials. The RTD alternatives rank moderately well because additional measures are required to excavate contaminated soils and package them to meet ERDF disposal requirements.

For the Settling Tanks waste group, the alternative ranks moderately well since the sludge will require packaging to meet transportation and WIPP disposal requirements.

10.7 Cost

For the Z-Ditches, the Barrier alternative is the lowest cost alternative, RTD is the next lowest cost alternative, followed by the combination alternatives, ISV/Barrier and ISV/RTD/Barrier. Table 23 shows a cost summary for the Z-Ditches.

Table 23. Cost Summary for the Z-Ditches Waste Group

Alternatives	Costs (\$ millions) ^a		
	Capital	Total O&M ^b	Present Worth
216-Z-1D Ditch, 216-Z-11 Ditch, 216-Z-19 Ditch, 216-Z-20 Tile Field, and UPR-200-W-110 Unplanned Release			
RTD	\$60.4	\$0	\$58.1
Barrier	\$9.4	\$285.1	\$19.6
ISV/RTD/Barrier	\$338.9	\$283.4	\$318
ISV/Barrier	\$296.9	\$284	\$287

a. These cost estimates are based on the best available information for the site-specific anticipated remedial actions. The actual costs are expected to range from -30 to +50 percent of these estimated values. Major changes to assumed remedial action scope can result in remedial action costs outside of this range. Present Worth calculations are based on 1,000 years.

b. Total O&M costs presented as total Nondiscounted Annual and Periodic Costs and include 1,000 year IC/O&M, where applicable.

For the High-Salt waste group, the Barrier alternative has the lowest cost followed by RTD Option B, ISV, and RTD Options A, C, and E. RTD Option B is lower because this option only applies to one High-Salt waste site (216-Z-1A Tile Field). The costs associated with final disposal include estimated costs for disposal at the WIPP for any transuranic waste that is generated. Table 24 shows a cost summary for the High-Salt waste group.

Table 24. Cost Summary for the High-Salt Waste Group

Alternatives	Cost (\$ millions) ^a		
	Capital ^b	Total O&M ^c	Present Worth ^b
216-Z-1A Tile Field, 216-Z-9 Trench, and 216-Z-18 Crib			
Barrier	\$12.3	\$107.5	\$19.1
ISV	\$115.1	\$107.4	\$94.0
RTD (Option A)	\$112.2	\$107.5	\$107.2
RTD (Option B)	\$78.1	\$107.5	\$77.5
RTD (Option C)	\$642.5	\$107.4	\$577.0
RTD (Option E)	\$895.5	\$6.6	\$786.3

a. These cost estimates are based on the best available information for the site-specific anticipated remedial actions. The costs are expected to range from -30 percent to +50 percent of these estimated values. Major changes to remedial action scope can result in remedial action costs outside of this range. Present Worth calculations are based on 1,000 years.

b. Capital and Present Worth costs include WIPP disposal costs.

c. Total O&M costs presented as total Nondiscounted Annual and Periodic Costs and include 1,000 year IC/O&M, where applicable.

For the Low-Salt waste group, the Barrier alternative has the lowest cost, followed by the ISV, and then the RTD alternatives. The RTD Option A alternative would cost less than Options C and E because less soil would be excavated. Table 25 shows a cost summary for the Low-Salt waste group.

Table 25. Cost Summary for the Low-Salt Waste Group

Alternatives	Cost (\$ millions) ^a		
	Capital ^b	Total O&M ^c	Present Worth ^b
216-Z-1&2 Crib, 216-Z-3 Crib, 216-Z-12 Crib and 216-Z-5 Crib			
Barrier	\$4.2	\$171.0	\$10.1
ISV	\$17.8	\$171.0	\$23.7
RTD (Option A)	\$61.8	\$171.0	\$67.7
RTD (Option C)	\$81.4	\$171.0	\$89.3
RTD (Option E)	\$81.4	\$0	\$81.4

a. These cost estimates are based on the best available information for the site-specific anticipated remedial actions. The costs are expected to range from -30 percent to +50 percent of these estimated values. Major changes to remedial action scope can result in remedial action costs outside of this range. Present Worth calculations are based on 1,000 years.

b. Capital and Present Worth Costs include WIPP disposal costs.

c. Total O&M costs presented as total Nondiscounted Annual and Periodic Costs and include 1,000 year IC/O&M, where applicable.

For the Cesium-137 waste group, the MEESC alternative has the lowest cost, followed by the RTD alternatives. RTD Option B has lower costs because less contaminated soil would be excavated than for RTD Option C. Table 26 shows a cost summary for the Cesium-137 waste group.

Table 26. Cost Summary for the Cesium-137 Waste Group

Alternatives	Cost (\$ millions) ^a		
	Capital	Total O&M ^b	Present Worth
216-A-7 Crib, 216-A-8 Crib, 216-A-24 Crib, 216-A-31 Crib and UPR-200-E-56 Unplanned Release			
Maintain/Enhance Existing Soil Cover	\$4.4	\$68.0	\$11.1
RTD (Option B)	\$13.2	\$63.9	\$19.6
RTD (Option C)	\$22.7	\$63.9	\$29.1

a. These cost estimates are based on the best available information for the site-specific anticipated remedial actions. The costs are expected to range from -30 percent to +50 percent of these estimated values. Major changes to remedial action scope can result in remedial action costs outside of this range. Present Worth calculations are based on 350 years.

b. Total O&M costs presented as total Nondiscounted Annual and Periodic Costs and include 1,000 year IC/O&M, where applicable.

c. The No Action alternative is not ranked because it does not meet the threshold criteria.

A cost summary for the Settling Tanks waste group is shown in Table 27. Table 28 through Table 31 at the end of this section show summaries of the comparative analysis.

Table 27. Cost Summary for the Settling Tanks Waste Group

Alternatives	Cost (\$ millions) ^a		
	Capital ^b	Total O&M ^c	Present Worth ^b
241-Z-361 Settling Tank and 241-Z-8 Settling Tank			
Sludge Removal and Tank Stabilization	\$33.4	\$0	\$39.6

a. These cost estimates are based on the best available information for the site-specific anticipated remedial actions. The costs are expected to range from -30 percent to +50 percent of these estimated values. Major changes to remedial action scope can result in remedial action costs outside of this range. Present Worth calculations are based on 1,000 years.

b. Capital and Present Worth Costs include WIPP disposal costs.

c. Total O&M costs presented as total Nondiscounted Annual and Periodic Costs.

Table 28. Comparative Analysis Summary for the Z-Ditches Waste Group

Criteria	No Action	MESC/ICs	RTD	Barrier	ISV/RTD/Barrier	ISV/Barrier
216-Z-1D Ditch, 216-Z-11 Ditch, 216-Z-19 Ditch, 216-Z-20 Tile Field, and UPR-200-W-110 Unplanned Release						
Threshold Criteria						
Overall Protection of Human Health and the Environment	No	No	Yes	Yes	Yes	Yes
Compliance with ARARs	No	No	Yes	Yes	Yes	Yes
Balancing Criteria						
Long-Term Effectiveness and Permanence	NA	NA	Minimal long-term risks because contaminated soil would be removed	Moderate long-term risks because all contaminated soil would be left in place under the barrier	Minimal long-term risks since contaminated soil is removed or vitrified and left in place	Moderate long-term risks because contaminated soil is vitrified and left in place
Reduction in Toxicity, Mobility, and Volume through Treatment	NA	NA	No reduction, but removes contaminated soil from the environment	Restricts water infiltration which reduces mobility, but there is no treatment, waste remains in place	Vitrification and a barrier reduce contaminant mobility	Vitrification and a barrier reduce contaminant mobility
Short-Term Effectiveness	NA	NA	Moderate risks because contaminated soils are excavated and packaged	Lowest short-term risks because work is not intrusive	Moderate risks because contaminated soils are excavated and packaged and from worker risk associated with ISV	Moderate risks because of worker risk associated with ISV

Criteria	No Action	MESC/ICs	RTD	Barrier	ISV/RTD/Barrier	ISV/Barrier
Implementability	NA	NA	Relatively implementable, but requires excavation and disposal of contaminated soil	Relatively easy to construct	Less implementable due to challenges associated with ISV	Less implementable due to challenges associated with ISV
Cost (in millions)						
Capital	NA	NA	\$60.4	\$9.4	\$338.9	\$296.9
Total O&M ^b	NA	NA	\$0	\$285.1	\$283.4	\$284
Present Worth	NA	NA	\$58.1	\$19.6	\$318	\$287
Modifying Criteria						
State Acceptance	NA	NA	Yes	No	No	No
Community Acceptance	NA	NA	Yes	No	No	No

a. These cost estimates are based on the best available information for the site-specific anticipated remedial actions. The actual costs are expected to range from -30 to +50 percent of these estimated values. Major changes to assumed remedial action scope can result in remedial action costs outside of this range. Present Worth calculations are based on 1,000 years.

b. Total O&M costs presented as total Nondiscounted Annual and Periodic Costs and include 1,000 year IC/O&M, where applicable.

Table 29. Comparative Analysis Summary for the High-Salt Waste Group

Criteria	No Action	Barrier	ISV	RTD (Option A)	RTD (Option B)	RTD (Option C)	RTD (Option E)
216-Z-1A Tile Field, 216-Z-9 Trench, and 216-Z-18 Crib							
Threshold Criteria							
Overall Protection of Human Health and the Environment	No	Yes	Yes	Yes	Yes	Yes	Yes
Compliance with ARARs	No	Yes	Yes	Yes	Yes	Yes	Yes
Balancing Criteria							
Long-Term Effectiveness and Permanence	NA	Moderate long-term risks because all contaminated soil would be left in place under the barrier	Moderate long-term risks because contaminated soil is vitrified and left in place	Moderate long-term risks because not all of the contaminated soil would be removed	Moderate long-term risks because not all of the contaminated soil would be removed	Moderate long-term risks because not all of the contaminated soil would be removed	Minimal long-term risks because enough contaminated soil would be removed that ICs would not be required
Reduction in Toxicity, Mobility, and Volume through Treatment ^c	NA	Restricts water infiltration which reduces mobility	Restricts water infiltration which reduces mobility	No reduction, but removes contaminated soil from the environment	No reduction, but removes contaminated soil from the environment	No reduction, but removes contaminated soil from the environment	No reduction, but removes contaminated soil from the environment
Short-Term Effectiveness	NA	Lowest short-term risks because work is not intrusive	Moderate risks because of worker risk associated with ISV	Moderate risks because contaminated soils are excavated and packaged	Moderate risks because contaminated soils are excavated and packaged	Moderate risks because contaminated soils are excavated and packaged	Moderate risks because contaminated soils are excavated and packaged

Criteria	No Action	Barrier	ISV	RTD (Option A)	RTD (Option B)	RTD (Option C)	RTD (Option E)
Implementability	NA	Relatively easy to construct	Less implementable due to challenges associated with ISV	Relatively implementable, but requires excavation and disposal of contaminated soil	Relatively implementable, but requires excavation and disposal of contaminated soil	Relatively implementable, but requires excavation and disposal of contaminated soil	Less implementable since excavation would be needed to depths >90 ft
Cost (in millions)							
Capital	NA	\$12.3	\$115.1	\$112.2	\$78.1	\$642.5	\$895.5
Total O&M ^b	NA	\$107.5	\$107.4	\$107.5	\$107.5	\$107.4	\$6.6
Present Worth	NA	\$19.1	\$94.0	\$107.2	\$77.5	\$577.0	\$786.3
Modifying Criteria							
State Acceptance	NA	No	No	Yes ^d	No	Yes	Yes
Community Acceptance	NA	No	No	No ^e	No	Yes ^e	Yes ^e

a. These cost estimates are based on the best available information for the site-specific anticipated remedial actions. The actual costs are expected to range from -30 to +50 percent of these estimated values. Major changes to assumed remedial action scope can result in remedial action costs outside of this range. Present Worth calculations are based on 1,000 years.

b. Total O&M costs presented as total Nondiscounted Annual and Periodic Costs and include 1,000 year IC/O&M, where applicable.

c. Carbon tetrachloride and other VOCs are being removed by SVE and are subject to treatment

d. Ecology recommended RTD-Option C as the preferred alternative in a letter to EPA's National Remedy Review Board dated July 2010. Ecology also concurs with the use of RTD-Option A as part of the selected remedy.

e. Public comments on the Proposed Plan supported an RTD option that would remove nearly all or all of the plutonium-contaminated sediments at the High-Salt Waste Group, as in RTD Options C and E. RTD-Option A was selected as the final remedy for this waste group since it meets the threshold criteria and provides the best balance of the CERCLA balancing criteria and modifying criteria considerations.

Table 30. Comparative Analysis Ranking Summary for the Low-Salt Waste Group

Criteria	No Action	Barrier	ISV	RTD (Option A)	RTD (Option C)	RTD (Option E)
216-Z-1&2 Crib, 216-Z-3 Crib, 216-Z-12 Crib and 216-Z-5 Crib						
Threshold Criteria						
Overall Protection of Human Health and the Environment	No	Yes	Yes	Yes	Yes	Yes
Compliance with ARARs	No	Yes	Yes	Yes	Yes	Yes
Balancing Criteria						
Long-Term Effectiveness and Permanence	NA	Moderate long-term risks because all contaminated soil would be left in place under the barrier	Moderate long-term risks because contaminated soil is vitrified and left in place	Moderate long-term risks because not all of the contaminated soil would be removed	Minimal long-term risks because enough contaminated soil would be removed that ICs would not be required	Minimal long-term risks because enough contaminated soil would be removed that ICs would not be required
Reduction in Toxicity, Mobility, and Volume through Treatment	NA	Restricts water infiltration which reduces mobility	Restricts water infiltration which reduces mobility	No reduction, but removes contaminated soil from the environment	No reduction, but removes contaminated soil from the environment	No reduction, but removes contaminated soil from the environment
Short-Term Effectiveness	NA	Lowest short-term risks because work is not intrusive	Moderate risks because of worker risk associated with ISV	Moderate risks because contaminated soils are excavated and packaged	Moderate risks because contaminated soils are excavated and packaged	Moderate risks because contaminated soils are excavated and packaged

Criteria	No Action	Barrier	ISV	RTD (Option A)	RTD (Option C)	RTD (Option E)
Implementability	NA	Relatively easy to construct	Less implementable due to challenges associated with ISV	Relatively implementable, but requires excavation and disposal of contaminated soil	Relatively implementable, but requires excavation and disposal of contaminated soil	Relatively implementable, but requires excavation and disposal of contaminated soil
Cost (in millions)						
Capital	NA	\$4.2	\$17.8	\$61.8	\$81.4	\$81.4
Total O&M ^b	NA	\$171.0	\$171.0	\$171.0	\$171.0	\$0
Present Worth	NA	\$10.1	\$23.7	\$67.7	\$81.4	\$81.4
Modifying Criteria						
State Acceptance	NA	NA	No	No	Yes	Yes
Community Acceptance	NA	NA	No	No	Yes	Yes

a. These cost estimates are based on the best available information for the site-specific anticipated remedial actions. The actual costs are expected to range from -30 to +50 percent of these estimated values. Major changes to assumed remedial action scope can result in remedial action costs outside of this range. Present Worth calculations are based on 1,000 years.

b. Total O&M costs presented as total Nondiscounted Annual and Periodic Costs and include 1,000 year IC/O&M, where applicable.

Table 31. Comparative Analysis Summary for the Cesium-137 Waste Group

Criteria	No Action	Maintain/Enhance Existing Soil Cover (MEESC)	RTD (Option B)	RTD (Option C)
216-A-7 Crib, 216-A-8 Crib, 216-A-24 Crib, 216-A-31 Crib and UPR-200-E-56 Unplanned Release				
Threshold Criteria				
Overall Protection of Human Health and the Environment	No	Yes	Yes	Yes
Compliance with ARARs	No	Yes	Yes	Yes
Balancing Criteria				
Long-Term Effectiveness and Permanence	NA	Moderate long-term risks because all contaminated soil would be left in place under the soil cover	Moderate long-term risks because not all of the contaminated soil would be removed	Moderate long-term risks because not all of the contaminated soil would be removed
Reduction in Toxicity, Mobility, and Volume through Treatment	NA	Reduces water infiltration which reduces mobility	No reduction, but removes contaminated soil from the environment	No reduction, but removes contaminated soil from the environment
Short-Term Effectiveness	NA	Lowest short-term risks because work is not intrusive	Moderate risks because contaminated soils are excavated and packaged	Moderate risks because contaminated soils are excavated and packaged
Implementability	NA	Relatively easy to construct	Relatively implementable, but requires excavation and disposal of contaminated soil	Relatively implementable, but requires excavation and disposal of contaminated soil

Criteria	No Action	Maintain/Enhance Existing Soil Cover (MEESC)	RTD (Option B)	RTD (Option C)
Cost (in millions)				
Capital	NA	\$4.4	\$13.2	\$22.7
Total O&M ^b	NA	\$68.0	\$63.9	\$63.9
Present Worth	NA	\$11.1	\$19.6	\$29.1
Modifying Criteria				
State Acceptance	NA	Yes	Yes	Yes
Community Acceptance	NA	Yes	Yes	Yes

a. These cost estimates are based on the best available information for the site-specific anticipated remedial actions. The actual costs are expected to range from -30 to +50 percent of these estimated values. Major changes to assumed remedial action scope can result in remedial action costs outside of this range. Present Worth calculations are based on 1,000 years.

b. Total O&M costs presented as total Nondiscounted Annual and Periodic Costs and include 1,000 year IC/O&M, where applicable.

10.8 State Acceptance

The State of Washington Department of Ecology (Ecology) provided the following state acceptance statement for inclusion in this ROD:

Ecology is the supporting regulatory agency for remedial actions at the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units (OUs). Under Washington's Resource Conservation and Recovery Act of 1976 (RCRA)-authorized Hazardous Waste Management Act (HWMA) and Dangerous Waste Regulations, Ecology has corrective action jurisdiction over the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs concurrent with Comprehensive Environmental Response Conservation, and Liability Act of 1980 (CERCLA). Under the Hanford Facility Dangerous Waste Permit (Site-wide Permit), Ecology allows for work under other cleanup authorities or programs to be used to satisfy corrective action requirements, provided such work protects human health and the environment: Site-wide Permit Condition II.Y.2. Ecology specifically accepts work under the Tri-Party Agreement and the CERCLA program as satisfying corrective action requirements, subject to certain reservations (Site-wide Permit Condition II.Y.2.a). These reservations include a qualification that "a final decision about satisfaction of corrective action requirements will be made in the context of issuance of a final ROD," Sitewide Permit Condition II.Y.2.a.ii.

In addition to jurisdiction asserted under the permit, certain HWMA corrective action requirements are "applicable or relevant and appropriate requirements" (ARARs) under CERCLA. Ecology has evaluated protection of human health and the environment by considering how the selected remedy will address state corrective action requirements under the Washington Administrative Code (WAC) 173-303-64620(4). This regulation provides that corrective action must, at a minimum, be consistent with certain provisions of Washington's Model Toxics Control Act (MTCA) regulations, including the requirements for state remedial investigation/feasibility study (RI/FS) in WAC 173-340-350, and the remedy selection requirements of WAC 173-340-360.

Ecology agrees that the selected remedy is consistent with the remedy selection requirements of WAC 173-340-360. In reaching this conclusion, Ecology agrees that US DOE has collected sufficient information to identify and evaluate cleanup alternatives for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs, consistent with WAC 173-340-350. Ecology believes, however, that further sampling of nitrate and technetium-99 is necessary to confirm that nitrate levels do not pose an unacceptable risk to groundwater.

Ecology understands that further site characterization for nitrate and technetium-99 (also called "post-ROD confirmatory sampling" and "verification sampling") will be described in a future Remedial Design Report/Remedial Action Work Plan approved by EPA. Ecology and the U.S. Environmental Protection Agency Region 10 entered into a Memorandum of Understanding (MOU), effective 27 August 1996, concerning Hanford Federal Facility Agreement and Consent Order. The MOU indicates that Ecology will generally not be involved with EPA-lead operable units after the ROD is issued. For these operable units, Ecology will request an EPA briefing on the post-ROD sampling as EPA develops data quality objectives (DQOs). Ecology will provide feedback on these draft DQOs. Also, Ecology anticipates requesting that US DOE conduct the post-ROD sampling using a methods-based approach analyzing & reporting on all constituents within a given analytical method, compared to analyzing & reporting specific contaminants of interest within an analytical method. Ecology anticipates that by being briefed on and providing feedback on DQOs, and by requesting methods-based analysis and reporting, the proposed remedy will be consistent with WAC 173-340-410, "Compliance monitoring requirements".

Ecology further concurs with the decision that the 241-Z-361 and 241-Z-8 Settling Tanks "will be managed using the CERCLA past-practice process," subject to the following comments. Assuming it is

confirmed that these tanks hold mixed waste and that the material in the tanks was not disposed of prior to the effective date of hazardous waste regulation, Ecology maintains that the tanks are subject to closure under Washington's RCRA-authorized state hazardous waste program, as implemented through the Hazardous Waste Management Act (HWMA), chapter 70.105 RCW, and Dangerous Waste Regulations, chapter 173-303 WAC. While the material within the tanks has undoubtedly been "discarded," it is at this point still being determined whether it was "disposed of" as defined under RCRA during the 1970s. See 42 U.S.C. § 6903(3); see also, WAC 173-303-040. If it was not disposed of in the 1970s, then the material has continued in storage after the effective date of applicable HWMA requirements and RCRA regulation, which makes both the material in the tanks and the tanks themselves subject to HWMA requirements. Even if it was disposed of prior to the effective date of hazardous waste regulation, HWMA closure requirements are still relevant and appropriate under CERCLA to the disposition of the tanks and their contents. Ecology therefore agrees with the inclusion of WAC 173-303-610(2) (defining closure standards) as an ARAR. Ecology expects that detailed closure requirements based on this ARAR will be developed in conjunction with the RD/RA work plan. In the event HWMA requirements are determined to be applicable, Ecology believes that it can accept a CERCLA action that implements closure actions in conformance with the ARAR as satisfying closure under the HWMA, and Ecology will develop a framework for implementing this approach in the pending renewal of the Hanford Sitewide Permit.

Periodic review of cleanup actions is listed as a corrective action requirement at WAC 173-303-64620(4)(e). The corrective action requirement for consistency with the WAC 173-340-420 requirements for periodic review can be satisfied by the CERCLA requirement for 5-year review of CERCLA RODs. For the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs, Ecology has identified several elements that it believes will need to be addressed in the CERCLA 5-year review:

1. Extent of nitrate contamination, re-evaluation of potential impact to groundwater, and evaluation of protectiveness of selected remedy for nitrate in soil-to-protect groundwater (WAC 173-340-747).
2. Evaluating effectiveness of soil vapor extraction of carbon tetrachloride, and whether selected remedy will achieve a reasonable restoration time frame (WAC 173-340-360(4)).
3. Extent of technetium-99 contamination, re-evaluation of potential impact to groundwater, and evaluation of protectiveness of selected remedy for technetium-99 in terms of ability to not exceed the Method A cleanup level for Gross Beta particle activity in groundwater (WAC 173-340-900, Table 720-1).
4. Evaluation of the sampling and analysis results from post-ROD to support the protectiveness determination required for the CERCLA 5-year ROD review.

This ROD does not set precedents for other RODs on the Central Plateau, as every CERCLA decision must be evaluated on its own merit.

The public comment period and responsiveness summary address the public's concerns. After evaluating the remedy, the state has determined that the selected remedy described in section 12 is acceptable as a final remedy, subject to the above comments.

10.9 Community Acceptance

Numerous comments were received on the proposed plan. The public voiced concerns over implementation of a final remedial action that will leave waste, particularly long-lived plutonium contamination, in place. Other concerns were the use of barriers and soil covers, maintaining institutional controls over the long term. The public's comments, along with the agency responses, are included in the Responsiveness Summary in Part III of this ROD.

11.0 Principal Threat Waste

Principal threat waste is defined as 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. They include soils containing significant concentrations of highly toxic materials and surface or subsurface soils containing high concentrations of contaminants that are, or potentially are mobile due to wind entrainment, volatilization, surface runoff, or subsurface transport. The NCP states that “EPA expects to use treatment to address the principal threats posed by a site, wherever practicable” (40 CFR § 300.430(a)(1)(iii)(A)). At these waste sites, the soils contaminated with significant concentrations of plutonium or cesium radionuclides are considered principal threat wastes since they are highly toxic contaminants. EPA has a preference to treat principal threat waste, wherever practicable. However, there is no feasible technology to practicably treat radionuclides that will not result in larger volumes of waste, creating greater impracticability for disposal. The contaminated soils will be packaged appropriately for on-site disposal at the Hanford Site Environmental Restoration Disposal Facility (ERDF) or for off-site disposal at the Waste Isolation Pilot Plant (WIPP), as appropriate. The amount of waste disposed is a limiting factor since plutonium waste generated at 200-PW-1 and 200-PW-6 waste sites will include transuranic waste, which will be disposed at the WIPP, a half-mile deep repository in southern New Mexico that has limited capacity. Transuranic mixed waste disposed at WIPP is exempt from treatment standards promulgated pursuant to section 3004(m) of the Solid Waste Disposal Act (42 U.S.C. 6924(m)) and shall not be subject to the land disposal prohibitions in section 3004(d), (e), (f), and (g) of the Solid Waste Disposal Act (*the WIPP Land Withdrawal Act (LWA) of 1992*, Pub. L. No. 102-579, § 9, 106 Stat. 4777, as amended by the *National Defense Authorization Act for Fiscal Year 1997*, Pub. L. No. 104-201, 110 Stat. 2422). While radiological constituents from the Hanford waste stream that are disposed at WIPP will not be treated, the deep geologic disposal in a dry, 220 million-year-old salt bed has many of the same benefits as treatment with respect to permanence and control of migration. The selected remedy consists of an evapotranspiration barrier over plutonium contaminated soils and a soil cover over cesium-contaminated soils, which will protect human health and the environment from future unacceptable risk. DOE and EPA have determined that the waste remaining in place will not be an unacceptable risk to human health or the environment.

12.0 Selected Remedy

This ROD presents the selected final remedial action for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs in the Hanford Site, 200 Area, Benton County, Washington, in accordance with CERCLA, as amended by SARA, and to the extent practicable, the NCP. This decision is based on the information contained in the Administrative Record, which includes the public comments on the Proposed Plan for these OUs. An expedited response action is currently ongoing in the 200-PW-1 OU to address carbon tetrachloride contamination through use of a soil vapor extraction system. Use of the SVE system will be incorporated into the final remedial action. The following subsections provide a summary of the rationale for the selected remedy, the description of the selected remedy, the summary of estimated remedy costs, and expected outcomes of the selected remedy.

12.1 Summary of the Rationale for the Selected Remedy

As part of the evaluation, several key factors influenced selection of the selected remedy including the following:

- The location of the waste sites within the Central Plateau of the Hanford Site where they are adjacent to long-term waste disposal facilities.
- The depth to groundwater at the waste sites 40m to 75m (132 ft- 246 ft) in the 200 West Area and 54m to 104 m (177 ft- 340 ft) in the 200 East Area.

- The semiarid climate of the area that has an average annual precipitation of 17 cm (6.8 in.).
- The anticipated industrial land-use for these waste sites.
- The minimal risk reduction associated with removing plutonium-contaminated soils at greater depths.
- Public acceptance of a remedy that removes contaminated soil. A barrier alternative would also be protective of human health and the environment.

The 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs consist of 21 waste sites that have been grouped together into six waste groups (Z-Ditches, High-Salt, Low-Salt, Settling Tanks, Cesium-137, and Other Sites) based on liquid waste type, primary contaminants, and similarities in the distribution of contaminants in the subsurface. A remedial approach that would best address the type of contamination present was selected for each of these waste groups. The two waste sites in the Other Sites Group were determined to have limited contamination and do not pose a risk to human health and the environment; therefore, there is no basis for action at these waste sites. Table 32 shows a brief summary of the selected remedial actions for each waste group.

Table 32. Summary of Remedial Actions Selected by Waste Group

Waste Group	Selected Remedy
Z-Ditches	RTD with disposal at ERDF or WIPP, as appropriate.
High-Salt	RTD—Option A: Remove soil to 0.6 m (2 ft) below the bottom of the disposal structure to 20 ft – 23 ft bgs. Plutonium waste will be disposed of at WIPP or ERDF, as appropriate. SVE to treat VOCs. Use of evapotranspiration barriers.
Low-Salt	RTD—Option C: Remove soil up to a depth of 22 ft - 33 ft at each waste site. Plutonium waste will be disposed of at WIPP or ERDF, as appropriate. Use of evapotranspiration barriers.
Cesium-137	Maintain/ Enhance Soil Cover. Maintain a 15 ft thickness of soil cover over these waste sites.
Settling Tanks	Sludge Removal and Tank Stabilization.
Other Sites	No action since these waste sites do not pose a risk to human health and the environment

Removal, treatment (if necessary), and disposal (RTD) of contaminated soil and structures was the preferred alternative for the Z-Ditches waste group. The basis for selecting this alternative is that it reduces site risk through removal of contamination from the waste sites to levels that are protective of the current and reasonably expected future land use. This alternative is cost-effective relative to other alternatives, taking into account the reduction of overall site risk achieved and reduction of the cost of long-term ICs and maintenance.

Contaminated soil removed from the High-Salt Waste Group is anticipated for disposal at WIPP, which is a greater cost than disposal at ERDF. The RTD Option A alternative was identified as the preferred alternative for the High Salt waste group over RTD Option C because it is protective of the current and reasonably expected future land use and the incremental cost of retrieving and disposing of the additional quantity of contaminated soils under Option C are disproportionate to the reduction in risks posed to human health and the environment. The construction of an evapotranspiration barrier over the waste sites after RTD is complete will control the amount of precipitation that infiltrates into the remaining

contaminated media, thereby reducing the potential migration of contaminants and providing protection of groundwater.

For the Low-Salt waste group, the RTD Option C alternative was selected over the RTD Option A alternative because excavating to 10.1 m (33 ft) under RTD Option C instead of stopping at 9.5 m (31 ft), would remove an estimated 90 percent of the plutonium contamination beneath these waste sites and is cost effective. This is different from the High-Salt Waste Group because removing a significant portion of plutonium contamination at the High-Salt Waste Group would require digging an additional 13 to 16 feet. The construction of an evapotranspiration barrier over the waste sites after RTD is complete will control the amount of precipitation that infiltrates into the remaining contaminated media, thereby reducing the potential migration of contaminants and providing protection of groundwater.

The Maintain/Enhance Existing Soil Cover (MEESC) alternative was selected for the Cesium-137 waste group because it will provide a minimum of 4.6 m (15 ft) of cover over the waste which will break environmental pathways to humans and ecological receptors, is protective of the current and reasonably expected land use, and is cost effective. The MEESC alternative ranked high for implementability because it is relatively easy to construct soil cover with readily available construction methods and materials while the RTD alternative ranked moderately well because additional measures are required to excavate contaminated soils and package them to meet ERDF disposal requirements. The MEESC alternative was also the lowest cost alternative considered. Since the cesium contamination at these waste sites is not mobile under existing or anticipated conditions, all the alternatives considered do not include waste treatment and therefore do not provide for the reduction of toxicity, mobility, or volume through treatment.

12.2 Detailed Description of the Selected Remedy

A brief summary of the selected remedy for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs is listed in Table 32. A detailed description of the major remedy components for each waste group is provided in this section.

12.2.1 Z-Ditches Waste Group Remedy Components

Removal, treatment to meet disposal requirements (if needed), and disposal of contaminated soils at ERDF or WIPP, as appropriate, will be applied to the Z-Ditches Waste Group which consists of the 216-Z-1D Ditch, 216-Z-11 Ditch, 216-Z-19 Ditch, 216-Z-20 Tile Field, and UPR-200-W-110 Unplanned Release in accordance with an approved remedial design/remedial action (RD/RA) work plan. For the Z-Ditches Waste Group, the excavation will remove contaminated soil located from 0 to 15 ft bgs that exceeds cleanup levels for plutonium 239/240, americium-241, cesium-137, radium-226, strontium-90, PCBs, boron, and mercury.

The RTD process for this waste group requires:

- Removal and stockpiling of clean overburden for backfilling.
- Removal of contaminated soils and debris to a depth of 15 ft bgs that exceed the cleanup levels identified in Table 35 for contaminants specified above.
- Removal of structures and other debris within the excavation areas. This includes the 200-W-207-PL pipeline associated with this waste group.
- Sampling during design to confirm the extent of excavation required.

- Placement of contaminated soil and debris in waste containers.
- Screening of waste in containers to determine if it qualifies for disposal at ERDF. If transuranic waste is present in the containers, it will be packaged to meet waste disposal criteria for disposal at WIPP.
- Treatment of waste to meet disposal requirements (if needed).
- Sampling for plutonium 239/240, americium-241, cesium-137, radium-226, strontium-90, PCBs, boron, and mercury to verify the remediation meets the cleanup levels identified in Table 35 after excavation is complete and before backfilling occurs.
- Sampling of nitrate, at the request of Ecology, to confirm that nitrate levels do not pose an unacceptable risk to groundwater. Sampling will be done in accordance with a sampling and analysis plan that will be part of the RD/RA work plan. In the event sampling indicates contaminant levels do pose an unacceptable risk to groundwater, then the CERCLA process will be used to modify the remedy as necessary to protect groundwater.
- Backfilling of the excavations with clean fill followed by compaction and revegetation.

12.2.2 High-Salt Waste Group Remedy Components

Removal, treatment to meet disposal requirements (if needed), and disposal of contaminated soils at ERDF or WIPP, as appropriate, will be applied to the High-Salt Waste Group which consists of the 216-Z-1A Tile Field, 216-Z-9 Trench, and 216-Z-18 Crib in accordance with an approved RD/RA work plan. For the High-Salt Waste Group, the excavation will remove soils located to 6.1 m (20 ft) bgs at the 216-Z-1A Tile Field, 7 m (23 ft) bgs at the 216-Z-9 Trench, and 6.1 m (20 ft) bgs at the 216-Z-18 Crib. The selected RTD (Option A) process for this waste group requires:

- Removal and stockpiling of clean overburden for backfilling.
- Removal of soils and debris to 6.1 m (20 ft) bgs at the 216-Z-1A Tile Field, 7 m (23 ft) bgs at the 216-Z-9 Trench, and 6.1 m (20 ft) bgs at the 216-Z-18 Crib. This includes the 200-W-174-PL and 200-W-206-PL pipelines and removal of the above-grade structures at the 216-Z-9 Trench.
- Removal of structures and other debris within the excavation areas or that must be removed in order to conduct required remediation. This may include removal of parts of the 200-W-178 pipeline from the 241-Z building to the 3rd bend in the 200-W-178-PL pipeline. The 200-W-178 pipeline is part of a Dangerous Waste Management Unit (DWMU) and any necessary removal of parts of the 200-W-178 pipeline will satisfy applicable or relevant and appropriate requirements for DWMUs.
- Placement of contaminated soil and debris in waste containers.
- Screening of waste in containers to determine if it qualifies as transuranic waste. Waste that qualifies as transuranic waste will be packaged to meet waste disposal criteria for disposal at WIPP. Other waste will be packaged to meet disposal criteria for disposal at ERDF.
- Treatment of waste to meet disposal requirements (if needed).

- Sampling of nitrate and technetium-99, at the request of Ecology, to confirm that contaminant levels do not pose an unacceptable risk to groundwater. Sampling will be done in accordance with a sampling and analysis plan that will be part of the RD/RA work plan. In the event sampling indicates contaminant levels do pose an unacceptable risk to groundwater, then the CERCLA process will be used to modify the remedy as necessary to protect groundwater.
- After excavating to the specified depths in these waste sites, plutonium-239/240 levels will be assessed in accordance with a sampling and analysis plan that will be part of the RD/RA work plan. DOE will consider removing additional plutonium-contaminated soil from these waste sites.
- Backfilling of the excavations with clean fill, followed by compaction.
- Construction of evapotranspiration (ET) barriers over each waste site. ET barrier construction will include planting the barrier surface with vegetation.

The ET barriers will be constructed in accordance with an approved RD/RA work plan. The barrier will cover the entirety of each waste site it addresses to minimize infiltration into and through contaminated soil remaining in those waste sites, prevent vapor buildup within the surface barrier, and inhibit plant and animal intrusion into the remaining waste. The integrity of the barrier will be monitored in accordance with an approved Operations and Maintenance (O&M) plan.

An SVE system was constructed and operated under an expedited response action to address carbon tetrachloride contamination at the High-Salt Waste Group (*Action Memo: Expedited Response Action Proposal for 200 West Carbon Tetrachloride Plume, 1992*). The SVE system requirements are being incorporated as part of the selected remedy. SVE will be used to address carbon tetrachloride and methylene chloride contamination. Soil vapor concentrations presented in Table 35 will be further refined and assessed to ensure soil cleanup levels, which are protective of groundwater, are met. DOE will continue to implement the SVE system in accordance with the expedited response action until the RD/RA Work Plan is approved.

12.2.3 Low-Salt Waste Group Remedy Components

Removal, treatment to meet disposal requirements (if needed), and disposal of contaminated soils at ERDF or WIPP, as appropriate, will be applied to the Low-Salt Waste Group which consists of the 216-Z-1&2 Crib, 216-Z-3 Crib, 216-Z-12 Crib and 216-Z-5 Crib in accordance with an approved RD/RA work plan.

For the Low-Salt Waste Group, the excavation will remove soils located to 7.6 m (25 ft) bgs at the 216-Z-1&2 Crib, 10.1 m (33 ft) bgs at the 216-Z-3 Crib, 6.7 m (22 ft) bgs at the 216-Z-5 Crib, and 7.3 m (24 ft) bgs at the 216-Z-12 Crib.

The RTD (Option C) process for this waste group requires:

- Removal and stockpiling of clean overburden for backfilling.
- Removal of soils and debris to 7.6 m (25 ft) bgs at the 216-Z-1&2 Crib, 10.1 m (33 ft) bgs at the 216-Z-3 Crib, 6.7 m (22 ft) bgs at the 216-Z-5 Crib, and 7.3 m (24 ft) bgs at the 216-Z-12 Crib.
- Removal of structures and other debris within excavation areas or that must be removed in order to conduct required remediation. This includes the 200-W-208-PL and 200-W-210-PL pipelines.

- Placement of contaminated soil and debris in waste containers
- Screening of waste in containers to determine if it qualifies for offsite disposal at the Waste Isolation Pilot Plant (WIPP). Waste that does not meet waste acceptance criteria for WIPP will be sent to the Hanford Environmental Restoration and Disposal Facility (ERDF).
- Treatment of waste to meet disposal requirements (if needed).
- Backfilling of the excavations with clean fill, followed by compaction.
- Construction of evapotranspiration (ET) barriers over each waste site. The requirements for these ET barriers are the same as for the High-Salt Waste Group.

12.2.4 Cesium-137 Waste Group Remedy Components

The use of soil covers over contaminated soils will be applied at the Cesium-137 Waste Group which consists of the 216-A-7 Crib, 216-A-8 Crib, 216-A-24 Crib, 216-A-31 Crib and UPR-200-E-56 Unplanned Release in accordance with an approved RD/RA work plan.

For the Cesium-137 Waste Group, the soil covers will provide a minimum of 4.6 m (15 ft) of uncontaminated soil cover over each waste site.

Soil cover for this waste group requires:

- Addition of soil, as necessary, to waste sites to achieve a minimum 4.6 m (15 ft) of cover, at the 216-A-7 Crib, 216-A-8 Crib, and the UPR-200-E-56 Unplanned Release waste sites.
- Maintenance of a 4.6m (15ft) thickness of soil cover.

12.2.5 Settling Tanks Waste Group Remedy Components

Removal of sludge followed by tank stabilization will be applied to the Settling Tank Waste Group which consists of the 241-Z-361 Settling Tank and 241-Z-8 Settling Tank in accordance with an approved RD/RA work plan.

The sludge removal and tank stabilization process for this waste group requires:

- Removal of sludge from the tanks.
- Packaging of sludge to meet waste disposal criteria for disposal at WIPP.
- Screening of waste in container to confirm it meets the requirements for disposal at WIPP. Waste in containers that does not meet WIPP disposal criteria will be treated if necessary and sent to ERDF.
- Verification of removal of tank contents prior to grouting will be conducted in accordance with the RD/RA work plan.
- Grouting of empty tanks with a suitable fill material to remove the potential for collapse. Tanks will remain in place.

In addition, remediation of the tanks will be conducted to satisfy substantive requirements for closure of dangerous waste tanks.

12.2.6 Other Sites Waste Group Remedy Components

The two waste sites in the Other Sites Group, the 216-Z-8 French Drain and 216-Z-10 Injection/Reverse Well, were determined to have limited contamination and do not pose a risk to human health and the environment; therefore, no action has been selected for these waste sites.

12.2.7 Institutional Controls Component

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 at the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs will effectively remove or isolate contaminants and break exposure pathways for industrial use which is the current and reasonably expected future use of the waste sites addressed by this ROD. Therefore, land use will be restricted indefinitely to industrial uses. In addition, use of groundwater located beneath these OUs will be restricted for the foreseeable future until drinking water standards are achieved. 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 remedy is protected and that the groundwater and Columbia River water quality are protected as well. Hence, institutional controls are an integral part of the selected remedy.

The DOE is responsible for implementing, maintaining, reporting on, and enforcing the institutional and land-use controls required under this ROD. Although DOE may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or through other means, DOE shall retain ultimate responsibility for remedy integrity and institutional controls. The current implementation, maintenance, and periodic inspection requirements for the institutional controls at the Hanford Site are described in approved work plans and in the *Sitewide Institutional Controls Plan* (DOE/RL-2001-41) that was prepared by DOE and approved by EPA and Ecology in 2002 as updated and approved by EPA and Ecology. One requirement listed in the *Sitewide Institutional Controls Plan* is the commitment to notify EPA and Ecology immediately upon discovery of any activity that is inconsistent with the land-use designation of the site.

No later than 180 days after the ROD is signed, DOE shall update the *Sitewide Institutional Controls Plan* to include the institutional controls required by this ROD and specify the implementation and maintenance actions that will be taken, including periodic inspections. The revised *Sitewide Institutional Controls Plan* shall be submitted to EPA and Ecology for review and approval as a Tri-Party Agreement primary document. The DOE shall comply with the *Sitewide Institutional Controls Plan* as updated and approved by EPA and Ecology.

The following institutional control performance objectives are required to be met as part of this remedial action. Land-use controls will be maintained at the waste sites until EPA authorizes the removal of restrictions where contamination is at such levels to allow for unrestricted use and unlimited exposure. Institutional controls required until EPA authorizes the removal of restrictions where contamination is at such levels to allow for unrestricted use and unlimited exposure are:

- 1) The DOE shall control access to the waste sites to prevent unacceptable exposure of humans to contaminants in the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs. Visitors entering any of these OUs will be required to be badged and escorted at all times.
- 2) The DOE shall post and maintain warning signs at the waste sites in these OUs that caution visitors and workers of potential hazards from contaminants below the ground surface.

- 3) In the event of any unauthorized access to the site (e.g. trespassing), DOE shall report such incidents to the Benton County Sheriff's Office for investigation and evaluation of possible prosecution.
- 4) The DOE shall prohibit activities that are not industrial in nature, and prohibit drilling, excavation, or use of soils at these waste sites.
- 5) The DOE shall prohibit use of groundwater located beneath the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs for the foreseeable future until drinking water standards are achieved.
- 6) DOE shall maintain the integrity of and prohibit activities that could damage or lessen the performance of required ET caps and soil covers.
- 7) The DOE shall report annually on the effectiveness of institutional controls for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs as specified in the Hanford Sitewide Institutional Controls Plan or an alternative reporting frequency specified by EPA.
- 8) The DOE shall provide notice to EPA at least six months prior to any transfer or sale of the land in the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs so EPA can be involved in discussions to ensure that appropriate provisions are included in the transfer terms or conveyance documents to maintain effective ICs. If it is not possible for DOE to notify EPA at least six months prior to any transfer or sale, then the DOE will notify EPA as soon as possible but no later than 60 days prior to the transfer or sale of any property subject to ICs. In addition to the land transfer notice and discussion provisions above, the DOE further agrees to provide EPA with similar notice, within the same time frames, as to federal-to-federal transfer of property. The DOE shall provide a copy of executed deed or transfer assembly to EPA.
- 9) The DOE shall prevent the development and use of 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs for residential housing, elementary and secondary schools, childcare facilities and playgrounds.
- 10) Land use controls will be maintained as long as the contamination remains at levels that do not allow for unrestricted use and unlimited exposure and shall not be removed without the prior authorization of EPA.

12.2.8 Land Use Control Boundary

For federal facility RODs, EPA requires the inclusion of a land use control boundary map. The land use control boundaries for the 200-CW-5, 200-PW-1, and 200-PW-6 OUs are shown in Figure 8 and the land use control boundary for 200-PW-3 is shown in Figure 9.

Figure 8. 200-CW-5, 200-PW-1, 200-PW-6 OU IC Boundaries

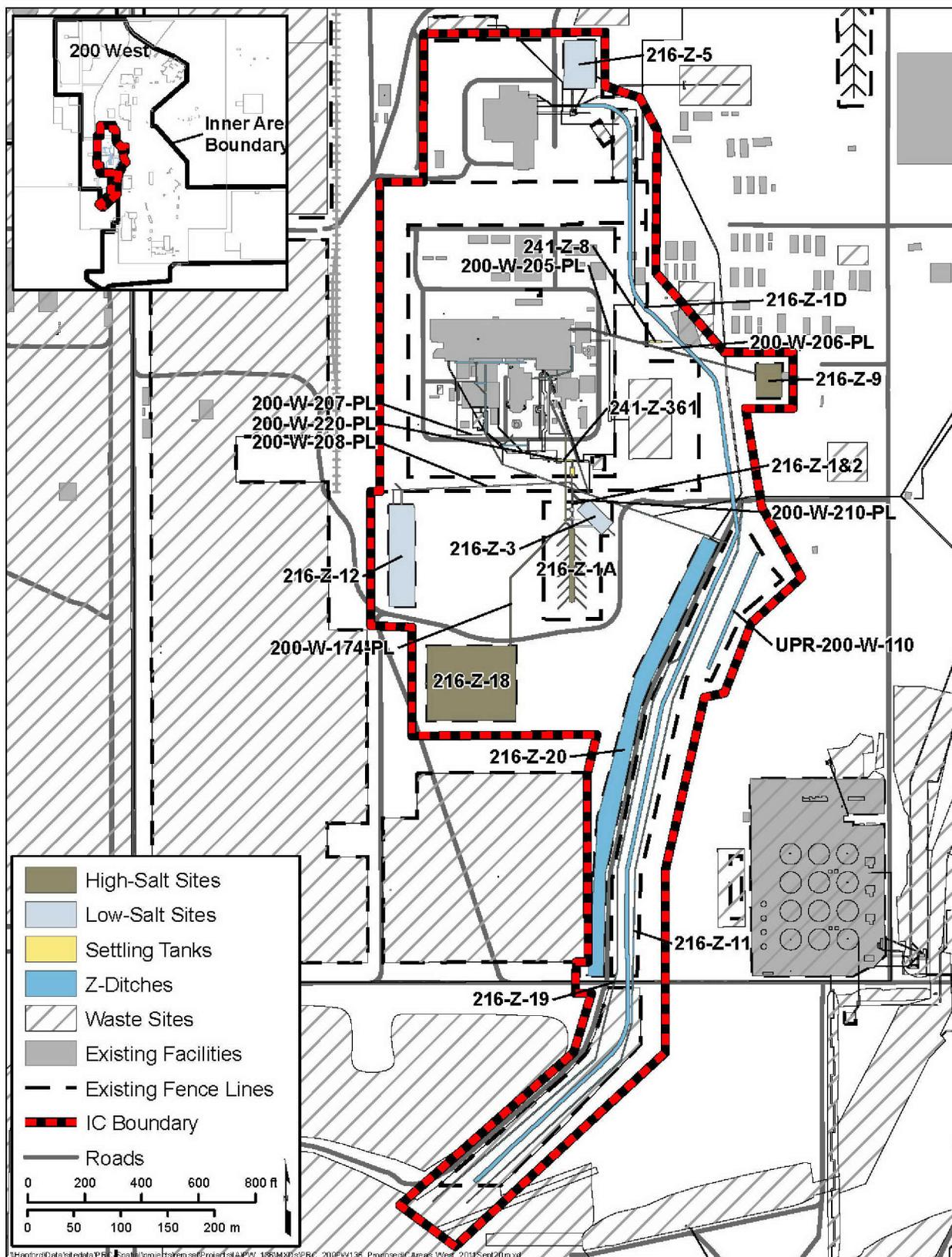
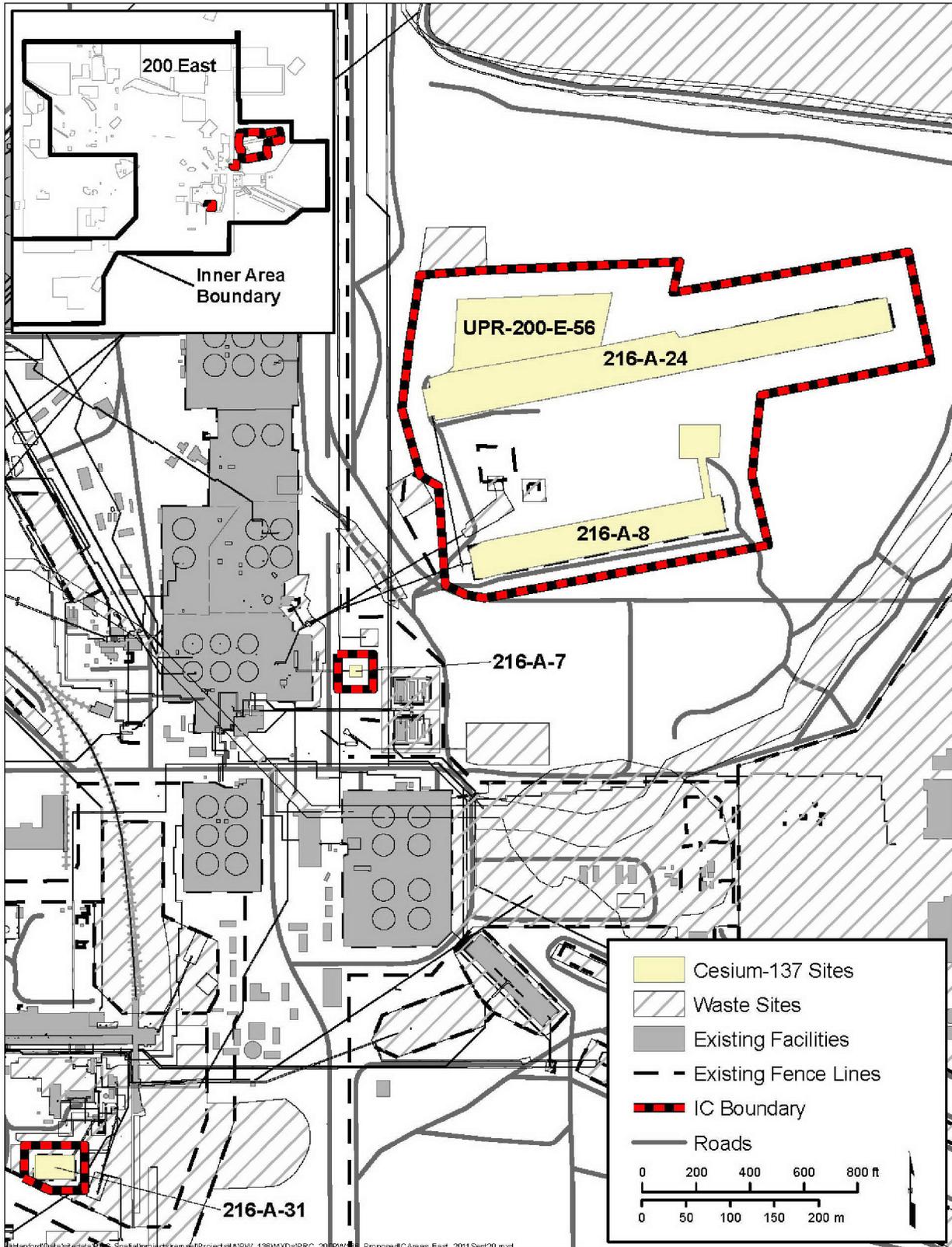


Figure 9. 200-PW-3 Waste Site IC Boundaries



12.2.9 Long-term Operations and Maintenance Component

Following construction of the ET barriers over the waste sites in the High-Salt and Low-Salt Waste Groups and soil covers over waste sites in the Cesium-137 Waste Group, long-term surveillance and maintenance will be implemented at the completed ET barriers and soil covers.

Surveillance, operations, and maintenance will include operation and maintenance of the SVE system and inspecting and repairing the ET barriers, maintaining a minimum 4.6 m (15 ft) depth of soil covers, maintaining peripheral components (e.g. fences and signs), and addressing observable degradation (e.g., subsidence, erosion, loss of vegetative cover, and biotic intrusion). An operations and maintenance plan and monitoring plans will be developed by DOE and submitted to EPA for approval and implementation and periodically updated as needed.

12.2.10 Five-Year Review Component

A review (in accordance with CERCLA § 121(c) and 40 CFR § 300.430[f][4][ii]) is required at a minimum every five years after initiation of the selected remedial action if a remedy is selected that results in hazardous substances, pollutants or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure. Because the selected remedy will not achieve levels that allow for unlimited use and unrestricted exposure, five-year reviews will be required in accordance with CERCLA and the NCP. Reviews will begin within five years after the initiation of the remedial action to help ensure that the selected remedy is protective of human health and the environment.

12.3 Summary of the Estimated Remedy Costs

The summary of costs for the selected remedy is shown in Table 33. Table 33 presents the estimated capital, total operations and maintenance, and present worth for the selected remedy, in non-discounted dollars. Present worth calculations are based on 1,000 years of institutional controls and operations and maintenance costs, Table 34 gives a more detailed breakdown of the capital costs for each waste group. The information in the cost estimate summary tables is based on the best available information regarding the anticipated scope of the selected remedy. The cost elements and the resulting present worth cost estimate provide an order-of-magnitude engineering cost estimate that is expected to be +50% to -30% of the actual project cost. Changes in the cost elements are likely to occur because of new information and data collected during the engineering design of the selected remedy. Major changes will be documented in the form of a memorandum in the Administrative Record file, an explanation of significant difference, or a ROD amendment, as appropriate.

Table 33. Estimated Capital, Operations & Maintenance, and Present Worth Costs

Costs Summary				
Waste Site Grouping	Preferred Alternative	Cost (\$ millions)		
		Capital ^a	Total O&M ^b	Present Worth
Z-Ditches	RTD	\$60.7	\$0.0	\$58.4
High-Salt	RTD - Option A	\$114.9	\$107.5	\$109.8
Low-Salt	RTD - Option C	\$81.9	\$171.0	\$89.3
Cesium-137	MESC/IC	\$4.4	\$68.0	\$11.1
Settling Tanks	Sludge Removal and Tank Stabilization	\$41.1	\$0.0	\$41.1
	Total	\$303	\$346.5	\$309.7

Table 34. Capital Costs Breakdown (Non-Discounted Values)

Costs	Waste Groups				
	Z-Ditches	High-Salt	Low-Salt	Cesium-137	Settling Tanks
Mobilization/ Demobilization	\$1,356,188	\$2,871,649	\$2,335,282	\$1,380,213	na
Monitoring & Sampling	\$3,350,828	\$2,164,581	\$1,592,224	\$17,005	na
Site Work	\$3,818,419	\$513,790	\$412,827	\$159,290	\$608,900
Soil Excavation & Treatment	\$42,502,137	\$29,054,936	\$23,048,773	\$0	\$17,495,791
Site Improvements	na	\$820,600	\$230,626	\$600,934	na
Construction Staff	\$3,716,276	\$2,107,604	\$941,472	\$621,960	\$1,683,736
Project Management	\$2,298,533	\$616,917	\$551,031	\$384,847	\$1,403,114
Sub Total	\$57,042,381	\$38,150,077	\$29,112,236	\$3,164,249	\$18,104,691
Contingency (25%)	(a)	\$9,537,519	\$7,278,059	\$791,063	\$9,957,580 ^b
Sub Total	na	\$47,687,596	\$36,390,295	\$3,955,312	\$28,062,271
WIPP	na	\$54,800,000	\$42,500,000	na	\$6,200,000
Cap	na	\$6,900,000	na	na	na
Remedial Design	\$3,422,543	\$2,861,256	\$2,483,755	\$474,638	\$2,244,982
Total	\$60,464,924	\$112,248,852	\$81,374,050	\$4,429,950	\$39,594,103
Costs (Pipelines)					
Associated Pipeline Total Costs	\$268,102	\$2,617,871	\$495,933	na	\$1,495,869
Total Project Capital Cost	\$60,733,026	\$114,866,723	\$81,869,983	\$4,429,950	\$41,089,972
Annual Average O&M Cost^c	\$0	\$107,500	\$171,000	\$68,000	\$0
Notes:					
a. contingency costs for Z-Ditches waste group were incorporated into line items in the capital cost and not calculated as a separate line item.					
b. The percentage used for contingency value for settling tanks was 55% instead of the 25%.					
c. The annual average O&M costs is the Total O&M costs presented as total Nondiscounted Annual and Periodic Costs divided by 1,000 years.					
na – information is not applicable					

12.4 Expected Outcomes of the Selected Remedy

The purpose of this response action is to control risks posed by direct contact with soil and to minimize migration of contaminants to groundwater. The expected outcome of the selected remedy is to remediate the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs to a level that is protective of human health and the environment given current and anticipated future use as an industrial land use area. The RD/RA work plan will be submitted to EPA for formal review on or before September 30, 2015. The removal, treatment (if needed), and disposal of contaminated soil portion of the selected remedy is expected to take 2 to 5 years to complete after the start of remedy implementation. SVE will continue to run until carbon tetrachloride levels no longer pose a threat to human health and the environment. Institutional controls will need to be maintained and enforced by DOE since the remaining contamination will not allow for unrestricted use and unlimited exposure.

The selected remedy is expected to achieve remedial action objectives when removal, treatment (if needed), and disposal of contaminated soils, evapotranspiration barrier construction, soil cover enhancement, and SVE activities are complete. The final cleanup levels listed in Table 35 establish acceptable exposure levels for specific contaminants and exposure pathways that are protective of human health, the environment, and groundwater.

Table 35. Final Cleanup Levels for 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Soils

COC	Final Cleanup Level	Basis for Cleanup Level ^b	Risk at Cleanup Level
Plutonium-239-240	765 pCi/g ^c	Human Health (Industrial Use)	Cancer risk < 1 x 10 ⁻⁴ c, d
Americium-241	940 pCi/g	Human Health (Industrial Use)	Cancer risk = 1 x 10 ⁻⁴ d
Cesium-137	17.7 pCi/g	Human Health (Industrial Use)	Cancer risk = 1 x 10 ⁻⁴ d
Radium-226	4 pCi/g	Human Health (Industrial Use)	Cancer risk = 1 x 10 ⁻⁴ d
Strontium-90	20 pCi/g	Ecological Receptor Protection	HQ = 1
PCBs	0.65 mg/kg	Ecological Receptor Protection	HQ = 1
Boron	0.5 mg/kg	Ecological Receptor Protection	HQ = 1
Mercury	0.1 mg/kg	Ecological Receptor Protection	HQ = 1
Carbon Tetrachloride	100 ppmv ^a	Groundwater Protection	Excess Lifetime Cancer Risk = 1 x 10 ⁻⁵ e
Methylene Chloride	50 ppmv ^a	Groundwater Protection	

- a. Soil vapor concentrations will be further refined and assessed to ensure they are protective of groundwater.
- b. Cleanup levels are based on an industrial land use scenario. When cleanup levels for ecological receptors or groundwater protection were lower than human health protection, the lower value was used as the final cleanup level.
- c. The preliminary remediation goal identified in the FSs based on 10⁻⁴ risk was 2,900 pCi/g for plutonium 239-240. However, DOE has agreed to a more conservative value of 765 pCi/g for this remedial action.
- d. Final verification sampling for radiological contaminants at the Z-Ditches Waste Group will be evaluated to confirm that the aggregate risk level is less than 1 x 10⁻⁴.
- e. The DOE will cleanup up COCs for the 200-PW-1 OU subject to WAC 173-340, "Model Toxics Control Act-Cleanup" (carbon tetrachloride and methylene chloride), so the total excess lifetime cancer risk from carbon tetrachloride and methylene chloride does not exceed 1 x 10⁻⁵ at the conclusion of the remedy.

13.0 Statutory Determinations

Under CERCLA Section 121 and the NCP Section 300.430(f)(5)(ii), the lead agency must select remedies that are protective of human health and the environment, comply with ARARs (unless a statutory waiver is justified), are cost-effective, and use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous substances, pollutants, or contaminants as a principal element, and a bias against offsite disposal of untreated wastes.

CERCLA Section 121(c) and the NCP Section 300.430(f)(4)(ii) requires review, at least every five years, to determine if adequate protection of human health and the environment is being maintained in those instances where remedial actions result in hazardous substances, pollutants, or contaminants remaining onsite above levels that allow for unlimited use and unrestricted exposure.

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 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs and ERDF

are reasonably close to one another, and the wastes are compatible for the selected disposal approach. Therefore, the two sites are considered to be a single site for response purposes. Wastes determined to be transuranic waste will be sent offsite to WIPP, as appropriate. The subsections below summarize the basis for determining the selected remedy for these OUs meets the statutory requirements.

13.1 Protection of Human Health and the Environment

The selected remedy for remediation of the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs will be protective of human health and the environment through removal, treatment (if needed), and disposal of contaminated soils, evapotranspiration barriers, soil covers, institutional controls, and long-term monitoring. These portions of the selected remedy will eliminate the exposure pathways for workers to encounter contaminated soil, thus controlling the potential exposure pathways from ingestion, inhalation, dermal contact, and external radiation. Additionally, exposure pathways to ecological receptors will be removed.

Continued operation of the SVE system will remove carbon tetrachloride and other volatile organics that pose a threat to groundwater. Sludge removal and stabilization of the two settling tanks in these OUs will address any future potential exposure risks posed by the sludge they contain by removing the sludge, treating it as needed, and shipping it to the Waste Isolation Pilot Plant for final disposal. The evapotranspiration barrier will inhibit water infiltration and reduce contaminant migration to groundwater, thereby protecting groundwater.

The selected remedy will reduce the excess lifetime cancer risk (ECLR) to within the acceptable health-protective 10^{-4} to 10^{-6} risk range for industrial use, and will achieve the threshold protective hazard quotient of 1 for non-cancer health effects. The selected remedy will also protect the Columbia River and its ecological resources from degradation and unacceptable impact caused by contaminants originating from these OUs by removing and controlling migration of potential sources of contamination.

13.2 Compliance with ARARs

The NCP Sections 300.430(f)(5)(ii)(B) and (C) require that a ROD describe the Federal and state ARARs that the selected remedy will attain and any ARARs the remedy will not meet, the waiver invoked, and the justification for any waivers. All Federal and state ARARs will be met upon completion of the selected remedy, and no ARARs are being waived.

The ARARs are the substantive provisions of any promulgated Federal environmental or more stringent state environmental or facility siting standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate for a CERCLA site or action. Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance found at a CERCLA site (40 CFR § 300.5). Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or state environmental or facility siting laws that, while not legally “applicable” to circumstances at a particular CERCLA site, address problems or situations sufficiently similar to those encountered at the site that their use is well-suited (40 CFR § 300.5). A definitive list of the ARARs that are to be complied with by the selected remedy is provided in Table 36 and Table 37. Table 36 lists the Federal requirements and Table 37 lists Washington State requirements.

Table 36. Federal Applicable or Relevant and Appropriate Requirements for the Selected Remedy

ARAR Citation	ARAR or TBC	Requirement	Rationale for Use
"National Primary Drinking Water Regulations," 40 CFR 141			
"Maximum Contaminant Levels for Organic Contaminants," 40 CFR 141.61	ARAR	Establishes MCLs that are drinking water criteria designed to protect human health from the potential adverse effects of organic contaminants in drinking water.	The groundwater beneath the these OUs is not currently used for drinking water. However, Central Plateau groundwater is considered a potential drinking water source and, because the groundwater discharges to the Columbia River (which is used for drinking water), the substantive requirements in 40 CFR 141.61 for organic constituents are relevant and appropriate. This requirement is chemical-specific. The selected remedy must prevent migration of contaminants that could cause MCL exceedances in groundwater.
"Maximum Contaminant Levels for Inorganic Contaminants," 40 CFR 141.62	ARAR	Establishes MCLs that are drinking water criteria designed to protect human health from the potential adverse effects of inorganic contaminants in drinking water.	The groundwater beneath the these OUs is not currently used for drinking water. However, Central Plateau groundwater is considered a potential drinking water source and, because the groundwater discharges to the Columbia River (which is used for drinking water), the substantive requirements in 40 CFR 141.62 for inorganic constituents are relevant and appropriate. This requirement is chemical-specific. The selected remedy must prevent migration of contaminants that could cause MCL exceedances in groundwater.
"Maximum Contaminant Levels for Radionuclides," 40 CFR 141.66	ARAR	Establishes MCLs that are drinking water criteria designed to protect human health from the potential adverse effects of radionuclides in drinking water.	The groundwater beneath the these OUs is not currently used for drinking water. However, Central Plateau groundwater is considered a potential drinking water source and because the groundwater discharges to the Columbia River (which is used for drinking water), the substantive requirements in 40 CFR 141.66 for radionuclides are relevant and appropriate. This requirement is chemical-specific. The selected remedy must prevent migration of contaminants that could cause MCL exceedances in groundwater.
"Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions," 40 CFR 761			
"Applicability" Specific Subsections: 40 CFR 761.50(b)(1) 40 CFR 761.50(b)(2) 40 CFR 761.50(b)(3) 40 CFR 761.50(b)(4) 40 CFR 761.50(b)(7) 40 CFR 761.50(c)	ARAR	These regulations establish standards for the storage and disposal of PCB wastes.	The substantive requirements of these regulations are relevant and appropriate to the storage and disposal of PCB liquids, items, remediation waste, and bulk product waste at ≥ 50 ppm. The specific subsections identified from 40 CFR 761.50(b) reference the specific sections for the management of PCB waste type. The disposal requirements for radioactive PCB waste are addressed in 40 CFR 761.50(b)(7). This requirement is chemical-specific.
Federal Historic Laws			
<i>Archeological and Historic Preservation Act of 1974</i> , et seq. 16 USC 469a-1 through 469a-(2)d	ARAR	Requires that remedial actions at 200-PW-1/3/6 OU waste sites do not cause the loss of any archaeological or historic data. This act mandates preservation of the data and does not require protection of the actual waste site or facility.	Archeological and historic sites have been identified within the 200 Areas; therefore, the substantive requirements of this act are applicable to actions that might disturb these sites. This requirement is location-specific.
<i>National Historic Preservation Act of 1966</i> , et seq. 16 USC 470, Section 106	ARAR	Requires Federal agencies to consider the impacts of their undertaking on cultural properties through identification, evaluation and mitigation processes, and consultation with interested parties.	Cultural and historic sites have been identified within the 200 Areas, and therefore the substantive requirements of this act are applicable to actions that might disturb these types of sites. This requirement is location-specific.

ARAR Citation	ARAR or TBC	Requirement	Rationale for Use
<i>Native American Graves Protection and Repatriation Act of 1990</i> , 25 USC 3001, et seq.	ARAR	Establishes Federal agency responsibility for discovery of human remains, associated and unassociated funerary objects, sacred objects, and items of cultural patrimony.	Substantive requirements of this act are applicable if remains and sacred objects are found during remediation and will require Native American Tribal consultation in the event of discovery. This requirement is location-specific.
<i>Endangered Species Act of 1973</i> , 16 USC 1531, et seq., Subsection 16 USC 1536(c)	ARAR	Prohibits actions by Federal agencies that are likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. If remediation is within critical habitat or buffer zones surrounding threatened or endangered species, mitigation measures must be taken to protect the resource.	Substantive requirements of this act are applicable if threatened or endangered species are identified in areas where remedial actions will occur. This requirement is location-specific.
“National Emission Standard for Asbestos,” 40 CFR 61, Subpart M; “Applicability,” 40 CFR 61.140			
“Standard for Demolition and Renovation,” 40 CFR 61.145	ARAR	Specifies that facilities are to be inspected for the presence of asbestos before demolition. The standard defines regulated asbestos-containing materials and establishes removal requirements based on quantity present and handling requirements. These requirements also specify handling and disposal requirements for regulated sources that have the potential to emit asbestos. Specifically, no visible emissions are allowed during handling, packaging, and transport of asbestos-containing materials.	Although asbestos-containing materials are not anticipated, substantive requirements of this standard are applicable, should this remedial action include abatement of asbestos and asbestos-containing materials on pipelines or buried asbestos. As a result, there is a potential to emit asbestos to unrestricted areas, and the requirements for the removal, handling, and packaging of asbestos apply. This requirement is chemical-specific.
“Standard for Waste Disposal for Manufacturing, Fabricating, Demolition, Renovation, and Spraying Operations,” 40 CFR 61.150	ARAR	Identifies the requirements for the removal and disposal of asbestos from demolition and renovation activities.	Although asbestos-containing materials are not anticipated, the substantive requirements of this standard are applicable, should asbestos-containing material be located during remedial action activities of associated pipelines and buried asbestos. This requirement is chemical-specific.

- ARAR = applicable or relevant and appropriate requirement
CFR = *Code of Federal Regulations*
DOE = U.S. Department of Energy
MCL = maximum contaminant level
PCB = polychlorinated biphenyl
ppm = parts per million
TBC = to-be-considered
WAC = *Washington Administrative Code*

Table 37. State Applicable and Relevant or Appropriate Requirements for the Selected Remedy

ARAR Citation	ARAR or TBC	Requirement	Rationale for Use
"Dangerous Waste Regulations," WAC 173-303			
"Identifying Solid Waste," WAC 173-303-016	ARAR	Identifies those materials that are and are not solid wastes.	Substantive requirements of these regulations are applicable, because these define how to determine which materials are subject to the designation regulations. Specifically, materials that are generated for removal from the CERCLA site during the remedial action would be subject to substantive requirements for identification of solid waste to ensure proper management. This requirement is action-specific.
"Recycling Processes Involving Solid Waste," WAC 173-303-017	ARAR	Identifies materials that are and are not solid wastes when recycled.	Substantive requirements of these regulations are applicable, because these define how to determine which materials are subject to the designation regulations. Specifically, materials that are generated for removal from the CERCLA site during the remedial action would be subject to the procedures for identification of solid waste to ensure proper management. This requirement is action-specific.
"Designation of Dangerous Waste," WAC 173-303-070(3)	ARAR	Establishes the method for determining whether a solid waste is, or is not, a dangerous waste or an extremely hazardous waste.	Substantive requirements of these regulations are applicable to materials encountered during the remedial action. Specifically, solid waste that is generated for removal from the CERCLA site during this remedial action would be subject to the dangerous waste designation substantive requirements to ensure proper management. This requirement is action-specific.
"Excluded Categories of Waste," WAC 173-303-071	ARAR	Describes those categories of wastes that are excluded from the requirements of WAC 173-303 (excluding WAC 173-303-050, "Department of Ecology Cleanup Authority").	The conditions of this requirement are applicable to remedial actions in the OUs addressed by the ROD, should wastes identified in WAC 173-303-071 be encountered. This requirement is action-specific.
"Closure and Post-Closure" WAC-173-303-610 [2]	ARAR	Describes RCRA closure and postclosure performance standards.	Substantive requirements of these regulations are ARARs for TSD units encountered during the remedial action This requirement is action-specific.
"Conditional Exclusion of Special Wastes," WAC 173-303-073	ARAR	Establishes the conditional exclusion and the management requirements of special wastes, as defined in WAC 173-303-040, "Definitions."	Substantive requirements of these regulations are applicable to materials encountered during the remedial action. Specifically, the substantive standards for management of special waste are applicable to the interim management of certain waste that will be generated during the remedial action. This requirement is action-specific.
"Requirements for Universal Waste," WAC 173-303-077	ARAR	Identifies those wastes exempted from regulation under WAC 173-303-140 and WAC 173-303-170 through 173-303-9907 (excluding WAC 173-303-960, "Special Powers and Authorities of the Department"). These wastes are subject to regulation under WAC 173-303-573, "Standards for Universal Waste Management."	Substantive requirements of these regulations are applicable to materials encountered during the remedial action. Specifically, the substantive standards for management of universal waste are applicable to the interim management of certain dangerous waste that will be generated during the remedial action. This requirement is action-specific.
"Recycled, Reclaimed, and Recovered Wastes," WAC 173-303-120 Specific Subsections: WAC 173-303-120(3) WAC 173-303-120(5)	ARAR	These regulations define the requirements for recycling materials that are solid and dangerous waste. Specifically, WAC 173-303-120(3) provides for the management of certain recyclable materials, including spent refrigerants, antifreeze, and lead-acid batteries. WAC 173-303-120(5) provides for the recycling of used oil.	Substantive requirements of these regulations are applicable to certain materials that might be encountered during the remedial action. Recyclable materials that are exempt from regulation as dangerous waste and that are not otherwise subject to CERCLA as hazardous substances can be recycled and/or conditionally excluded from certain dangerous waste requirements. This requirement is action-specific.
"Land Disposal	ARAR	This regulation establishes state standards for	The substantive requirements of this regulation are

ARAR Citation	ARAR or TBC	Requirement	Rationale for Use
Restrictions," WAC 173-303-140(4)		land disposal of dangerous waste and incorporates, by reference, Federal land-disposal restrictions of 40 CFR 268 that are applicable to solid waste that is designated as dangerous or mixed waste in accordance with WAC 173-303-070(3).	applicable to dangerous/mixed waste encountered during the remedial action. The actual offsite treatment of such waste would not be an ARAR to this remedial action, but instead would be subject to all applicable laws and regulations. This requirement is action-specific.
"Requirements for Generators of Dangerous Waste," WAC 173-303-170	ARAR	Establishes the requirements for dangerous waste generators.	Substantive requirements of these regulations are applicable to materials encountered during the remedial action. Specifically, the substantive standards for management of dangerous/mixed waste are applicable to the interim management of certain waste that will be generated during the remedial action. For purposes of this remedial action, WAC 173-303-170(3) includes the substantive provisions of WAC 173-303-200, "Accumulating Dangerous Waste On-Site," by reference. WAC 173-303-200 further includes certain substantive standards from WAC 173-303-630, "Use and Management of Containers," and WAC 173-303-640, "Tank Systems," by reference. This requirement is action-specific.
"Requirements," WAC 173-303-64620(4)	ARAR	Requires Corrective Action to be "consistent with" specified section in WAC 173-340	The substantive portions of this regulation establish minimum requirements for HWMA corrective action.
"On-site containerized storage, collection and transportation standards for solid waste" WAC 173-304-200	ARAR	Establishes the requirements for the onsite storage of solid wastes that are not radioactive or dangerous wastes.	Substantive requirements of these regulations are applicable to materials encountered during the remedial action. Specifically, nondangerous, nonradioactive solid wastes (i.e., hazardous substances that are only regulated as solid waste) that will be containerized for removal from the CERCLA site would be managed at the Hanford Site according to the substantive requirements of this standard. This requirement is action-specific.
"Model Toxics Control Act-Cleanup," WAC 173-340			
"Ground Water Cleanup Standards," "Standard Method B Potable Ground Water Cleanup Levels," WAC 173-340-720(4)(b)(iii)(A) and (B) And "Adjustments to Cleanup Levels," WAC 173-340-720(7)(b)	ARAR	Use of Method B equations 720-1 and 720-2 to calculate groundwater cleanup levels for noncarcinogens and carcinogens, respectively. Requires an adjustment downward of Method B groundwater cleanup levels based on an existing state or federal cleanup standard so that the total excess cancer risk does not exceed 1×10^{-5} and the hazard index does not exceed 1.	The groundwater beneath these OUs is not currently used for drinking water. However, Central Plateau groundwater is considered a potential drinking water source and, because the groundwater discharges to the Columbia River (which is used for drinking water), the substantive requirements in the specified subsections are relevant and appropriate with respect to prevention of migration of contaminants to the groundwater. This requirement is chemical-specific.
"Soil Cleanup Standards for Industrial Properties," WAC 173-340-745(5)(b)	ARAR	Establishes the process and methods used to evaluate direct contact risk to human health and the environment and to develop cleanup standards for soil and other environmental media.	Soil in these OU contains contaminants that require remediation. The substantive requirements of the specified subsections are ARARs to developing cleanup standards for the selected remedy. This is a chemical-specific requirement.
"Deriving Soil Concentrations for Ground Water Protection," WAC 173-340-747(3)	ARAR	Establishes the process and methods used to evaluate soil concentration that may cause an impact to human health and the environment through the groundwater and to develop cleanup standards for soil and other environmental media.	Soil in these OUs contains contaminants that require remediation. The substantive requirements of the specified subsections are ARARs to developing cleanup standards for the selected remedy. This is a chemical-specific requirement.
"Site-specific Terrestrial	ARAR	Establishes the process and methods used to	Soil in these OUs contains contaminants that require

ARAR Citation	ARAR or TBC	Requirement	Rationale for Use
Ecological Evaluation Procedures," WAC 173-340-7493(3)		evaluate soil concentration that may cause an impact to terrestrial ecology and to develop cleanup standards for soil and other environmental media.	remediation. The substantive requirements of the specified subsections are ARARs to developing cleanup standards for the selected remedy. This is a chemical-specific requirement.
"Solid Waste Handling Standards," WAC 173-350			
"On-Site Storage, Collection and Transportation Standards," WAC 173-350-300	ARAR	Establishes the requirements for the temporary onsite storage of solid waste in a container and the collecting and transporting of the solid waste.	The substantive requirements of this rule are relevant and appropriate to the Hanford Site collection and temporary storage of solid wastes at these remediation waste sites. Compliance with this regulation is being implemented in phases for existing facilities. This requirement is action-specific.
"Minimum Standards for Construction and Maintenance of Wells," WAC 173-160			
"What Are the Minimum Standards for Resource Protection Wells and Geotechnical Soil Borings?" WAC 173-160-400	ARAR	Identifies the minimum standards for resource protection wells and geotechnical soil borings.	To the extent that wells are required for monitoring, the substantive requirements of these regulations are ARARs. These requirements are action-specific.
"What Are the General Construction Requirements for Resource Protection Wells?" WAC 173-160-420	ARAR	Identifies the general construction requirements for resource protection wells.	
"What Are the Minimum Casing Standards?" WAC 173-160-430	ARAR	Identifies the minimum casing standards.	
"What Are the Equipment Cleaning Standards?" WAC 173-160-440	ARAR	Identifies the equipment cleaning standards.	
"What Are the Well Sealing Requirements?" WAC 173-160-450	ARAR	Identifies the well sealing requirements.	
"What Is the Decommissioning Process for Resource Protection Wells?" WAC 173-160-460	ARAR	Identifies the decommissioning process for resource protection wells.	
"General Regulations for Air Pollution Sources," WAC 173-400			
"General Standards for Maximum Emissions," WAC 173-400-040 and "Requirements for New Sources in Attainable or Unclassifiable Areas," WAC 173-400-113	ARAR	Methods of control shall be employed to minimize the release of air contaminants associated with fugitive emissions resulting from materials handling, construction, demolition, or other operations. Emissions are to be minimized through application of best available control technology.	Substantive requirements of these standards are relevant and appropriate to this remedial action, because there may be visible, particulate, fugitive, and hazardous air emissions and odors resulting from decontamination, demolition, and excavation activities. As a result, standards established for the control and prevention of air pollution are relevant and appropriate. These requirements are action-specific.
"Controls for New Sources of Toxic Air Pollutants," WAC 173-460			
"Applicability," WAC 173-460-030 and "Control Technology Requirements," WAC 173-460-060	ARAR	Requires that new sources of air emissions provide the emission estimates identified in this regulation.	Substantive requirements of these standards are applicable to this remedial action, because there is the potential for toxic air pollutants to become airborne as a result of decontamination, demolition, and excavation activities. As a result, standards established for the control of toxic air contaminants are relevant and appropriate. These requirements are action-specific.
"Ambient Impact Requirement," WAC 173-460-070	ARAR	Requires that when applying for a notice of construction, the owner/operator of a new toxic air pollutant source that is likely to increase toxic air pollutant emissions shall	The substantive requirements of this standard are applicable to remedial actions in these OUs, should the remedial action result in the treatment of the soil or debris that contains contaminants of concern identified

ARAR Citation	ARAR or TBC	Requirement	Rationale for Use
		demonstrate that emissions from the source are sufficiently low to protect human health and safety from potential carcinogenic and/or other toxic effects.	in the regulation as a toxic air pollutant. This requirement is action-specific.
"Ambient Air Quality Standards and Emission Limits for Radionuclides," WAC 173-480			
"General Standards for Maximum Permissible Emissions," WAC 173-480-050(1)	ARAR	Whenever another Federal or state regulation or limitation in effect controls the emission of radionuclides to the ambient air, the more stringent control of emissions shall govern.	The substantive requirements of this standard are applicable in that the more stringent aspect of Federal or state emission limitation is specified as governing. This requirement is action-specific.
"Emission Monitoring and Compliance Procedures," WAC 173-480-070(2)	ARAR	Requires that radionuclide emissions compliance shall be determined by calculating the dose to members of the public at the point of maximum annual air concentration in an unrestricted area where any member of the public may be.	The substantive requirements of this standard are applicable to remedial actions involving disturbance or ventilation of radioactively contaminated areas or structures, because airborne radionuclides may be emitted to unrestricted areas where any member of the public may be. This requirement is action-specific.
"Radiation Protection – Air Emissions," WAC 246-247			
"National Standards Adopted by Reference for Sources of Radionuclide Emissions," WAC 246-247-035(1)(a)(ii)	ARAR	Establishes requirements equivalent to 40 CFR 61, Subpart H. Radionuclide airborne emissions from the facility shall be controlled so as not to exceed amounts that would cause an exposure to any member of the public of greater than 10 mrem/yr effective dose equivalent.	Substantive requirements of this standard are applicable because a remedial action may include activities such as excavation, decontamination, and stabilization of contaminated areas and equipment, and operation of exhausters and vacuums, each of which may provide airborne emissions of radioactive particulates to unrestricted areas. As a result, requirements limiting emissions apply. This is a risk-based standard for the purposes of protecting human health and the environment. These requirements are action-specific.
"General Standards," WAC 246-247-040(3) WAC 246-247-040(4)	ARAR	Emissions shall be controlled to ensure that emission standards are not exceeded. Actions creating new sources or significantly modified sources shall apply best available controls. All other actions shall apply reasonably achievable controls.	Substantive requirements of this standard are applicable because fugitive, diffuse, and point source emissions of radionuclides to the ambient air may result from remedial activities, such as excavation of contaminated soils and operation of exhauster and vacuums, performed during the remedial action. This standard exists to ensure compliance with emission standards. These requirements are action-specific.
"Monitoring, Testing, and Quality Assurance" WAC 246-247-075(1) and –(2) and –(4)	ARAR	Establishes the monitoring, testing, and quality assurance requirements for radioactive air emissions from major sources. Effluent flow rate measurements shall be made and the effluent stream shall be directly monitored continuously with an inline detector or representative samples of the effluent stream shall be withdrawn continuously from the sampling site following the specified guidance. The requirements for continuous sampling are applicable to batch processes when the unit is in operation. Periodic sampling (grab samples) may be used only with lead agency prior approval. Such approval may be granted in cases where continuous sampling is not practical and radionuclide emission rates are relatively constant. In such cases, grab samples shall be collected with sufficient frequency so as to provide a representative sample of the emissions. When it is impractical to measure the effluent flow rate at a source in	Substantive requirements of this standard are applicable when fugitive and nonpoint source emissions of radionuclides to the ambient air may result from activities, such as excavation of contaminated soils and operation of exhauster and vacuums, performed during a remedial action. This standard exists to ensure compliance with emission standards. This requirement is action-specific.

ARAR Citation	ARAR or TBC	Requirement	Rationale for Use
		accordance with the requirements or to monitor or sample an effluent stream at a source in accordance with the site selection and sample extraction requirements, the facility owner or operator may use alternative effluent flow rate measurement procedures or site selection and sample extraction procedures as approved by the lead agency. Emissions from nonpoint and fugitive sources of airborne radioactive material shall be measured. Measurement techniques may include, but are not limited to, sampling, calculation, smears, or other reasonable method for identifying emissions as determined by the lead agency.	
"Monitoring, Testing, and Quality Assurance," WAC 246-247-075(3)	ARAR	Methods to implement periodic confirmatory monitoring for minor sources may include estimating the emissions or other methods as approved by the lead agency.	Substantive requirements are applicable when fugitive and diffuse emissions from any excavation and related activities occur and will require periodic confirmatory measurements to verify low emissions. This requirement is action-specific.
"Monitoring, Testing, and Quality Assurance," WAC 246-247-075(8)	ARAR	Facility (site) emissions resulting from nonpoint and fugitive sources of airborne radioactive material shall be measured. Measurement techniques may include ambient air measurements, or inline radiation detector or withdrawal of representative samples from the effluent stream, or other methods as determined by the lead agency.	Substantive requirements are applicable when fugitive and diffuse emissions of airborne radioactive material due to excavation and related activities occur and will require measurement. This requirement is action-specific.
ALARA	=	as low as reasonably achievable	
ARAR	=	applicable or relevant and appropriate requirement	
CERCLA	=	<i>Comprehensive Environmental Response, Compensation, and Liability Act of 1980</i>	
CFR	=	<i>Code of Federal Regulations</i>	
OU	=	operable unit	
TBC	=	to be considered	
WAC	=	<i>Washington Administrative Code</i>	

13.3 Cost Effectiveness

The selected remedy combines elements that remove a significant amount of the contaminated soil, continues to remove carbon tetrachloride and other volatile organics from the environment, and provides long-term protection of the groundwater and Columbia River. While other alternatives, such as a barrier, would cost significantly less at the High-Salt and Low-Salt Waste Groups, the selected remedy provides greater long-term effectiveness since it is removing contaminated soils from the soil column. It has been determined that, in accordance with Section 300.430(f)(1)(ii)(D) of the NCP, the selected remedy provides overall effectiveness proportional to its costs because it balances removal of contaminated soil with evapotranspiration barriers, soil covers, worker safety, and cost.

13.4 Use of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The EPA and DOE have determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be used in a practicable manner for the 200-CW-5 200-PW-1, and 200-PW-6 OUs. The amount of plutonium-contaminated soils that were selected for retrieval and disposal under the selected remedy was balanced with the reduction in risk and the incremental cost of retrieving and disposing of additional soils. This does not result in a reduction of toxicity or volume through treatment of the plutonium contaminated soils; however, the use of an

evapotranspiration barrier at the 200-PW-1 and 200-PW-6 waste sites controls the amount of precipitation that infiltrates the contaminated media, which reduces contaminant mobility. Plutonium contaminated soils that qualify as transuranic waste will be sent for disposal at WIPP. Plutonium-contaminated soils that do not qualify as transuranic waste will be packaged to meet waste disposal criteria and disposed of at ERDF.

For the cesium-contaminated sites in 200-PW-3, all the alternatives considered included the use of institutional controls since waste would remain in place and preclude unrestricted use and unlimited exposure. None of the alternatives for the cesium waste sites were considered effective in reducing the mobility of cesium as it is not mobile under existing or anticipated conditions nor did they result in a reduction in toxicity or volume through treatment. The use of a soil cover at the cesium-contaminated waste sites resulted in a selected remedy that will ensure potential exposure pathways are broken.

State acceptance and Community acceptance heavily supported using the most robust remedy possible to remediate these OUs. EPA and DOE have determined that the selected remedy provides the best balance of trade-offs in terms of the five balancing criteria, while also considering the statutory preference for treatment as a principal element, bias against off-site treatment and disposal, and considering state and community acceptance. The selected remedy removes a substantial amount of contaminated soil for disposal at WIPP. The selected remedy provides adequate short-term effectiveness and is technically implementable. There are no special implementability issues that set the selected remedy apart from any of the other alternatives evaluated. The services and materials required to implement this remedy are readily available and use current technologies.

13.5 Preference for Treatment as a Principal Element

Principal threat waste is defined as 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. They include soils containing significant concentrations of highly toxic materials and surface or subsurface soils containing high concentrations of contaminants that are, or potentially are mobile due to wind entrainment, volatilization, surface runoff, or subsurface transport.

The NCP states that “EPA expects to use treatment to address the principal threats posed by a site, wherever practicable” (40 CFR § 300.430(a)(1)(iii)(A)). At these waste sites, the soils contaminated with significant concentrations of plutonium or cesium radionuclides are considered principal threat wastes since they are highly toxic contaminants. EPA has a preference to treat principal threat waste, wherever practicable. However, there is no feasible technology to practicably treat radionuclides that will not result in larger volumes of waste, creating greater impracticability for disposal. The amount of waste disposed is a limiting factor since plutonium waste generated at 200-PW-1 and 200-PW-6 waste sites will include transuranic waste, which will be disposed at the WIPP, a half-mile deep repository in southern New Mexico that has limited capacity.

The contaminated soils will be packaged appropriately for on-site disposal at the Hanford Site Environmental Restoration Disposal Facility (ERDF) or for off-site disposal at the Waste Isolation Pilot Plant (WIPP), as appropriate. DOE and EPA have determined that the waste remaining in place will not pose an unacceptable risk to human health or the environment.

13.6 Five-Year Review Requirements

A review, in accordance with CERCLA Section 121 (c) and 40 CFR 300.430[f][4][ii], is required at a minimum every five years if a remedy is selected that results in hazardous substances, pollutants or contaminants remaining at the site above levels that allow for unrestricted use and unlimited exposure. Since the selected remedy will not achieve levels that allow for unrestricted use and unlimited exposure, DOE and EPA will conduct five-year reviews in accordance with CERCLA Section 121(c) and NCP

Section 300.430(f)(4)(ii). Reviews will begin no later than five years after the initiation of the remedial action to help ensure the selected remedy is protective of human health and the environment.

14.0 Documentation of Significant Changes

No significant changes were made to the remedy.

PART III: RESPONSIVENESS SUMMARY

1.0 Introduction

This responsiveness summary was prepared in accordance with the requirements of Section 117(b) of CERCLA, as amended. The purpose of this responsiveness summary is to summarize and respond to significant public comments on the Proposed Plan for remediation of the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs on the Hanford Site.

2.0 Community Involvement

A formal public comment period on the Proposed Plan, originally scheduled to run from July 5 through August 5, 2011, was extended through September 6, 2011 in response to requests from stakeholders. Individuals sent written comments through the mail or electronically. Written comments were also collected at the four public meetings held in Richland, WA, Seattle, WA, Hood River, OR, and Portland, OR. The public meetings and comment period were publicized in the *Tri-City Herald*, *Seattle Weekly Hood River News*, and *Willamette Weekly*. A fact sheet was mailed to the Hanford mailing list and sent electronically on the Hanford Listserv.

3.0 Comments and Responses

318 comments were received from 122 individuals and groups covering a wide range of topics and varying perspectives. The public comments were separated out and aggregated into the following general categories:

- Excavate and Remove All Plutonium
- Remove All Cesium
- Dig Deeper Than Two Feet in the High-Salt Waste Sites
- Ship Plutonium Off-Site
- Plutonium Is Mobile
- Don't Rely On Barriers/Caps
- Government Is Not Long-term Stewardship
- Don't Rely On Institutional Controls
- Modeling for Seismic Activity, Floods, Climate Change
- Insufficient Scientific Data
- Support for Leaving Cesium in Place
- Public Involvement Process
- Other Comments on the Proposed Plan
- General Comments

Appendix A provides all the public comments received on the Proposed Plan, sorted by the categories listed above. A summary of significant public comments is provided below and agency responses are provided in the ***bold italicized text***.

EXCAVATE AND REMOVE ALL PLUTONIUM

Excavate and Removal All Plutonium Comment Summary

Some commenters identified issues with the long half-life of plutonium (24,000 years), carcinogenic risks from exposure to plutonium, long time frames that institutional controls would be required when plutonium is left in place, the potential for plutonium to reach groundwater and the Columbia River, and the level of protectiveness of the preferred alternative presented in the Proposed Plan.

Some commenters stated that budget limitations should not be the deciding factor on how much plutonium contamination is removed. Regarding cleanup, comments included the following: there is more risk reduction when more plutonium is removed; plutonium belongs in a deep geologic repository; partial removal of plutonium is not sufficient or at least 90% should be removed; and cleanup levels for plutonium should be as stringent as levels identified for other locations.

Some commenters discussed the need for surgical removal of plutonium at the Z-Ditches Waste Group instead of methods that would intentionally mix clean soil and contaminated soil during excavation. Other concerns were future dangers of someone attempting to retrieve plutonium from these waste sites and risks to individuals who may use the area for subsistence farming.

Response to comments:

The Tri-Party agencies recognize that plutonium is a dangerous contaminant that must be remediated carefully to protect human health and the environment and that institutional controls would be used, as part of the selected remedy, over long time frames where plutonium is left in place. Concern over plutonium reaching groundwater and the Columbia River is understandable. However, plutonium is not currently entering the Columbia River from the Hanford Site. Monitoring programs are in place to monitor if any contaminants from Hanford are entering the Columbia River and to identify any need for additional actions to protect human health and the environment from unacceptable risk.

The Tri-Party agencies also recognize that many members of the public would prefer to have all or nearly all of the plutonium contamination removed from the High-Salt Waste Group. DOE and EPA do not agree that all plutonium contamination should be sent to WIPP for disposal and have determined that the plutonium contamination that will remain in place after the selected remedy is implemented will not pose an unacceptable risk to human health and the environment. The selected remedy will remove approximately 90% of the plutonium contamination in the Low-Salt Waste Group and almost all of the plutonium contamination from the Z-Ditches and Settling Tanks Waste Groups. For the High-Salt Waste Group, soils located two feet below the bottom of the disposal structure, where the highest concentrations of plutonium are located, will be removed. After excavating to the specified depths in these waste sites, plutonium-239/240 levels will be assessed. DOE will consider removing additional plutonium-contaminated soil from these waste sites.

At waste sites in the Z-Ditches Waste Group, traditional excavation methods will be used to remove contaminated soils as part of the selected remedy. Clean overburden will be removed and stockpiled for backfilling. Subsequent excavation using traditional excavation methods will result in plutonium-contaminated soil being removed with some clean soil. This is not an intentional “blending” of clean and contaminated soil, but rather a result of the traditional excavation methods that are used for digging up soil. As contaminated soil is removed and packaged for disposal, waste in containers will be screened to determine if it meet ERDF waste acceptance criteria as low-level waste or if the waste has plutonium concentrations greater than 100 nCi/g. Since Hanford waste is a result of defense-related activities, waste containers that have plutonium concentrations greater than this value qualify as

transuranic waste and can be disposed in the approved geologic repository. Transuranic waste will be sent to WIPP for disposal.

The EPA and DOE did evaluate the removal of contaminated soils that pose an unacceptable risk at waste sites in the High-Salt and Low-Salt Waste Groups. This was evaluated under Removal, Treat (if necessary) and Dispose – Option E in the feasibility study. This cleanup alternative was evaluated along with the other alternatives that were identified through the CERCLA process. There are nine criteria that must be considered when evaluating cleanup alternatives under CERCLA. The first two criteria, known as “threshold criteria”, are the overall protection of human health and the environment and compliance with (or qualification for a waiver from) Applicable or Relevant and Appropriate Requirements (ARARs). The next five criteria, known as “balancing criteria”, allow for a comparison of the relative performance of each alternative against these criteria. These criteria are: long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost. The last two criteria, known as “modifying criteria”, are State acceptance and community acceptance. The selected remedy meets the threshold criteria and provides the best balance of the CERCLA balancing criteria and modifying criteria considerations.

The land where the waste sites addressed in this Proposed Plan and ROD are located is considered an industrial-use area and will have the necessary land-use restrictions for land that has contamination in place that does not allow for unrestricted use and unlimited exposure.

It is important to note that cost is only one factor that is considered for deciding how much plutonium-contaminated soil to remove. While cost was a factor in selecting the remedy, budget limitations were not. A remedy must be protective of human health and the environment and comply with (or qualify for a waiver from) ARARs in order to be selected for implementation. After the plutonium-contaminated soil is removed in accordance with the selected remedy at the High-Salt and Low-Salt Waste Groups, the waste sites will be backfilled with clean soil and covered with an evapotranspiration barrier which will provide further isolation from humans and the environment.

The current and anticipated future land use for this area is industrial. The selected remedy and final cleanup level for plutonium were developed based on this anticipated industrial land use. Waste will remain in place that will not allow for unlimited use of the land (e.g., no residential or farming activities). Institutional controls will be used to prohibit activities that would disturb the soil at these waste sites to prevent potential human exposure to contamination and to protect the integrity of the remedy. DOE is ultimately responsible for maintaining institutional controls at the Hanford Site, even if the land is transferred to another owner.

The Tri-Party agencies understand that some members of the public are concerned about the possibility of someone trying to access the residual plutonium-contaminated soil in the future. Institutional controls will prohibit access to the plutonium-contaminated soil which, after implementation of the selected remedy, will be located deeper than 15 feet below the ground surface. Since contamination will remain in place that will not allow for unlimited land use, CERCLA requires that the selected remedy be reviewed no less often than every five years to ensure that human health and the environment are being protected by the remedial action. If, based on a five-year review, further action at the site is determined appropriate, such action will be taken. Please see the “Government Is Not Long-Term Stewardship” section for additional agency responses related to this concern. Please see the “Regulatory Standards” section for agency responses regarding cleanup levels for plutonium.

REMOVE ALL CESIUM

Remove All Cesium Comment Summary

Some commenters stated that they preferred the removal of cesium contaminated soil over a capping remedy for the following reasons: removal is more protective; contaminated soil is more secure when disposed of at ERDF; and capping is not effective.

Response to comments: The Tri-Party agencies recognize that some members of the public prefer to remove cesium-contaminated soil rather than leave it in place. When selecting a remedy, the Tri-Party agencies must select a remedy that meets the threshold criteria and provides the best balance of the CERCLA balancing criteria and modifying criteria considerations. The selected remedy for the Cesium-137 Waste Group to maintain/enhance the existing soil cover (MEESC) meets the threshold criteria and provides the best balance of the CERCLA balancing criteria and modifying criteria considerations. The 15 ft depth of the soil cover is effective in eliminating environmental pathways from biological activity, such as from plant roots or burrowing animals and from workers coming in direct contact with contamination.

DIG DEEPER THAN 2 FEET AT THE HIGH-SALT WASTE SITES

Dig Deeper Than 2 Feet Comment Summary

Comments received on dealing with digging deeper than 2 feet are specific to the High-Salt Waste Group. Multiple commenters stated that digging to 2 feet below the bottom of a waste site is not sufficient and that long-term protectiveness is not achievable for the High-Salt Waste Group if enough plutonium contamination remains in the soil. It was also stated that an observational approach should be used to determine how deep to dig at the High-Salt waste sites or that the same approach used at the Low-Salt Waste Group, which is to remove approximately 90% of the contaminated soils, be used. One commenter went on to state that the Proposed Plan did not provide sufficient data to support digging to 2 feet below the bottom of a waste site when the Feasibility Study states that plutonium is found to depths of 121 ft. This commenter continued by stating that cleanup should be based on contaminant concentration levels and not on the depth to contaminants.

Commenters expressed concern over plutonium-contaminated soils potentially being used to make nuclear bombs in the future and also the potential harm these soils pose to future generations.

Response to comments: The Tri-Party agencies acknowledge that the public generally prefers digging deeper than 2 ft below the bottom of a waste site for the High-Salt Waste Group and that there is concern over the protectiveness of leaving plutonium-contaminated soils in place.

Risk evaluations were conducted as part of the CERCLA process to identify the source of the risk and exposure pathways to humans and the environment. When these pathways are broken, the risk is eliminated. Pathways are identified by considering the current and reasonably anticipated future land use for the area, which is industrial use. Institutional controls will be used to prohibit activities that would disturb the soil at these waste sites to prevent potential human exposure to contamination and to protect the integrity of the remedy.

No complete exposure pathways or unacceptable risks will remain after implementation of the selected remedy. Regular workers, meaning Hanford Site workers not involved in digging activities, are not at risk since there are no complete pathways to contamination under an industrial scenario. A construction worker could potentially be at risk since they could come into contact with contaminated

soil when conducting digging activities. Exposure pathways for construction workers via contact with contaminated soil would be through ingestion, inhalation, dermal contact, and external radiation. However, the institutional controls of the selected remedy will break the pathways to construction workers and eliminate the unacceptable risk. Further removal of contamination at greater depths will not achieve additional protectiveness. Under the selected remedy, after the contaminated soil is removed, the waste sites will be backfilled with clean soil to a minimum depth of 15 feet which is effective in eliminating environmental pathways to contaminated soils from biological activity, such as from plant roots or burrowing animals.

The DOE and EPA have determined that the plutonium that will remain in place after the selected remedy is implemented will not pose an unacceptable risk to human health and the environment. The selected remedy for the High-Salt Waste Group, (removal of contaminated soil to a depth of 2 feet below the bottom of the disposal structures, construction of an evapotranspiration barrier, and use of institutional controls consistent with industrial land use) meets the threshold criteria and provides the best balance of the CERCLA balancing criteria and modifying criteria considerations. After excavating to the specified depths in these waste sites, plutonium-239/240 levels will be assessed. DOE will consider removing additional plutonium-contaminated soil from these waste sites.

Please see the “Use of the Observational Approach” and “Excavate and Remove All Plutonium” sections for additional agency responses.

SHIP PLUTONIUM OFF-SITE

Ship Plutonium Off-Site Comment Summary

Some commenters stated that more or even all plutonium contaminated soil should be disposed in a deep geologic repository, such as WIPP, regardless of the additional costs since they believe it provides a more permanent remedy. Commenters stated this is due to the long-half life of plutonium and the potential for plutonium-contaminated soils to migrate now or in the future. Commenters also stated that plutonium should be moved away from the Columbia River.

Response to comments: The Waste Isolation Pilot Plant (WIPP) in Carlsbad, New Mexico is where the US disposes of the nation's defense-related transuranic radioactive waste. Plutonium contaminated soils removed from the Hanford Site must qualify as “transuranic waste” in order to be accepted at WIPP. This means the contaminated soil and debris must have alpha-emitting TRU radionuclides possessing half-lives greater than 20 years and in concentrations greater than 100 nCi/g. Under the selected remedy, any contaminated soil and debris that are excavated and packaged for disposal that qualify as TRU waste will be sent to WIPP for disposal. Contaminated soil and debris that are excavated and packaged for disposal that do not qualify for disposal at WIPP will be disposed of at Hanford’s Environmental Restoration and Disposal Facility (ERDF).

Some plutonium will remain in place as part of the selected remedy. The risks from the plutonium that remains were evaluated as documented in the Remedial Investigation and Feasibility Study (RI/FS)(DOE/RL-2007-27). Based on that information, DOE and EPA have determined that the plutonium that will remain in place after the selected remedy is implemented will not pose an unacceptable risk to human health and the environment and that the selected remedy will protect the Columbia River and its ecological resources from degradation and unacceptable impact associated with hazardous substances, pollutants or contaminants originating from these waste sites.

PLUTONIUM IS MOBILE

Plutonium Is Mobile Comment Summary

Some commenters stated that plutonium is mobile and that it can travel to groundwater and the Columbia River. Commenters also stated that there is no certainty that plutonium will remain immobile over the long-term. Some commenters stated that plutonium is currently reaching the Columbia River or will reach it in a relatively short period of time. Some commenters expressed concern over the potential for future unexpected exposures.

Response to comments: The Tri-Party agencies agree that the mobility of plutonium can be affected by certain environmental conditions. However, we do not agree that plutonium is mobile under the environmental conditions at these waste sites. The presence of plutonium at depths to approximately 110 feet at the High-Salt waste sites was due to the driving force of large amounts of highly acidic liquid discharges during active operations. Liquid disposal of highly acidic waste is no longer occurring at these waste sites and the average precipitation rate is low at 6.8 in/year. Based on its insolubility and strong sorption to sediments, and the pH of the soil at these waste sites, plutonium is highly immobile. Since the plutonium at these waste sites is highly immobile, it does not pose an unacceptable risk to groundwater or the Columbia River.

Some plutonium will remain in place under the selected remedy. The waste sites where plutonium will remain will be covered with an evapotranspiration barrier which will minimize water infiltration and also reduce the potential for contaminant migration with water flow. The risks from the plutonium that remains were evaluated as documented in the RI/FS (DOE/RL-2007-27). Based on that information, DOE and EPA have determined that the selected remedy meets the threshold criteria and provides the best balance of the CERCLA balancing criteria and modifying criteria considerations. The plutonium that will remain in place after the selected remedy is implemented will not pose an unacceptable risk to human health and the environment. The selected remedy will protect groundwater, the Columbia River and its ecological resources from degradation and unacceptable impact associated with hazardous substances, pollutants or contaminants originating from these waste sites.

Please see the “Excavate and Remove All Plutonium” section for responses regarding plutonium reaching the Columbia River and the “Do Not Rely on Institutional Controls” section for responses regarding future unexpected exposures.

DO NOT RELY ON BARRIERS/CAPS

Do Not Rely On Barriers/Caps Comment Summary

Some commenters stated that caps are not sufficient because they cannot be maintained in perpetuity and will deteriorate over time. Some commenters also stated that these waste sites are located too close to the Columbia River for caps to be considered. Some commenters stated lateral water movement is possible and trenched walls to stop water flow should be used. One commenter stated that surface barriers should not impede soil vapor extraction activities.

Response to comments: The Tri-Party agencies recognize that many members of the public generally prefer to remove contaminated soil rather than leave it in place. When selecting a remedy, DOE and EPA must select a remedy that is protective of human health and the environment, meets the other threshold criterion, and provides the best balance of the CERCLA balancing criteria and modifying criteria considerations. The selected remedy for the Cesium-137 Waste Group is to maintain or enhance the existing soil cover (MEESC). The selected remedy for the Cesium-137 Waste Group to maintain/enhance the existing soil cover (MEESC) meets the threshold criteria and provides the best balance of the CERCLA balancing criteria and modifying criteria considerations. The cesium-137

contamination is not mobile under existing or anticipated conditions and will not pose an unacceptable risk to groundwater or the Columbia River under the Selected Remedy. The 15 ft depth of the soil cover is effective in eliminating environmental pathways from biological activity, such as from plant roots or burrowing animals, and from workers coming in direct contact with contamination. Institutional controls will prohibit activities to prevent potential human exposure to contamination and to protect the integrity of the remedy. The soil cover will need to be maintained as long as there is unacceptable risk from these waste sites.

The selected remedy for the Low-Salt and High-Salt Waste Groups consist of constructing an evapotranspiration (ET) barrier after the excavated area is backfilled with clean soil. The ET barriers will be made from natural materials (i.e., nothing man-made) and covered with vegetation. ET barriers in semi-arid climates like that at the Hanford Site make use of high evaporation, high transpiration and native plants to maintain low soil moisture levels, which minimize water infiltration. Minimizing water infiltration also reduces the potential for contaminant migration with water flow. This barrier will keep workers from coming in direct contact with the remaining contamination and will also eliminate environmental pathways. The ET barriers will need to be maintained as long as there is unacceptable risk from these waste sites. Since the plutonium at these waste sites is highly immobile, it does not pose an unacceptable risk to groundwater or the Columbia River. Due to the low precipitation rate at the Hanford Site (6.8 in/yr), lateral water movement in the soil column will not be a significant transport mechanism for contamination located beneath the ET barriers. Soil vapor extraction (SVE) will be used to address carbon tetrachloride and methylene chloride contamination, the contaminants that were identified at threats to groundwater, at waste sites in the High-Salt Waste Group in conjunction with the other parts of the selected remedy. The ET barriers will not impede SVE activities.

DOE and EPA have determined that the selected remedy is protective of human health and the environment, complies with ARARs, and provides the best balance of the CERCLA balancing criteria and modifying criteria considerations. Since contamination will remain in place that will not allow for unlimited land use, CERCLA requires that the selected remedy be reviewed no less often than every five years to ensure that human health and the environment are being protected by the remedial action. If, based on a five-year review, further action at the site is determined appropriate, such action will be taken.

Please see the “Excavate and Remove All Plutonium” section for responses regarding plutonium reaching the Columbia River.

GOVERNMENT IS NOT LONG-TERM STEWARDSHIP

Government Is Not Long-Term Stewardship Comment Summary

Some commenters stated that the remedy cannot be dependent on the existence of government hundreds or thousands of years into the future. Some commenters stated this is because plutonium has a half-life of 24,000 years, making it impossible to guarantee protectiveness of a remedy that consists of maintaining institutional controls 240,000 years into the future.

Some commenters stated that a more conservative approach should be selected since long time frames have high levels of uncertainty and it would be cheaper to remove the contamination than to guard it in perpetuity.

Response to comments: The Tri-Party agencies understand there is some public concern over the ability to maintain control of the Hanford Site far into the future. We acknowledge that there is

uncertainty associated with the future of society beyond hundreds of years into the future. However, when cleanup decisions are made those decisions follow the CERCLA process which requires the appropriate amount of scientific data and analysis as well as the appropriate consideration of the nine CERCLA criteria.

Institutional controls are part of the selected remedy and will be maintained. The land where these waste sites are located is considered an industrial-use area and will have appropriate land-use restrictions for land that has contamination in place that does not allow for unlimited land use. DOE is ultimately responsible for maintaining institutional controls at the Hanford Site for as long as necessary, even if the land is transferred to another owner.

Since contamination will remain in place that will not allow for unlimited land use, CERCLA requires that the selected remedy be reviewed no less often than every five years to ensure that human health and the environment are being protected by the remedial action. If, at any time based on a five-year review, further action at the site is determined appropriate to ensure protectiveness, such action can be taken.

DO NOT RELY ON INSTITUTIONAL CONTROLS (ICs)

Do Not Rely On Institutional Controls Comment Summary

Some commenters stated that ICs should not be relied on due to the uncertainty in the ability to maintain ICs over 1,000 years into the future. Some commenters stated that it cannot be assumed that Hanford's Central Plateau will never be developed for residential use. Other commenters stated that Tribal nations may want to use the land in the future and questioned if there was an analysis of exposure from contamination originating from the 200 Area to Native American tribes exercising treaty rights or agricultural-related exposures to those using land beyond fenced portions of the 200 area.

*Response to comments: Institutional controls will be used as part of the selected remedy to prevent or limit exposure to hazardous substances, pollutants, or contaminants in a manner that is protective of human health. Institutional controls are a necessary part of this remedy because contamination will remain in place that will not allow for unrestricted use of the land and unlimited exposure. CERCLA cleanup standards consider the reasonably anticipated future land use. The future reasonably anticipated land use for these waste sites is for industrial use. The DOE worked for several years with cooperating agencies to define land use goals for the Hanford Site. The cooperating agencies and stakeholders included: the National Park Service; Tribal Nations; the States of Washington and Oregon; local, county, and city governments; economic and business development interests; environmental groups; and agricultural interests. A 1992 report, *The Future for Hanford: Uses and Cleanup: The Final Report of the Hanford Future Site Uses Working Group* (Drummond, 1992) was an early product of these efforts to develop land use assumptions. The report recognized that portions of the Central Plateau would be used to some degree for waste management activities for the foreseeable future. This, in part, affected the 1999 Hanford Comprehensive Land-Use Plan Environmental Impact Statement (DOE/EIS-0222-F) and associated ROD where DOE designated the Central Plateau as an industrial land use area suitable and desirable for the treatment, storage, and disposal of hazardous, dangerous, radioactive, and nonradioactive wastes, as well as related activities.*

Industrial cleanup standards are different from residential cleanup standards because industrial cleanup standards consider the amount of time people are in the area and the types of activities that occur under industrial use. Residential cleanup standards allow for unrestricted activities on the land after cleanup occurs. The feasibility studies for these waste sites analyzed a number of risk scenarios

to compare against the industrial scenario. This includes a Native American Exposure scenario which is located in Appendix F (DOE/RL-2004-24) for the Z-Ditches Waste Group and in Appendix G (DOE/RL-2007-27) for the other waste groups. The selected remedy includes using evapotranspiration (ET) barriers to minimize water infiltration which reduces contaminant migration and soil covers to break environmental pathways that could result in human contact with contamination. The ET barriers will also minimize contamination migration that could result in unacceptable exposures in areas beyond the waste sites. Also, institutional controls will be used to prohibit activities that would disturb the soil at these waste sites to prevent potential human exposure to contamination and to protect the integrity of the ET barrier and soil covers which are part of the selected remedy.

DOE and EPA recognize the public skepticism with maintaining ICs over many years into the future. ICs are required to be maintained as long as necessary for the selected remedy to be protective. However, since contamination will remain in place that will not allow for unlimited land use, CERCLA requires that the selected remedy be reviewed no less often than every five years to ensure that human health and the environment are being protected by the remedial action. If, based on a five-year review, further action at the site is determined necessary to be protective of human health and the environment, such action will be taken.

MODELING FOR SEISMIC ACTIVITY, FLOODS, AND CLIMATE CHANGE

Modeling For Seismic Activity, Floods, and Climate Change Comment Summary

Some commenters stated that seismic activity, flooding, and other natural disasters should be considered when developing and evaluating cleanup alternatives. Some commenters stated that events such as glacial flooding, earthquakes, and severe storms will occur on the Hanford Site and any remedy selected should address risks posed from those events.

Response to comments: The Tri-Party agencies understand public concern over the potential for natural disasters at the Hanford Site. The probability of these types of disasters occurring were considered. Large Columbia River floods have occurred in the past, but the likelihood of recurrence of large-scale flooding has been reduced by the construction of several (7) flood control/water-storage dams upstream of the Hanford Site. Major floods on the Columbia River are typically the result of rapid melting of the winter snowpack over a wide area augmented by above-normal precipitation. Evaluation of flood potential was conducted, in part, through the concept of the probable maximum flood.

The probable maximum flood for the Columbia River downstream of Priest Rapids Dam has been calculated to be greater than a 500-year flood scenario. This flood would inundate parts of the Hanford Site adjacent to the Columbia River, but the central portion of the Hanford Site, where these operable units are located, would remain unaffected. Potential dam failures on the Columbia River have also been evaluated. The Army Corps of Engineers evaluated a number of scenarios on the effects of failures of Grand Coulee Dam. The remainder of the areas along the Columbia River and nearly all of Richland, WA would be flooded, but the central portion of the Hanford Site, where these operable units are located, would not be flooded.

The Tri-Party agencies acknowledge public concern over the consideration of seismic activity when selecting a remedy. There is an active program for seismic monitoring at Hanford, the Hanford Seismic Assessment Program (HASAP), to maintain instrumentation (or other means) to detect and record the occurrence and severity of seismic events. The program provides interpretations of seismic events from the Hanford Site and vicinity, locates and identifies sources of seismic activity, monitors

changes in the historical pattern of seismic activity, and builds a “local” earthquake database that is permanently archived.

Once the waste sites are remediated, the potential effect of seismic events on the remediated waste sites will be minimal (e.g. structures will be removed, voids filled, soil covers and ET barriers can be repaired). Seismic events should have no effect on plutonium chemistry, and thus should have no direct effect on plutonium mobility. Potential seismic effects are considered in design and placement of evapotranspiration barriers over a remediated site, as necessary.

DOE and EPA have selected a remedy that is protective of human health and the environment, meets the other threshold criterion and provides the best balance of the CERCLA balancing criteria and modifying criteria. The probability of natural disasters occurring at the Hanford Site was evaluated and considered. Regarding events that may occur on a geologic time scale, such as glacial flooding, the Tri-Party agencies acknowledge that there is uncertainty associated with environmental conditions that far into the future. However, when cleanup decisions are made those decisions follow the CERCLA process which requires the appropriate amount of scientific data and analysis as well as the appropriate consideration of the CERCLA criteria. Since contamination will remain in place that will not allow for unlimited land use, CERCLA requires that the selected remedy be reviewed no less often than every five years to ensure that human health and the environment are being protected by the remedial action. If, based on a five-year review, further action at the site is determined appropriate, such action can be taken.

INSUFFICIENT SCIENTIFIC DATA

Insufficient Scientific Data Comment Summary

Some commenters stated that there is not sufficient characterization data to select a remedy for these waste sites, particularly for the Settling Tanks, Z-Ditches and High-Salt Waste Groups. One commenter stated that no data was presented on the values of contaminant concentrations at various depths or cost information for removing contaminated soil at various depths. Some commenters stated the data available for the waste sites were dated and that new data should be collected before proceeding. Other commenters stated that potential risks to groundwater were not evaluated and that a baseline risk assessment could not be fully conducted without additional information.

Response to comments: The Tri-Party agencies recognize public concern over the amount of scientific data that was used to determine risks and select an appropriate remedy for these waste sites. Following the CERCLA process, DOE conducted an assessment of the nature and extent of contamination and the associated health and environmental risks (in the Remedial Investigation) and developed and analyzed the range of potentially viable cleanup alternatives for these operable units (in the Feasibility Study). The scientific data included use of historical data such as process history. For the Settling tanks, historical data on the tank contents is one valid source of information since there have been no leaks from the tank to date and long-lived radionuclides remain. For the Z-Ditches and High-Salt Waste Groups, there have been no major contaminant transport mechanisms (such as large volumes of liquid discharges) since operations ceased to cause the contamination to migrate. The long-lived radionuclide contamination is still present, making process history a valuable source of information for characterizing these waste sites. DOE and EPA have determined that the existing data and information is sufficient to make this remedy decision.

The Tri-Party agencies acknowledge public concern with age and amount of data used to characterize the Settling-Tanks, Z-Ditches, and High-Salt Waste Group. Characterization information is available for each waste site, including information on contaminant concentrations, in their respective FS documents (Chapter 2 in DOE/RL-2004-24 and Chapter 2 in DOE/RL-2007-27). The information in the FS document is intended to provide a synopsis of all the available information on the waste sites. Typically, highly technical documents are used to write the FS, but are not included in their entirety. Appendix C of the FS (DOE/RL-2007-27) provides the cost estimates for the remedial alternatives identified for potential implementation. The cost estimates in the FS were developed in accordance with EPA guidance (EPA/540/R-00/002 A Guide to Developing and Documenting Cost Estimates During the Feasibility Study, OSWER 9355.0-75.) The cost estimates did not identify costs for remedial alternatives that were not identified during the RI/FS process. Appendix F of the FS (DOE/RL-2007-27) provides an evaluation of the amount of risk reduction achieved when removing soil to various depths under an unrestricted land use scenario at the High-Salt Waste Group, which was used to evaluate the remedial alternatives that were considered. Appendix E of the FS (DOE/RL-2007-27) provides an evaluation of groundwater protection from all potential contaminants of concern. The baseline risk assessment was conducted with sufficient data and information.

SUPPORT FOR LEAVING CESIUM IN PLACE

Support For Leaving Cesium In Place Comment Summary

Some commenters expressed support for the maintain or enhance soil cover (MEESC) remedy for the Cesium-137 Waste Group. Some commenters stated that they supported the MEESC alternative if it would allow for the removal of more plutonium contamination.

Response to comments: DOE and EPA agree and have selected the maintain/enhance the existing soil cover (MEESC) remedy as part of the selected remedy for the Cesium-137 Waste Group. The Tri-Party agencies acknowledge that the public generally prefers to have more plutonium contamination removed, but the plutonium waste sites were assessed independently of the Cesium-137 Waste Group.

PUBLIC INVOLVEMENT PROCESS

Public Involvement Process Comment Summary

Some commenters stated that information on the waste sites is not easily accessible and that it is difficult to find documents in the Administrative Record. Some commenters also stated that the information presented in the Proposed Plan and technical documents is complex and difficult to understand. Some commenters suggested increasing outreach efforts and advertising for meetings and providing 30 to 45 days of advance notice for upcoming meetings. One commenter stated that the Tri-Party Agencies failed to provide the minimum thirty days of public notice for public meetings as prescribed in the Hanford Community Relations Plan and that not all key documents were publically available. An additional comment was that the original notices simply identified the operable units to be addressed which did not make clear to the public that plutonium and cesium discharge sites were to be addressed.

Response to comments: Public involvement is important to the Tri-Party agencies. We strive to include our stakeholders and the public in the decision-making process at Hanford. The remedial investigation reports and feasibility studies developed as part of the CERCLA decision-making process present highly technical information. We agree that these technical documents need to be publically available during the public comment period on the Proposed Plan and allow at least 30 days for the public to

review these documents. The technical documents that support the basis for alternatives presented in the Proposed Plan are long and complex. This is particularly true for the waste sites located in these operable units due to the complexity of each waste site. The Proposed Plan and fact sheet are a high level summary of the technical documents and are meant for a general audience and are not intended to present highly technical information in detail. The Tri-Party agencies recognize the difficulty readers may have had with the Proposed Plan due to the complexity of and manner in which the information was presented.

The Hanford public involvement team engaged stakeholders and the public throughout the CERCLA process for selecting this remedy. For example, a stakeholder call was held on June 15, 2011 to measure interest in public meetings and to discuss meeting locations. The Tri-Party agencies strive to provide the public with early notification (30 to 45 days notice) of upcoming public comment periods and meetings whenever possible, as described in the Hanford Community Relations Plan. However, this is not a legal requirement. Situations occur when it is not possible to provide early notification. In those cases, notice is provided by the Tri-Party agencies as soon as definitive information is available. The public meetings for the Proposed Plan were advertised in advance in four regional newspapers (in a major circulation newspaper in each city where a meeting was to be held), on the www.hanford.gov website, and through the Hanford electronic listserv and mail list. A formal public comment period on the Proposed Plan, originally scheduled to run from July 5 through August 5, 2011, was extended through September 6, 2011 in response to requests from stakeholders. A fact sheet with a more reader-friendly title, "Reference Guide on the Remediation of Waste Sites in Hanford's Central Plateau", indicating the nature of the proposed cleanup was sent through the Hanford electronic listserv and mail list on July 5, 2011. The fact sheet also listed the date and location of public meetings on the Proposed Plan. A reminder was sent out on the Hanford electronic listserv on August 18, 2011 with information on how to access the Proposed Plan, related links to key technical documents, and a video of the public meeting held in Seattle, WA.

The Tri-Party agencies encourage individuals to contact agency representatives with any concern or questions they have. During the public comment period, members of the public contacted DOE and EPA representatives by phone and email to discuss the Proposed Plan and to request additional information. These requests were met in a timely manner.

REGULATORY STANDARDS

Some commenters stated that the Resource Conservation and Recovery Act (RCRA) applies to waste sites in these OUs, particularly the Settling Tanks and Z-Ditches Waste Groups. One commenter questioned the integrity of the settling tanks and indicated that the tanks should be removed. Some commenters stated that Hanford should use the same plutonium cleanup values that have been used at other cleanup sites in the nation. A commenter stated that carbon tetrachloride originating from these waste sites is still contaminating groundwater. Other commenters expressed concern over whether the cleanup values identified in the Proposed Plan will provide groundwater protection. A commenter questioned why different risk considerations are used for nonradionuclide and radionuclide contaminants. One commenter stated that the State has more rigorous cleanup standards and that those should be used over the federal cleanup standards. Another commenter stated that this remedial action cannot proceed without the completion of the Tank Closure and Waste Management Environmental Impact Statement (EIS) and indicated that the proposed plan failed to consider the cumulative impact from all the waste sites in these units and related similar wastes sites on the Central Plateau.

Response to comments: The Tri-Party agencies recognize that some members of the public believe the Resource Conservation and Recovery Act (RCRA) applies to the Settling Tanks and Z-Ditches Waste

Groups. The Tri-Party agencies agree that the settling tanks present a substantial threat of release that requires action to protect human health and the environment and need to be remediated in a manner that complies with all substantive requirements for closure of a dangerous waste tank. As the settling tanks are remediated, the cleanup actions will comply with the substantive requirements of the State Hazardous Waste Management Act, Dangerous Waste Regulations for closure of a dangerous waste tank as applicable or relevant and appropriate requirements (ARARS.) The tanks would only be removed if necessary to comply with substantive closure requirements. Dangerous waste closure requirements have been included as an ARAR.

The Z-Ditches waste sites were used to dispose of cooling water from the Plutonium Finishing Plant. Unlike liquid discharges from plutonium processing activities, the cooling water did not come into direct contact with chemicals used during plutonium processing. The 216-Z-19 Trench and 216-Z-20 Trench operated after RCRA was enacted in 1976. However, there is no evidence that these Z-Ditches were used to dispose of dangerous waste.

The Tri-Party agencies also recognize that the public is concerned with the final cleanup level for plutonium. While many contaminants have standardized cleanup levels across the nation, there is no national cleanup level identified for plutonium. When cleanup of a site deals with plutonium contamination, the appropriate cleanup value is developed based on protecting human health and the environment, the specific conditions of that site, and the anticipated land use. This is why there are varying cleanup values for plutonium at different locations across the nation. The selected remedy and final cleanup level for plutonium were developed from EPA guidance and methodology based on Hanford Site conditions where these waste sites are located and the anticipated industrial land use. The respective FSs and Proposed Plan identified 2,900 pCi/g as the preliminary remediation goal for plutonium 239/240. However, for the final cleanup level in the selected remedy, DOE has agreed to use a more conservative value of 765 pCi/g.

The potential migration of hazardous substances, pollutants or contaminants to groundwater was evaluated for each waste site. This evaluation identified carbon tetrachloride and methylene chloride as the only contaminants that could potentially migrate through the soil from waste sites in the High-Salt Waste Group and impact groundwater at unacceptable risk levels. The cleanup levels for these contaminants are specified in the ROD. These values will provide for the protection of groundwater. The other contaminants of concern (COCs) were not identified as posing a threat to groundwater based on screening levels and fate and transport modeling. Soil vapor extraction is currently being conducted at High-Salt Waste Group and will be implemented as part of the selected remedy to continue to address unacceptable risk from carbon tetrachloride and methylene chloride. Although nitrate and technetium-99 were determined to not pose an unacceptable risk to groundwater, sampling will be conducted at Ecology's request to confirm that these contaminant levels do not pose an unacceptable risk to groundwater.

Risks are calculated differently for nonradionuclide and radionuclide contaminants. The target cancer risk range of 1×10^{-4} to 1×10^{-6} used to evaluate carcinogenic risks from radionuclides is based on the acceptable risk range identified under CERCLA. The target cancer risk level of 1×10^{-5} used to evaluate multiple non-radionuclide contaminants is stated in Washington Administrative Code (WAC 173-340), also referred to as the Model Toxics Control Act (MTCA). WAC regulations do not address cancer risks from radionuclides. Cleanup levels for all contaminants of concern in this ROD were established consistent with the CERCLA and MTCA.

As described in EPA's ROD guidance (EPA 540-R-98-031), this ROD presents an overall site cleanup plan including the relationship between CERCLA and other remediation activities at the site. In accordance with EPA's Framework for Cumulative Risk Assessment (EPA/630/P-

02/001F) the risk assessment evaluated the multiple contaminants, both chemical and radiological, that human or ecological receptors could be exposed to at these sites. The risk assessment combined the toxicities and risk from all chemicals and from all exposure routes (such as inhalation and ingestion) for a cumulative hazard to establish the basis for action, and to establish cleanup levels. Likewise for radionuclides, cumulative risk was evaluated for these sites. The Tri-Party agencies do not agree that this remedial action cannot proceed without completion of the Tank Closure and Waste Management EIS. The remedy was selected in accordance with CERCLA and the NCP. The EIS covers a specific scope including closure of Hanford's single-shell and double-shell tanks and on-going waste management activities. However, the EIS has no direct bearing on the evaluations conducted as part of this cleanup decision.

USE OF OBSERVATIONAL APPROACH

Use Of Observational Approach Comment Summary

Some commenters expressed support for use of the observational approach at waste sites in the High-Salt Waste Group. Some commenters stated that the observational approach would be ideal for dealing with the removal of plutonium-contaminated soil and that it is a more effective and efficient process for determining the appropriate depth of contaminated soil removal.

Response to comments: The Tri-Party agencies acknowledge that some members of the public support use of the observational approach when removing plutonium contaminated soil at waste sites in the High-Salt Waste Group. For the High-Salt Waste Group, soils that are located up to 2 ft below the bottom of the waste site (6.1 m (20 ft) bgs at the 216-Z-1A Tile Field, 7 m (23 ft) bgs at the 216-Z-9 Trench, and 6.1 m (20 ft) bgs at the 216-Z-18 Crib) will be removed. This area represents soil with the highest concentrations of plutonium. The DOE and EPA have determined that the plutonium that will remain in place after the selected remedy is implemented will not pose an unacceptable risk to human health and the environment. However, based on public comment, it has been determined that after excavating to the specified depths in these waste sites, plutonium-239/240 levels will be assessed. DOE will consider removing additional plutonium-contaminated soil from these waste sites.

OTHER COMMENTS ON THE PROPOSED PLAN

Other Comments On The Proposed Plan Comment Summary

Some commenters thanked the Tri-Party agencies for their efforts on this cleanup decision or for the opportunity to provide comment on the Proposed Plan. Some commenters expressed support of the remedies identified for the Z-Ditches and Low-Salt Waste Groups, pipelines, and the use of soil vapor extraction at the High-Salt Waste Group. Some commenters asked for clarification on the remedy for the Settling Tanks and cost tables presented in the Proposed Plan. Another commenter stated that WIPP disposal costs should not be included since these costs are not part of the Hanford DOE office budget.

Response to comments: The Tri-Party agencies would like to thank those who provided comment on the Proposed Plan and acknowledge those comments that expressed support of portions of the selected remedy. The selected remedy for the Settling Tanks Waste Group includes removal of the remaining contents (including any liquid and sludge) and grouting of the tanks for stabilization, and will satisfy substantive closure requirements for dangerous waste tanks. The cost tables presented in the Proposed

Plan show present worth calculations based on 350 years for the Cesium-137 Waste Group to 1,000 years for the Low-Salt and High-Salt Waste Groups and include estimated disposal costs at WIPP, where applicable. WIPP costs were included in the Proposed Plan in order to fully present the full range of life-cycle costs for each alternative. This was done in part in response to HAB advice #207 regarding Criteria for Development of the Proposed Plan for 200-PW-1,3,6 (available at http://www.hanford.gov/files.cfm/HABAAdv_207.pdf) which specifically requested life-cycle costs be provided.

GENERAL COMMENTS

General Comments Summary

General comments that were not specific to a particular part of the Proposed Plan were also received. Some commenters expressed concern with the following: if the protectiveness of the remedy is limited to protection of workers; increases in cancer risks if groundwater from the central part of Hanford is used; threats to the Columbia River; and possibility of major nuclear accidents occurring at Hanford in the future. Some commenters also share personal stories regarding their experiences with people who were exposed to radiation and their concern that others may also suffer from future radiation exposure from Hanford. Some commenters stated vitrification technology should be used and one commenter asked for the meaning of the “ET” abbreviation.

Comments that were not directly related to this decision dealt with shipping of waste to the Hanford Site, ending nuclear power, and supporting alternative energy.

Response to comments: When determining how contaminated waste sites will be cleaned up, CERCLA requires that the selected remedy be protective of human health and the environment. The Tri-Party agencies have determined that the selected remedy is protective of human health and the environment, including, but not limited to, workers since industrial use is the current and reasonably expected future land use, the public living near Hanford and throughout the Pacific Northwest, groundwater on the Hanford Site, and the Columbia River and its ecological resources.

The groundwater located on the Hanford Site is contaminated and not suitable for use. Under other CERCLA RODs, remedies are being implemented to clean the contaminated water; however, restrictions on using the groundwater will continue to be in place until the water is safe for consumption. The Tri-Party agencies agree that the risks from using Hanford’s groundwater are not acceptable and will be restricted from use until it reaches drinking water standards. The selected remedy will protect groundwater, the Columbia River and its ecological resources from degradation and unacceptable impact associated with hazardous substances, pollutants or contaminants originating from these waste sites.

The Tri-Party agencies agree that the Columbia River is vital to the Pacific Northwest region. One of the main priorities of the Tri-Party agencies is to protect the Columbia River from contamination originating from the Hanford Site. The main way contamination can potentially reach the river is from the migration of contaminated groundwater. Extensive groundwater monitoring is done on the Hanford Site to monitor for this migration. This information is located in the Hanford Site Annual Groundwater Monitoring and Performance Reports which are available at <http://www.hanford.gov/page.cfm/SoilGroundwaterAnnualReports>. If Hanford-related contamination from areas on Hanford not addressed by this ROD is moving towards or reaching the river at levels that would pose an unacceptable risk to human health or the environment, actions will be taken to

address the contamination. For people who would like more information on the Columbia River in general, the State of the River Report for Toxics is a summary of contaminants in the Columbia River Basin. It describes all sources of contamination in the region, not just contamination from the Hanford Site. This report is available at <http://yosemite.epa.gov/r10/ecocomm.nsf/Columbia/SoRR/>.

The Tri-Party agencies understand public concern over the potential for major nuclear accidents at the Hanford Site. One key difference between Hanford and nuclear power plants is that there are no active Hanford Site nuclear power plants. The nine nuclear reactors that were part of Hanford plutonium-production activities have all been shut down and eight of the reactors have been cocooned (to allow radioactive materials to decay) and the surrounding structures removed. One nuclear reactor, B-Reactor, has not been cocooned since the radioactive materials have been removed and it is used as part of guided tours and is a national historic landmark.

There is a commercial low-level radioactive waste disposal facility, US Ecology, Inc., that leases land on the Hanford Site. DOE and EPA are not involved with the activities at US Ecology; however, the Washington State Department of Ecology and Washington State Department of Health are responsible for interacting with US Ecology. More information is available at US Ecology's website at <http://www.americaneecology.com/richland.htm> or at Ecology's website at <http://www.ecy.wa.gov/programs/nwp/llrw/llrw.htm>. Energy Northwest operates the Columbia Generating Station, a commercial nuclear power plant, located north of Hanford's 300 Area. This commercial power plant is licensed through the Nuclear Regulatory Commission and is not part of Hanford cleanup activities. More information on the plant is available at Energy Northwest's website at <http://www.energy-northwest.com/generation/cgs/>.

The Tri-Party agencies would like to thank those commenters who shared their experiences of those who suffered from radiation exposure.

In-situ vitrification was considered as a possible remedial alternative to address contamination at the Z-Ditches, Low-Salt, and High-Salt Waste Groups. Vitrification was not suitable for implementation for these waste groups due to the distribution of contaminants. At the Z-Ditches and Low-Salt Waste Group, the contamination was relatively shallow; thus, the Tri-Party agencies determined it was better to remove the contamination instead of vitrifying it in place. At the High-Salt Waste Group, the contamination is relatively deep, which makes using vitrification technology difficult to implement. As a result, the Tri-Party agencies determined that vitrification was not as implementable as other technologies considered. After analyzing all the remedial alternatives using the CERCLA criteria, the Tri-Party Agencies determined that vitrification did meet threshold criteria but did not provide the best balance of the balancing and modifying criteria and it was thus not selected as the final remedy.

"ET" stands for evapotranspiration. This abbreviation was used to describe the evapotranspiration barrier that will be constructed over the waste sites that have plutonium contamination remaining in place. The purpose of using an ET barrier is to reduce the amount of water that will infiltrate through the soil column that could potentially cause contaminants to migrate with water flow.

The Tri-Party agencies understand the public's concern with the shipping of wastes to the Hanford Site. Currently, the Hanford Site is receiving no offsite waste except for what was decided in a court settlement agreement between the Department of Energy (DOE) and the State of Washington in 2006. This agreement is available at www.hanford.gov/orp/uploadfiles/settlement-agreement.pdf.

The Tri-Party agencies acknowledge public comments on ending nuclear power and supporting alternative energy. Thank you for your comments

ACRONYMS

ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
BRA	baseline risk assessment
CCU	Cold Creek Unit
CERCLA	<i>Comprehensive Environmental Response, Compensation, and Liability Act of 1980</i>
CFR	<i>Code of Federal Regulations</i>
COC	contaminant of concern
COPC	contaminant of potential concern
CSM	conceptual site model
CTUIR	Confederated Tribes of the Umatilla Indian Reservation
CW	Cooling Water
DBBP	dibutyl butyl phosphate
DNAPL	dense, nonaqueous phase liquid
DOE	U.S. Department of Energy
DOE-RL	DOE Richland Operations Office, also known as RL
Ecology	Washington State Department of Ecology
ELCR	excess lifetime cancer risk
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
ESA	<i>Endangered Species Act of 1973</i>
ET	evapotranspiration
FS	feasibility study
HAB	Hanford Advisory Board
HCP EIS	Hanford Comprehensive Land Use Plan Environmental Impact Statement
HI	hazard index
HQ	hazard quotient

ICs	institutional controls
ISV	in situ vitrification
MCL	maximum contaminant level
MEESC	maintain and/or enhance existing soil cover
NCP	National Contingency Plan
NPH	normal paraffin hydrocarbon
NPL	National Priorities List
O&M	operations and maintenance
OSWER	Office of Solid Waste Emergency Response
OU	operable unit
PCB	polychlorinated biphenyl
PFP	Plutonium Finishing Plant
ppmv	parts per million by volume
PRF	Plutonium Reclamation Facility
PRG	preliminary remediation goal
PUREX	Plutonium Uranium Extraction
PW	Process Water
RAO	remedial action objective
RBC	risk based concentration
RCRA	<i>Resource Conservation and Recovery Act of 1976</i>
RECUPLEX	Recovery of Uranium and Plutonium by Extraction
RESRAD	RESidual RADioactivity (dose model)
RfD	reducing reference dose
RI	remedial investigation
RME	reasonable maximum exposure
ROD	record of decision
RTD	removal, treatment, and disposal
SLERA	screening level ecological risk assessment
SVE	soil vapor extraction
TBP	tributyl phosphate
TSD	treatment, storage, and disposal

UPR	unplanned response
USFWS	U.S. Fish and Wildlife Service
VOC	volatile organic compound
WAC	<i>Washington Administrative Code</i>
WIPP	Waste Isolation Pilot Plant

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APPENDIX A

Comments Received During Public
Comment Period on the Proposed
Plan for the Remediation of 200-
CW-5, 200-PW-1, 200-PW-3, and
200-PW-6

All Comments Sorted by Theme

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Excavate and remove all plutonium

COMMENTS

Commenter # 1

Pam Larson Brown

Comment:

This decision troubles me more than the decisions that I've seen in 18 years of Hanford cleanup. Just fundamentally it troubles me. The half-life of cesium I'm pretty comfortable with. The stuff is going to go away in a reasonable time frame that we can have some confidence of institutional controls. The plutonium is not going away. I don't care if you deal with it now or 10 years from now or 15 years from now when you've got the money to do it right.

But when you take a look at threats in the world we're not worried about digging up enough plutonium to make a bomb. We're thinking about a dirty bomb and what the consequences of that are. And we have what I characterize as a plutonium mine out there for somebody to go after. And not in our lifetime maybe but in some lifetime in the future. I don't think we should be making this decision based on budget. And if it's a budget decision then put it off until a point in time. The PFP is your priority. I absolutely support that. That's where we need to go right now. Getting that done, getting it behind us is what we need. But when I think about the evolution of what the bad guys have been going after in the last ten years it's changed so much. We were worried about people stealing plutonium and making a bomb. Then we realized they didn't need to steal it. They could do something with it right there. And that changed our whole scenario. We had an analysis where the bad guys got in and blew it up. Never thought about that before. They thought they would steal it.

So as we evolve in terms of the bad guys and what they might want to do with this material we need to make the most cautious, the most protected decision for us and future generations. And you may not be in a position to do that now. But I just think this is one of the most strategic, one of the most important decisions on the Hanford site and you need to go cautious. It scares me.

Commenter # 3

Susan Leckband

Comment:

I absolutely believe that we need to go farther. I just think there is a better risk reduction. There is more safety. There's more permanence. The waste load on this site is already extraordinary. And if we can get the plutonium which does have a huge half-life, get it in a deep geological repository I believe that's where it belongs.

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Commenter #4:

Tom Carpenter

Comment E:

Therefore, there needs to be a very rigorous effort to make sure that all the plutonium that we can remove from that site is taken from that site and processed and treated and put into a deep geological repository even if it costs a lot of money. It is not the most important thing. This stuff is dangerous for a quarter of a million years. And there's nothing we know about how to do – how to neutralize that except let it decay away somewhere far away from us.

Commenter #7:

Alera Walker

Comment A:

I'm here to say that the EPA and Washington Ecology should insist that plutonium, cesium, and other chemicals are dug up and removed at all of these sites, and they should have a cleanup standard for plutonium on Hanford's Central Plateau which is just as protective as the level of the cleanup being used at Lawrence Livermore National Lab because that shows that it is possible, or even the same -- the same strictness as they have for the Hanford sites that are closer to the river.

Commenter #8:

Nancy Morris

Comment A:

My name's Nancy Morris, and I just wanted to add a few points to what others have already said because I want us all to get out tonight here.

First of all, I feel there is a great need for better remedies and actual attitudes towards removal of this waste. And what I mean by "attitudes" is that you might say, sir, that your grandchild might be trying to deal with this legacy, and I think that is a very -- I don't know -- it's kind of a talk that doesn't really set well with me because you can also easily leave the area once you realize that all is lost and go with your retirement that's been supported by the taxpayers.

Commenter #14:

Jurgen Hess

Comment A:

I want to thank the turnout tonight, thank everybody for coming. It is wonderful. It is really neat to see so many interested people. It is great.

Just a day ago there was a big gasoline tanker that overturned east of Multnomah Falls. The state was required 100 percent cleanup even if they have to remove all the soil. And I think we should apply that same principle to the cleanup here. Two years ago when DOE and EPA came to Hood River, that was the overwhelming comment, 100 percent cleanup, don't leave anything.

I think there are too many unknowns, particularly with transference of plutonium. We just don't know enough about it yet, and I don't know my spirit will still be here 24,000 years from now,

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but I hope -- you know, we don't know enough about this stuff. It is too new. So I think be cautious. Take the low risk, and the low-risk approach here is to do the complete removal. You have a Hanford advisory board that recommended that. That is a cross-balanced group from all different interests.

I think that's the best thing to do. I strongly recommend you do that.

Comment C:

I think that's the best thing to do. I strongly recommend you do that. I defer a lot to Ken and the State of Oregon about the cesium. I don't know enough about that, but I think certainly for the plutonium take the cautious approach. Excavate it all, bring it to the salt caves in New Mexico.

Commenter #15

Dave Berger

Comment:

As far as the cleanup is concerned, I think that we should go to the California standard, at least, for the plutonium cleanup, and perhaps, you know, as far as any cleanup we should be looking at something like a 99 percent removal.

Commenter #17:

Hafiz Heartsun

Comment B:

You really got to clean it up so it becomes the no-action alternative that you are thinking, that it requires no action because that it is the only realistic thing that you can sustain over the period of time necessary.

Commenter #19:

Corey Water

Comment:

I understand everybody is working under a budget regime, but I consider it a waste -- okay. So more thorough options in cleaning up the plutonium specifically in these sites was rejected on the basis of being too expensive, but I consider it a waste of our money to only do two feet. So that is -- that is where the waste lies. Yeah, just talking budget here.

Commenter #20:

Robbie

Comment A:

I have a little scar in my throat. I am able to talk. I have thyroid cancer. The only known cause of thyroid cancer is radiation.

Plutonium is not a friendly element in its form there, and saying we are going to go down two feet and get 50 percent of the plutonium is not cleaning up. I think it is like spelling. I used to get every letter right except one, and I still missed the word for knowing how to spell it.

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Leaving 50 percent of the plutonium in the ground is not cleaning it up. I don't know a lot about running the operational. So it is an operational model. Instead we are going to do two feet, we are going to dig until it's, you know, only a certain percentage of what's come up would be much better. To go after 99 percent of it is just more realistic.

Covering something with 15 feet of soil, I presume that in Hanford they have winds, and there is water erosion. And 15 feet of soil for 10,000 years or for what is -- for -- anyway it is not enough.

Commenter #21:

Keith Harding

Comment C:

The nuclear program in 1944 was wrong then, and it is still wrong, and you need to really clean it up, get really committed to it. I have got lovely young children, and I work with preschool kids all the way down to diapers, and I have to think about them.

All right. So do your best and don't schmooze on it.

Commenter #22:

Chandra Radiance

Comment B:

Internal exposure to plutonium causes cancer. The DOE plans to leave large quantities of plutonium in the soil in the waste sites it has identified for cleanup in the central plateau. This is unacceptable.

Comment G:

And, five, focus on remove, treat, dispose.

The public has long advocated for a process of cleanup of the Hanford site by removing, treating and disposing of radioactive and chemical wastes in a manner that protects the public. DOE's proposal falls short of this goal. The Hanford advisory board summarized its concern with the proposed plan in the following statement: "The board advises the U.S. Department of Energy to get as much plutonium out of these waste sites as possible."

Commenter #23:

Bob Ruder

Comment B:

And I think that it is very difficult to take what we consider as realtime and try to make the leap to the dangers of plutonium over what is really unimaginable time as far as I am concerned, and that given those sets of constructs of what we think of as realtime and what we think of as unimaginable time, I think it really moves us to take advantage of this opportunity and to clean the site up completely because in the other imaginable period of time we don't know what will happen, you know.

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People have highlighted many possibilities that would make the present proposal for cleanup completely a waste of time and energy and money and resources, and so to really clean the site up for all the future involves the complete removal and repository of the contaminated waste.

Commenter #24:

Karen Harding

Comment:

Karen Harding, Mt. Hood.

I vote that we clean it up 100 percent even if it takes a zillion dollars. The future deserves that from us.

Commenter #26:

Gerry Pollet

Comment:

If the Energy Department had obeyed the law after 1970, it would have stopped dumping liquid waste and untreated liquid waste into trenches, right? And it would have treated it and pulled out the plutonium, and the plutonium would have gone to WIPP eventually. Instead it is in the soil, and now the Energy Department should not be rewarded for having broken the law for 25 years by continuing to discharge it and then say, "We don't want to dig it up."

The Energy Department's proposed plan in a calculation we think is a gross underestimate says: Here is the lifetime cancer risk from these supposedly safe cesium sites that they are going to put 15 feet of dirt over or the Z-9 trench, which will only dig up two feet. If instead of an industrial worker, the area has subsistence farming, and the cancer risk from the Z-9 trench is 1.4 in 10 lifetime cancer risk. 14 percent of the people exposed, instead of the industrial worker, if it is farmed 14 percent die of cancer. If we look at the cesium trenches where we are only going to put 15 feet of dirt on top, if we have made a mistake the cancer risk is -- get this -- 65 percent. Now, do you think we should dig it up?

Commenter #27:

Jody Frank

Comment B:

Could we just spend the money on digging the stuff up on getting rid of it, please.

Commenter #28:

FEMALE SPEAKER

Comment:

I implore the Oregon DOE to not just rubber stamp the data provided by the federal DOE. Just know that for you to rubber stamp and agree to decision to, you know, take care of two feet is just based on very poor data, and you need to look a little deeper....We want it 100 percent cleaned up now. We are not going to be here in a hundred years, but our children and our children's will be. We want it cleaned up 100 percent.

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Commenter #29:

Jade Sherrer

Comment:

Jade Sherrer, and I live here in Hood River, and I hearing the words protection and service a lot tonight, and I would just like to be a voice for the other-than-human world, for the more-than-human world, that also shares the environment and this planet and beg all of us to come to our senses to do everything, everything, everything possible to clean up this disaster now. Thank you.

Commenter #31:

Paige Knight

Comment A:

The United States Department of Energy promised the citizens of the Pacific Northwest in 1989, that they would cleanup the vast contamination of the Hanford Nuclear Reservation which for the past half century has compromised the health safety of people who have lived in the region and who have relied on the great Columbia River to provide water for inhabitants and viable crops. We are over the sacrifices many have made in living with the production of plutonium as a deadly element. This plutonium has already entered the Columbia River and as evidenced in your reference guide is a continuing threat to the groundwater and Columbia River. Plutonium has a half-life of 24,000 years meaning it will take 240 years -- 240,000 years for it to decay.

Comment C:

The simple fact is it must be cleaned up with due diligence. It must be done to the highest degree possible, with testing and removal of contaminants in hot spots, treatment of waste and safe disposal. The proposed evacuation of two feet below the crib zone is unacceptable. According to the Oregon Department of Energy's findings in these documents, contamination was found at up to 200 feet deep at some spots.

Comment H:

We want a "surgical approach," and there I am using the comment from the Oregonian today. Do this cleanup effort. We have been promised.

Commenter #32

Jan Castle

Comment B:

Therefore, we are morally bound to get as much plutonium out of there as possible.

Commenter #33

Dvija Michael Bertish

Comment B:

So I think that long-term risk-based assessment planning needs to, therefore, increase soil depth removal to the best and the lowest known depth possible with the high salt wastes that have been determined to be 100 to 110 feet at present. So I think you have to go far deeper than

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what you're planning. The cost of doing this now is going to be nothing if something cataclysmic happens in the future.

Commenter #35:

John Hallis

Comment:

I'm with Oregon Physician's for Social Responsibility and I'd like to record that our physicians are in accordance with the position of Hanford Advisory Board and that of the Columbia Riverkeepers and that of the Heart of America Northwest. It is we support the removal, treat and dispose solution and we think that it is a great mistake to restrict the depth of the excavation. That the plutonium should be removed from whatever depth it is found and we also support removal of the cesium from these sites.

Commenter #38:

Audience Member

Comment B:

I would like to ask that it all be cleaned up.

Commenter #40:

Margie

Comment A:

I'm Margie from Vancouver, Washington. On the planet earth where I live, where Hanford is located, is a living breathing planet where life surges through it's veins. There's no stopping any exposed liquids, chemicals, solvents from getting into the soil, thereby contaminating all soil and groundwater as well being carried in the air. I do not want any covering up of those extremely toxic contaminants. It must all be completely cleaned up.

Commenter #43:

Lloyd Marbet

Comment C:

The majority of the waste that were produced at Hanford were produced in our lifetime. I mean, we are the ones that are responsible now for these wastes. And this contamination should not be pushed off to future generations. The buck needs to stop with us. It really does. It needs to stop with all of us. And it's, I think, immoral to make the kinds of arguments that you're making here this evening to pan off what you think is somehow an acceptable form of disposal on this reservation. From my perspective, it's a travesty. We deal with great unknowns and long time frames of impact. Yet, the unforeseen flaws in risk-based decision making grow great as you grow out into time. It's just been proven over and over again, especially with this particular technology and now we're experiencing climate change. I mean, give me a break. I just cannot see how you can with a straight face even talk about control in the uncontrollable situation that we're getting ourselves into. Thus I think, that we face a moral question here. We've always confronted this as a moral question. I'm disappointed in Oregon's new position now on Hanford's disposal of these wastes. Now is not the time to compromise on this. Not at all. Or sign off on our responsibly to either fully cleanup our mess now. I want, as a citizen of the United States of America, for us to take responsibility fully for what it is that we have done to this

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environment now. I don't want to hear about these variables that set up future generations to have no place to go for accountability. No matter how sincere your integrity, your coffin is not going to speak volumes to the people that demand accountability in the future for what we do here in this room and from this room. Anything less is betrayal of our moral responsibility to future generations.

Commenter #44:

Audience Member

Comment B:

Everyone wants -- we want it all cleaned up. You guys want to clean it up. We also all need to literally call our congressional representatives and that's where the money comes and that's where we can say, I need another half billion dollars to cleanup the plutonium there. And literally, very simple, quick statement that captures that summary for them. They're not tracking all of it but then they can go back and pass it along to their budget committee.

Commenter #45:

Laura Feldman

Comment A:

My name is Laura Feldman. and I've come to a lot of these meetings. What I have continually perceived as a huge disconnect between the lay people who come, like myself, who don't really understand a lot of it, though I know more about this process than I ever did before. But still, I mean, I can say please dig up all the plutonium and take care of the cesium. And I have a zillion questions and I have a hard time visualizing it. As that woman said, a little bit of computer technology would help with that.

Commenter #46:

Sophia

Comment B:

Removing two feet of the waste at the High- Salt cesium sites, is obviously not enough to avoid risk to human life for all future. And I believe that the plan that proposed for the two sites is based in cost savings objectives. And I want to remind the representatives of both federal and state agencies, and especially the EPA, that I'm ultimately the one that is paying your salary. Your task, what I'd like for you to do, is to protect human health and welfare from environmental degradation. You're not doing an adequate job with the mentioned two sites. And to put it simply, it is my opinion that you need to go back to your offices and do the job I'm paying you to do, which means RTD, I learned tonight, at the High-Salt and cesium sites. We made a huge mistake in designing these unsafe nuclear waste sites. And now we need to remedy that by fully and rigorously cleaning them.

Commenter #47:

Joel Garbin

Comment C:

I do think, absolutely, the responsible thing to do for the present generations and those to come is to do a more thorough cleanup. Two feet does not get it done. We should be going as deep as needs to be done to get all the contaminants. And although we all recognize to economics based into these decisions, it's much cheaper to do it now before it becomes contaminated river cleanup and a devastating health and environment consequences afterwards. We cannot afford to cleanup at that point. We can afford to do it now. So let's make the right decision and take care of what's our responsibility. We know there's going to be changes political, economic, environmental that we're going to face here probably in very short order and we will not have the cultural memory in two generations to even know what the hell was World War II, what was the Cold War? I mean, let's face it. You know, our children aren't really right now good students of history, for whatever reason. I've got two of them. All right. So I know that's the case. So it's on us. We fouled it up. We've got to be responsible for cleaning it up. Let's do it now.

Commenter #48:

Tom Comfort

Comment:

My name is Tom Comfort. I also want to see the cleanup complete and the two feet is not sufficient. I've done farming in years past and I can tell you that the earth is not a solid. A field that you plow one year and remove all the stones, the next year when you plow that field there will be more stones. The earth is moving. The earth is a vibrant alive entity. And to think that if you remove two feet of plutonium the rest is going remain stable for perpetuity is ridiculous. So I want to see more thorough cleanup, as thorough as possible.

Commenter #50:

Kathleen Fitzgerald

Comment D:

The long-term risk-based assessment plan is not an option. I agree with that. And I urge and demand the EPA and Washington Ecology to insist the plutonium, cesium and other radionuclides and all the chemicals and everything be completely cleaned up as much as possible. So here's just a little bit more. Right now as early May 19th, 2011, there was a letter sent out from a lot of people that represent us. And I think it was May 23rd, 2011, there was a public hearing about them trying to dump even more plutonium out there in Hanford. That was a couple months ago. So on the 23rd, what I was talking about, they shouldn't do that. So I don't trust you. I don't trust what's going on here. It doesn't matter the money. I think we should spend the money and get it cleaned up. I don't think that we should wait. I don't think it's good idea. Please, I'm begging you to clean it up right. Okay. Don't wait.

Commenter #54:

Gerry Pollet

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Comment D:

The only way to achieve is to retrieve. The only way to achieve it is to retrieve it.

Comment I:

The only way to protect the groundwater, the only way to achieve protection of the groundwater is to retrieve.

Commenter 55:

Sam Dechter, Richland, WA

Comment:

I lean heavily in favor of removing more of the Pu in the ground with money available today & deferring the Cs & other stuff until later.

My fear is that money in the future will be extremely difficult to come by & when we finally decide to remove up to 90% of the Pu the money won't be there. There are extreme pressures on the federal budget & reduced spending coupled with increased social welfare needs will make cleanup funding all the more difficult to maintain.

So, let's do the Pu now. Eventually, we'll capitulate & go for 90%, but it will be too late!

Commenter # 57:

Illiar Walker, Seattle, WA

Comment:

The E.P.A. and Wa. Dept of Ecology should insist that plutonium, cesium, and other dangerous chemicals are dug up and removed at all sites. They should adopt a cleanup standard for plutonium on Hanford's central plateau which is as protective as Lawrence Livermore National Lab, or for Hanford's near river sites. The plutonium should be sent to a repository, because if it's left near the surface it will spread, as it has in the 200-PW-1 sites, where already plutonium has been found 100 ft. deep.

Commenter #58:

J.Sherer, Hood River, OR

Comment B:

To me, service and protecting, means the following:

- DIG IT UP, don't cover it up. REMOVE, TREAT, DISPOSE.
- It is unacceptable & a crime to leave any plutonium in the ground
- DO NOT LEAVE PLUTONIUM, other radionuclides & chemicals in near surface soils
- D.O.E should excavate more plutonium, no matter the cost

Commenter #59:

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Sarah Brooks, Portland, OR

Comment B:

Re the “high salt waste areas”, digging only 2 feet is inadequate! Digging until there is not trace is more responsible and moral for future generations. As the ground water is already being affected, it is urgent to get as much as possible out of the ground. If you’re going to do a job, why give it 30-50%? Nothing less than 100% effort is acceptable to the health of the beautiful Columbia River Gorge, and future generations & wildlife!

Commenter #60:

Sophia Gidlund/Geoff Guillor, Portland, OR

Comment B:

You must “RTD” the “high salt” and only “cesium” sites you are currently proposing 2 ft removal at.

Commenter #72:

Don Meyers 7/12/11

Comment A:

I have chosen to comment on the Central Plateau Inner Area cleanup levels using some of my past Hanford Cleanup comments. Since 1989 when Hanford’s first tank waste retrieval required removal of 99.9% of radioactive waste content, I have suggested alternate approaches for isolating radioactive waste during the Hanford Cleanup effort. The alternate approaches would save considerable time, money and risk to workers, while minimizing the risk of contaminating the river, groundwater and public throughout the Columbia River Corridor.

Commenter #74:

Oregon Department of Energy

Comment H:

Oregon strongly advises the Tri-Parties to implement an Observational Approach (as has been applied elsewhere at Hanford) for the “High-Salt Waste Group” sites. We do not know what the sufficient depth of retrieval would be to ensure the bulk of the plutonium is removed, but the Observational Approach will help to answer that question.

Commenter #80:

John H. Herbert, 7/25/11

Comment:

You, our federal government, made all the mess. You clean it all up.

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No dishonest dilutions, which foils cleanup and containment. No leaving the deeper stuff. No leaving the chemicals or the Plutonium, Americium, and other radioactive wastes that are inconvenient to get to because you or your predecessors were irresponsible and still are.

You need to extract all the radioactive wastes and encase it in safe containers that will last hundreds of thousands of years, given half-lives as long as 24,000 years.

Commenter #81:

Emily Herbert, 7/26/11

Comment:

I urge you to insist that Plutonium, Cesium other radionuclides and chemicals be dug up and removed at all sites, not stopping at 2' or 15'. Pu especially should be sent to a geologic repository. Having these wastes leech into ground water and the Columbia River is not acceptable. After the Japanese disaster, we are just waiting for earth disturbances to make this matter far worse. the time to act is NOW.

Commenter #82:

Ed Martisuzus, 7/25/11

Comment A:

PW136PP, The radioactive contamination in Hanford's soil will need to be removed, no matter the financial cost. Pu has such a long half life and can form compounds with so many elements, that it will move through the ecosystem exposing many species, sickening and killing them.

Commenter #84:

Shannon Knapp, 7/27/11

Comment:

As a member of the Hood River community I am deeply concerned about the plutonium issue at Hanford - it is surprising to me that I even need to be writing this letter as it is well known that plutonium is highly toxic and has a 24,000 year half life. Please do what's right and clean up ALL of it, not just 2 feet down and not even just 15 feet down - all of it! move through the ecosystem exposing many species, sickening and killing them.

Commenter #85:

Tom Comfort, 7/28/11

Comment:

My name is Thomas Comfort, I live in Portland, Oregon. I attended a public hearing about the proposed cleanup of radioactive waste at Hanford, Washington at Portland State University. It

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is my opinion that while there are many good results being achieved in the cleanup process, there is at present flawed thinking with regard to the standard set with regard to plutonium and cesium at Hanford. At present the proposal calls for removal of contamination only two feet below the bottom of the trench or drain in high salt waste sites, even though it is known that the contamination has penetrated far deeper. This is unacceptable. It is common knowledge that plutonium is one of the most poisonous substances known, and that it remains poisonous for hundreds of thousands of years. To leave this time bomb in the ground for future generations to contend with is ethically wrong. These substances were created within my lifetime, we should be responsible for the cleanup.

Not only is this imperative from an ethical standpoint, but it is necessary in order to assess the true cost of any large scale nuclear weapons or nuclear industry projects in the future. The cost of cleanup and storage of nuclear waste must be known and taken into consideration by those who would propose a weapons manufacturing, or nuclear power generating facility.

We must clean up all of the nuclear contamination at Hanford, not cover it up, and we must stop accepting nuclear waste at Hanford until such time as it can be stored safely without threatening the health and safety of the public.

The recent political and economic issues facing this country underscore the urgency of the situation. We must clean up now against the real possibility that political or economic expediency in the future will threaten to de-emphasize the necessity to protect the site. If not now, when will we be able to finish what we have begun?

Commenter #88:

Lynn Bergeron, 7/29/11

Comment B:

ANYTHING LESS THAN TOTAL CLEANUP OF THE HANFORD SITE IS UNACCEPTABLE - REGARDLESS OF THE COST. (PERHAPS WE COULD BUILD A FEW LESS WAR MACHINES TO PAY FOR THE CLEANUP -- NOW THERE'S AN IDEA.)

Commenter #89:

Lyrrik Pitzman, 7/29/11

Comment C:

I strongly encourage you to reconsider your plan to leave so much potentially toxic materials in place.

Comments Received During Public Comment Period on the Proposed Plan for the Remediation of 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6

Commenter #91:

Daniel Dancer, 7/30/11

Comment A:

Please do absolutely everything to safeguard the future from 24,000 yr half life plutonium leaking into the groundwater in these old trenches. Dealing with only the top 2 feet of soil and leaving the rest is a slap in the face to future generations of humans and wildlife.

Commenter #93:

John Howieson, 8/1/11/11

Comment A:

These comments refer to the proposed cleanup actions for remediation of Hanford Waste Sites (200-CW-5, 200-PW-1, 200 PW-3, and 200-PW-6 Operable Units.

Oregon Physicians for Social Responsibility supports the positions taken by the Hanford Advisory Board, Columbia Riverkeepers, and Heart of America Northwest, namely that a Remove, Treat and Dispose approach should be directed toward disposal of both Plutonium and Cesium Wastes, both of which pose significant health hazards.

Comment D:

Recovery of these wastes should not be limited to 2 feet below the bottom of cribs and/or trenches, but retrieval should extend as deep as necessary to access significant concentrations of the contaminants at whatever depth they are found.

Commenter #95:

Jeanne Raymond, 8/4/11

Comment:

Public comment on Hanford Waste Clean UP

To all concerned:

I was among those residents of Portland, Vancouver, and cities located along the Columbia River who were first concerned about radioactive nuclear waste at Hanford. We were most concerned with the highly radioactive trenches and with the leakage of radioactive wastes reaching the Columbia River from ground water contamination.

The original intent of citizens in Oregon and Washington states, and Washington DC, was for clean up, NOT storage, refinement, or acceptance of nuclear wastes from any off-site area.

All clean up should be in compliance with these agreed upon goals.

Comments Received During Public Comment Period on the Proposed Plan for the Remediation of 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6

Sincerely,

Jeanne Raymond

Commenter #96:

Kris Gann, 8/8/11

Comment:

I urge DOE, EPA and WA Ecology to see to it that ALL of the plutonium, cesium and other radio nuclides be dug up and removed from the Hanford site.

Digging to 2 ft or 15 ft is not sufficient. The Tri-Parties Agreement should be honored as it was intended and the public should be protected.

Anything short of this is a breach of faith. The Columbia River is the most important natural resource in the Northwest and should be protected. I enjoy recreation on and in the river and so do my grandchildren.

It must be protected and Hanford cleaned up. I have been coming to Hanford meetings since 2003 when I moved to the area. Please clean it ALL UP.

Commenter #97:

Stan Miller, 8/10/11

Comment:

Dear USDOE,

I write to urge the federal Energy Department to cleanup - not coverup with dirt - the Plutonium in the Soil at Hanford's Liquid Waste Discharge Sites, (which is enough to Make 70 Nuclear Weapons). I urge USDOE to remove, not coverup, the Plutonium and other wastes, to cleanup of the Plutonium, Cesium, other radioactive and chemical wastes - not coverup or limit digging to 2 feet.

Commenter #98:

Jane Boyajian, 8/10/11

Comment:

Please clean up the Plutonium and other hazardous at Hanford. That means digging to a far deeper extent than proposed and disposing of the waste in other than shallow landfill on site.

Comments Received During Public Comment Period on the Proposed Plan for the Remediation of 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6

Commenter #99:

Maridale Moore, 8/10/11

Comment:

I urge that the strictest methods possible be used to clean up this dangerous and disgraceful nuclear waste dump.

I heard about this site in the early '70's from a neighbor whose husband was ordered to bury the containers in the '40's. She said he worried until the day he died about what would happen when the containers inevitably deteriorated and leaked into the Columbia River. Since my family roots are in Hood River, it is an issue I feel strongly about! I have family, including great grandchildren, living in the Portland area. This could be another ecological disaster!

Perhaps it could be considered part of the creating jobs program! I can't think of anything more important.

Please I implore you, **take action!!**

Commenter #100:

Genny Kortes, 8/10/11

Comment A:

I fully agree with Heart of America and thank them for all their efforts to keep us and the environment freer from nuclear wastes. I want all elements cleaned up, down to 40 feet

Comment C:

No more cover-ups. Clean it up!

Commenter #101:

Stacey Stockton, 8/11/11

Comment A:

1. Plutonium, needs to be dug up and then buried in deep underground repositories and not covered up or mixed with other soil to dilute the concentration (Half live of 24,000. years are you kidding me ?) These contaminants need to be isolated from the environment.

2. Enforce digging 40 to 100 feet to remove up to 90% of plutonium

Comment C:

Please listen to the people. We want to remain safe and free to enjoy our beautiful area.

Comments Received During Public Comment Period on the Proposed Plan for the Remediation of 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6

Commenter #103:

Mike Conlan 7/15/11

Comment A:

US Department of Energy, WA Department of Ecology;

ALL radioactive & chemical liquid waste need to be removed NOT down to 2 feet or 15 feet - ALL of it.

Commenter #104

Karen Axell, 8/17/11 via e-mail

Comment A:

I am writing to urge you to clean-up NOT just cover-up the waste at Hanford.

There is radioactive waste known to be at least 100 feet down which is already in the groundwater moving toward the river.

There is enough Plutonium buried in the soil at Hanford to make 70 nuclear bombs. Plutonium is what made Fukushima so dangerous. Plutonium, Cesium and other radioactive and chemical wastes should be dug up, digging down 40 or more feet where needed to meet standards to protect both groundwater and future excavation exposure not left under a dirt cover. Digging foundations deeper than 40, or even 100, feet is common. For the DOE to dig no deeper than 2 (or even 15 feet) is inexcusable and dangerously inadequate.

Commenter #105:

Bob Johannsen, 8/4/11 US Mail

Comment:

Suggestions: Clean up all Plutonium and TRU elements, not just the first 2 feet. Hire an independent auditor to confirm status and progress of all actions taken.

Commenter #106:

Jack Lunden, 8/4/11 via US Mail

Comment A:

I recently attended the public hearing in Hood River regarding proposed cleanup actions @ Hanford's Central Plateau/ 200 Areas. Hanford is the curse of my father's generation placed upon us all. I strongly recommend and believe that the cleanup actions need to go much further than proposed. Concerning the half-life of plutonium, as much of this material as possible needs to be removed, treated, and stored in a deep geological repository.

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Commenter #108:

Mike Conlan, (8/19/11)

Comment A:

Pleasw, EPA and WA Ecology insist that Plutonium, Cesium other radionuclides and chemicals be dug up and removed at all sites, not stopping at 2' or 15'.

Commenter #109:

Dvija Michael Bertish

Comment A:

Submitted by: Dvija Michael Bertish, Director of Environment & Conservation, Rosemere Neighborhood Association

Members of the Rosemere Neighborhood Association [Rosemere] attended the public hearing on the proposed cleanup actions for Plutonium/Cesium waste sites on July 27, 2011 in Portland.

The cleanup action proposed by the Department of Energy is to remove plutonium and cesium from only the top two feet of soil in trenches or burial pits, then backfill with different soil.

Rosemere offers the following comments:

1) Removal of only the top two feet of soil to retrieve the noted contaminants is insufficient in that the contaminants have already sunk well below that level and have contaminated deep soils and groundwater. To achieve drinking water standards in the waste site area, then remediation must include deep soil removal. Plutonium/cesium are present as far down as 100 feet below surface soil levels, and remediation must remove all known contaminants, not just surface level contaminants. Removing only the first two feet of soil is dangerous, irresponsible, and negligent.

Commenter #112

Deb Muhlbeier

Comment:

I urge the EPA and WA Ecology to insist on the plutonium and cesium be dug up and removed at all sites and be sent to a geologic repository site.

Commenter #113

Heather Flanagan

Comment A:

Plutonium, Cesium and other radioactive and chemical wastes should be dug up at ALL sites, digging down 40 or more feet where needed to meet standards to protect both groundwater and future excavation exposure - not left under a shallow (2-15 feet) dirt cover.

Commenter #115

Hanford Advisory Board

Comment C:

In addition, the Draft Plan proposes to apply the RTD approach to the Z ditches in the 200 West Area by mixing clean top soil with lower layers of soil containing concentrated plutonium (blending) to qualify for disposal at the Environmental Restoration Disposal Facility (ERDF), rather than the Waste Isolation Pilot Plant (WIPP). The Board strongly disagrees with this approach.

In Advice #207, the Board specifically advised sending as much plutonium to WIPP as possible. Plutonium is “forever.” The high salt waste sites typically contain high plutonium concentrations in the near surface, making them candidates for the RTD remedy. Employing RTD for shipment to WIPP is the approach that would remove the plutonium (and the risks associated with that plutonium) from Hanford forever, and would result in a cleaner remediated site with substantially less plutonium permanently disposed in ERDF.

Commenter #115

Hanford Advisory Board

Comment D:

The Board advises the U.S. Department of Energy (DOE) to get as much plutonium out of these waste sites as possible.

Commenter #116

Nez Perce Tribal Executive Committee

Comment E:

- * NPT supports the remove, treat and dispose approach to remediating these waste sites. We believe that the contaminated soil underneath these wastes sites can be safely exhumed in a cost efficient manner using a dragline.

Commenter #111

Confederated Tribes and Bands of the Yakama Nation ERWM

Comment P:

We reiterate our concern that USDOE still lacks a comprehensive, integrated approach to the vadose zone. We believe that USDOE should perform interim and concurrent actions concerning the groundwater and the vadose zone to ensure that the cleanup of the source sites reduces risks to levels that are protective of Tribal subsistence uses without relying on long-term stewardship and permanent institutional controls.

We reiterate our recommendation that USDOE consider the following in developing a systematic approach to vadose zone cleanup:

- Potential future impacts from the deep vadose zone to groundwater and to the confined aquifer in 200 areas
 - Use of more publically available and advanced models for doing modeling to determine potential level of risk to human health and the environment.
 - Pursue an independent review of treatability technologies to apply to the deep vadose zone contamination problem.
-
- DOE should ensure that sufficient and additional funding is directed to address the vadose zone contamination problem.

Commenter #120

Hanford Challenge

Comment F:

Hanford Challenge urges the government to remove, treat and dispose of as much of the plutonium and cesium contamination as possible contained in the 21 burial grounds, regardless of how deep the contamination is found.

Comment G:

Hanford Challenge is a member of the Hanford Advisory Board, and as such agrees with and supports the advice to the Department of Energy as stated in its June 3, 2011 letter to the Department, which states on pages 2 and 3:

“Advice

- The Board advises the U.S. Department of Energy (DOE) to get as much plutonium out of these waste sites as possible.
- The Board advises DOE to implement a RTD policy for plutonium that emphasizes remediation of plutonium disposal sites. DOE policy should opt to ship eligible plutonium-contaminated soil to WIPP for geological disposal, permanently removing it from Hanford.
- The Board advises DOE to utilize a RTD approach when a high concentration of a radionuclide exists. This approach is consistent with established Board values.

Commenter #121

Heart of America Northwest and Heart of America Northwest Research Center

Comment A:

- EPA and WA Ecology require that Plutonium, Cesium other radionuclides and chemicals be dug up and removed at all sites, not stopping at 2' or 15'.

Comment I:

Heart of America Northwest and Heart of America Northwest Research Center (HoANW) along with the Hanford Advisory Board (6-3-2011) strongly urge adoption of Remove, Treat and Dispose remedies – not leaving Plutonium, other radionuclides and chemicals in near surface soils. This decision will also be a precedent for the 43 miles of unlined trench “burial grounds.”

Commenter #122

Fish and Wildlife

Comment:

The U.S. Fish and Wildlife Service (Service) appreciates the opportunity to comment on the Proposed Plan for the Remediation of the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units. Although personnel and time limit a thorough review, as with other actions on the Hanford site, we support the RTD of wastes on site and discourage capping waste in place.

The proposed plan preferred alternatives, in general, will leave waste in place in several instances. This is based, in part, on the results of the screening-level ecological risk assessment where contaminants below the biologically active zone (i.e. 15 feet bgs) are not considered to be biologically available. See for example page B.1: “The Hanford Site-specific data indicate the shallow-zone soil (<4.6 m [15 ft] bgs) is the primary contaminated medium of concern for ecological receptors. Waste sites were considered inaccessible to ecological receptors under either current or future conditions if the contamination was deeper than 4.6 m (15 ft) bgs.” The Service is concerned with this assumption and believes it is inappropriate and not supported by the best available science. We encourage the Department of Energy (DOE) to consider contaminants deeper than 15 feet below ground surface as potentially biologically available for the reasons outlined in our detailed comments (attached). Since the decisions to stop removal at a shallower depth were made, in part, on an assumption that there will be no reduced risk and thus no additional benefit compared to the added cost of deeper excavation, we feel it is important to revisit risk decisions based on the assumption of no bioavailability of contaminants at depths greater than 15 feet bgs. Additional on-site studies of rooting depth may be necessary.

Commenter #124

Confederated Tribes of the Umatilla Indian Reservation

Comment H:

Plutonium as an Attractive Nuisance

Minable quantities of plutonium represent an attractive nuisance to future inhabitants. Presently, the total amount of plutonium associated with the 200-PW-6 OU cribs and trenches is estimated to be greater than 50 kilograms and most likely more than 100 kg. It is conceivable that someone living in the future could recover plutonium from the soil beneath the 200-PW-6 OU cribs and trenches using construction or mining equipment and techniques available today. The process of extracting plutonium from a sand matrix is simple and straightforward. The chemistries for the extraction of plutonium are well known, and numerous practical processes are conceivable. The equipment needed to perform these extractions might include polyethylene or stainless steel tanks, mixers, pipes, pumps and other readily available components. [Parenthetically, if the technologies are available today, they could be used for remediation today.]

Removing or reducing the concentration of plutonium closest to the surface, then capping and using administrative controls to attempt to prevent access does not remove the attractive nuisance. A person living in the future, with sufficient means and knowledge, could develop countermeasures to any administrative controls. Leaving large quantities' of plutonium behind can provide sufficient motivation for someone to attempt its recovery. This reasoning is not without precedent. The consequences to a future society of a properly motivated individual exploiting the "resource" for nefarious purposes could be devastating. If the plutonium is judged to not be mobile, then this scenario has even greater likelihood. Just as with glass making, at one time the techniques and recipes required for the initial fusing of glass from raw materials was a closely guarded technological secret reserved for the large palace industries of powerful states. The same might be said for construction of nuclear weapons in the future.

Remove all cesium

COMMENTS

Commenter #7:

Alera Walker

Comment A:

I'm here to say that the EPA and Washington Ecology should insist that plutonium, cesium, and other chemicals are dug up and removed at all of these sites, and they should have a cleanup standard for plutonium on Hanford's Central Plateau which is just as protective as the level of the cleanup being used at Lawrence Livermore National Lab because that shows that it is possible, or even the same -- the same strictness as they have for the Hanford sites that are closer to the river.

Commenter #22:

Chandra Radiance

Comment F:

Or DOE should remove rather than cap cesium waste sites.

DOE rejected an alternative that would have involved digging down 15 feet into cesium-polluted and highly-radioactive areas in the 200 east area. Instead DOE proposes to add a soil cap over these areas. We urge DOE to reconsider the more protective alternative of digging up the cesium waste sites.

Commenter #31:

Paige Knight

Comment D:

Capping cesium or blending clean topsoil with contaminated soil is a sloppy and unconscionable approach.

Commenter #41:

Chuck Johnson

Comment B:

And secondly, to support our staff member, Dan Serres, position that the cesium waste should be removed and placed in at the ERDF facility, onsite, at that additional cost. It adds one less thing that we have to keep track of.

Commenter # 57:

Illar Walker, Seattle, WA

Comment:

The E.P.A. and Wa. Dept of Ecology should insist that plutonium, cesium, and other dangerous chemicals are dug up and removed at all sites. They should adopt a cleanup standard for

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plutonium on Hanford's central plateau which is as protective as Lawrence Livermore National Lab, or for Hanford's near river sites.

Commenter #58:

J.Sherer, Hood River, OR

Comment C:

To me, service and protecting, means the following: Remove, DO NOT CAP, cesium waste sites

Commenter #59:

Sarah Brooks, Portland, OR

Comment C:

Also- just soil capping cesium waste sites is not effective! We demand a better approach!

Commenter #61:

no name, no address, Portland meeting

Comment :

You must "RTD" the "high salt" and only "cesium" sites you are currently proposing 2 ft removal at.

Commenter #74:

Oregon Department of Energy, 7/19/11

Comment J:

The *draft Proposed Plan* proposes to apply the RTD approach through ordinary excavation methods which would, as a part of these methods, mix (or blend) clean adjacent soil with layers containing concentrated plutonium such that the waste may qualify for disposal at ERDF rather than at WIPP. Oregon strongly recommends that DOE utilize a more "surgical removal" methodology, being careful to avoid dilution of the plutonium deposited layer. This would maximize the amount of plutonium shipped to WIPP, while minimizing the amount of material that needs to be disposed. Placing this waste in geologic disposal is consistent with WIPP's mission and would permanently remove it from the near-surface environment. We do not believe that WIPP's statutory limitations on waste volume and curie content will limit acceptance of additional waste excavated from the "High-Salt Waste Group." In addition, DOE should work with WIPP to gain approval on classifying this waste stream as "homogenous," to reduce characterization and documentation costs related to disposal at WIPP.

Commenter #101:

Stacey Stockton, 8/11/11

Comment B:

3. Cesium and other radioactive wastes (half life of 300 years- are you kidding me ?) You need to "unobject" to deeper digging for the safety of our environment and the people of this region.

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Commenter #104

Karen Axell, 8/17/11 via e-mail

Comment A:

I am writing to urge you to clean-up NOT just cover-up the waste at Hanford.

There is radioactive waste known to be at least 100 feet down which is already in the groundwater moving toward the river.

There is enough Plutonium buried in the soil at Hanford to make 70 nuclear bombs. Plutonium is what made Fukushima so dangerous. Plutonium, Cesium and other radioactive and chemical wastes should be dug up, digging down 40 or more feet where needed to meet standards to protect both groundwater and future excavation exposure not left under a dirt cover. Digging foundations deeper than 40, or even 100, feet is common. For the DOE to dig no deeper than 2 (or even 15 feet) is inexcusable and dangerously inadequate.

Commenter #107:

Marshall Goldberg, 8/11/11 via US Mail

Comment B:

Cesium contaminated soil should be removed (at least to 15 feet), treated, and disposed of in a safe long-term secure manner.

Commenter #108:

Mike Conlan, (8/19/11)

Comment A:

Pleasw, EPA and WA Ecology insist that Plutonium, Cesium other radionuclides and chemicals be dug up and removed at all sites, not stopping at 2' or 15'.

Commenter #111

Confederated Tribes and Bands of the Yakama Nation ERWM

Comment LL:

Cesium-137 Waste Group: The USDOE preferred alternative, is a modified barrier as the remedy for the Cesium-137 waste sites, leaving contamination in place. The ERWM Program does not

support this alternative The ERWM Program requests the preferred alternative be RTD of all shallow contaminated soils. We support and encourage USDOE to dig below fifteen (15) feet in places where deeper excavation completely or nearly eliminates (90% or more) of waste site residuals by removing them.

Commenter #113

Heather Flanagan

Comment A:

Plutonium, Cesium and other radioactive and chemical wastes should be dug up at ALL sites, digging down 40 or more feet where needed to meet standards to protect both groundwater and future excavation exposure - not left under a shallow (2-15 feet) dirt cover.

Commenter #115

Hanford Advisory Board

Comment B:

The Draft Plan proposes to cover the cesium waste sites in 200-PW-3 with additional soil to achieve a 15-foot thick “cap” thought to be protective of human health for 300-400 years of institutional control. The Board disagrees with this solution. Use of the Remove/Treat/Dispose (RTD) approach for this waste is consistent with the Board’s Central Plateau Remedial Action Values Flowsheet (Advice #173).

In the case of the five Cesium Sites, most of the cesium-137 appears to be accessible within the top 15 feet of the disposal site, which would make these sites a good candidate for RTD. The configuration of these waste sites provides an excellent opportunity to remove the clean top soil in order to access the concentrated layer of radionuclides.

Comment I:

The Board advises the proximity of cesium-137 to the surface necessitates implementing an RTD approach in order to dispose of cesium into the ERDF burial ground.

Commenter #116

Nez Perce Tribal Executive Committee

Comment E:

- * NPT supports the remove, treat and dispose approach to remediating these waste sites. We believe that the contaminated soil underneath these wastes sites can be safely exhumed in a cost efficient manner using a dragline.

Commenter #117

Columbia Riverkeeper, 8/31/11 via e-mail

Comment K:

Similarly, rather than employing a remove-treat-dispose strategy for cesium waste sites, U.S. DOE concludes that a combination of institutional controls and soil caps will be a cheaper, protective option. However, U.S. DOE draws this conclusion based on the assumption that the public will be prevented from accessing the subsurface of highly radioactive cesium-polluted liquid waste sites. The Hanford

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Advisory Board encouraged U.S. DOE to adopt a more protective approach by digging up cesium-contaminated sites in Hanford's 200 area. In part, the HAB encouraged removal of contaminated soil in cesium sites because the depth of contamination is relatively shallow and accessible, making these sites suitable for an RTD approach. Again, U.S. DOE should evaluate how a more aggressive RTD approach might diminish the costs of institutional controls over the next 300 years.

U.S. DOE's proposal to heap soil on top of waste sites, rather than to excavate radioactive cesium, is a —novel approach|| according to the U.S. EPA. In determining that the proposed alternative will be protective of the environment, U.S. DOE concluded that 15' of soil cover would be maintained for the 300 years needed for the cesium to decay to safe levels. While 300 years is a more reasonable timeframe for institutional control than 240,000 years, the overwhelming majority of public comments and the advice of the HAB note that the risk of failures in institutional controls should prompt U.S. DOE to dig up cesium wastes that are relatively shallow and readily accessible.

Commenter #120 Hanford Challenge

Comment J:

The Board advises the proximity of cesium-137 to the surface necessitates implementing an RTD approach in order to dispose of cesium into the ERDF burial ground.

Commenter #121 Heart of America Northwest and Heart of America Northwest Research Center

Comment O:

5 Highly Radioactive Cesium Sites (200-PW-3 in 200 East Area)

- USDOE's proposed cleanup plan:
Cover-up, not clean-up
- Cover with 15 feet of soil
- "maintenance and/or enhancement of the existing soil cover to ensure that the potential exposure pathways are broken... provide a minimum of 4.6 m (15 ft) of cover over the waste..."
- Cesium in tank farms has migrated all the way to groundwater...
- So why would USDOE or regulators believe the Cesium in these sites won't migrate?
- Why do they believe no one will excavate? The maximum reasonable exposure scenario for all of these units should include the high likelihood that construction excavation, e.g., for utility lines, will breach the unit and go down twenty to thirty feet.

We urge that the Cesium sites be retrieved and wastes treated, not covered up with fifteen feet of dirt!

Commenter #124

Confederated Tribes of the Umatilla Indian Reservation

Comment L:

Cesium Waste

For the waste sites with cesium-137, the current depth to this waste is between 12 and 15 feet. This is easily excavated for disposal. Rather than construction of an additional layer or barrier on top, the waste from this site should be excavated and eliminated from any additional long-term monitoring.

Dig Deeper than two feet

COMMENTS

Commenter #2

Dale Engstrom

Comment C:

The real one to worry about is the high-salt plutonium waste disposal sites. The reason they are a problem is because a lot more plutonium ended up there. As an example I see on the chart over here for the Z-1 field that there's 57 kilograms of plutonium in there. And in the Z-9 trench there's 48 kilograms of plutonium in there. And Dirk tells me it only takes four to build a bomb. Now, you're right, it has to be refined and it has to be made into a better product ut [but] there's the beginning of something there just for an idea of what we're talking about.

So what I would like to propose, what I would like to make a comment on is I don't think you're going far enough. I again reiterate the idea that you're taking out just two feet at the bottom of the trench. You're going to get about 48 to 50 percent of what's in there but we're talking about Z-9 in that case. And you can go just a few more feet as Dick Smith was saying and you could get maybe 89 percent of what is in there. And while you're already there this could be done with an observational approach. And one of the problems you're going to run into with places like Z-9 is when the water ran down the trench there was places that plutonium was being deposited and there were other places where it wasn't. And so it's going to be a very almost mining sort of method moving through the trench cleaning up the stuff that's in there. And as you run into the stuff that you run into in terms of plutonium that would be a good time to extract it and remove it.

Commenter #22:

Chandra Radiance

Comment E:

DOE should consider a broader range of alternatives for cleaning up these waste sites. DOE's proposed plan stops short of an adequate cleanup, leaving waste below two feet under the bottom of its liquid waste disposal sites in place.

DOE argues that other alternatives such as digging down 37 feet will be too expensive. At the very least DOE should aim to remove 90 percent of the plutonium as it proposed to do in other areas such as the low-salt waste sites.

Commenter #36:

Chris

Comment B:

Maybe two feet is not okay if we went 18 feet. But anyway, it's helpful.

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Commenter #39:

Audience Member

Comment B:

Maybe not the full 18 feet, but I think at the margin, greater excavation and greater removal of plutonium from the site can better preserve the possibility of real harm coming to people in the future.

Commenter #56:

no name, Richland, WA

Comment:

I believe that for the 216-Z-Tile field, DOE should dig the 22 feet an attempt to get 84% of the waste.

I believe that the plans for 200-PW-1 and 200-PW-6 are good. Leaving tanks is the best option. Removing them & taking the "parts" to ERDF is a waste of time & money and is a risk to the workforce.

Commenter #59:

Sarah Brooks, Portland, OR

Comment D:

Digging deeper again is crucial until no radioactive waste remains!

Commenter #60:

Sophia Gidlund/Geoff Guillory, Portland, OR

Comment B:

You must "RTD" the "high salt" and only "cesium" sites you are currently proposing 2 ft removal at.

Commenter #62:

(Sabine Hilding, Portland) PLEASE DO NOT POST ON INTERNET) comment for internal use only.

Comment:

It is not acceptable to "clean" only the top two feet of Hanford soils. In some places serious radioactive pollution is much deeper because of the porous nature of the soils rainwater can percolate pollution into ground water and into the Columbia River wind and fire can also expose shallowly "cleaned" soils.

The Department of Energy owes the American public an investment in "cleaning" radionuclides of all kinds, and in removing long term radioactive pollutants resulting from munitions production and power production.

The fact that there is a possible 70 nuclear bombs worth of plutonium at various levels in Hanford soils is not acceptable.

Additionally, the “buffer” zone of the 585 square miles of Hanford around its Central Plateau must remain. Less severely polluted lands should not be used by any industry.

Commenter #74:

Oregon Dept of Energy, 7/19/11

Comment B:

High-Salt Waste Group: We are pleased that the Tri-Party agencies have taken previous comments into consideration and the *draft Proposed Plan* includes proposals to excavate contaminated soil and debris from a number of the waste sites. In the case of the “High-Salt Waste Group,” limiting the proposed excavation to “up to two feet” is inadequate and insufficient to ensure long-term protectiveness. In addition, the logic that the Tri-Party agencies provide in the *draft Proposed Plan* to support this proposed action is flawed. Further comments on this waste group are provided below.

Comment F:

Further Discussion of the High-Salt Waste Group

By proposing to remove up to two feet of contaminated soil at the bottom of these waste sites, the Tri-Parties acknowledge that large amounts of plutonium in the near surface pose a risk that must be addressed. The *draft Proposed Plan* points out that “because (plutonium) wastes have longer half-lives, it is disposed of more cautiously than other radioactive wastes,” a reference to deep geologic disposal at the Waste Isolation Pilot Plant (WIPP).

The Tri-Parties presume that an arbitrary depth of two additional feet will excavate the “highest concentrations of contaminated soils.” The *draft Proposed Plan* does not provide sufficient characterization data to support that assertion. The *Feasibility Study* points out that plutonium was detected up to 121 feet below both the Z-9 Trench and the Z-1 A Tile Field and in significant concentrations well below the two foot mark. We believe that excavating as little as two additional feet within these waste sites, as well as in the Z-18 Crib, will leave substantial amounts of plutonium in relatively shallow burial (the *Feasibility Study* estimates as much as 128 kilograms of plutonium remain in these three waste sites).

The *draft Proposed Plan* provides no assurances or explanation for what criteria would be used to assess whether the proposed cleanup action in these waste sites is protective. For the “Z Ditches,” the *draft Proposed Plan* proposes that “sampling would be conducted to verify the remediation meets cleanup standards.” There is no comparable language or explanation for the “High-Salt Waste Group.” Depth alone – a physical measurement – neither defines nor provides an assessment of risk or compliance with cleanup standards. Depth in inches or feet is an inadequate way to gauge risk reduction or adequacy of cleanup. The remedial plan should be based instead on specific contaminant concentrations as measures of when additional removal is – or is not – required.

Comments Received During Public Comment Period on the Proposed Plan for the Remediation of 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6

Commenter #87:

Paige Knight, 7/28/11

Comment B:

The Central Plateau must be cleaned up with due diligence. It must be done to the highest degree possible through the testing and removal of contaminants in hot spots, treatment of waste and safe disposal. The proposed excavation of 2 ft below the cribs is unacceptable. According to the Oregon Department of Energy contamination was found up to 121 feet deep at some spots.

Commenter #107:

Marshall Goldberg, 8/11/11 via US Mail

Comment A:

I do not believe the DOE proposal to remove contamination only to the two foot level below trench & drain sites ("high salt") is sufficient (50% of plutonium left behind). 90% would be removed by deeper excavation (10 feet) and is essential

Commenter #111:

Confederated Tribes and Bands of the Yakama Nation ERWM

Comment D:

storage of such wastes on the Hanford site. The ERWM Program considers removal of a significant portion to be at least 90% to 96% waste removal. We request USDOE edit RTD options to reflect a more stringent risk level and to define 'remove significant portion' as *removal of at least 90% of waste*. We request all structural and piping components to be similarly remediated along with their associated waste sites.

Comment X:

The ERWM Program considers removal of a significant portion to be at least 90% to 96% waste removal. We request USDOE edit RTD options to reflect a more stringent risk level and to define 'remove significant portion' as *removal of at least 90% of waste*. We request all structural and piping components to be similarly remediated along with their associated waste sites.

Comment FF:

216-Z-Ditches Waste Group: The ERWM Program requests the preferred alternative be RTD of all shallow zone contaminated soils. We support and encourage USDOE to dig below fifteen (15) feet in places where deeper excavation completely or nearly eliminates (90% or more) of waste site residuals by removing them.

Comment KK:

Remediation of the U-Pond is unclear. The ERWM Program requests clarification. The ERWM Program requests RTD of shallow zone contaminated soils. We support and encourage USDOE to dig below fifteen (15) feet in places where deeper excavation completely or nearly eliminates (90% or more) of waste site residuals by removing them.

Comment MM:

High-Salt Waste Group: The USDOE preferred alternative is RTD Option A, removal of the highest concentration of contaminated soils two (2) feet below the base of the waste site and a barrier. Characterization information presented in DOE/RL-2007-27, DRAFT C indicates excavation of the 'mass' source of long-lived radionuclide wastes to a depth of forty (40) feet removes approximately ninety-six (96) percent of wastes. The ERWM Program requests the RTD Option 3C-removal (to at least forty (40) feet below ground surface) of contaminated soils. We anticipate removal of structures associated with these waste sites, placement of an appropriately designed soil barrier, and continuation, as needed, of the SVE system will be included in this option.

Low-Salt Waste Group: The USDOE preferred alternative is RTD Option C, which removes a significant portion of plutonium contamination, two (2) feet beyond that for Option A.

No soil characterization was performed for some of the cribs. Given this uncertainty, the ERWM Program does not support this alternative. We request the preferred alternative is Option 3C with modification, i.e., removal to at least forty (40) feet below ground surface of contaminated soils. We request USDOE conduct soil sampling within the crib boundaries to identify the type, concentration and extent of the contaminants. We anticipate removal of structures associated with these waste sites, placement of an appropriately designed soil barrier, and as needed, a SVE system will be included in this option.

Commenter #114

Robert Watkins

Comment A:

I attended the public meeting in Richland on the Proposed Plan for Remediation of Waste Sites in Hanford's Central Plateau, and have the following comment:

I disagree with the selection of "Option A" as the preferred alternative for remediation of the High Salt Waste Group (216-Z-1A Tile Field). Option A proposes to excavate only to a depth of 20 feet below ground, or 2 feet below the bottom of the tile field. As shown on one of the backup slides from the public meeting, excavation to this depth will only remove about 51% of the Plutonium inventory in the soil. Extending the excavation by only another 6 feet (26 feet below ground) would remove 90% of the PU contamination.

I urge DOE to consider going at least another 6 feet deeper in order to cleanup an additional 40% of the contamination.

I realize this is a difficult decision as to where to “draw the line”. Some people would argue to go deeper yet and remove 95% of the Pu, or even 99%, but the depth increases rapidly for each additional percentage after you pass the “knuckle” of the curve at about 26 feet. The incremental cost of going 6 feet deeper is relatively small compared to the base cost of excavating the waste site to 20 feet. This extra depth could probably be removed using small backhoes, without removing additional overburden.

This same argument may be applicable to other waste sites in the Central Plateau, but I do not have the other contamination distribution curves by depth for comparison. If the same situation does exist for other preferred alternatives, I urge DOE to reconsider the proposed final depths of these excavations also. The amount of contamination to be removed by excavation should be optimized for each waste site, as balanced with the cost of going deeper.

Commenter #124

Confederated Tribes of the Umatilla Indian Reservation

Comment G:

Excavation Depths

For the high-salt waste sites, the report claims (page 37) that excavating the waste to 15 feet removes any contamination to threaten human health, but excavating to greater depths would not provide additional beneficial protection to groundwater. This is assuming that the plutonium cannot be mobilized as some time in the future. The RTD option is also ranked low because of the “challenges of excavating to 90 feet”. The workshop that the Tribes and the WA State Dept of Ecology held regarding industrial technologies that could be used at Hanford showed that the depth of excavation is not a challenge with currently available technology. Excavations deeper than 15 feet should be a reasonable cleanup goal...especially with the view of potential future contamination mobilization outlined below.

Ship plutonium off-site

COMMENTS

Commenter #2

Dale Engstrom

Comment G:

To put it somewhere where it will be safe which is deep geologic disposal and to get it out of where it is now.

Commenter # 3

Susan Leckband

Comment C:

And if we can get the plutonium which does have a huge half-life, get it in a deep geological repository I believe that's where it belongs.

Commenter #4:

Tom Carpenter

Comment E:

Therefore, there needs to be a very rigorous effort to make sure that all the plutonium that we can remove from that site is taken from that site and processed and treated and put into a deep geological repository even if it costs a lot of money. It is not the most important thing. This stuff is dangerous for a quarter of a million years. And there's nothing we know about how to do – how to neutralize that except let it decay away somewhere far away from us.

Commenter #7:

Alera Walker

Comment B:

And I think also plutonium, when they dig it up, it should be sent to a geologic repository instead of just leaving it near the surface because it will spread.

Commenter #9:

Margaret Swartzman

Comment A:

Again, my name is Margaret Swartzman, and I just want to say how impressed I am with Tom's comments and various other people here. Definitely Hanford is a disaster, and we're all trying to deal with it. And I hope -- I really do want to put my trust in you, and I have great doubts because the problem is so huge. And -- but our intent must be to go beyond what we think we can do, to do as much as we possibly can to put the plutonium and other materials in geological stable environments.

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Commenter #14:

Jurgen Hess

Comment C:

I think certainly for the plutonium take the cautious approach. Excavate it all, bring it to the salt caves in New Mexico.

Commenter #20:

Robbie

Comment B:

Covering something with 15 feet of soil, I presume that in Hanford they have winds, and there is water erosion. And 15 feet of soil for 10,000 years or for what is -- for -- anyway it is not enough. And it needs to be -- what needs to be required is to have it sent to New Mexico. That's my bottom line, and I am glad that we know a lot more about radiation and it's gift and limitations.

Commenter #22:

Chandra Radiance

Comment C:

Simply put, DOE should dig deeper, remove as much plutonium as possible and send this long-lived waste to a deep geologic repository at the waste isolation pilot project in New Mexico.

Commenter #31:

Paige Knight

Comment E:

The serious waste needed to be disposed of at Waste Isolation Pilot Plant in New Mexico -- or they need to be disposed there.

Commenter # 57:

Illiar Walker, Seattle, WA

Comment:

The plutonium should be sent to a repository, because if it's left near the surface it will spread, as it has in the 200-PW-1 sites, where already plutonium has been found 100 ft. deep.

Commenter #58:

J. Sherer, Hood River, OR

Comment C:

To me, service and protecting, means the following: REMOVE, TREAT, DISPOSE. → TO WIPP in New Mexico

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Commenter #74:

Oregon Department of Energy, 7/19/11

Comment G:

Oregon's disagreements with DOE's position that plutonium does not move in the Hanford subsurface have been long documented through correspondence and meetings over the past several years. We will not repeat those arguments here, other than to point out that even if DOE's position was accurate, given the very long 24,000 year half-life of plutonium 239, there is no way to ensure that soil conditions, climatic conditions, and future surface land use will not change such that it might remobilize the plutonium or move the plutonium containing soil to the surface. Removing the plutonium and disposing of it in WIPP, one-half mile below the surface in an ancient salt formation, does provide that long-term protectiveness.

Commenter #87:

Paige Knight, 7/28/11

Comment D:

The serious wastes need to be disposed at the Waste Isolation Pilot Project in New Mexico—saving pennies at the expense of present and future citizens is pound foolish. (Note the increasing threats to our health and the costs of health care.)

Commenter #89:

Lyrik Pitzman, 7/29/11

Comment D:

These materials should be removed and disposed of in a proper facility (far away from the largest river in the pacific northwest).

Commenter #91:

Daniel Dancer, 7/30/11

Comment B:

Please sent all plutonium to a geologic repository.

Commenter #100:

Genny Kortes, 8/10/11

Comment:

and to have them removed to some other safe repository. I do not want them hauled on our nation's highways.

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Commenter #104

Karen Axell, 8/17/11 via e-mail

Comment D:

Finally, all Plutonium that is dug up should go to a deep underground repository, not reburied in a shallow landfill at Hanford.

Commenter #106:

Jack Lunden, 8/4/11 via US Mail

Comment B:

Concerning the half-life of plutonium, as much of this material as possible needs to be removed, treated, and stored in a deep geological repository.

Commenter #108:

Mike Conlan, (8/19/11)

Comment B:

Insist that Pu be sent to a geologic repository.

Commenter #109:

Dvija Michael Bertish

Comment C:

2) Any and all removal actions of the noted radioactive contaminants must be relocated to a licensed deep underground repository such as WIPP. Rosemere objects vehemently to any proposal where radioactive contaminants are retrieved and then burned or reburied in pits, even if they are lined and capped.

Commenter #109:

Dvija Michael Bertish

Comment G:

6) The radioactive half life of the contaminated materials will outlast any man-made barriers. Thus soil backfill and capping, or other minimal attempts at constraint of contamination will be insufficient methods of control. Deep geologic storage is the only viable answer to this problem that could be present for tens of thousands of years.

Commenter #111

Confederated Tribes and Bands of the Yakama Nation ERWM

Comment B:

Mixed Low-Level and Transuranic Mixed Waste Cleanup: Most of the waste sites in the 200-PW-1 and 200-PW-6 OUs have transuranic contaminants (or transuranic constituents) in the soil at various depths. The contaminated soil and debris excavated from these sites that contain alpha-emitting transuranic isotopes with half-lives exceeding 20 years in concentrations that exceed 100 nCi/g require disposal offsite at WIPP. Remedies that may generate transuranic waste must

Comment K:

Summary of Remedial Alternatives (disposal costs): The disposal costs at WIPP and ERDF are listed as \$44,000 per cubic meter and \$100 per cubic meter, respectively. There is no backup for these unit costs, but it seems that the substantial difference presumably introduces a strong bias to disposing of contaminated material onsite. The basis of the costs should be presented to demonstrate that a reasonable comparison can be made. The Yakama Nation supports disposal of TRU waste at WIPP or a similar offsite, deep disposal facility.

Comment HH:

Z-Ditches. The remedy should include these soils in the RTD remedy. The plutonium and americium concentrations shown on the figure indicate that this material should be transported to WIPP for disposal as TRU waste. Figure 6-2 also summarizes sample results that exceed the ERDF disposal criteria of 100 nCi/g, and reference "statistical outliers" that are orders of magnitude above the ERDF criteria. Rather than dismiss these sample results as outliers, DOE should resample these areas to investigate the nature and extent of the highly contaminated material. Additionally, Figure 2-4 in the FS (DOE/RL-2004-24, REV 0) shows borehole C3808 and

Commenter #113

Heather Flanagan

Comment D:

- The dug up Plutonium should all go to a deep underground repository, not reburied in a shallow landfill at Hanford.

Commenter #115

Hanford Advisory Board

Comment C:

In addition, the Draft Plan proposes to apply the RTD approach to the Z ditches in the 200 West Area by mixing clean top soil with lower layers of soil containing concentrated plutonium (blending) to qualify for disposal at the Environmental Restoration Disposal Facility (ERDF), rather than the Waste Isolation Pilot Plant (WIPP). The Board strongly disagrees with this approach.

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In Advice #207, the Board specifically advised sending as much plutonium to WIPP as possible. Plutonium is “forever.” The high salt waste sites typically contain high plutonium concentrations in the near surface, making them candidates for the RTD remedy. Employing RTD for shipment to WIPP is the approach that would remove the plutonium (and the risks associated with that plutonium) from Hanford forever, and would result in a cleaner remediated site with substantially less plutonium permanently disposed in ERDF.

Commenter #115

Hanford Advisory Board

Comment E:

The Board advises DOE to implement a RTD policy for plutonium that emphasizes remediation of plutonium disposal sites. DOE policy should opt to ship eligible plutonium-contaminated soil to WIPP for geological disposal, permanently removing it from Hanford.

Commenter #116

Nez Perce Tribal Executive Committee

Comment F:

- * We expect that actinides with activities greater 100 nanoCi/g will ultimately be transferred to the Waste Isolation Pilot Project (WIPP) in New Mexico.

Commenter #118

Ruth Williams

Comment B:

Please do it right: clean it up! As you well know, transuranic wastes must be sealed in a deep underground repository. PCB's, Strontium, Cesium, and Carbon Tetrachloride must be contained and isolated from groundwater. You have done a much better job at other sites, so why skimp here? Sure it will cost more, but we need a jobs program anyway. For the sake of jobs today and a healthy environment for future generations, please clean it up!

Commenter #120

Hanford Challenge

Comment E:

The goals of this cleanup are sometimes difficult to understand. On the one hand, making Hanford safe for future generations is obviously important, but it seems like short term monetary concerns and time constraints get in the way of truly cleaning up Hanford. It may be a lot easier to dump the nuclear waste in a ditch on site, and for some of the waste that will probably be fine. But with waste like plutonium, which will in all likelihood outlive any

man made safety features, a different solution, like moving it to the Waste Isolation Pilot Project, should be given a higher priority, even if it is more expensive.

Commenter #121

Heart of America Northwest and Heart of America Northwest Research Center

Comment B:

- *Plutonium which is dug up should be sent to a geologic repository.*

Comment Q:

How should Plutonium (Pu) be disposed?

Plutonium should not be “mixed” with other dirt to be reburied in the ERDF cleanup landfill at Hanford (shown on map above in corridor between 200 E and W areas). Plutonium 239, with a half-life of 24,000 years, **needs to be buried in deep underground repositories**, where it can be isolated from the environment for tens of thousands of years. Starting in 1970, federal rules said all Plutonium and other long-lived “Transuranic” (TRU) elements (e.g., Americium) should go to a deep underground repository. USDOE operates such a repository in salt mines near Carlsbad, NM (the WIPP site). However, the quantity of TRU and Pu wastes in the soils at Hanford and other USDOE sites far exceed WIPP’s legal capacity limit. Instead of considering another repository, USDOE wants to either abandon Pu and TRU in the soil or mix it with other soil so it is below the legal limit for removal to WIPP and then rebury it in the cleanup landfill (ERDF) in the center of Hanford. In USDOE’s proposed cleanup decision, the cost of removal and burial to WIPP and the lack of capacity at WIPP are major factors driving USDOE and EPA to propose leaving Plutonium in the soil at Hanford or mixing it and reburying it in the central Hanford ERDF landfill. The cost comparison – for purposes of decision making in the RI/FS and CERCLA process should include the costs of cleanup alternatives at Hanford, NOT including the fully burdened costs of disposal of TRU waste in the WIPP repository. Those costs are borne by a separate USDOE program and the sunk / capital costs are incurred regardless of whether or not the Plutonium in these units is exhumed and sent to WIPP or another hypothetical repository.

Bottom Line: Plutonium does not belong in surface landfills any more than it belongs in the old Plutonium cribs and ditches.

Plutonium is mobile

COMMENTS

Commenter #2

Dale Engstrom

Comment A:

Once again I'm Dale Engstrom and I'm from Oregon. And I'm not speaking for Oregon. I'm speaking for myself. As a citizen of Oregon we worry about what comes down the river and what comes down the river comes from Hanford in terms of groundwater. And J. D. was absolutely right that Dirk and I who work together do worry a lot about the mobility of plutonium. And that's a question that hasn't been answered very well and we need to look some more at it and I'm going to provide you with a citation list. But let's go to this project, this problem, and talk about our concerns.

Commenter #3

Susan Leckband

Comment A:

I don't think I need the microphone. I've got a pretty loud voice. I'm speaking for myself now, not the Hanford Advisory Board. I struggled with the slide that J. D. presented with the curve. I struggled with the slide that J. D. presented with the curve. I really struggled with that because it is predicated on the assumption that plutonium isn't mobile. And I guess I'm not a scientist and I'm not so convinced that that's absolute.

Commenter #4:

Tom Carpenter

Comment C:

So based on 30 years of studies, we know that plutonium won't move. I don't buy it.

Commenter #7:

Alera Walker

Comment B:

And I think also plutonium, when they dig it up, it should be sent to a geologic repository instead of just leaving it near the surface because it will spread.

Commenter #22:

Chandra Radiance

Comment D:

Given the extremely long half lives of plutonium of 24,000 years and other contaminates, DOE and EPA cannot assume that leaving this contamination is protected. DOE's plan rests on the false assumption that plutonium in the soil will remain immobile for thousands of years.

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Given the highly dynamic geology of the Columbia River basin over tens and thousands of years, DOE should not make this assumption.

Additionally, DOE's own sampling shows that plutonium has migrated deep into the soil. Clearly plutonium poses a long-term risk to groundwater and the Columbia River.

Commenter #31:

Paige Knight

Comment B:

In the early days of cleanup of the site the public was told that it would take 1,000 or more years for the plutonium that contaminates this 10-square miles and more of the Hanford site to reach the Columbia. A few years later, and I remember this meeting clearly, it was the Oregon Hanford Cleanup Board Meeting, Ken, where the Department of Energy informed us that they had discovered the plutonium was much more mobile than they thought and it was moving more quickly. So I want people to take note of that and most of you probably suspected it any way.

Commenter #54:

Gerry Pollet

Comment C:

And the modeling for the first landfill we were just talking about shows, indeed, even with a liner it will leak and contaminate the groundwater. Chemicals and radionuclides. But trust us. This stuff won't move. Has no liner, but it won't move. At all costs, we will achieve drinking water standards.

Comment F:

Same with the radioactive iodine and technetium and cesium will move -- these sites were located in places where the energy department also discharged hundreds of thousands of liters of really, incredibly good solvents from moving plutonium and cesium.

Comment H:

On that, one of the documents relied upon had this to say –

MR. NILES: Jerry, I want to just tell you we've got one more person waiting to speak.

JERRY POLLET: Okay. Unexpected high migration of plutonium in the past suggests possible unexpected exposures in the future. Plutonium americium have migrated to unexpected depths due to primarily to the unique features of the organic wastes disposed.

Commenter #66

Chris Pew

Comment B:

The fact is that Pu and other harmful toxins are mobile – now or in the future -- and present a threat to human health and the environment.

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Commenter #91:

Daniel Dancer, 7/30/11

Comment C:

Please sent all plutonium to a geologic repository. It does not belong near the surface where it spreads so easily.

Commenter #93:

John Howieson, 8/1/11/11

Comment C:

Oregon Physicians for Social ResponsibilityWe agree with the Oregon Department of Energy position that the greater health hazard resides with the "high salt" deposits of Plutonium because these wastes are judged to be more mobile than the Cesium waste.

Commenter #109:

Dvija Michael Bertish

Comment H:

7) Rosemere rejects DOE's assertion the plutonium does not migrate through soils. The presence of plutonium already in deep soils points to this faulty assumption. Geologic shifts and other climate events could potentially exacerbate the spread of radioactive waste at the site, therefore complete removal is required.

Commenter #111

Confederated Tribes and Bands of the Yakama Nation ERWM

Comment E:

Sampling and Modeling: Migration of contaminants, including plutonium, from the waste sites to groundwater should be considered and addressed in the proposed plan. Data acquired within the last 5 years indicate that significant plutonium contamination remains within the 200 Area and, in particular, in the vicinity of the 216-Z-9 covered trench. In less than 50 years, plutonium has migrated to depths of approximately one hundred and twenty (120) feet at concentrations that exceed EPA standards for geologic disposal (100 nCi/g). Such data provide strong evidence for the need to include plutonium as a contaminant of concern in the vadose zone and groundwater at these Operable Units (OUs). Moreover, DOE's draft Tank Waste EIS (Appendix U, Table U-2) indicates that plutonium migration in groundwater from the Central Plateau will reach the near shore of the Columbia River at levels more than three times the EPA drinking water limits.

Comment II:

material. Additionally, Figure 2-4 in the FS (DOE/RL-2004-24, REV 0) shows borehole C3808 and describes releases that may have traveled vertically to the Cold Creek unit and moved laterally on that unit. The nature and extent of such contamination should be further evaluated so that an appropriate remedy can be developed.

Commenter #116

Nez Perce Tribal Executive Committee

Comment C:

remediation to waste sites and views surface barriers as an interim measure. Plutonium and americium-241 remaining underneath the waste sites are slowly converting to more highly mobile isotopes such as neptunium-237.

Commenter #117

Columbia Riverkeeper, 8/31/11 via e-mail

Comment G:

A. U.S. DOE's plan falsely assumes that plutonium is "stable", or "immobile."

The U.S. DOE and its partner Tri-Party agencies have proposed a plan that relies on multiple assumptions that are highly disputed by Columbia Riverkeeper, the Hanford Advisory Board (HAB), Oregon Department of Energy, and the vast majority of the public comments during hearings in July 2011. The first and most glaring error is U.S. DOE's assumption that plutonium is not mobile in the soil at Hanford. Columbia Riverkeeper urges U.S. DOE to revise its analysis and acknowledge that, over the 240,000 years that it will take for radioactive decay to eliminate most of the plutonium, the plutonium remaining in the 200 Area could be mobilized through soil, into groundwater, and into the Columbia River. U.S. DOE fails to incorporate the best available science in asserting that plutonium will remain stable in Hanford's soil. First, U.S. DOE's analysis does not present a reasonable picture of the geologic variability that may impact Hanford's 200 area in the coming 240,000 years. Hanford's soil and its geologic formations could be altered in the coming eons by catastrophic geologic events. For example, roughly 14,000 years ago, glacial dams upstream of the Hanford site repeatedly failed, releasing massive flows of water through the Hanford site. These events, known as the Missoula floods, are known to have shaped large areas of the Hanford site.

Given the dynamic recent history Source. WA Dept. of Ecology of the Hanford site, U.S. DOE must assume that the geology and hydrology of the Hanford site is highly likely to shift over the next 240,000 years. As a result, U.S. DOE must evaluate the durability of its proposed remedies over a wide range of potential climatic conditions.

During the July 27th Portland hearing on the proposed plan, a member of the public asked U.S. DOE and U.S. EPA if shifts in climate had been incorporated into their analysis. U.S. EPA gave a direct response, stating that climate change was not factored into its selection of the preferred alternative. The proposed plan and supporting materials simply do not evaluate a reasonable range of climate conditions. The Tri-Parties cannot make a conclusion about the protectiveness of the proposed alternative without

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considering a broader range of climatic conditions. Changes in precipitation, Columbia River flows, and temperature are absolutely guaranteed to occur over the 240,000 years that plutonium on the site will remain dangerous. In terms of the proposed plan, the U.S. DOE cannot assume that evapo-transpiration barriers and other barriers that are designed to operate in our current climate regime will remain effective. Given the 24,000-year half-life of plutonium and the historic variability of Hanford's climate, the DOE must address the durability of its proposed plan in a range of future climate scenarios. This analysis is wholly lacking in U.S. DOE's proposal.

In addition to failing to evaluate the long-term geologic and climatic variability of the high-salt waste sites in the proposed plan, U.S. DOE dramatically understates the potential for subsurface transport of plutonium. The U.S. DOE does not fully evaluate whether chemical conditions in soils and soil-water on the Hanford will promote transport of plutonium during the 240,000 years during which the plutonium will remain dangerous. Indeed, recent studies suggest that sub-surface transport of plutonium is possible. Moreover, the presence of plutonium at depths of over 100 feet in the soil demonstrates that plutonium, under some conditions, is mobile. Hence, DOE's fate and transport modeling for Pu is contradicted by the recent migration of plutonium in the soil column.

U.S. DOE falsely concludes that Pu will remain stable in the soil because the groundwater and soil transport models in its analysis are inadequate. The fate and transport models that underpin U.S. DOE's conclusions for groundwater protection extend for only 1000 years, and they fail to incorporate the long-lived threat of Pu-239 and the long-term instability of the Hanford site.^{xi} As a result of its limited fate and transport model for groundwater, the proposed plan does not include preliminary remediation goals (PRG's) for groundwater for several long-lived contaminants, including Pu-239/240. This analysis fails to incorporate long-term risks to the public and the environment. U.S. DOE must evaluate the chemical and physical conditions that would promote plutonium transport and make a reasonable judgment about whether these conditions might occur in the next 240,000 years. 1000 years is not an adequate timeframe for assessing the risks of Pu transport in soils and groundwater.

We urge U.S. DOE to re-evaluate the fundamental assumption that Pu-239/240 will remain stable in the soils for the next 240,000 years. We concur with the Oregon Department of Energy, the Hanford Advisory Board, and hundreds of people who have commented that plutonium poses a long-term risk to human health and the environment. Because U.S. DOE makes the flawed assumption that Pu will remain stable in soils for 240,000 years, and because Pu is demonstrably mobile under some conditions that may occur over that timeframe, U.S. DOE must revise its plan for cleanup of plutonium-laden high-salt waste sites.

Comment O:

U.S. DOE's plan does not disclose the impacts of leaving waste in the soil near the Columbia River.

The proposed plan acknowledges that the proposed actions in high-salt waste sites will leave significant amounts of long-lived radionuclides in the soil at Hanford. Contamination in Hanford's soil can move into Hanford's groundwater. That groundwater, in turn, enters the Columbia River. Because of the extremely long-lived nature of plutonium and other radionuclides in the areas addressed by the proposed plan, the migration of these contaminants could reach the Columbia River. The U.S. DOE dismisses the transport of plutonium in groundwater, using models with short timeframes (1,000 years)

and excessive confidence in surface barriers. This fundamental flaw in U.S. DOE's analysis requires that the proposed plan be withdrawn and revised.

Commenter #119

Oregon Department of Energy

Comment:

On July 19, 2011, Oregon submitted written comments on the *Draft Proposed Plan for the Remediation of the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units*, DOE/RL-2009-117, Revision 0. This letter provides additional formal comments on Oregon's behalf.

Our July 19 comments expressed strong concerns with the *draft Proposed Plan* for proposing to leave potentially large amounts of plutonium in the three waste sites that make up the High-Salt Waste Group. The *draft Proposed Plan* contends this would be protective because plutonium will not move in the Hanford subsurface and therefore will pose no threat to people or the environment.

Our July letter referenced Oregon's disagreements with the U.S. Department of Energy's (DOE) position that plutonium does not move in the Hanford subsurface. Those disagreements have been well documented through correspondence and meetings over the past several years. Through this additional comment letter, we wish to further emphasize our concern that plutonium in the subsurface at Hanford is likely mobile. We are attaching a summary of recent literature on this topic, including extensive bibliographic material, to support our argument. We hope that DOE and Hanford regulators will review these materials and will seriously consider a more protective remedy for the High-Salt Group waste sites.

During the more than 20 years that Oregon staff have been involved in the Hanford cleanup, we have observed tremendous growth in the scientific understanding of the environmental chemistry of plutonium. The chemistry of plutonium and other actinides in the soil has been shown to be tremendously complex, and the improvements in understanding this chemistry have been significant. The attached materials provide an overview of recent research on the environmental geochemistry of plutonium. Among key findings noted in the attached discussion, with regard to the fate and transport of plutonium:

- The solution chemistry of plutonium is complex, and is strongly affected by three major factors – redox conditions, pH and carbonate concentration.
- Plutonium commonly exists in equilibrium in more than one valence state. No single valence dominates for long, as valence changes with subtle changes in soil conditions.
- Plutonium readily forms stable complexes with carbonate and hydroxyl ions, especially in high pH, carbonate-rich environments like those that occur in Hanford soils and groundwater. Complexes can be soluble at concentrations well above water quality standards.

- The complexes may be dissolved or colloidal, with colloids ranging from nanometer- to micron-sized particles. Complexes and colloids can be very mobile in water; transport in soils over distances greater than one kilometer has been observed at several locations.

There remains considerable uncertainty regarding the precise mechanisms that control the movement of plutonium in any individual soil environment, and in the resulting rate and amount of movement. There is, however, virtually no debate in the scientific community about the fact that plutonium is mobile in soil and groundwater environments. The issue is not whether plutonium moves in soil and groundwater, but rather how much, and how fast, it is moving.

Given the complexities of plutonium aqueous chemistry, it should be recognized that simplistic tools that have been used in the past to predict plutonium mobility, such as K_{ds} , are not adequate for predicting plutonium dynamics in the complex environments of soils and waste sites or for predicting protectiveness. It is therefore essential to develop better quantitative tools to estimate the rate and amount of movement, in order to support a sound assessment of the protectiveness of any proposed remedial action at Hanford for waste sites with a significant inventory of plutonium.

The science and chemistry described in the attached discussion and citations directly challenge the assertions that plutonium is not mobile, and that leaving substantial amounts of plutonium in the Hanford subsurface is protective. We strongly urge DOE as the Site owner, and the U.S. Environmental Protection Agency as lead regulator for the waste sites considered in the *draft Proposed Plan*, to carefully review these materials and to reconsider the proposed remedies for waste sites in the High-Salt Waste group.

Please contact Dale Engstrom of my staff (503-378-5584), with any questions or comments.

ATTACHMENT

Discussion of research related to the movement of plutonium in the environment

Research conducted by the U.S. Department of Energy (DOE), its national laboratories, and by others mostly outside of Hanford note there is great uncertainty associated with plutonium mobility. The following documents raise questions about previous assertions that plutonium in the subsurface is not mobile. The range of authors includes many of the principal experts in the United States and in the world in this field of chemistry, variously called “actinide chemistry,” “f-element chemistry,” “transuranic chemistry” and other names.

With regard to *Plutonium Chemistry*:

As noted by Contardi et al.⁶ “even in situations where plutonium transport has been documented it is often difficult to determine what mechanism was responsible.” Duff said in her summary in 2001⁷ that “sorption, co-precipitation and oxidation state speciation behavior of Pu on geologic materials is poorly understood.” Also noted by Duff⁷ was that “a

once highly stable form of Pu contamination may eventually become a very active source-term to the surrounding environment.”

Plutonium released to the environment continues to be a major concern at a number of DOE facilities. Los Alamos National Laboratories² found that the fate and transport of plutonium in the subsurface is strongly influenced by “coupled physical and biogeochemical processes” present at these contaminated sites. Under groundwater conditions, Pu(IV), Pu(V) and Pu(VI) are the most available and stable oxidation states, with Pu(V) and Pu(VI) fractions generally remaining in solution and Pu(IV) usually present in the solid phase as sparingly-soluble oxyhydroxides and surface sorbed species. However, plutonium nearly always exists in many valence states in equilibrium at the same time. No single valence dominates the valence mix for long except under very controlled conditions that do not exist in the natural environment. Plutonium equilibrates under natural conditions in several valence states, changing from one valence to another in reaction to subtle changes in soil conditions and location. Oxidized plutonium species Pu(V) and Pu(VI) are present in solutions at low concentrations under oxic environmental conditions, but are highly soluble and play an important role in defining overall transport behavior of plutonium.”¹

Given the importance of plutonium’s oxidation state to its mobility, workers at EPA²⁷ and others find it necessary for risk assessments to carefully consider all of the factors that may influence oxidation state at a given site. This task is complicated by the fact that the oxidation state of plutonium depends both on how the contaminant was originally formed and released to the environment, as well as on the environmental conditions it is exposed to following placement.^{8,9,14,19,20,24,26,27}

Most major plutonium mobility research has found that, in addition to adsorption, a number of other processes are known to be important to determine plutonium mobility. These processes include such things as changes in the oxidative state of the plutonium through redox transformations¹⁰, transport of plutonium on or in at least seven different types of colloidal particles²⁵, formation of charged and neutral chemical complexes with even greater mobility, and precipitation or co-precipitation of solid contaminant phases.^{10,17,25}

According to Clark, et. al.^{4,5}, plutonium chemistry is extremely complex. Clark et al⁵ found that the dominant aspects of plutonium mobility usually involve carbonate and other complexes that are soluble at levels well above standards, that are mobile and that contribute to movement of plutonium. Plutonium electrochemistry likewise plays an important role resulting in negatively and positively charged complexes¹⁰.

“For example, as discussed in the article “The Chemical Interactions of Actinides in the Environment” (Runde (2000)²⁰, beginning on page 392) if plutonium is accidentally released into the environment, its chemical properties will determine to a large extent whether its transport will be retarded by precipitation from solution or sorption to a mineral surface or whether it will migrate freely as a soluble molecular species.”

More about the importance of the Redox State:

Choppin and Morgenstern³ conclude that “in most natural systems plutonium is always found in the +4 and +5 oxidation states.” And that, “while dissolved plutonium can be in either the +4 or +5 redox state, most adsorbed plutonium is found to be in the +4 redox state. The most important property of plutonium with respect to its environmental behavior (mobility) is its oxidation state because solubility, hydrolysis, complexation, sorption and colloid formation reactions differ significantly from one oxidation state to another.”

The +5 and +6 oxidation states have been found to typically be more mobile in groundwater than the +3 or +4 redox states. For example, an 11 year study at the Savannah River Site¹⁰ found that, if the oxidation of plutonium in the environment was not considered, the mobility of the radionuclide would be underestimated by approximately three and a half times. The electrochemistry of plutonium ensures that there will nearly always be several valence states present in equilibrium, resulting in a large fraction of the plutonium being in more mobile valence forms.

Carbonate complexes:

The EPA²⁷ notes that, “at pH values above 7, the mobility of plutonium can be influenced by concentrations of dissolved carbonate and hydroxyl ions” and that the “hydroxy-carbonate complexes are among the strongest complexes of plutonium known to exist in the environment. These complexes can inhibit the adsorption of plutonium, and thus increase its mobility in the +4 and +5 oxidation states”. The EPA concludes that “These data suggest that plutonium would be most mobile in high pH carbonate-rich ground waters (like Hanford).”²⁷ Carbonate and bicarbonate are common anions present in significant concentrations in many natural water environments (Clark et al. 1995⁵). They are exceptionally strong complexing agents for plutonium and the actinide ions in general. Ions (plutonium) that normally exhibit quite low solubilities in near-neutral solutions can be complexed by carbonate ligands and, through the formation of anionic complexes, become much more soluble. Carbonate complexes have an important role in the migration of plutonium ions from a nuclear waste repository or an unplanned release contamination.

The plutonyl-carbonate system can also be quite complicated in that it consists of several different complex ions in equilibrium with one another and with the aqueous ion or hydrolyzed species, depending on solution conditions. Under dilute solution conditions, compounds of composition $\text{PuO}_2(\text{CO}_3)_0(\text{aq})$, $\text{PuO}_2(\text{CO}_3)_2^{2-}$, and $\text{PuO}_2(\text{CO}_3)_3^{4-}$ have all been reported (Clark 2000⁴). These reported compounds all have varying amounts of solubility and mobility in the natural environment.

Organic complexes:

Dissolved plutonium also forms complexes with many naturally occurring organic ligands such as acetate, citrate, formate, fulvate, humate, lactate, oxalate, and tartrate; as well as with synthetic organic ligands such as EDTA and 8-hydroxyquinoline derivatives.⁵ Though the naturally occurring ligands, humate and fulvate are mildly acidic, their principal impact

on plutonium mobility is through complexation resulting in neutral or mildly charged dissolved complexes or organic colloids.⁴

Rai, Serne and Moore¹⁸ suggested that the degradation of organic agents originally in the waste will have changed the environmental chemistry of plutonium, probably resulting in inhomogeneous migration of plutonium over time.

About nano-particles and colloidal mobilization:

Thorsten Schafer²² reported at the MIGRATION 2009 conference in Kennewick, Washington that it has been demonstrated at several hydrogeological sites in Europe and North America that the mobility of natural or artificially introduced strongly sorbing radionuclides can be enhanced under certain hydrogeochemical conditions by the presence of mobile colloids or the more *en vogue* nanoparticles.

Wilson and Soderholm²⁹ of the Argonne National Laboratory said “Colloidal metal oxide phases are known to have significant roles in transport and migration of metal contaminants in the environment. Recently published studies have demonstrated the association of plutonium with geochemical colloidal phases is responsible for enhanced transport of plutonium in groundwater systems. Much less understood is the role that eigencolloids (or nanoparticles) of plutonium oxide have in subsurface water transport.”

Soderholm et al²⁵ also report that plutonium and other light actinides (thorium, uranium and neptunium) naturally and spontaneously form nanometer scale clusters which are negatively charged, stable, fairly soluble, and very mobile. These form the basis of what was formerly called “plutonium polymer” when formed in high concentration from disposed strong acid solutions.

Work at Lawrence Livermore National Laboratory²⁸ demonstrates that colloid-like nanoparticles in groundwater have been shown to facilitate migration of several radionuclides: plutonium, Cesium, Europium and Cobalt. However, the exact type of nanoparticles and the speciation of the associated radionuclides have remained unknown. These chemical associations with nano-scale particles in the size range <100nm may facilitate transport, and may be responsible for the migration of fissiogenic and actinide elements in groundwater.¹⁸

Laboratory batch and column experiments at Los Alamos National Laboratory² evaluating the generation of calcite colloids and the transport of Pu(VI) by such colloids through saturated alluvium revealed that colloid generation is strongly influenced by flow transects. During the first ~60 days of flushing, as the flow rate increased by a factor of 12, colloid generation increased by a factor of ~6, while increasing the flow rate by a factor of ~3 doubled the colloid generation rate. Results of these experiments indicated that Pu(VI) sorption onto the calcite colloids is strong and almost instantaneous. This in turn suggests a significant potential for colloidal-facilitated transport of Pu(VI) under the hydrogeochemical conditions investigated so far.

Recent field studies by Lawrence Livermore National Laboratories²⁸ have demonstrated subsurface transport of plutonium over kilometer length scales where the plutonium is

associated with colloidal particles and not with the dissolved fraction. Yet, despite these observations and a body of experimental and modeling studies, a comprehensive understanding of the mechanism of colloid-facilitated transport of plutonium remains elusive.

Penrose et al. in a study published in 1990¹⁵ at Los Alamos National Laboratory as part of the DOE's Subsurface Science Program found that colloidal transport of plutonium was important. Plutonium and americium were found in samples drawn from wells as far as 3.39 kilometers down gradient from the point at which waste was discharged into Mortandad Canyon.

The potential for colloidal transport to affect the mobility of contaminants like plutonium was recognized more than 50 years ago. While the colloid transport pathway has been known for some time, the interest of researchers in the ability for colloids to enhance the mobility of plutonium in the environment was heightened by the discovery that plutonium from at least one nuclear weapons test at the Nevada Test Site had migrated as much as 1.3 kilometers in approximately 30 years^{11,12}. Kersting et al., the researchers who reported this discovery, concluded that "models that either predict limited transport or do not allow for colloid-facilitated transport significantly underestimate the extent of radionuclide migration." Additional experiments have affirmed the conclusion that the mobility of plutonium and other transuranic elements could be much higher than earlier models would have predicted due to adsorption on colloids.^{1,6,13,16,21,22,23,25,28,29}

In addition to the findings of Kersting et al. at the Nevada Test Site, Santschi et al.²¹ at Rocky Flats found that most of the ²³⁹Pu, ²⁴⁰Pu and ²⁴¹Am transported from contaminated soils to streams occurred in the particulate and colloidal phases. They went on to conclude that colloidal plutonium formation can be one of the most important vectors for enhancing plutonium dispersion at Rocky Flats. Santschi et al.²¹ found that at Rocky Flats the mobile plutonium was associated with organic (humic or fulvic) rather than with the more abundant inorganic (iron oxide and clay) colloids and that remobilization of colloid-bound plutonium during soil erosion events was enhanced by the presence of humic and fulvic acids.

The U.S. EPA noted that the oxidation state of dissolved plutonium has itself been found to be dependent on the colloidal organic carbon content in the system.²⁷

Choppin and Morgenstern³ note that the mechanism of the formation of actinide associative colloids has been shown to be closely related to the hydrolysis of the actinide ions" and the strong tendency for plutonium in the +4 oxidation state to undergo hydrolysis thus favors its sorption onto colloidal particles.

Additionally, under the environmental conditions present in Hanford soil waters (circa a pH of 8.5 and redox of 0.5 with substantial carbonate), the expected dominant valence state for plutonium is the more mobile pentavalent V state, rather than the less mobile tetravalent IV state. This increases the proportion of plutonium in the environment that would be expected to be in sparingly soluble anionic carbonate complex forms at solution concentrations well above the appropriate health protection and environmental standards.^{10,17,20}

The findings presented above are but a selected few of the many articles and thoughts available from DOE National Laboratories, U.S. University researchers and respected actinide chemists from around the world. The overall opinion that is repeatedly articulated is that plutonium, whether by chemical-compound, valence changes, or attachment to colloids and nanoparticles, is mobile in the natural environment.

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Commenter #121

Heart of America Northwest and Heart of America Northwest Research Center

Comment N:

The fact that Plutonium migrated to 40 to 140 feet beneath the Plutonium cribs, trenches and ditches defeats the claim that Plutonium does not migrate and will not be subject to “colloidal” transport. The chemicals which assisted in mobilizing the Plutonium to move deeply in the soil within 20 to 30 years of disposal are still there, e.g., Carbon tetrachloride, Tributyl phosphate, TCE....

There is no basis for the claims that the Plutonium has not moved deeper beneath the Z Ditches, and it is irresponsible for USDOE to make such claims without any testing!

- 1959, 1976, and 1979 testing was *only for radionuclides*
- 2002 testing limited to only one “worst case site” along the 2 miles of trenches for radionuclides
- BUT, maximum concentrations for radionuclides all came from 1970s testing – 2002 borehole not worst case at all.

USDOE’s own recent draft Tank Closure and Waste Management Environmental Impact Statement (TCWMEIS) is being ignored. For the EIS, USDOE was required to analyze the total cumulative impact to groundwater from all waste sites on Hanford’s Central Plateau – and the health of the people who will drink the groundwater for thousands of years.

USDOE projected Plutonium concentration levels in groundwater will rise to 2,660 pCi/L at the edge of the Central Plateau – 177 times the Drinking Water Standard (set at a level projected to cause 1 fatal cancer for every 10,000 adults drinking the water), and nearly 300 times the standard along the Columbia River shore.ⁱ Plutonium does move through soil and contaminate groundwater – contrary to the assertions in USDOE’s proposed plan. PCBs, Strontium, Cesium, and Carbon Tetrachloride will all spread through soil and to the water. USDOE’s response to this concern that the TCWMEIS only projected movement for Plutonium where other contaminants mobilizing Plutonium would be present applies in spades to the units in question.

Commenter #124

Confederated Tribes of the Umatilla Indian Reservation

Comment J:

This report states that plutonium and americium are not mobile under existing or anticipated conditions (page 39). A report in the Los Alamos National Labs site titled: “Mobility of Plutonium and Americium through a Shallow Aquifer in a Semiarid Region” have shown that plutonium can be mobile and was detected in monitoring wells 3390 m downgradient from the point of discharge. In addition and very importantly, a recent PNNL report (PNNL- 17839 titled “Plutonium Mobility Studies: 216-Z-9 Trench Sample Analysis Results”) have shown plutonium and americium mobility at the 200-PW-1 Operable Unit that have migrated to a depth of 110 feet below the ground surface. Cesium is also stated to not be mobile under existing or anticipated conditions (page 40), yet cesium has been mobilized in other locations at Hanford.

It is time for USDOE to stop claiming that Pu geochemistry, redox chemistry, mineral and salt formation/dissolution, and colloid formation are understood well enough to assume that Pu is always immobile, when there is a wealth of evidence that clearly disputes this continued assertion.

Don't rely on barriers/caps

COMMENTS

Commenter #15

Dave Berger

Comment D:

A cap isn't sufficient. With lateral movement of water, there should be trenched walls going down to stop the lateral movement of water in your engineering design.

Commenter #33

Dvija Michael Bertish

Comment C:

It's not viable to think that any barrier is going to be maintained in perpetuity. So in this regard, I think the cleanup standards that are being proposed here are arbitrary based on the long-term projections.

Commenter #64:

Nancy Murray, Lake Oswego, OR

Comment:

Caps/barriers do not have a track record of effective longevity. While some areas are not appropriate to complete RTD, I think we are penny-wise/ pound foolish to rely so often on caps. I strongly feel RTD should be the default.

Comment #74:

Oregon Department of Energy, 7/19/11

Comment D:

Cesium-137 Waste Group: For the "Cesium 137 Waste Group," the *draft Proposed Plan* proposes adding additional soil to achieve a 15-foot thick "cap" with the intent for it to be protective of human health for 300-400 years of institutional control. We acknowledge that barriers and caps will have an important role in isolating wastes from workers, the public and the environment at a number of locations at Hanford (as examples, at the Environmental Restoration Disposal Facility (ERDF), the Canyon facilities and the two licensed mixed low-level waste disposal trenches). For liquid waste disposal sites, capping alone is not an approach that Oregon would typically support as it is not a substitute for actual cleanup.

Comments Received During Public Comment Period on the Proposed Plan for the Remediation of 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6

Commenter #83:

Kathy McCullough, 7/27/11

Comment B:

But apparently, common sense is not prevailing. Since when does putting topsoil over nuclear waste count as cleanup. Ten square miles with enough waste for 70 nuclear bombs? Seriously? Enough is enough. Please don't make us protest something this obvious.

Commenter #87:

Paige Knight, 7/28/11

Comment C: Capping cesium, or blending "clean" top soil with contaminated soil is a sloppy and unconscionable approach.

Commenter #89:

Lyrik Pitzman, 7/29/11

Comment B:

Given the close proximity of the location to the Columbia river and all the users downstream, none of these substances should be covered up and allowed to remain as a potential toxic pollutant based on "screening values and fate and transport modeling". If history shows us anything our best predictions today can be drastically wrong in 10 years.

Commenter #111

Confederated Tribes and Bands of the Yakama Nation ERWM

Comment AA:

The preferred alternatives for this feasibility study should place little or no reliance on evapotranspiration barriers or institutional controls for long term protection. In some instances, barrier components would include impossible to replace components (i.e., physical concrete component). It is unclear how there can be any reliance on the long-term effectiveness and

Commenter #116

Nez Perce Tribal Executive Committee

Comment B:

Our general comments on these documents are listed below, and our specific comments are shown in Attachment A.

- * In general, the NPT doesn't support the use of surface barriers as a viable permanent remediation to waste sites and views surface barriers as an interim measure. Plutonium and

Commenter #117

Columbia Riverkeeper, 8/31/11 via e-mail

Comment H:

U.S. DOE's plan relies on surface barriers and institutional controls that will not remain effective for the length of time required for dangerous wastes to decay away

Fundamentally, U.S. DOE's conclusion that Pu will remain stable in the soil in Hanford's 200 Area rests on the assumption that surface barriers will be effective in preventing moisture from promoting plutonium transport for over 240,000 years. According to the proposed plan, —Because residual contamination would be left in place after the RTD remedial action was completed, an evapotranspiration barrier would be constructed over the waste sites to control the amount of precipitation that infiltrates into the contaminated media, thereby reducing the potential migration of contaminants to groundwater.|| Notably, U.S. DOE states that the ET barrier would —reduce|| the potential migration of contaminants , but it cannot conclude that the potential is eliminated. U.S. DOE provides no evidence that an engineered ET barrier will provide a durable impediment to infiltration of precipitation for the 240,000 year timeframe during which Pu will remain a danger. Indeed, as noted above, U.S. DOE modeled the fate and transport of Pu for 1000 years for groundwater. Because U.S. DOE overstates the efficacy of surface barriers and thus underestimates the risk of plutonium transport, U.S. DOE must re-evaluate its proposed plan.

Comment L:

In summary, the U.S. DOE's reliance on surface barriers and institutional controls for high-salt waste sites and cesium sites does not protect the public and the environment. Additionally, the analysis and assumptions that form the basis of U.S. DOE's plan severely underestimate the risk of these measures failing, particularly for plutonium. U.S. DOE must withdraw and re-work its plan.

Commenter #124

Confederated Tribes of the Umatilla Indian Reservation

Comment D:

Barriers

A depth of 15 feet appears to be still used as a cleanup cutoff level (page 8 and 24) for considerations when it is stated that “most soil contamination associated with these 200-PW-1,3,6 OU waste sites is located beneath the bottom of the waste sites and is deeper than 4.6 m (15 ft) below the existing ground surface (bgs).” Although 15 ft is being used as the standard point of compliance for ecological protection as described in the state of Washington's regulations for cleanup for protection of ecological receptors, the CTUIR feels that this is not deep enough and contamination could still be brought up to the surface from either human or natural causes. The engineered surface barrier alternative includes adding 15 feet of separation between the contaminated soil and the ground surface. This would be modified to include an evapotranspiration barrier layer; and 4 feet of coarse basalt rock to act as a physical barrier if plutonium was present (page 29). Again, the CTUIR feels that this would still not be a deterrent to either natural or unintentional intrusion. The barrier option was given a high ranking (page

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35) because it is stated that this is a proven technology with readily available construction methods and materials. The CTUIR questions if the technology is proven to last 1000 years with all possible environmental changes, and if there is an adequate supply of materials nearby to cover all of the waste sites at Hanford.

Gov't not Long-term Stewardship

COMMENTS

Commenter #2

Dale Engstrom

Comment F:

One of the things that I would like to suggest to you is the plutonium as Susan said is forever. It is one of those really bad actors. You said we're going to be around here for the long term. Well, the half-life of plutonium is something like 24,000 years. You're going to be around for 240,000 years, sir? I don't think so. So one of the problems is that you can't project that into the future. You can't guarantee that that's going to happen as a safeguard for human health. So the real safeguard is to get it away from the surface. It's only 15 feet down.

Commenter #4:

Tom Carpenter

Comment D:

And I think it's absurd to think that we have institutions that will last dozens of years or hundreds of years or thousands of years that will be there to make sure that nobody goes in there or that it's protected from flooding or that we can stop an earthquake or a volcano or whatever can happen to that area.

Commenter #16

Kathy Carlson

Comment E:

And then another term I heard here tonight was long-term stewardship. Again, we are going back to 24,000 to 240,000 to 10,000, even to a hundred years. I mean we are always going to maintain that site. It seems like there is enough plutonium in these -- in the ground if you left what you want to leave in there that they could still be build 35 nuclear bombs. Seems like a great terrorist site to me.

Commenter #17:

Hafiz Heartsun

Comment A:

I live here in Hood River.

I guess I will say in my own words something I have heard from other people, but I found your assumption that DOE will safeguard this area for some number of years, hundreds, thousands, tens of thousands of years, to be absurd. It breaks the strains of credulity. How many years ago was the pyramids built? It was like 5,000 years ago, a mere half of that period. Where is the Pharaohs? Where are they guarding their pyramids? And where is any country that has been around for a thousand years? Is there a single country on the planet that has had a consistent government for 1,000 years? 500 years? No. It is just not in the historical record to believe that

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America, and let alone the DOE, will be around this long, is just absurd. It is ludicrous. It is arrogant beyond belief. I mean right now we are looking at, you know, the government may default next week.

What is the DOE going to do when nobody in this department has any money? Are you going to stand out there and guard it for the rest of your lives and set up camps so all of your generations forever will guard, never leave, because my ancestors 10,000 years ago were employed by DOE. It is our sacred mission to stay here. It is like, come on, guys. You really got to clean it up so it becomes the no-action alternative that you are thinking, that it requires no action because that it is the only realistic thing that you can sustain over the period of time necessary.

I mean sure, yeah, we love science, but this is like science fiction crap. You just got to give -- I mean you have got to give us a believable story. You are not going to be here for 10,000 years. That is just absurd. It insults our intelligence, really. I am serious. This is not scientific. You have no scientific basis to say we will be here 10,000 years.

Commenter #21:

Keith Harding

Comment B:

Over these past 20 years, we have heard reclassification from a higher level to lower level. We have heard redefinitions of terms, and I don't understand hardly any of this stuff, but I have a feel for it, and especially listening to you great people out in the audience. And I totally agree with Hafiz when he says it is bloody arrogant to think this civilization is going to be around. I mean I can see it collapsing a lot sooner than 200 years more. It is very important to get a deep mind set into the agency, into human beings to get reconnected with the earth that gives us life.

Commenter #36:

Chris

Comment E:

We can only think ahead seven generations, maybe. For planning purposes, we can only think ahead two generations. There is no fence. What there can be is this. If we will educate two generations below us up to taking over our tasks when we die, we might be able to carry it through for the 10,000 generations we will need. But we will need the seven generations back, seven generations forward which our tribal friends suggest to us.

Commenter #39:

Audience Member

Comment A:

Obviously, I'm not qualified to adjudicate on the various scientific models around the migratability of plutonium, the soil or anything like that but all this being equal, given the sort of structure problem with DOE's inability to guarantee what's going to happen in 2 or 300 years, and that's fine. I totally understand that. That, I think, means that the DOE has a responsibility and that the parties involved have a responsibility to default to the more conservative solution, the more small conservancy solution. The fact that we can't guarantee 2 or 300 years from now

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I think is the driving force. The reason why people point that out so much, the driving force behind that is the idea that as a result, we need to focus on removal and safe storage because we can't guarantee that we'll be able to police the area and we won't be able to shield the area from people coming to harm a few hundred years in the future. And as a taxpayer, or rather as a future taxpayer, because I'm a poor college student, I think I would be comfortable supporting that in exchange for peace of mind even at the cost of greatest expense.

Commenter #40:

Margie

Comment C:

And one way that we can carry on the message is what the Native Americans do is they have words of mouth. They have their legends. It is something that we haven't done because certainly paper is going to be -- probably not lasting 24,000 years nor are DVDs. So we are going to have to tell our children our grandchildren and carry it on by word of mouth or petroglyphs.

Commenter #41:

Chuck Johnson

Comment C:

And that's the main point that I'd like to make is that I asked during the question period Mr. Dowell from DOE, the following question, which is a more rational assumption, that the U.S. DOE will be able to guarantee that the Central Plateau will remain an industrial site without migration outside of the area for 23,000 or 230,000 years. Or if the U.S. Government finds the money to remove treat and dispose of the plutonium waste properly now and obviate the need to guard that site for a ridiculous number of years.

Mr. Dowell responded with the CERCLA process. In the CERCLA process if funding is one the considerations that led to the decision they made for only going two feet down talking out only half of the plutonium under their estimates. I mean it's immoral and extreme to make the preposterous claim that the Central Plateau can be kept an industrial zone in the foreseeable future and for tens of thousands or hundreds of thousands of years. And that it's our responsibility as the people who generated that waste to protect future generations. And it would be immoral to do anything else other than to remove all that waste.

Commenter #53:

Jacob O'Brian

Comment:

Hello, my name is Jacob O'Brian. I'm 30 years old. I was born into this world and I didn't have a choice about the decisions that were made before my time, the mess that was created. To be honest, I'm pretty angry that we are in this situation that we are having this conversation right now. That we've been having this conversation and that the best you can propose is two feet. It's crazy. It's ridiculous. I have a 14-month-old son at home. Having him has changed my perspective of the legacy that we leave. And I don't want him to have this legacy. I don't want his children to have this legacy. I don't want any future generations to have this legacy. I don't know that I can be very articulate about this because I -- this is in many ways a new issue to me but one thing that I do know is that I work for a small firm. We're a data visualization firm. I

work with data all day long. I understand how difficult it is to get a clear picture of what's really going on when you do not have full and clear data sets. When you don't have information that fully tells the story and you're trying to do models or project things based on the situations that you can't even account for but you don't control. It's inexcusable. You have absolutely no right to stand up there and say, "We're going to do the best we can." Not the best you can. You have to fix it. We have to fix it. I know that you're human beings and you probably have good intentions. You're doing your job and I respect that, but your job is to listen to us. Your job is to make sure it gets done right. And I think it's absolutely disturbing. Think about your children. Think about your families. Think about our future and the legacies that we have to leave on this earth. It's -- you can't put a band-aid on it. You can't just say, "You know what, this is good enough." 3,000 years ago, we're like looking at pyramids and we're, like, trying to figure out languages that people used and communication forms that people used 3,000 years ago. We can't even figure that out. And your saying, yeah, 24,000 years from now we're going to be able to communicate, "Don't go here. Don't mess with this." No. That's insane. It's insane. Fix it now. It's your responsibility. We support you. And if you choose not to, you're going to have to live with that and you're going to have to die with that. We all are. Not just you, we are all. That's the issue here. That is the issue. So that's all I have to say.

Commenter #52:

Audience Member

Comment:

I'm -- I guess the word is shocked that we're considering a remediation that is going to require care in perpetuity while you can't even find the resources to do as much as we can in the present to be adequately characterizing the site. And I've heard talk about, you know, vitrification and other futuristic technology that ten years might get there when we're limiting right now the resources that will provide towards doing removal and cleanup that we could do with the technology that we do now. So it's just struck me that -- that the promises that the same person is making and seems to be heartfelt is just crazy because in the next sentence you're saying what you're not doing what we could do. I'm concerned about the CERCLA process. It seems to me that leaving it in the state of deciding what the remediation will be and I was really glad to hear that there was some mitigation going on and some stabilization. But it was really reassuring from last year, but that as long as long as we characterize it as not yet cleanup, that the Navy can continue to bring things there. And I think that's -- I'm concerned that what I hear about leaving things in perpetuity in this site will mean that this is a site that by default will become a place that will become a repository. And that's all I've been hearing since I've been coming to these meetings. So I'm, once again, submitting that concern. And I want to recognize and honor the people who have already been harmed, the Downwinders, the tribal people and all of the people include my uncle who was based at Hanford during the Army and never told. And I just lost my nephew to a very rare disease that was probably generated by that and so the assurances that care and perpetuity will happen and the people who are already suffering have experienced no accountability to the harm that already happened. I just don't really understand what about taking it and cleaning it up you don't understand. I mean, this not reassuring.

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Commenter #58:

J. Sherer, Hood River, OR

Comment E:

To me, service and protecting, means the following: Think geological time perspective

Commenter #65:

Aaron Baker, Lake Oswego, OR

Comment A:

I think given the DOE's inability to guarantee the Hanford site will remain off-limits for the foreseeable future provides a powerful incentive for a more comprehensive solution of waste removal and treatment. The nature of risk mitigation is that we do not necessarily know what impacts and long-term effects we are talking about.

Commenter #67

no name, notepaper

Comment B: "Guarenteed Presence" of DOE for 100s of years. What happens if US goes bankrupt or USD crashes? Need an ultimate "No Action needed" state because oversight cannot be assured over 1000s of years, let alone decades.

Commenter #68:

no name, index card

You are Proposing DOE will keep a protective presence for 100s of year, even thousands! This is not believable considering DOE's recent activity in DUMPING all this waste! Also – how will DOE fulfill their 1000's year mission if USA goes bankrupt? What about extreme climate change? (torrential rains, extreme drought, extreme heat, cataclysmic flood & storms, How many nations have had a stable government for, say, 1000 years? Or 500 years? I don't know of any. Assuming USA will go on forever is not a rational assumption.

Commenter #86:

Hafiz Heartsun, 7/28/11

Comment B:

JD assured us in his presentation that the DOE would guard the site from trespass, and thus exposing people to the ongoing radiation hazard, even after this proposed clean up, for 10,000 years or even more; "as long as necessary". Written in the proposed plan I find; "Institutional controls, long-term monitoring, and maintenance will be required under all alternatives because they do not meet standards that would allow unrestricted use and unlimited exposure." I cannot find any specific definition of "long-term" in the proposed plan. I find the arrogance of the assumption of "long-term monitoring and maintenance" to be astounding. To assume that DOE is going to maintain a mission for 10,000 years is total sci-fi fantasy. It is possible the US government will be bankrupt within a few weeks. Even if the hyper-

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inflating dollar stands for a few more years, it is inevitable that DOE's long term missions will soon be dramatically curtailed as USA becomes subject to our years of exorbitant debt accumulation.

The only acceptable alternative to dealing with long lived radioactive elements is to ultimately arrive at a "no action" state at the completion of clean up, because "no action" is the only option that can be reasonable maintained for the period of time necessary.

Commenter #104

Karen Axell, 8/17/11 via e-mail

Comment C:

I do not believe DOE claims that it will prevent any non-industrial use and all excavation activity in the core area of Hanford's Central Plateau for even 100 years, much less 250,000 years!

Commenter #106:

Jack Lunden, 8/4/11 via US Mail

Comment D:

Considering the vast amount of time these wastes remain hazardous and a threat to groundwater and the Columbia River, the DOE's claims to providing 'stewardship' over that amount of time is quite frankly, absurd.

Commenter #111

Confederated Tribes and Bands of the Yakama Nation ERWM

Comment L:

Evaluation of Remedial Alternatives (cost estimates): The cost estimates presented in Tables 7 through 10 are confusing and problematic. In all cases, the O&M costs are discounted to present worth values, which, while typical for FS-level evaluations, are problematic for a 1,000-year assumed time frame for O&M activities. Due to the long time period, costs past 100 years have a net present value near zero. For example, the difference between 100 years and 1,000 years of O&M, assuming an equal annual outlay, is only 5 percent. Conceptually, this introduces a bias into the alternative evaluation process to select long-term "low-cost" alternatives that require essentially no financial commitment beyond 100 years. This characteristic has the tendency to mislead decision makers and the public into selecting an alternative that may in fact be less protective over time (decades and centuries) as the collective memory of the waste location fades and DOE's mission focus shifts elsewhere.

Commenter #113
Heather Flanagan

Comment E:

With all due respect, I do not believe the USDOE can prevent any non-industrial use and all excavation activity in the core area of Hanford's Central Plateau for the extended period of time necessary.

Commenter #120
Hanford Challenge

Comment D:

Hanford Challenge disagrees with the preferred alternatives chosen by DOE. At the public hearings on these matters, agency representatives attempted to assure the public that these sites would be safeguarded for "as long as the plutonium is dangerous." It is a considerable stretch to base a cleanup decision based upon the predicted institutional presence for a period exceeding one hundred years, and downright ludicrous to postulate a governmental presence for thousands of years. A quarter of a million years ago, there were no humans on the planet. Language itself is a few thousand years old.

Commenter #124
Confederated Tribes of the Umatilla Indian Reservation

Comment B:

Future Use/Risk

The RI/FS evaluations and decisions for the need to cleanup these sites were based on an unrestricted land use scenario that "include an exposure from a driller bringing contaminated drill cuttings to the surface and then a subsistence farmer growing food crops or raising livestock on the cuttings." (page 3) However, the Remedial Action Objectives and human health Preliminary Remediation Goals are based on the industrial worker scenario (page 27). Even though the current belief is that this land will be used as an industrial site now, it is impossible to fathom how the site will be used in 1000 years. Placing caps over a landfill site does not prevent a driller from bringing cuttings back to the surface from either an intermediate depth, or from some contamination that has migrated deeper at some time in the future. The plan also states that the Tribal Nations risk scenarios are stated to be similar to those presented for the subsistence farmer exposure (page 21).

Don't rely on institutional controls

COMMENTS

Commenter #16

Kathy Carlson

Comment A:

My name is Kathy Carlson. I am a resident here in Hood River. I have been coming to these meetings for more than 20 years, and I remember some stuff that was said at previous meetings.

One of the things that I recall pretty strongly was that the site would be left in a state -- the goal was for the site to be left in a condition where the public could use it. And then they are talking about here today about putting stuff over other stuff, and it is going to be an industrial site and it is going to be maintained for 10,000 years. And then plutonium is like around for 24,000 and half life can go to 40,000 years. I don't even think anything we engineer is going to last for 10,000 years. It will probably last for, you know, the life of a car, 20 years or whatever, you know.

Commenter #31:

Paige Knight

Comment G:

It is impossible to promise that no one will live in the Central Plateau area in the decades to come. That is not the answer.

Commenter #32

Jan Castle

Comment A:

My name is Jan Castle and I would second everything Paige just said. I think it is -- there is no reasonable expectation of being able to keep control of this site for as long as would be necessary. That's just impossible.

Comment D:

This is land that belongs to the tribes. To leave this here and expect that it will be an industrial site seems to me a violation of a promise long made and as we have violated all of our other treaties with tribes. So I think it's unreasonable to clean it up to the industrial standard. It needs to be cleaned up, period. And returned to reasonable use to the tribes as promised.

Commenter #34:

Loren Paulson

Comment:

My name is Loren Paulson, I had a job once that allowed me to look into the future on an eerily similar situation as we have here. In World War II, the U.S. Government manufactured nerve gas in an obscure plain now known as Torrance, California. I worked for Shell Oil Company at the

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time and the federal government sold that site to Shell Oil Company to make pesticides. Pesticides is nothing more than nerve gas. Years followed and after 40 years of making nerve gas and pesticides on this sites, housing developments started to move in. And Shell Oil sold that site to Cadillac Fairview, a company that then decided to put in a high-end industrial site across the street from this housing development.

They bored a hole to make sure that foundations could be poured and covered it up and it is now one of the Superfund sites in California right across the street from a housing development. So as you look in the future with certainty about how this property is going to be used in the future, think about Torrance, California, Shell Oil Company, the U.S. government and nerve.

Commenter #109:

Dvija Michael Bertish

Comment F:

5) With only 2 feet of removal proposed, DOE proposes the reliance on institutional controls and institutional memory to protect the site in the distant future. Rosemere contents that institutional controls will not be sufficient to protect the public and natural resources from the spread of radioactive contamination in the long term, and thus purposeful and complete removal of the contamination is required under the greatest amount of care available, as with deep underground storage.

Commenter #111

Confederated Tribes and Bands of the Yakama Nation ERWM

Comment F:

Institutional Controls: The FS makes statements about USDOE retaining institutional controls over these waste sites for 1,000 years (High and Low Salt Waste Sites) and 350 years (Cs-137 Waste Sites), where residual risks would remain above acceptable levels. IC may be feasible in the short-term, but to assume long-term institutional control (over 1000 years) is in conflict with U.S. Nuclear Regulatory Commission regulations in 10 CFR 61.59 which limit reliance upon ICs to 100 years after transfer of radioactive disposal facility property to a new owner.

Comment BB:

component). It is unclear how there can be any reliance on the long-term effectiveness and performance of maintaining an alternative which requires institutional controls for a thousand 1000 years. The five (5) year CERCLA reviews should be conducted to evaluate the effectiveness of the remedy selected not simply to evaluate the need for continued ICs as implied.

Commenter #117

Columbia Riverkeeper, 8/31/11 via e-mail

Comment I:

Additionally, the U.S. DOE cannot realistically claim that institutional controls will prevent access to plutonium-laden waste sites at Hanford. Given the 24,000-year half-life of plutonium, U.S. DOE would have to ensure that the site is restricted for 240,000 years. In the words of the Hanford Advisory Board's advice on this proposed plan, —plutonium is forever.|| Because of the staggering timeframes involved with managing plutonium waste, U.S. DOE's reliance on institutional controls is inappropriate and poses a severe long-term risk and cost to the public and the environment.

Comment L:

In summary, the U.S. DOE's reliance on surface barriers and institutional controls for high-salt waste sites and cesium sites does not protect the public and the environment. Additionally, the analysis and assumptions that form the basis of U.S. DOE's plan severely underestimate the risk of these measures failing, particularly for plutonium. U.S. DOE must withdraw and re-work its plan.

Commenter #121

Heart of America Northwest and Heart of America Northwest Research Center

Comment R:

"In 2000, the National Academy of Science challenged the DOE's approach to leaving Plutonium under caps or in surface landfills, and concluded that:

'Institutional controls will fail [emphasis added]. Past experience with such measures suggests, however, that failures are likely to occur, possibly in the near term, and that humans and environmental resources will be put at risk as a result.'

A recent estimate by the DOE underscores the Academy's concern and finds that plutonium in groundwater from dump sites at Hanford could reach the near shore of the Columbia River in less than 1,000 years at concentrations 283 times greater than the federal drinking water standard."ⁱⁱ

In closing: clean-up, don't cover-up!!!

Sources for Section on Characterization of Settling Tanks and CW-5 Ditches:

TPA MILESTONE M-15-37B - Validated Data Packages and Recommendation for Regulatory Path Forward For Remediation of Tank 241-Z-361

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Feasibility Study for the Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units

Fact Sheet: Reference Guide on the Proposed Plan for the Remediation of Waste Sites in Hanford's Central Plateau

DOE/RL-2009-117: Proposed Plan for the Remediation of the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units

****200-W-205-PL and 200-W-220-PL are pipelines connected to the settling tanks. The pipeline characterization and remediation information is said to be listed in Appendix H (NOT ATTACHED TO DOCUMENT).

Commenter #124

Confederated Tribes of the Umatilla Indian Reservation

Comment C:

Risk Assessment and Thousand-Year Land Uses

The risks for Native Americans at 150 years are essentially unity. No estimation of the length of time that institutional controls would be needed was given, and the remedial goals are not based on protecting Native American health related to natural resource use. This means that the future lost use under Natural Resource Damage Assessment will have to be estimated once the final remedy is selected and the amount of residual contamination is known. Lost use is defined as the acreage that is unsafe to use in a manner reflected in the CTUIR exposure scenario, multiplied by the duration of restriction (or institutional controls) necessary to protect people living in a traditional manner at the study location.

USDOE proposes that institutional controls can be maintained for 300-400 years, longer than the United States has been a sovereign government. This assumption violates the USEPA requirement that institutional controls are assumed to fail at 100 or 150 years. Thus, a remedy with capping and essentially permanent institutional controls is non-compliant and should not be approved by USEPA.

Modeling for seismic activity, floods, climate change

COMMENTS

Commenter #4:

Tom Carpenter

Comment B: I want to put some perspective on this -- on this plutonium. It's acknowledged that microscopic quantity. And 15,000 years ago, the Hanford site was 200 feet under water because of glacial flooding, the Great Walluki [sic] flood.

Well, it turns out that that event of Ice Age, the retreat of the glaciers, big glacial floods follow, that -- that cycle repeats in Eastern Washington hundreds of times as far as geologists know. They're huge, massive floods, and there are water rings in the hills and mountains around the Hanford site and all over Eastern Washington way up from that event happening. In other words, it's not a stable geological area. It's going to be inundated again.

We are overdue for one of those ice ages coming up. And we can expect to see, maybe not in our lifetimes or our kids' lifetimes, but the profile -- geological profile of the Hanford site changed from what it is today.

Commenter #16

Kathy Carlson

Comment B:

I think that -- and I heard a lot today about -- oh, the other thing the lady brought up about the seismic. Nothing was done to put into the thing about seismic conditions. I don't see anything about floods. They are having a flood in the Midwest. You know, Fort Calhoun is in great jeopardy because they didn't look at floods.

Comment C:

And so Hanford is on the river. I don't see why they would not look at floods as part of their conditioning to make -- I heard a lot of things saying: Our assumptions. We are assuming. We are assuming. "We felt. We feel. We are confident." And none of this stuff is backed up by scientific data.

Commenter #18:

Joe Still

Comment B:

Of all the comments I have heard tonight, I would just like to focus on one, and it was a woman in the back -- I don't know who it was -- who mentioned about the seismic. And I know something about CERCLA SuperFund Model Toxics Control Act. I actually work in the Tri-Cities. So I am somewhat familiar with that.

On May 18, 1980 I was hiking in a place called Randal, Washington and there was a little event that day if you remember. Mt. St. Helens lost half of itself, and I am standing here right now, and I remember watching rocks the size of cars fly horizontally through the air, and I hope that you

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go through your decision-making processes, that you will reconsider and evaluate the seismic components of all these decisions.

We are in the ring of fire. All it takes is slight tectonic plate movement, and we could have a problem of gigantic proportions, and I hope that state and federal officials do not make a decision about considering seismic based on what judges, legislators and attorneys have decided is the right thing to do because there is no do-over.

Commenter #20:

Robbie

Comment C:

I will say that in Japan all of the nuclear power plants had to be renegotiated with how safe they are because of the just upping the earthquake to a 9.0 earthquake. They had to be reevaluated. So I think evaluating this for seismic activity is an excellent idea to make it safer.

Commenter #27:

Jody Frank

Comment A:

And there has been some call for studies on seismic and floods and that sort of thing, but we live in the middle of the results of the Mazola floods. I think we kind of know what those studies are going to say

Commenter #33

Dvija Michael Bertish

Comment E:

One other thing to consider here relative to soil study is that I haven't heard anything about seismic shift or frost heaving. So when you have vast swaths of solids that are being bored and/or remediated, are open to the general atmosphere and we have seasonal shifts from rain and front that causes soil undulation. And so the soil isn't going to stay in one place. So anything that's built is going to move and soil will fall and the residues that are beneath will rise up. I haven't heard anything that describes how that soil mobility will be controlled.

Commenter #46:

Sophia

Comment C:

And I also want to add that you need to take into consideration climate change impacts and natural disasters in all planning for Hanford cleanup.

Commenter #47:

Joel Garbin

Comment B:

I also work in the storm water field and anyone who has paid attention to these incredible storms that we've been seeing globally, recognizes the 100-year storm which is supposed to

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happen one time every 100 years, in many places is happening year after year. And even a 500-year storm. So it was quite dismaying to hear that climate change modeling particularly rainfall intensity has not been factored into the clean up plan. That's inexcusable given the high level of attention that climate has on the front page of the newspaper everywhere. We see it. We see it in our climate, here in Portland. We see it everywhere.

Commenter #50:

Kathleen Fitzgerald

Comment A:

My name is Kathleen Fitzgerald and I'm a born and raised Pacific Northwestern. I'm a massage therapist. I'm the mother of son who is 27 who lives up in the Gorge. I have a lot of family up there. I've been up there. It's God's country. Hanford is built on an earthquake fault and if we have an earthquake, which we all know can happen and things are changing, there is really good chance that might happen and if it does, it's going to cause radiation, radioactive chemicals to spill in to the Columbia River and go all the way down through more of God's country into the ocean that would send a 500-mile radius all throughout that region will be pretty much uninhabitable. So that's a good chance that that could happen. I agree with what's going on here as far as complete cleanup, as far as we can get.

Commenter #58

J. Sherer, Hood River, OR

Comment E:

To me, service and protecting, means the following: TAKE SEISMIC Activity into Account – Rowena plateau

Commenter #86:

Hafiz Heartsun, 7/28/11

Comment C:

Other assumptions (about the long term climate, rainfall, erosion, flooding, temperature, storms, earthquakes, volcanos, as well as animal activities and human habitation, etc.) are faulted by their narrow thinking. "Global warming" is a scientific fact. That it remains controversial in political and social arenas should have no influence in DOE's science-based plan. The changes are only going to increase. To not include the possibility of radical events that have not occurred for 1000's of years is only reasonable with what we know is coming.

Commenter #90:

Margaret Comfort, 7/30/11

Comment B:

The site exists in earth quake and flood zones and climate change is also a real factor that have not even been considered. Those of us who live down river from Hanford are all at risk and so is our world's largest ocean. The oceans all connect, so, the viability of our world is at risk. Vitrify the deadly waste now. Do not wait for "technology in the future" that may become available. Use what we have now. Get started right away and begin by vitrifying the most toxic

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substances first. Contain all of it. Eliminate the risk now with the most effective available technology.

Commenter #106:

Jack Lunden, 8/4/11 via US Mail

Comment E:

The possibility (or probability) of earthquakes, flooding, the next ice age, the collapse of the U.S. Government over that amount of time requires the best possible job that can be done with the cleanup.

Commenter #109:

Dvija Michael Bertish

Comment E:

4) The cleanup action plan for these contaminants must include provisions for seismic shift, frost heave, and alternate climate potentialities.

Commenter #120

Hanford Challenge

Comment B:

For a point of reference, what is now known as the Hanford Site was under 200 feet of water resulting from glacial flooding 14,000 years ago. These incidents of glacial flooding are historical events that have occurred hundreds of times in the past hundreds of thousands of years. We therefore can fully anticipate that within the foreseeable future, an episode of glacial flooding will occur again, likely mobilizing whatever contaminants remain on the Hanford site. The U.S. Geological Service website states,

“The glacial lake, at its maximum height and extent, contained more than 500 cubic miles of water. When Glacial Lake Missoula burst through the ice dam and exploded downstream, it did so at a rate 10 times the combined flow of all the rivers of the world. This towering mass of water and ice literally shook the ground as it thundered towards the Pacific Ocean, stripping away thick soils and cutting deep canyons in the underlying bedrock. With flood waters roaring across the landscape at speeds approaching 65 miles per hour, the lake would have drained in as little as 48 hours.”

Insufficient scientific data

COMMENTS

Commenter #5:

Lindsay O'Brien

Comment A:

I just started the externship, so I'm fairly new to what's going on to the issues that have arised [sic] with Hanford. But when I review the proposed plan, I basically focused on the settling tanks. Those are located, if you guys look at the map, on the proposed plan on the northwest side of the -- of the map.

And, basically, I have two main issues which I've -- actually, I have several issues, but the main issues are with the proposed plan which I hope will be addressed is, first, the information provided about the contaminants present in the settling tanks is either lacking, outdated, or just simply confusing. So, for example, the primary contaminants described to be found or supposedly found on the settling tanks are plutonium and americium.

What about other contaminants? There is nothing in the proposed plan stating what other contaminants, what other might either are there or might be found. Just because a contaminant's not primary does not mean that it's not harmful, does not mean that it does not pose a risk.

And, also, according to all the information that I've read, and I did a lot of research these last few days, there's no testing, at least no proper testing has been done, at least nothing in the research and the paperwork does it state that any testing has been done of the settling tanks currently to let us know what contaminants are there. The only testing that I found out about was a characterization -- and I'm not sure exactly what that means-- of one of the tanks in 1984. 1984. I was born in 1983. I'm 28. 27 years. Three decades. Trust me, that's -- every birthday I realize how long that is.

Technology has changed drastically. I think I believe that today we have better technology to do testing. Therefore, the only testing that has been done is just not sufficient and not sufficient to basically really tell us what's going on, what is present there and, also, what remedies we should look for in dealing with it.

So, for example, if we found out there's other contaminants, what remedies are we going to -- what remedies are we going to apply here?

I actually had a slide this morning, but I had a little fight with PowerPoint, and PowerPoint won, and -- so I will pass that around if you guys want to take a look. It's basically a little chart that I did which lists the primary contaminants which are listed on the proposed plan. And next to them, like the three columns to the right, there are other contaminants which I believe, according to the information on the proposed plan, which is all over the place, that are likely to be found in the tanks.

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So, for example, one of the tanks -- one of the settling tanks, waste used to go through that tank prior to being discharged into one of the low-salt cribs. So since those contaminants have been found to be in those cribs, I don't think it's unreasonable to expect them to be present in the tanks as well.

Also -- excuse me. My second issue is that due to the lack of information due to the lack of testing, basically, new remedies need to be come up with. New remedies need to be analyzed. Excuse me.

One of the remedies that was listed on the Power-- actually, the only remedy that was listed for the tanks on the proposed plan was that, quote/unquote, "The remedy proposed for tanks is to remove sludge from tanks and backfill the -- backfill the empty tanks."

That's the only remedy that's given, or referred to at least. The problem with that is, so, okay, we're removing all of the chemicals from the tanks. What about the tanks themselves? They're contaminated. We haven't done any testing in the last 28, 27 years, so we can't really determine whether the tanks have leaked into the soil around it, so we don't even have any information as to whether the soil right below the tanks or surrounding the tanks are contaminated.

By leaving the tanks there -- I understand that they're supposed to be encased. Or routed, excuse me. I think that was the language in the proposed plan -- we're still making ourselves vulnerable to the risk that that contamination in those tanks can still spread.

So in conclusion, Hanford -- excuse me -- my nonprofit organization and myself and especially Gerry, we ask that prior to reviewing these -- the proposed plan prior to coming to finalizing it, that proper testing be done on the tanks to figure out what the contaminants are, whether there has been leakage, and also test the area below the tanks, surrounding the tanks, and, finally, to remove the tanks.

You can do this by basically breaking the tanks apart. You will have to encase them before disposing them in a different landfill, but at least that way -- at least most of the danger will be removed.

Commenter #8:

Nancy Morris

Comment B:

And, however, if we were all required to meet certain standards where it's not just dependent on a few individuals or their -- their stakes in all this, I think we'd all be better off and that we had a better citizen committee involved with this that included nonpartisan scientists and so on. There are definitely remedies out there currently being researched about the geological chambers being dug.

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Commenter #36:

Chris

Comment C:

It would helpful, I think, to have three-dimensional moving models shown. You can do this with computers now. It's not square miles we're dealing with, it's cubic miles. Okay. And it's moving things not static things. So I think putting models, three dimensional, moving them around like you can and then showing the stuff flowing might be really exciting and thrilling and if we could just overcome our fear it wouldn't lead to so much denial.

Commenter #37:

Eric

Comment:

Hi, I'm Eric. I'm an intern at Hanford Challenge from Seattle. You talked about not having projection for flood area or something like that. I just feel it would be a lot better proposal if there were projections for something like that. It seems like building a house that is not prepared to take or sustain an earthquake and any reasonable person knows you ought to have that. And so I just feel it's as though somebody needs to go into the data for it to be effective.

Commenter #42:

Rob Pearson

Comment:

I'm Rob Pearson and I have a brief comment. I think everyone else has made some really good points. I'm more concerned at the testing in the CW-5 sites is inadequate. I know during the Q & A session we mentioned it. Other sites have been tested more recently in 2002 and 2006. But the fact remains that the CW-5 site most of it was tested before 1979, and a large portion of it has not been tested in the trenches since 1959. I'd like to see that change before you go any further.

Commenter #44:

Audience Member

Comment A:

Specifically, about the upcoming record of decision, considerations to somehow figure out a way to make those million dollar tests much less expensive that we can have confidence in the data and really where we need to focus on. That's very concerning that it costs a million dollars just to get information that we can rely on. So invest in that technology. And specifically about the cesium and the deep waste. Some sort of robot or remote thing that will really go down there and get, you know, figure out something. Get really, really creative.

In that record of decision, I'm going to look for some really great options and details. I know that you're looking for some sort of details.

Comment C:

So specifically about the record of decision creativity, inspiration.

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Commenter #50:

Kathleen Fitzgerald

Comment C:

The DOE and EPA need new samples. You did one in 2001, 2006, now it's time for another one in 2011. The plutonium could potentially move. How do we know it hasn't moved since 2006? How do we know where it currently is now, and how do we know how far to dig? I think two feet is not -- I mean, two 5 feet. You even said yourself that digging -- the possibility of an animal to dig is maybe even 18 feet. That's what I think I heard you say. So I think you need to at least go down, maybe I'm wrong but I'm not sure, but it just sounded like it needed to be more than two feet. So I think you need to update the information so that you have more information to go on.

Commenter #65:

Aaron Baker, Lake Oswego, OR

Comment B:

Obviously, I am not qualified to arbitrate on the truth of the scientific models involved in predicting plutonium migration, but I know that an unfortunate feature of science is that it can never prove a proposition (or a model), and only disprove it. Given that, I feel that a more cautious approach is not only justified, it is necessary.

Commenter #71:

Richard Smith, 7/5/11

Comment B:

However, there does not appear to be any data on contamination concentrations as a function of depth below ground surface (bgs) presented to support the various choices that are made.

As an example, I searched the proposed plan, the feasibility study, and the remedial investigation documents for any data that showed the concentration profile for plutonium as a function of depth beneath the floor of the Z-9 trench. The only information I could find was in Table B-3 of DOE/RL-2006-51 REV 0, which was from Vertical Borehole C3426. The data point nearest to the trench floor was at (47.5 – 50) ft bgs, about 30 ft beneath the floor. Subsequent data points were at much deeper depths. These data are not useful for characterizing the plutonium concentrations within the first few feet beneath the trench floor. There must be other more detailed data available that specifically illustrate the concentration profile over the first 5-10 feet beneath the trench floor, but I could not find any such information in the documents I examined. As a result, the choice to excavate only 2 ft of contaminated soil from the bottom of the Z-9 trench is totally unsupported. The reader is given no idea of how much plutonium is actually in that region of soil, and saying that removing the additional 2 ft of soil from the bottom of the trench will remove over 50% of the remaining plutonium appears to be pure conjecture on the part of DOE.

Such detailed concentration profile data are essential to doing calculations of the dose and risk arising from residual contaminants left behind after remediation. It is not clear how the risk analyses could be properly conducted with such a lack of detailed information. Similarly, not

knowing the concentrations versus depth profiles makes it impossible to know how deep the excavations will need to be, and what the cost of those excavations, waste packaging, transport, and disposal will be. Thus, the cost comparisons between alternatives and options may be highly suspect.

These concerns could be resolved by including the concentration versus depth profiles in this document (and in the preceding RI/FS documents). A convenient place to display such information would be on the figures that show the structural characteristics of the individual waste sites. Such a combined display would be very helpful to the reader in understanding the physical difficulties, potential cost, and possible benefits of contaminant removal to various depths.

Commenter #74:

Oregon Department of Energy 7/19/11

Comment I:

The Observational Approach method should be used as the waste sites are exposed to determine the locations of plutonium deposits that require RTD. The adaptive nature of this RTD approach will allow for identification and removal of higher concentrations of plutonium in some soil locations, as well as identification of insignificant contamination in other parts of the waste sites. It appears from the *draft Proposed Plan* that characterization of the trench and crib floors is incomplete, although it has been reported that more concentrated “pockets” of plutonium deposition did occur. The Observational Approach of RTD provides a more effective and efficient process than conducting more extensive characterization prior to remediation. Excavation of each of the waste sites should continue until cleanup verification data show that the plutonium concentrations in remaining soils are below the concentrations necessary to define transuranic waste and are at a permissibly low level in terms of risk, as has been routinely done for other contaminants at 100-Area and 300-Area waste sites.

Commenter #79

Richard Smith, 7/25/11

Comment A:

**Additional Comments on DOE/RL-2009-117,
Proposed Plan for the Remediation of
The 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units**

Richard I Smith, P.E.

July 25, 2011

After much reading and searching through the PP and the FS, and after listening to the presentation at the public meeting held in Richland, I have developed additional comments on the Proposed Plan and its predecessor documents.

Important bits of information are missing from the PP. First, there is no information presented on the total mass of plutonium presently residing in the subject waste sites. Second, there is no information presented on the total mass of plutonium expected to be remaining in those waste sites after remediation. The inventory data are contained within the FS, but are hidden in the text for the sites in Chapter 2 and displayed in very small print on Figures 2-3 through 2-9. They are not presented in any summary tables, either in the FS or in the PP, where they could readily be seen by the reader. While the calculated risks for these sites after remediation are low (based on the chosen residential farmer with one well drilled), the public is entitled to see the whole story on the amounts of plutonium involved, and I suspect that the public perception about leaving that much plutonium in the near-surface soil will be very unfavorable.

I could not find any explicit development of the rationale for removing only 2 ft. of soil from Z-9 trench in either the FS or the PP. While some interesting data displays of plutonium concentration as a function of depth are presented in Appendix F of the FS, no documentation of an analysis of these data for Z-9 for the purpose of selecting an acceptable excavation depth is presented in either the FS or the PP. Without some analyses in the FS to support the preferred 2 ft. removal choice, that choice appears to be rather arbitrary. Lack of any data displays in the PP that could provide bases for the remediation choices make it impossible for the reader to understand and evaluate the efficacy of the preferred remediation choices

Commenter #89:

Lyrik Pitzman, 7/29/11

Comment A:

I am an environmental scientist and a resident of Beaverton Oregon. I am also a user of the Columbia river for recreational purposes. I have reviewed the entire Proposal for remediation of the operable units. The biggest issue for me is it seems you have not properly estimated the potential risks to groundwater contamination. It is apparent you did not calculate impact from plutonium-239-240, americium-241, cesium-137, radium-226, strontium-90, PCBs, boron, and mercury (see Table 5 on page 28 of the Proposal plan).

Commenter #91:

Daniel Dancer, 7/30/11

Comment D:

please perform

**a full investigation of
the chemicals and radionuclides in and under all
of the waste sites—not rely on data from 40 years
ago!**

Commenter #111:

Confederated Tribes and Bands of the Yakama Nation ERWM

Comment H:

- Proposed RTD Options 3A & 3B: Ecological direct-contact exposure to non-radionuclides is to be evaluated at fifteen (15) feet below ground surface unless Ecology grants permission (in compliance with WAC 173-340 regulations). Neither of these options reflects this requirement nor was a complete baseline risk assessment conducted. Post-ROD confirmatory sampling does not substitute for a complete ecological assessment. Delay of sampling until development of a Work Plan is inconsistent with the CERCLA process which requires a baseline risk assessment (human health and environmental receptors) during the Remedial Investigation phase.

Comment J:

ELCR of 1×10^{-4} is for individual and is presented as EPA's target risk threshold; however EPA uses the general 10^{-4} to 10^{-6} risk range within which the Agency strives to manage risks as a part of a CERCLA cleanup, with a preference for cleanups achieving the more protective end of the range (i.e., the point of departure, 10^{-6}). Human health direct-contact exposure to non-radionuclides within fifteen (15) feet of ground surface risk to multiple carcinogens cannot exceed 1×10^{-5} in compliance with WAC 173-340. The more stringent values should be used.

Comment N:

Attachment 1: Review Comments on the Feasibility Study for the Remediation of the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units, DOE/RL-2009-117, Draft A

The Yakama Nation ERWM Program identified several areas that have significant concerns.

Characterization: There is considerable uncertainty associated with how sampling and data represents contaminant conditions in the vadose zone. Issues include:

- Assumption of similar and/or maximum future concentration values and lack of quantification and uncertainties in estimations.
 - Spatial and temporal difference may have influenced sample bias.
 - Plutonium and Americium radionuclides have been located at depths below 37 meters, indicating mobility not clearly defined.
-

Comments Received During Public Comment Period on the Proposed Plan for the Remediation of 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6

- indicating mobility not clearly defined.
- Limited or no data identified regarding the concentration or distribution of nonradiological contaminants in soils at some waste sites. The quantity of nitrate received some sites suggest it probably contributed in the past, and could have future impacts, to nitrate contamination in the unconfined aquifer.
- It is suggested that, rather than attempt to reduce uncertainties through design of alternatives which include groundwater impact mitigation efforts, efforts should focus on additional post-ROD site-specific vadose zone sampling with adjustments to the selected alternative. This is over-simplistic. Changes to alternatives cannot simply be done using this approach. Should decisions regarding whether the soil is protective of groundwater require changes be made to the chosen remedy, is USDOE going to follow the CERCLA modification process with an ESD or ROD amendment? Both would require Tribal/public review opportunities. The ERWM Program requests clarification on this issue.
- Sampling and Modeling: Generally stated, there appears to be a reliance on professional judgments to decide on the need for action that will be refined with additional characterization (confirmatory sampling) activities planned during remedial design and implementation of chosen alternative. Additional post-ROD sampling for mobile contaminants is suggested to improve the approximations of the distribution of these contaminants in the vadose zone and to improve estimates of the potential threat to groundwater.
 - Use of the 'analogous site' approach is only appropriate when the representative sites have been thoroughly characterized. Admittedly, the 216-Z-9 Trench did not have complete sampling.

To reduce uncertainties regarding the long-term reliability of management controls (including ICs) for providing continued protection from residuals, the ERWM Program requests USDOE perform necessary soil sampling within this Feasibility Study's activities.

The ERWM Program requests USDOE conduct sampling at waste sites where none were done and that analysis include Technetium-99, nitrate, PCBs, boron, mercury, TCE, hexavalent chromium as well as carbon tetrachloride and methylene chloride.

Groundwater: The RI and FS evaluations concluded that the majority of the waste sites pose a current or potential risk to human health and the environment (plants, animals, or groundwater) via direct contact or contaminant migration into the underlying groundwater from

unrestricted land use. The National Contingency Plan expectation for groundwater is that usable groundwater will be returned to the highest beneficial use (i.e., drinking water) "...wherever practicable, within a timeframe that is reasonable given the particular circumstances of the site" (40 CFR 300.430[a][1][iii][F]).

- It was stated that the majority of sampling and data uncertainties stem from the estimation of source term amounts, from sparse data, difficulties in understanding contaminant release/retention in the vadose zone, and/or data bias resulting from the tendency for preferential sampling of the more contaminated portions of contaminant plumes and associated sampling and measurement frequency bias.
-

Comments Received During Public Comment Period on the Proposed Plan for the Remediation of 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6

- Statements are made that some remediation of some contaminants (i.e. Nitrate and Technetium-99) will be addressed under the Deep Vadose Zone OU, 200-DV-1.
- Clarification needed as to why soil concentration value for Carbon Tetrachloride (.0031 mg/kg) was not used in place of less stringent groundwater values of 3.4ug/L.
- Borehole C3427 (DOE/RL-2006-51, 2007, Rev. 0) was drilled adjacent to the 216-Z-9 covered trench from February to May of 2006. At the time of construction, a maximum concentration of 254,000 pCi/g plutonium-239/240 was measured in Borehole C3427 at a depth of seventy (70) to seventy-two (72) feet below the ground surface. In less than fifty (50) years, plutonium has migrated to depths of approximately one hundred and twenty (120) feet at concentrations that exceed EPA standards for geologic disposal (100 nCi/g). Such data provide strong evidence for the need to include plutonium as a contaminant of concern in the vadose zone and groundwater at these Operable Units (OUs).

The ERWM Program requests USDOE perform additional groundwater site-specific sampling on the 200-PW-1, -3, -6, and 200-CW-5 waste sites under current Feasibility Study actions. Additionally, as filtered data for metals potentially underestimates the concentrations present in the groundwater, the ERWM Program requests USDOE perform unfiltered groundwater sampling to reflect a more accurate risk assessment.

Comment S:

- Proposed RTD Options 3A & 3B: Ecological direct-contact exposure to non-radionuclides is evaluated at 15 ft below ground surface unless Ecology grants permission (in compliance with WAC 173-340 regulations). Neither of these options reflects this requirement nor was a complete baseline risk assessment conducted. Post-ROD confirmatory sampling does not substitute for a complete ecological assessment. Delay until development of a Work Plan is inconsistent with the CERCLA process.
-

Comment V:

Ecological Risk: The Executive Summary states that there is no identified or projected ecological risk. Other text states a screening level ecological risk assessment (SLERA) ruled out further consideration of sites with regard to ecological risk potential; therefore no final COPCs were identified by the ecological risk assessment process. Yet, discussion in Section 3.3 states ecological exposures are likely present at twelve of the sixteen waste sites.

- The working hypothesis for the purposes of the SLERA is that biological activity at these 200-PW-1, -3, and -6 waste sites are limited largely to the top eight (8) to ten (10) feet. This is an erroneous assumption. We do not agree that the biologically active zone is limited to ten (10) feet below ground surface or to an alternate point of compliance for protection of human health or the environment. Ecological direct-contact exposure to non-radionuclides is to be evaluated at fifteen (15) feet below ground surface unless Ecology grants permission (in compliance with WAC 173-340 regulations).
- Statements are made that at least one of the remedial alternatives would address contaminants potentially posing a threat to ecological receptors (i.e., RTD of soils to a depth of 4.6 meters [15feet] for protection of human health or groundwater) and that demonstration that remediation will also protect ecological receptors will be addressed as a part of the remedial design/remedial actions post-ROD. Unless USDOE intends to RTD soils to at least fifteen (15) feet at each waste site, this assumption is invalid.
- Furthermore, delay of sampling until development of a Work Plan is inconsistent with the CERCLA process which requires a baseline risk assessment (human health and ecological receptors) during the Remedial Investigation phase. Identifying ecological screening values or preliminary remediation goals (PRGs) in the Work Plan is unacceptable.
- We also request USDOE clarify the decision-making process and what is the screening level for Tc-99.

The ERWM Program requests USDOE perform a complete ecological risk assessment, identify all pathways, and characterize current and potential threats to the environment and ecological receptors, and include results in this Feasibility Study. Consider animals consuming contaminated plants in the assessment. Note Federal maximum contaminant levels (MCLs) are NOT risk levels. Although an evaluation of how MCLs compare to risk levels can be made (and MCLs may be used for screening) they are not the same as risk levels.

Comment EE:

questionable. The ERWM Program does not believe sections 6.6.2.3 *Natural, Cultural, and Historical Resources* and 6.6.2.7 *Irreversible and Irrecoverable Commitment of Resources* have adequately met the NHPA (and other Acts) or NEPA requirements. There is no discussion provided in previous sections which detail how compliance with ARARs will be met or source of backfill soils. The ERWM Program requests USDOE prepare an Environmental Assessment on these actions to assist decision-making.

Commenter #115

Hanford Advisory Board

Comment G:

The Board advises basing remedial design for cleanup of technetium and nitrates upon increased characterization. Extensive sampling is needed to determine the location and extent of technetium and nitrate contamination. This characterization should coincide with remediation efforts.

Commenter #116

Nez Perce Tribal Executive Committee

Comment G:

- * The risk scenarios should include a section on neutron and neutron-gamma ray activation exposure before a final remedy is selected.
- * The 216-Z-9 Trench and the 216-Z-18 Crib will require additional characterization before remediation activities can proceed.

Commenter #117

Columbia Riverkeeper, 8/31/11 via e-mail

Comment P:

The vast majority of comments submitted to U.S. DOE and U.S. EPA during public hearings rejected the assumption that plutonium and other contaminants would remain stable and immobile in Hanford's soil. Multiple scientific studies submitted to U.S. DOE indicate that plutonium may be transported through the subsurface in colloids and other chemical complexes. The best available science does not support U.S. DOE's umbrella assumption of plutonium immobility.^{xiii} Ultimately, if U.S. DOE implements its plan and this assumption proves false, plutonium will move through groundwater into the Columbia River and the surrounding environment. Because the best available science demonstrates that plutonium is not stable in the soil at Hanford^{xiv}, U.S. DOE must evaluate the impacts of plutonium from the 200 Area entering the Columbia River in hundreds, thousands, and potentially tens of thousands of years into the future.

Lastly, U.S. DOE acknowledges that it has an incomplete knowledge of other contaminants of concern, such as nitrates and Tc-99. U.S. DOE wrote,

—Two other contaminants at the 200-PW-1 and 200-PW-6 waste sites, technetium-99 and nitrate, had a high level of uncertainty as potential threats to groundwater.

These contaminants are not expected to pose an unacceptable risk based on fate and transport modeling results and process knowledge of the type of liquid waste discharged at these waste sites. Additional sampling will be conducted to confirm contaminant levels as part of the remedial design.^{xv}

Additionally, U.S. DOE's proposal for vapor extraction of carbon tetrachloride is unlikely to adequate volumes of this dangerous chemical to prevent future risks to the Columbia River and the surrounding environment. As shown in the TC/WM EIS, Tc-99 and carbon tetrachloride present a serious long-term risk to the Columbia River. By failing to implement an aggressive RTD approach, U.S. DOE falls short of addressing contaminants that pose a risk to human health and the environment. 11

Pictured above, Appendix U of U.S. DOE's TC/WM EIS demonstrate that dangerous levels of nitrate and Tc-99 will persist in groundwater near the Columbia River for hundreds of years. The nitrate plume shown above represents the possible plume in 2135, over 100 years from now. Disturbingly, even in year 3890, Tc-99 concentrations will continue to be increasing in Hanford's Central Plateau groundwater.

Commenter #120
Hanford Challenge

Comment H :

The Board (HAB) advises basing remedial design for cleanup of technetium and nitrates upon increased characterization. Extensive sampling is needed to determine the location and extent of technetium and nitrate contamination. This characterization should coincide with remediation efforts.

Commenter #124

Confederated Tribes of the Umatilla Indian Reservation

Comment E:

Treatment Options

On page 18, there is a discussion of "Principal Threat Waste". The soils are acknowledged to contain significant concentrations of highly toxic materials and considered a principal threat waste. Even though the preference is to treat this waste, it is stated that there is "no feasible technology to practicably treat radionuclides". This seems like a generalized statement one technology that has been tested at Hanford in the past and it has been shown to work.

Characterization

The CTUIR is skeptical by the section (page 26) that summarizes the potential of contaminants to migrate to ground water. Technetium-99 is the only radionuclide that their model showed had the potential of contaminating the ground water. Even then, it was not listed as a COC, but listed as having a high level of uncertainty at posing a threat to the ground water. Carbon tetrachloride and methylene chloride are listed as the only volatile contaminants that could potentially migrate through the soil to contaminate the ground water.

The CTUIR feel that there needs to be additional characterization of the technetium and nitrate contamination.

Support for leaving cesium in place

COMMENTS

Commenter #1

Pam Larson Brown

Comment:

The half-life of cesium I'm pretty comfortable with. The stuff is going to go away in a reasonable time frame that we can have some confidence of institutional controls.

Commenter #2

Dale Engstrom

Comment B:

First of all it's divided basically into those three groups that we talked about in the first place. And the PW-3 which is the cesium sites and the PW-6 and the CW-5 are not really a concern because there's not a lot of material there. There's not a lot of plutonium to worry about.

Commenter #14:

Jurgen Hess

Comment B:

I defer a lot to Ken and the State of Oregon about the cesium.

Commenter #55:

Sam Dechter, Richland, WA

Comment:

I lean heavily in favor of removing more of the Pu in the ground with money available today & deferring the Cs & other stuff until later.

Commenter #74

Oregon Department of Energy, 7/19/11

Comment E:

Oregon has long argued that the chemical interactions between contaminants and Hanford's soil are a key factor that needs to be considered when deciding on a remedy. In the case of plutonium, as we have explained many times in the past, we believe that Hanford's soil chemistry can and does result in mobility of certain forms of plutonium. Conversely, cesium generally binds well to Hanford's soil, so we therefore believe the cesium waste sites are unlikely to threaten Hanford groundwater.

The 15-foot barrier and a DOE presence at the Central Plateau for the next several hundred years would likely provide adequate protection from surface intrusion. If DOE cannot commit to a continuing presence within the Central Plateau until the cesium sites have

decayed to a safe level, then RTD should be the option selected. The remedy design should include specific detailed provisions to prevent the future application of irrigation and most especially the use of fertilizers. These could mobilize the cesium, invalidate the remedial decision, and threaten the groundwater.

We note that the projected cost differences for the RTD options for these waste sites are not significant, especially if complete life-cycle costs are included as part of the “barrier” option.

Commenter #94:

John Howieson, 8/1/11/11

Comment B:

These comments refer to the proposed cleanup actions for remediation of Hanford Waste Sites (200-CW-5, 200-PW-1, 200 PW-3, and 200-PW-6 Operable Units.

Oregon Physicians for Social Responsibility.... We agree with the Oregon Department of Energy position that the greater health hazard resides with the “high salt” deposits of Plutonium because these wastes are judged to be more mobile than the Cesium waste.

Commenter #114

Robert Watkins

Comment B:

In general, I agree with the remediation alternatives proposed. I simply wish to increase the amount of contamination that could be removed at a small additional cost.

Public Involvement Process

COMMENTS

Commenter #6:

Jucinta Heath

Comment:

JUCINTA: My name's JUCINTA. I go to University of Washington. I'm actually doing my honors thesis on the Hanford site, particularly the public participation aspect of your guys's plan.

What I'd really like to see is more easily accessible information about your alternatives and all the other operations at Hanford, just, you know, so the people can gain -- you know, can know about it through -- I've looked at all of your websites and there's just kind of surface information. It's not easy to get, like, really detailed things that are actually going on.

Also, I was thinking maybe changing the format of the meetings and increasing outreach because I've gone to a lot of these and seen a lot of similar faces, same messages being given, like, it seems like the communication between different parties isn't quite as effective as it should be or could be.

Commenter #11:

Eric Rosenfeld

Comment:

MR. ROSENFELD: Hi. I'm Eric Rosenfeld. I'm an intern at Hanford Challenge. I'd just like to follow up with what JUCINTA was saying about the difficulty of the -- understanding the proposed plan. I have started working on it about two weeks ago, and it wasn't until yesterday at about 4 o'clock that I finally finished just making a simple fact sheet just fully grasping everything. Like I was -- the Operable Units, all that stuff is just very confusing. And if -- I was actually, like, tasked to work on it, and I feel like for someone who is not given that job, it's incredibly difficult to grasp anything that is being proposed in the plan that's 360 pages and that is, what I'm told, a very short plan. And so just I would like to see a bit more accessibility for the public.

Commenter #12:

Gerry Pollet

Comment B:

And, secondly, I think it is really important to build on the point that was just made that the proposed plan is pretty -- not only incomprehensible, but the materials sent out, while there was nice effort at making a guide, anyone who looked at an e-mail that said "proposed plan for CW-5" is going to go back to sleep and not have a clue what this is about.

The agencies were urged by the Hanford Advisory Board Public Involvement Committee and by the stakeholder groups to put out a notice that said "proposed plan for cleanup of the plutonium liquid waste discharge sites." That would be understandable. It would be English. And you need to take this to heart. It's disheartening to me that, because of the lack

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of time, we didn't have -- we didn't -- these meetings were not set with 45 days notice, per the public involvement plan, so we couldn't do a mailing in time to tell thousands of people about it. We had to rely on e-mail. And that's very difficult to get people to turn out to. And your mailings and e-mail basically talked about this proposed plan that was incomprehensible.

If people want to look further and review the comments, as we discovered in the last 24 hours, the link was actually broken. If you search for the remedial investigation in the administrative record, you're faced with a search result of 600 documents, and you can't figure out which remedial investigation was actually the one relied upon for this proposed plan. Same with the feasibility studies. It's ridiculous.

What would make sense is why not put out a document that says Here's the link to the primary documents so you can actually read it and review it and see did they actually report when they characterized the sites and what was in the sites.

Commenter #15

Dave Berger

Comment A:

Regarding the sampling data, even though you have thousands of pages of data, there is only less than 300 elements in the periodic table last I looked. It would be fairly easy to present the data for these four sites based on ranges of, you know, a range of plutonium based on depth and a range for cesium based on depth and a range for carbon tet based on depth, you know, with statistical stuff like highs and lows.

I don't think that would be very difficult. I don't think we need to go through thousands of pages of data to see that. And that would make our understanding of the process a lot better.

Secondly, regarding the curve that you presented when Darrell asked the question about how you decided to go to two feet down. When I saw on that curve, and I may have misinterpreted that, but there was a lot of data points way down low but one or two data points where you made the two-foot decision. That doesn't seem like a sound way to make a decision if that is correct. So I wonder about that, and I wonder if there is not a better way to present that data, too.

Commenter #18:

Joe Still

Comment A:

First I want to say thank you to the federal representatives, state representatives for coming. I appreciate it.

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Commenter #16

Kathy Carlson

Comment D:

And then the other things were, comments that I heard here from you folks was, oh, "We are transparent. We want to be clear." Not. There is nothing here that is clear, and it is not transparent.

Commenter #23:

Bob Ruder

Comment A:

And I am just really encouraged by the desire to take advantage of this opportunity to make the Hanford site safe by everyone here, and I think that this is an unbelievable opportunity, and that we have come together at a time when we are making some real decisions about what is going to happen in realtime.

Commenter #26:

Gerry Pollet

Comment:

I want to thank everyone for coming and sticking with us this evening.

Remember, the Energy Department wouldn't have even stopped dumping liquid waste into the soil trenches without treatment if it wasn't for some of you here coming to meetings 20 years ago and sticking with it. You really make a difference.

And one of my comments tonight is the fact that we had far less than 45 days to provide public notice of this. We were supposed to have 45 days under the Hanford cleanup publically involved in the plan called the new relations plan. And without 45 days, River Keeper and Hearts of America Northwest cannot do a mailing to you and everyone else who wanted to be here tonight.

And I know that many of you helped out making phone calls and forwarding E-mails and Facebook announcements. Thank you for doing that because we would have had an empty room otherwise, and it is totally wrong for the agencies to put out a proposal, and say we will not give you 45 days of advanced notice for public meetings. The agencies didn't really want to have public meetings. So public involvement, advisory board and other people pushed hard, and they agreed to do public meetings, but they didn't really want you here. So they didn't give us 45 the days.

It is really important that we have 45 days so we can do mailings, and it is really important later this year they are going to come out with a proposed revision to public involvement plan.

I hope to see you all here with a lot of other people saying: If you don't give us 45 days, you don't get to go forward with your plan.

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Secondly, if you don't give us access to the documents, public comment period doesn't start, and in this case if you look -- there was a proposed plan that is, frankly, a piece of garbage that was distributed if you went beyond the agencies' fact sheet, and then you wanted to see where was that real data, and you had a broken link to the administrative record. If you knew where the administrative record was, you received back a search query of 640 documents and versions like A through G of the feasibility study, and you are supposed to try to figure out which one was used.

I appreciate Dennis Falk's and the EPA's commitment that if we ask for it there will be an extension of the comment period, and we asked for it because, first off, you need to establish the principle that if the documents aren't available the comment period keeps going until you have had plenty of time to review them.

Secondly, in this case, for real, people trying to review these documents were reading the wrong damn documents because you didn't provide the right access to them. What did the documents say? Let's get to this.

Commenter #38:

Audience Member

Comment D:

I'd like to request that we have at least 30 days notice, preferably 45 days for these meetings, but I'm glad to see the turn out.

Commenter #43:

Lloyd Marbet

Comment A:

I very much appreciate all the comments that have been made this evening. I understand and feel great sympathy for the people who are holding this hearing and asking for this input, when in fact, we have to confront you, unfortunately, with the insanity of this process. Three minute comments on 240,000 year decision is really not a great example of how to democracy should work. My name is Lloyd Marbet. I am Executive Director Oregon Conservancy Foundation and I have been a long-time anti-nuclear activist in the State of Oregon. I'm here representing myself, my family, and I'm speaking on behalf of the conservancy foundation.

Commenter #54:

Gerry Pollet

Comment A:

I want to thank you all for sticking with this tonight and for coming out, so many people who have children at home. My name is Jerry Pollet with Heart of America Northwest. There is no way that I can imagine that Mr. Dowell and the regulators can hear heartfelt testimony that given tonight and come back and not say they've changed their plans. At least they can't do that and say we're responsive to the public. Thank you for being here. Some of you got here tonight because someone else made a phone call to you. So please make sure you're on our list and

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maybe next time, if you have a chance, you can make some phone calls to other people you know to bring out to the next meeting.

Comment G:

And now that we are finally able to assess a feasibility study, which for most of this time period you couldn't even access and I appreciate that EPA last night said that the comment period would be extended to accommodate being able to review the studies.

Commenter #60:

Sofia Gidlund/Geoff Guillory, Portland, OR

Comment A:

I gave a verbal comment but would like to add my disappointment with the transparency and public outreach efforts. The documents and presentations you are "sharing" with the public are incomprehensive and that not ok.

You need to do a much better job letting people know of hearings in a timely manner. You should inform all state and municipal channels and request the share the information widely. You should also be required to inform media and put out ads.

You need to make the documents and presentation easy to understand and test them on a sample group of average Americans before releasing them to the public. Currently you need a phd in nuclear physics to understand what is proposed for the future of my life and my fellow northwesterners.

Commenter #61:

no name, no address, Portland meeting

Comment:

All of the charts (show & tell) were not included in the handout to the public.

It is disturbing to have & public interest group presentation in the room with displays & staff who can answer questions.

JD's answers got too long – justification.

Commenter #69:

no name, index card

Comment A:

Please provide Plain Language Titles on Plan – Not big numbers.

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Commenter #76:

Ross Pearson, 7/20/11

Comment A:

We would like to bring to your attention that the web address for the Administrative Record and accessing the RI/FS for the Plutonium Cleanup Sites Proposed Plan is either incorrect or broken. This is limiting and delaying our ability to review and prepare a presentation for the hearings tomorrow. See page 46 of the Proposed Plan, and page 4 of the TPA Fact Sheet

Comment B:

I was trying to review the administrative record for the Proposed Plan for the Remediation of Waste Sites in Hanford's Central Plateau, and I ran into a problem on this page:

<http://www.hanford.gov/arpir/>

Can you send me a link so I can reach the administrative record?

Commenter #78:

Gerry Pollet, 7/21/11

For the record, this is poor access to records and has wasted a lot of time and effort and delayed our review... others would most likely have simply given up when confronted with a broken link.

It is not just the wrong url that is the problem.

The links to the actual documents should have been provided. Because they were not, hours were wasted searching the Admin Record for each waste site. The Admin Record search is abysmal, as has been discussed before. How were we to know that the documents that we pulled up from the Admin Record were not the RI document actually relied upon, or the correct version of the FS for each unit?

The CRP / Public Involvement Plan needs to rectify this permanently by specifying that there will be timely access to all referenced and relied upon documents with links provided, not sending people to search through hundreds of documents for a unit in the AR.

The comment period for this Proposed Plan should be extended to provide for the days spent without appropriate access to the correct records.

Under NEPA, agencies must provide access to all referenced documents during the comment period. The same rule should be applied for TPA documents. Just having them in the AR is NOT adequate.

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This comment should be placed in the official record and responded to. In addition, we ask that the agencies respond to our request that the proper links to the documents be sent out and the comment period extended day for day during the time that we have not been able to review the correct documents.

Commenter #86:

Hafiz Heartson, 7/28/11

Comment D:

Thank You for your thoughtful consideration of these issues. I want to hear how your plan is modified in response to my, and others, public comments.

Commenter #111

Confederated Tribes and Bands of the Yakama Nation ERWM

Comment A:

August 3, 2011

Rich Holten, Assistant Manager
For the Central Plateau
Richland Operations Office
U.S. Department of Energy
P.O. Box 550
Richland, Washington 99352

Jane Hedges, Program Manager
Nuclear Waste Program
Washington Department of Ecology
3100 Port of Benton Blvd
Richland, WA 99354

Dennis Faulk, Hanford Project Manager
U.S. Environmental Protection Agency
309 Bradley Blvd., Suite 115
Richland, WA 99352

Re: Review Comments on the *Proposed Plan for the Remediation of the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units, DOE/RL-2009-117, Revision 0.*

Dear Mr. Holten:

The Yakama Nation ERWM Program appreciates the opportunity to review and provide comments on the *Proposed Plan for the Remediation of the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units, DOE/RL-2009-117, Rev 0.*

The Confederated Tribes and Bands of the Yakama Nation is a federally recognized sovereign pursuant of the Treaty of June 9, 1855 made with the United States of America (12Stat. 951).

There is no issue of greater importance to the Yakama Nation than protection of, and respect for the treaty-reserved rights. The Hanford Site lies within ceded area of the Confederated Tribes & Bands of the Yakama Nation. Within this ceded area, the Yakama Nation retains the rights to natural and cultural resources including but not limited to areas of ancestral use, archaeological sites and burial grounds. These resources are sacred and sensitive to the Yakama Nation, and must be managed to preserve, protect and perpetuate the resources that are inseparable from our way of life. Our concerns were previously identified in our March 2011 letter to DOE on this subject. These concerns remain valid. The ERWM Program identified several areas that have significant concerns.

Commenter #113
Heather Flanagan

Comment A:

Thank you for extending the comment period regarding the Hanford Liquid Waste cleanup requirements. I have ready through the issues, and very much support the following thoughts:

Commenter #116
Nez Perce Tribal Executive Committee

Comment A:

~~June 30, 2011~~
June 30, 2011

P.O. BOX 550 • RICHLAND, WASHINGTON 99352 • (509) 870-2200

Matthew McCormick
Richland Operations Office
P.O. Box 550
Richland, WA 99352

Dear Mr. McCormick:

RE: Proposed Plan for the Remediation of the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units, DOE/RL-2009-117, DRAFT A and Feasibility Study for the Plutonium/Organic-Rich Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units, DOE/RL-2007-27, Draft C.

The Nez Perce Tribe retains reserved treaty rights in the Mid-Columbia region under the Treaty of 1855 with United States Government. These rights have been recognized and affirmed through subsequent Federal and State actions. These actions protect Nez Perce rights to utilize our usual and accustomed resources and resource areas, including those in the Hanford Reach of the Columbia River. Accordingly, Nez Perce Tribe Environmental Restoration and Waste Management program (ERWM) has support from the DOE to participate in and monitor relevant DOE activities. Degradation of the environment is relevant to reserved treaty rights, and therefore we maintain involvement in waste management/vadose zone/groundwater issues.

The NPT appreciates the opportunity to comment on these plans. DOE has associated obligations of the federal fiduciary trustee to the Affected Tribes, and to the natural resource trustees (Tribes, states, and federal government) and their constituencies.

Tribal Values

In essence, tribal values are intent on protecting, preserving and perpetuating resources for the sake of our cultural survival. It is imperative that materials we use in a subsistence lifestyle be uncontaminated. Once resources become contaminated or lost then part of our connection to the land and part of our culture is lost.

**Commenter #120
Hanford Challenge**

Comment K:

The Board advises the Tri-Party agencies to hold public meetings to discuss the draft "Proposed Plan for the Remediation of the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units."

Hanford Challenge adopts and repeats these sound pieces of advice as our own, and incorporates this advice into our comments.

**Commenter #121
Heart of America Northwest and Heart of America Northwest Research Center**

Comment E:

- *That the serious public involvement and notice inadequacies in this comment period provide a guide to revising the Hanford Cleanup Public Involvement Plan to ensure these barriers to public review and comment are not repeated.*

Comment J:

Despite inadequate public notice, increasingly large numbers of concerned people came to the public hearings as HoANW increased public awareness of the proposal and its impacts. In Portland, the final hearing, the crowd overflowed the meeting room – and, the public called for real cleanup and overwhelmingly (indeed, unanimously) called for the regulators to reject the Energy Department's plans, even after hearing the Energy Department fully explain and seek to justify those plans.

These comments are accompanied by a PowerPoint presentation, which is an integral part of our comments for the agencies to consider and respond to.

Comment K:

The Notice and Public Comment Period Were Inadequate, and the Comment Period Should Continue With Renewed Notice and Additional Information – and the Hanford Public Involvement Plan (Community Relations Plan) should be revised to prevent this from recurring.

1. The TPA agencies failed to provide the minimum thirty days of public notice of when and where hearings / meetings will be as prescribed in the TPA Community Relations Plan (CRP at Page 4). The CRP is a legally binding public involvement plan, and can not be blithely ignored for the convenience of agencies. The need for giving 30 to 45 days of minimum notice was well illustrated for this comment period.

The agencies provided less than 19 days from their announcement that they would hold meetings. Indeed, the TPA email announcement was only sent on July 5, 2011 for the first meeting on July 19th.

Without 30 to 45 days of notice of the hearings, it was impossible for HoANW to prepare and mail one of our highly regarded Citizens' Guides to the public informing people how their

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values would be affected by the proposal and informing people of the results of any independent analyses.

The majority of all public attendance at these hearings, and other recent hearings, has been due to the combination of HoANW and HoANWRC's efforts with mailed Citizens' Guides, emailed versions of our Guides, phone banking, social media (with links to Guides), pre-meeting workshops, and media outreach.

The attendance increased dramatically from the first hearings in Richland and Seattle to the latter ones in Hood River and Portland (with over 80 overflowing the room), because we were able to do more of these notice and involvement efforts, including phoning and mailing (first class due to the time it takes to send bulk mailings would have meant that our Guide would not have arrived before the hearings).

Not providing at least 30 days of advance notice before the hearings is inexcusable. The comment period should be extended for this reason, as well as due to the legally inadequate opportunity to review key documents.

It takes longer than 30 days to review thousands of pages of documents and prepare a Citizens' Guide and workshops for the public.

As discussed below, key documents were not made available until AFTER the public meetings were half over. This prevented us from providing the public with the full information that the public deserved to have access to and summarized in workshops, Citizens' Guides and opening presentations at the hearings / meetings.

2. No one in the public should be expected to take note of, or comment upon, notices about: *"Proposed Plan for the Remediation of the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units."*

By insisting on keeping the waste sites organized for public comment based on arcane designations, even extremely knowledgeable Hanford cleanup advocates could not track which units and sites were described from which alternative. There was no reason not to have the public comment on waste sites by practical description, e.g., settling tanks; Cesium discharge sites; Plutonium discharge trenches. The agencies should take comments based on the practical descriptions, not the artificially imposed groupings of alternatives by "unit".

3. The extension given at our request due to USDOE's failure to provide access to the key documents with the proposed plan, study of alternatives ("Feasibility Studies") and results of the so-called "investigations" was inadequate and did not make up for the fact that we were deprived of access to the key records before the hearings.

This prevented us from fully exposing to the public and news media how the proposal is built upon characterization of sites that was done decades ago, and did not conform to modern era hazardous waste laws regarding investigation, characterization and designation of wastes.

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All key documents should be provided to the public with easy access on line prior to the start of the formal comment period. This should be firmly established in the Community Relations Plan, when it is updated this year.

For this comment period, the link provided to access the key documents in the TPA Fact Sheet was broken or mistyped. However, even with the link to the Administrative Record, the formal Administrative Record is so poorly maintained by USDOE that finding documents is a herculean task. Indeed, it appears that USDOE has no interest in providing simple searchable indices for each unit.

Thus, we were deprived until recently of the opportunity to review the key Remedial Investigation and Feasibility Study documents, which do not support the Proposed Plan and do not meet minimal legal requirements. Only with EPA's personal assistance (which we appreciated) was one of our legal interns able to find and obtain access to the sampling report for the Settling Tanks, which are a key part of the Proposed Plan. (Indeed, the pipeline characterization report for the pipelines which fed the tanks, which was stated to be attached, was not attached and we have been unable to review it to review what was actually sent into the tanks).

The Sampling Report could not have been found by anyone looking for it if they did not know exactly when it was issued and what it was entitled. This is not surprising, because, as our comments detail below, the report on the settling tanks reveals that USDOE's claims of characterization of the tanks in recent years was misleading at best; the settling tanks should be subject to formal legal closure pursuant to RCRA and HWMA (federal and state hazardous waste laws applicable to any tank or unit in which wastes were stored, managed, treated or disposed after 1985 at the latest); and, that the characterization fails to meet those hazardous waste law and CERCLA standards.

4. What's in these liquid waste discharge sites? You won't find this info by reading the agencies' guide or the "Proposed Plan" prepared by USDOE

Again, the notice and information were seriously inadequate.

Information about the contaminants was not provided in a manner understandable to the public:

- The liquid waste discharge "cribs", ditches, "French drains" & trenches on Hanford's Central Plateau have enough Plutonium (Pu) to make 70 nuclear weapons
- Plutonium 239 half-life... 24,000 years... Pu is forever
- Highly radioactive Cesium (half-life 30 years)
- Chemicals... metals, carcinogens, neurotoxins, poisons, solvents which are very good at moving Plutonium and other contaminants

5. The public is legally entitled to a cumulative impact analysis of the total cumulative impacts from all the wastes sites in these units and related, similar waste sites on the Central Plateau – this has not been provided.

Regulatory Standards

Commenter #5:

Lindsay O'Brien

Comment B:

And somebody mentioned the standards that have been used. Just one final thought. I noticed that on the proposed plan, it kind of keeps going back and forth between the Superfund and then RICCA. And I don't know how many of you guys know this, I was actually just informed, that as of 1985, RICCA is the one that's supposed to be applied.

So the usage of any Superfund standards are just not enough and are actually not the ones that are required by law. So my final request is to make sure that RICCA is being followed, as it's supposed to.

Commenter #7:

Alera Walker

Comment A:

I'm here to say that the EPA and Washington Ecology should insist that plutonium, cesium, and other chemicals are dug up and removed at all of these sites, and they should have a cleanup standard for plutonium on Hanford's Central Plateau which is just as protective as the level of the cleanup being used at Lawrence Livermore National Lab because that shows that it is possible, or even the same -- the same strictness as they have for the Hanford sites that are closer to the river.

Comment D:

And we're counting on you right now to insist on the highest possible cleanup standards because anything less would be putting lives at risk. And so that's why we're holding you accountable for that.

Commenter #8:

Nancy Morris

Comment B:

And, however, if we were all required to meet certain standards where it's not just dependent on a few individuals or their -- their stakes in all this, I think we'd all be better off and that we had a better citizen committee involved with this that included nonpartisan scientists and so on. There are definitely remedies out there currently being researched about the geological chambers being dug.

Commenter #12:

Gerry Pollet

Comment C:

And that brings us to the difference between state hazardous waste law and the balancing act on the high-wire of CERCLA Superfund which doesn't have strict criteria, but we're fortunate

because state law's also supposed to apply. And in this case, and I'll turn over and walk over to John Price from Ecology, hazardous waste law applies to every hazardous waste stored, treated, or disposed after 1985 on the Hanford site. We've had this conversation many times. Those storage tanks that Lindsay O'Brian was talking about still have waste in them. Over a thousand liters or 2,000 liters in one of them. I forget what quantity is in the other. It's still storing waste; therefore, it's under your jurisdiction at Ecology as a RCRA storage tank. And it is subject to the more stringent standards that say you have to actually find out what the heck is in it. And if those are extremely hazardous wastes, you have to remove the tank. And, actually, there's no legal place to even landfill it in the state of Washington.

Instead, we have a plan that says we're going to remove the contents, put them in a landfill that -- where it might be illegal to put them in, and leave the tank which might be illegal.

For the cesium sites, we have a similar situation. For ditches, we have some of the ditches that took hazardous waste all the way till the year 1995. Now, the Energy Department, for the goodness of their hearts, didn't end dumping waste in these unlined ditches without treatment in 1995 because it was just out of the goodness of their heart, about 30 years after everyone else stopped dumping liquid wastes without treatment in unlined ditches. They did it because they were sued and forced to stop in 1995. That's the point of having institutional memory. They're not very good at keeping commitments or following the law. And, again, the hazardous waste law for state and federal hazardous waste law, and our state rule says you have to characterize what is actually in a trench and the aerial extent of the contamination that is spread from it under our federal and state hazardous waste law, not just relying on characterization from 1970. In 1970, the Energy Department didn't believe -- well, there wasn't a hazardous waste law for it to follow. In 1985, it still wasn't willing to say it was subject to that federal and state hazardous waste law. It fought it tooth and nail. So even if the data was collected in 1985, they wouldn't have done characterization of what the chemical hazardous wastes were. 1970 they certainly didn't. They didn't try to identify which of these were corrosives, acidic, flammable, which of these need to be treated in what fashion and removed. We're talking about plutonium digging up two feet. But that same waste site has, I think -- I won't go back and look it up -- I think it's 300,000 liters of carbon tetrachloride in it and hundred thousand liters of dibutyl phosphate, tributyl phosphate. And we don't even know how much hydroxylamine nitrate was put into these trenches. They haven't reported it. Just failed to characterize for it. But we know it was used and discharged.

If we're following our federal and state hazardous waste law, we need to go back and recharacterize these sites properly and find out what is actually in them and then apply the state law that says. For instance, on PCBs, the Energy Department says they won't move; we don't need a groundwater protection standard. Just like for plutonium; it won't move; we don't need a groundwater protection standard. Well, we need a standard, and the state has a standard for those chemical wastes, and it says essentially, roughly, if you got level X, if the groundwater standard level is Y, you have to -- you can't be more than ten times it in the soil. We know we're way above that for these chemical contaminants and yet they're saying we'll just dig up two feet of soil or we'll just cover up the cesium sites. That's not cleanup; that's a coverup. We urge you to go back to the drawing board one more time. Once more it's in the breach, dear J.D.

Comments Received During Public Comment Period on the Proposed Plan for the Remediation of 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6

Commenter #15

Dave Berger

Comment B:

As far as the cleanup is concerned, I think that we should go to the California standard, at least, for the plutonium cleanup, and perhaps, you know, as far as any cleanup we should be looking at something like a 99 percent removal.

Commenter #30:

Chandra Radiance

Comment:

Thank you. Chandra Radiance, Hood River.

I just wanted to make a second comment requesting that you would clean up the plutonium up to at least the standards that has been set by the Lawrence Livermore Lab in California which is a thousand times more protective level of plutonium than what Hanford is currently allowing. I don't remember the exact numbers, but I think you have knowledge of the 2.5 picocuries per gram instead of, whatever, 29,000 -- 2900.

Commenter #33

Dvija Michael Bertish

Comment D:

We need cleanup standards to be far more restrictive as applied to the site to go as low as possible to the standard that's already in the Hanford Reach at 35 microcuries.

Commenter #40:

Margie

Comment B:

And cleaned up to the standards comparable to the Johnson standards, our health depends on it.

Commenter #49:

Katherine

Comment:

My name is Katherine and I live in Vancouver, Washington. I work in Portland with suicidal kids who are looking for adults to make right decisions so they can have hope for their future. Hearing this proposal makes my heart hurt because there is nothing I can find right in it. Balanced risk is a euphemism for selling them all out. I was initially encouraged to hear what Washington law requires but I'm appalled to hear the Washington Department of Ecology is buying into unreasonable assumptions. That incomplete cleanup is sufficient to meet the terms of Washington law. It isn't. The proposed plan is not thorough and not protective in spite of the effort being made here tonight to sell this plan under the guise of balanced risk. The EPA and Washington Ecology are obligated to dig up and remove all plutonium, cesium and other radionuclides and chemicals and safely place them in a repository. The right thing for human health and the environment is to do the most, not the least possible to protect us all.

Comments Received During Public Comment Period on the Proposed Plan for the Remediation of 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6

Commenter #54:

Gerry Pollet

Comment B:

I want to talk on behalf of -- in terms of testimony, let me just start -- Mr. Dowell tonight said, we will achieve the drinking levels standard, "at all costs." We will achieve at all costs. 1977 the federal government passed the amended clean water act banning the untreated water waste discharges the same type of discharges that continue at Hanford illegally for another 18 years, making this problem far worse. At that time, and through the late 1980s, when we started demanding an end to these charges, because before that they were secret. The mantra was, "It's too damn expensive," for the federal government to transport the waste. At all costs meant making bombs at all costs to help the environment. Being angry about this, well we've heard it so many times. It's hard to just be here and say calmly. Oh, now we'll trust at all costs. When the U.S. Department of Energy refused to end dumping of liquid waste without treatment, making these problems far worse. 18 years after the cleanwater act amendment was made legal. And they continued until 2004 to dump solid radioactive waste for 43 miles, 11-mile soil trenches. Why? Because it was cheap. And why does the Energy Department say it's sitting with it's decision issued in 2004 to add about 20,000 truckloads or radioactive waste to the landfill right near where all these sites are. With chemical waste as well as radioactive because it's cheaper than treating and disposing the underground disposing somewhere else. Why do they want to dispose of that greater than Class C waste in Hanford? It's very clear. The documents that many of you came to the public hearing on laid it out. Hanford is the second cheapest place to dispose of that waste in near surface landfills.

Comment E:

The PCB's in some of these sites are 100 to 150 times Washington's cleanup level. The carbon tetrachloride at these sites is at astonishingly high levels. You can apply vapor extraction to that between now and eternity, and will still continue to contaminate the groundwater over and over and over again for 10,000 years.

Commenter #63:

Lynn Ford, Portland

Comment:

Follow the law. Bury the plutonium according to the 1970 standards. Follow your own PCWMEIS. Follow the established standards. That is why they are called standards.

Further more, all exposure levels from Hanford materials must be adjusted DOWNWARD to compensate for THE MAXIMUM PROJECTED EXPOSURE FROM THE RECENT AND CONTINUING IRRADIATION OF THE PACIFIC NORTHWEST BY THE JAPANESE REACTORS.

WE ARE ALL AWARE OF THE MISINFORMATION AND DISTORTIONS BY THE MEDIA, REACTOR OWNERS, AND JAPANESE & US GOVERNMENTS REGARDING RADIOLOGICAL IMPACTS OF THE JAPANESE DISASTER. US DOE & CONTRACTORS ARE PART OF THE SAME INDUSTRIES, SO YOUR CREDIBILITIE IS NOT ENHANCED.

THE "MIX & SPREAD PROPOSAL ALSO VIOLATES NATIVE TREATY RIGHTS.

Commenter #66

Chris Pew

Comment A:

Calling the "Inner Area" an "Industrial zone", as the EPA and DOE do, seems to me to be an arbitrary label signifying a part of the waste that you don't want to clean up.

Commenter #102

Internet Comment

Comment:

At least 30 years ago, a nuclear scientist friend of mine said he was appalled at the low standard of protection the DOE had used when nuclear waste from the reactors that made our atomic bombs was being thrown into minimally prepared ditches. The situation can only have gotten worse. As a global citizen, the known threat to people downwind, and the now documented cases of "radioactive" rabbits in the area, alarms me greatly. The potential tragedy of inadequate cleanup can only make things worse. Please use the strictest standards available to avoid poisoning the Columbia River to save both jobs and endangered salmon runs. I often ponder how the USA first used the Atomic bomb in WWII, but has been unwilling to put this terrifying genie back into the ground properly.

As kids we were always told to put away our toys neatly. This is a classic example of the kid who just stuffed his stuff under his bed and hoped his mother wouldn't notice. We can't afford to let mother earth not notice this time.

Commenter #104

Karen Axell, 8/17/11 via e-mail

Comment B: EPA needs to apply a Plutonium soil cleanup standard equal to the one USDOE has to meet at its Lawrence Livermore Lab (2pCi/gm, and 10 pCi/gm where future use is proposed to be industrial) and Johnson Atoll cleanups. Those standards are 1,000 times lower than USDOE proposed guidance or goal for Hanford's Central Plateau (2,900 pCi/gm).

Soil cleanup standards to protect ground water should be applied for PCBs, and all other radioactive and chemical contaminants.

Commenter #109:

Dvija Michael Bertish

Comment B:

The cleanup standard for the noted radioactive contaminants should be far more restrictive than outlined in the proposal. The cleanup standards offered in the current proposal are based on old baseline data, and new site characterization is required, including additional bore samples, to provide adequate protections and long term planning.

Commenter #111

Confederated Tribes and Bands of the Yakama Nation ERWM

Comment C:

100 nCi/g require disposal offsite at WIPP. Remedies that may generate transuranic waste must be planned and implemented in coordination with the Hanford Transuranic Waste Certification Program – a step that should be documented during the remedial design phase. The ERWM Program does not support construction of waste storage facilities that are in violation of USDOE Orders or RCRA or CERCLA regulatory obligations and/or will result in long-term/permanent storage of such wastes on the Hanford site. The ERWM Program considers removal of a

Comment G:

Cancer Risk: USDOE indicates excess cancer risk is unacceptable if it is greater than the CERCLA risk range of 1×10^{-4} to 1×10^{-6} and continues on to say cumulative excess lifetime cancer risk from non-radiological carcinogens greater than 1×10^{-5} . The ERWM Program requests clarification as to why there is not a more stringent cancer risk used for radionuclides given that it is unacceptable to have a risk greater than 1×10^{-5} for multiple non-radiological contaminants.

Comment I:

- ELCR of 1×10^{-4} is for individual and is presented as EPA's target risk threshold; however EPA uses the general 10^{-4} to 10^{-6} risk range within which the Agency strives to manage risks as a part of a CERCLA cleanup, with a preference for cleanups achieving the more protective end of the range (i.e., the point of departure, 10^{-6}). Human health direct-contact exposure to non-radionuclides within fifteen (15) feet of ground surface risk to multiple carcinogens cannot exceed 1×10^{-5} in compliance with WAC 173-340. The more stringent values should be used.

Comment R:

Cancer Risk: USDOE indicates excess cancer risk is unacceptable if it is greater than the CERCLA risk range of 1×10^{-4} to 1×10^{-6} and continues on to say cumulative excess lifetime cancer risk from non-radiological carcinogens greater than 1×10^{-5} . Why isn't there a more stringent CERCLA cancer risk value for radiological contaminants given that it is unacceptable to have a risk greater than 1×10^{-5} for total excess cancer risks for non-radiological contaminants?

Comment T:

- ELCR of 1×10^{-4} is for individual and is presented as EPA's target risk threshold; however EPA uses the general 10^{-4} to 10^{-6} risk range within which the Agency strives to manage risks as a part of a CERCLA cleanup, with a preference for cleanups achieving the more protective end of the range (i.e., the point of departure, 10^{-6}). Human health direct-contact exposure to non-radionuclides within fifteen (15) feet of ground surface cumulative risk to carcinogens cannot exceed 10^{-5} in compliance with WAC 173-340. The more stringent values should be used.
-

Comment DD:

NEPA Evaluation: The Feasibility Study for the 200- PW- 1, -3, -6 waste sites for which this evaluation was performed is incomplete. Whether there are significant impacts remains questionable. The ERWM Program does not believe sections 6.6.2.3 *Natural, Cultural, and*

Commenter #113

Heather Flanagan

Comment C:

- The EPA needs to apply a Plutonium soil cleanup standard equal to the one USDOE has to meet at its Lawrence Livermore Lab (2pCi/gm, and 10 pCi/gm where future use is proposed to be industrial) and Johnson Atoll cleanups. Those standards are 1,000 times lower than USDOE proposed guidance or goal for Hanford's Central Plateau (2,900 pCi/gm).
- Soil cleanup standards to protect ground water should be applied for PCBs, and all other radioactive and chemical contaminants.

Commenter #121

Heart of America Northwest and Heart of America Northwest Research Center

Comment C:

- *EPA apply the same cleanup standard to the Plutonium in the soil at Hanford as USDOE is required to meet at Lawrence Livermore National Lab in California and at Johnson Atoll in the Pacific. USDOE proposes to use a cleanup “guide” level that would leave 1,000 times more Plutonium in the soil than these other sites!*

Comment D:

- *Washington State and federal hazardous waste laws must be met, including for retrieval of hazardous wastes (not abandonment under caps) and “closure” with removal of settling tanks*

Comment M:

The Settling Tanks Should be Removed and Their Removal and “Closure” is Legally Subject to Federal and State Hazardous Waste Laws (RCRA and HWMA), which USDOE’s Plan Ignores and Fails to Meet the Standards For:

There are two Settling tanks in the units being considered: 241-Z-361 and 241-Z-8.

The Z-361 tank served as the primary solids settling tank for Low-Salt liquid waste from 1949-1973. Prior to discharge to the tank, the effluent was neutralized in sump tanks by adding fly ash, and later sodium hydroxide. (Pg 104, Remedial Investigation and Feasibility Study [RI-FS])

The Z-8 Tank received wastes from 1955 to 1962, receiving pH neutral effluent waste from back flushes of the RECUPLEX feed filters. Silica gel was added to the waste stream as a settling agent, and the effluent was flushed to the tank with nitric acid. These two tanks played a vital role in the waste management of highly hazardous waste during their operations. (Pg 116, RI-FS)

Proposed Remediation for Settling Tanks:

-Remove the sludge, then grout and backfill the empty tanks

*****Formal Comment: Because these tanks continue to store waste, they are legally subject to formal closure under RCRA.**

This triggers requirements for permitting and an environmental impact statement, including analyses of alternatives and mitigation requirements; as well as subjecting the tanks to formal requirements that they be removed and treated prior to re-disposal.

241-Z-361 Settling Tank

- Last characterized in 1999-2001
- Tank integrity called into question upon inspection in 2000¹
- There are some cracks in the tank top and some of the reinforcing bar has been damaged

¹Pg 28 of TPA MILESTONE M-15-37B - Validated Data Packages and Recommendation for Regulatory Path Forward For Remediation of Tank 241-Z-361

- No leaks have been reported
- The tank structural integrity cannot be assumed to last indefinitely²
- Waste meets definition of a principal threat waste³
- Estimated to contain 75m³ of highly toxic sludge⁴

241-Z-8 Settling Tank

- Last Characterized in 1974 while pumping out majority of waste⁵
- In 1974 approximately 7,285 gallons of waste expected to be in the tank were not accounted for⁶
 - No leak is said to exist, faulty numbers were blamed
- No data on tank integrity
- Estimated to contain 500 gallons of highly toxic sludge⁷

The USDOE has failed to take into account the impact of leaving two highly contaminated settling tanks in the ground at Hanford. The inability to even consider the implications of leaving these tanks in our soil is inexcusable. The FS and RI provide no information as to how a structurally unsound tank will interact with human health and the environment.

In 2000, the waste in the Z-361 tank was characterized as meeting “the definition of a principal threat waste as a highly toxic material in a buried tank, based on the measured plutonium content of the sludge,” (Pg 43, TPA) but has remained in the tank since the time of this characterization. Also, the structural integrity of the tank was expected to “remain stable in the near term (less than 5 years), but the continued tank stability in the long term (5-10 years) is uncertain” (Pg 40, TPA). Ten years has passed since this report was written and the waste remains in the tank – with NO FURTHER characterization to base cleanup decisions upon!

The proposed remediation is to remove the sludge and backfill the “empty tank.” This seems like a cost driven measure rather than a smart decision. **The tank’s integrity has been called into question by the 2000 report and needs to be removed from the ground as soon as possible ALONG WITH the sludge.** The tank has been compromised by having high-level nuclear waste and cannot be allowed to stay buried inside the soil at Hanford.

The other Settling tank, Z-8, was **last characterized in 1974** when the tank was initially being emptied of waste. The use of 37 year old characterization reports is not, and should not be, an acceptable standard for the USDOE. The tank’s contents need to be characterized and removed in a timely fashion along with the tank itself. The structural integrity of the tank was not stated in 1974, continues to be unknown, and cannot be assumed. The tank has approximately 500 gallons of highly toxic sludge remaining according to the 1974 records. A large portion of the sludge was shown “to contain 38 grams of plutonium (WIDS) to as much as

²IBID

³Pg 40 of TPA MILESTONE M-15-37B - Validated Data Packages and Recommendation for Regulatory Path Forward For Remediation of Tank 241-Z-361

⁴Pg 104 of Feasibility Study for the Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units

⁵Pg 85 of Feasibility Study for the Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units

⁶ IBID

⁷ IBID

1.5 kilograms of plutonium” (Pg 85, FS). This seems to qualify it as a highly toxic material in a buried tank like the sludge in Z-361.

The fact – which USDOE tried to hide from the public by not providing early access to the characterization reports – that the tank was only “characterized” in 1974 means that *the tank has never been characterized for hazardous wastes pursuant to RCRA and the HWMA*. Storing uncharacterized wastes in an unpermitted tank is illegal – and, **these comments provide the agencies with notice of our intent to sue USDOE and its contractors for storing wastes without permits under RCRA and the HWMA, and without characterization, as well as for closure without a permit and meeting closure standards** (if the Plan proceeds to leave the tanks in place and if there is no RCRA compliant characterization and closure performance standards under HWMA are not met).

The remediation focuses solely on the sludge in the tanks and *OMITS THE ENVIRONMENTAL IMPACT* of leaving structurally unsound highly toxic tanks in the soil. The TPA Milestone report admits that “the scope of the milestone is for the sludge only” (Pg 48 TPA). The proposed solution to grout and backfill the empty tank has not been properly researched and therefore cannot be accepted as an option for remediation.

The tanks were not characterized for Washington State Extremely Hazardous Wastes, which are illegal to landfill bury or leave in place under the HWMA.

The fact that wastes remain in the tanks and have continued to be managed, subjects the waste and the tanks to full closure requirements under RCRA and HWMA. These include characterization of the tanks for designation as hazardous wastes, characterization of the quantity and location of all releases, and removal and treatment of both the wastes and the tanks (including subjecting the waste and tanks to Washington’s requirements to utilize a permanent remedy, rather than leaving wastes or a tank in the ground).

Washington Law Applies to Closure of the 200-CW-5 Operating Unit as well as the settling tanks in the 200-PW-1 and 6 units:

Washington State’s hazardous waste law (HWMA, through which Washington Ecology has delegated authority from EPA to ensure that federal Resource Conservation and Recovery Act (RCRA) standards are met), applies to sites that treat, store, or dispose dangerous wastes after “July 26, 1982, for wastes regulated by 40 CFR Part 261;” or, “October 31, 1984 for wastes designated only by this chapter and not regulated by 40 CFR Part 261....” WAC 173-303-040. Clearly, RCRA applies to the 216-Z-20 Tile Field, into which USDOE disposed dangerous wastes from 1981-1995.

Additionally, RCRA applies to the other Z-Ditches in the 200-CW-5 Operating Unit. Admittedly, the other trenches ceased operation in 1981. However,

70.105D.020 facility: (5) "Facility" means (a) any building, structure, installation, equipment, pipe or pipeline (including any pipe into a sewer or publicly owned treatment works), well, pit, pond, lagoon, impoundment, ditch, landfill, storage container, motor vehicle, rolling stock, vessel, or aircraft, or (b) any site or area where a hazardous substance, other than a consumer product in consumer use, has been deposited, stored, disposed of, or placed, or otherwise come to be located.

Thus, the trenches are facilities subject to RCRA and HWMA closure.

Testing on the 200-CW-5 OU Ditches, as with the Settling Tanks, is Inadequate under Washington Law

A Remedial Investigation must “adequately characterize the areal and vertical distribution and concentrations of hazardous substances in the soil.” WAC 170-340-350(7)(c)(iii)(B). However,

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the maximum reasonable exposure scenario for thousands of years. Further, this standard is supposed to be applied for all potential exposures to all carcinogens – summing the risks from each of the contaminants, rather than just meeting the standard for one at a time.

- For the Z-9 Plutonium ditches, the CW-5 Feasibility Study bases its proposed action on an industrial worker exposure scenario even though the document itself only projects that this is safe or reasonable to assume to be the maximum exposure scenario for the next fifty years:
“This land use can be reasonably predicted to be the same for the next 50 years, given DOE’s current commitment to vitrify waste in the tank farms, and is assumed to remain industrial...” FS at 95.
- Where is the analysis of exposure when Native American tribes exercise treaty rights to utilize the areas immediately adjoining the currently fenced portions of the 200 Area or when future agricultural development or other development comes to the fence line (e.g., air borne transport due to erosion, fire, excavation, animal and plant intrusion...)???

Washington State’s standard for all carcinogens is more than ten times as protective as the federal Superfund CERCLA standard. Without applying a numerical standard for Plutonium and numerous other chemicals and radionuclides, the Proposed Plan fails both Washington State and federal Superfund standards. Incredibly, not only does the Proposed Plan fail to set a cleanup level to be met for Plutonium, it does not even propose one for such mobile contaminants which threaten groundwater such as PCBs.

FEDERAL LAW (Superfund)		STATE LAW (RCRA/HWMA)
1 in 10,000	Maximum Acceptable Cancer Risk (# cancers for exposed # people)	1 in 100,000
No	RCRA Permit? (Permit includes more rigorous public review and comment on changes, and an EIS)	Yes
No	Required Reporting of Chemical Quantities, and location / extent of contaminants?	Yes
Depends on Cost and Other Values	Permanent Cleanup to the Extent Practicable	Yes

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Less Strict	Groundwater Monitoring	Stricter
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EPA and Washington State Should Impose the Same Plutonium Cleanup Standard for Soil on Hanford’s Central Plateau as USDOE is Required to Meet at Other Sites:

USDOE proposes not to cleanup Plutonium 239 at concentrations below 2,900 pCi/gm (This is called a PRG, or a remediation goal, but it is not even proposed as a standard which is required to be met).

- At Lawrence Livermore National Lab, USDOE is being required to cleanup to levels of 2.5 and 10 pCi/gm... more than 1,000 times more protective than proposed for Hanford’s Central Plateau!!!!
- The 2.5 pCi/gm standard is for areas with a reasonably foreseeable public exposure (e.g., residential or Tribal), and the 10 pCi/gm is for areas where USDOE says the maximum reasonable exposure scenario is for adult workers in an industrial zone. USDOE claims that the Hanford Central Plateau can be foreseen to be kept industrial with only adult worker exposures for the next 24,000 years. This is NOT Reasonable!

Site	Johnson Atoll	Rocky Flats (CO) (1996)	Rocky Flats (2002)	Lawrence Livermore National Lab (CA)	Hanford (1997 plan along River)	Hanford’s USDOE Proposal 2011 for Central Plateau
Clean-Up Level in pCi/gm soil	2.1 to 210	252	116	2.5 Or 10	35	2,900

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Basis	10-6 to 10-4 risk to wildlife researcher (1 in 1 million to 1 in 10,000 risk of fatal cancer)	15 mrem/yr dose to resident	10-5 risk to refuge worker	Resident (2.5); Industrial/office worker (10)	15 mrem/yr dose to resident (8 in 10,000 risk of fatal cancer in adults)	Industrial worker
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- Source for columns 1,2,3,5: Carl Spreng, CO Dept. of Public Health and Environment <http://www.nga.org/files/live/sites/NGA/files/pdf/1105FFTFSPRENG.PDF;jsessionid=1406BF3A0765CE479D4BF1FAC53D1E83> National Governors’ Association 2011 Spring Meeting

Under USDOE’s proposed plan there would be no true Plutonium cleanup standard applied at all for these units. Rather than meet any numeric standard, USDOE would only be required to dig up to the proposed depth or leave waste under dirt (although if Plutonium is at the surface, the lack of a standard will lead to a fight over whether and to what degree it would have to be cleaned up)).

- Proposed Plan claims that Plutonium is not a threat to groundwater, so has no cleanup level based on protecting groundwater and the people who will drink the groundwater for thousands of years.
- Same for Cesium, Strontium, PCBs
- (see Table 5, Proposed Plan, Preliminary Remediation Goals, ftnte a)
- Ignores fact that Plutonium is already 100 feet deep beneath some sites

“Data on how readily plutonium sorbs to the surface of soil particles (the partition coefficient or Kd value) is an essential element in understanding its long-term migration. The higher the Kd value the more readily plutonium is held up. 53 DOE’s site model uses a Kd value of 150 even though most of the Kd values measured at Hanford are below 10. 54 The model also does not account for the different chemical states of plutonium in the soil, lateral movement...” Alvarez Analysis (2010).

We Urge that the same standard for cleanup of Plutonium be adopted at Hanford as is being used at Lawrence Livermore National Lab, and that groundwater protective cleanup standards be applied to all soil contamination for Cesium, Strontium, PCBs and all chemicals and radionuclides, including Uranium as a toxic metal.

We urge that USDOE be required to perform a full investigation of the chemicals and radionuclides in and under all of the waste sites—not rely on data from 40 years ago!

Every waste site needs actual characterization of the quantity and extent of contaminants, unless USDOE is agreeing to move in to retrieve the wastes to meet numeric cleanup levels which are protective of human health and the environment (e.g., the same Plutonium cleanup level being applied at Lawrence Livermore National Lab).

Cost is not an excuse, as USDOE was able to cleanup to a Plutonium cleanup level of 35 pCi.gm in the 100 Areas along the River Corridor at reasonable cost.

Favor Observational Approach

COMMENTS

Commenter #2

Dale Engstrom

Comment E: And while you're already there this could be done with an observational approach. And one of the problems you're going to run into with places like Z-9 is when the water ran down the trench there was places that plutonium was being deposited and there were other places where it wasn't. And so it's going to be a very almost mining sort of method moving through the trench cleaning up the stuff that's in there. And as you run into the stuff that you run into in terms of plutonium that would be a good time to extract it and remove it.

Commenter #32

Jan Castle

Comment C:

The two foot limit does not sound like it will be adequate so I would like to see you continue to do the checking and continuing to go until you find that you've gotten it. I know it will be expensive but it is absolutely necessary.

Commenter #41:

Chuck Johnson

Comment A:

I'm on the board of Columbia Riverkeeper and just to start out with I'd like to support the Oregon Department of Energy's position on the plutonium wastes that their proposal to continue to dig below two feet in the areas where the two foot limit was established, to discover how much additional plutonium could be removed to move in a measured way and to continue it until virtually all of it has been remediated.

Commenter #111

Confederated Tribes and Bands of the Yakama Nation ERWM

Comment Y

Additionally, we request USDOE use an observational approach to sampling and removal contaminated soils with greater than a 10^{-6} risk level for individual hazardous substances.

Commenter #117

Columbia Riverkeeper, 8/31/11 via e-mail

Comment N:

Unfortunately, the proposed plan does not provide the public with adequate detail on where plutonium remains in the soil column. To justify leaving many pounds of highly

dangerous plutonium in the soil, U.S. DOE must provide the public with an iron-clad case for why incremental RTD (an —observational approach||) is unworkable. The analysis that underlies U.S. DOE’s conclusion does not rest on adequate characterization of the soils beneath high-salt waste sites. Because the U.S. DOE has not provided a profile of contamination at different depths, characterization data to support this profile, and the costs associated with excavating at depths between 2 feet and 20 feet, the analysis is arbitrary. The plan and its underlying documents do not support U.S. DOE’s conclusion that the 2’ excavation is adequate or that the benefit of plutonium removal from digging deeper would not be worth the incremental addition in cost.

Other Comments on the Proposed Plan

COMMENTS

Commenter #2

Dale Engstrom

Comment B: First of all it's divided basically into those three groups that we talked about in the first place. And the PW-3 which is the cesium sites and the PW-6 and the CW-5 are not really a concern because there's not a lot of material there. There's not a lot of plutonium to worry about.

Commenter #4:

Tom Carpenter

Comment A:

Put a lot of thought into Hanford over the years, and this really seems like an easy one to me. As U.S. taxpayers, we spent, according to the Brookings Institution, about \$5.5 trillion to make nuclear warheads. A lot of that money went to Hanford. Hanford made the plutonium from our nuclear arsenal in about a 45-year period, and in that time frame also left us this legacy of contamination. These --these waste sites are dangerous for many, many years, as we've been hearing.

Comment F:

So I think that we need to take a longer view of this, less of a, gee, this is driven by money; we gotta balance this against our budget. Look at the \$5.5 trillion that we spent on nuclear weapons and do the right thing here. I'm going to be submitting written comments that are much more extensive and a bit more technical than this, but those -- those are my major comments. And Gerry alluded to the fact that the Hanford Advisory Board had an excellent set of comments which we also helped develop and are part of and think are a great set of comments as well. And they're on the back table over there if folks want to see that.

Commenter #10:

Jacqueline Sorkin

Comment B:

If the Department of Energy goes ahead with its plan, there'll be an increase in cancer risk to future generations using the groundwater tenfold. Exposure to even an extra one millirem per day would be expected to cause an increase in fatal cancers of about 2 percent for an exposed adult male and three to ten times that risk for a child.

Commenter #12:

Gerry Pollet

Comment A:

First off, I'd like to ask that the formal record include what went before the formal record began because I think there was a lot of really terrific discussion and points being made from the public, and people are always hesitant and feel like, Well, I already said that; I don't need to say

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it again. And so we'd like to ask that everything all of you said earlier be in the record and be responded to formally later.

Commenter #13:

Dee Frankforth

Comment:

I'm a resident here in Seattle. Six hours ago I was not planning on being here this evening, but I found myself here and, frankly, quite riveted for three hours because it's really clear to me that the federal and state employees are here, are trying to do the best job that they can, but there have been a plethora of numbers thrown around tonight. Five and a half trillion dollars from Tom. 240,000 years by a number of people. Twenty-one sites. Twenty-one sites out of -- I forget, John Price, out of 300 or 600 -- 800? 21 sites out of 800. This is barely the surface of what has to be addressed.

Twenty-one sites, by my calculation at best, we had 21 nonpaid people here tonight to talk. How in the world, how in the world can you expect the public to be able to comprehend, let alone respond, to something of this magnitude? It is appalling.

And I can only say with five and a half trillion dollars spent to create this issue, there has to be a commensurate amount of will and money to clean it up.

Commenter #15

Dave Berger

Comment C:

I know that realistically and economically you are not going to probably end up going to some of these places, but if you don't go to those places, whatever is left in place should simply not just be kept. There should be monitoring wells surrounding the area. They should be guaranteed to monitor for an indefinite period of time because you don't know what is going to leach when.

Comment E:

And, perhaps, you know, once you get to the point that it seems like you are going to have to pull a lot of that stuff out regardless of what that decision is, you know, this is also a great jobs program. Finally we are at same page with the people in tri cities. We are want them all working.

Comment F:

But in the meantime, when you decide what you are pulling out, we should have a second meeting to determine where it is going and what we see regarding the acceptability of that decision.

Commenter #22:

Chandra Radiance

Comment A:

Chandra Radiance. I am a Hood River resident, and I, too, have been coming to these meetings for 20 years. Unfortunately, they go on and on.

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I am going to keep my testimony brief, and I second the points made by Heart of America. So I am just going to put them down here. I demand a better approach than remove, treat and dispose. DOE's plan does not protect the public from long-term plutonium risks. Plutonium is one of the deadliest substances on the plant.

Commenter #50:

Kathleen Fitzgerald

Comment B:

I agree with what's going on here as far as complete cleanup, as far as we can get. I am really disappointed every time I come to one of these meetings -- sorry, I'm trying to keep emotion out of this.

Every time I come to one of these meetings, these people stand up here and speak and I want to like them. She's really nice. And the other guy's -- you're a pretty nice speaker but you talk really fast. There's no emotion. You're disconnected from what you're saying. You have no idea, really, what you're saying. You think you know what you're saying, and it sounds good, but yet here I am at a meeting we're talking about the most radioactive site in the Western hemisphere in the whole United States. And Hanford was decommissioned in 2000, but here we are still -- you guy's want to still truck in more nuclear waste, when you haven't even addressed what's happening in the current situation and you still want to do that and that's the way you always are. You say, "Oh, yeah. We're going to do this and we're going to do that," Blah- blah-blah. But now you want to cleanup half of what's there. You want cap stuff off. EPA talks about the High-Salt risk that's immediate -- that's the one that's immediate going into the water. Yeah. And you don't even want to clean that up correctly. Stuff is already leaking into the Columbia River. We already know that. I don't even want to buy fish out of there. Okay. So what I'm saying to you is as steward of this land. I love this place. The Columbia Gorge is my home. That's where I come from.

Commenter #58:

J. Sherer, Hood River, OR

Comment A:

First of all, a thorough & effective clean up is mandatory, not discretionary. We are talking about lives... our, our children & all being's lives far out, thousands of years into the future. I hear the words "protection" & "service the public", and I wonder if we all define that the same way. To me, service and protecting, means the following:

- Let's follow California's standards at least!
- NO NEW WASTE SHIPPED IN – HANFORD DOES SIMPLY NOT HAVE APPROPRIATE WASTE CAPABILITIES
- WE MUST DO EVERYTHING HUMANLY POSSIBLE TO PROTECT OUR RIVERS.
- Don't wait to bring a focus in on the Uranium on the Hanford Site.

I am incensed & horrified that anything less than EVERYTHING is being acted upon!

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This is death sentence as it is & with the current plans of DOE & EPA. 100% CLEAN UP!

*I do not “use” the river, it is our life blood. Without our rivers, healthy, life will fail on Earth.

*Please reconsider the assumptions you’ve made. They may be myopic from an earth-time perspective.

*Consider 1000 & 10,000 year flood.

Commenter #59:

Sarah Brooks, Portland, OR

Comment A:

DOE has a moral responsibility to enforce and enact a thorough, effective clean up of all radioactive contamination at the Hanford Site.

Commenter #65:

Aaron Baker, Lake Oswego, OR

Comment C:

Also, I think a lot of the moralizing rhetoric around the scale of the cleanup is overblown. I think the CERCLA process is well laid-out and I wanted to thank the DOE for doing the best they can with a difficult situation, although I disagree with the substance of their decision.

Commenter #67:

no name, notepaper

Comment A:

What’s “appropriate disposal” of contaminated soil? (WHIP + YUCCA) N.M.

Where is material from waste disposed proposal intended to go? How will it be disposed

Commenter #71:

Richard Smith, 7/5/11

Comment A:

The document seems well-put-together, with nice graphics, tables, etc. The plan purpose is clearly presented, and the various remediation alternatives are well-described and presented clearly. The authors understood that one size of solution does not fit all waste sites, and their choices of alternatives and options reflect that understanding. For the material presented, the alternatives and options within those alternatives selected as preferred actions are reasonable.

Comment C:

After much reading and searching through the PP and the FS, and after listening to the presentation at the public meeting held in Richland, I have developed additional comments on the Proposed Plan and its predecessor documents.

Important bits of information are missing from the PP. First, there is no information presented on the total mass of plutonium presently residing in the subject waste sites. Second, there is no information presented on the total mass of plutonium expected to be remaining in those waste sites after remediation. The inventory data are contained within the FS, but are hidden in the text for the sites in Chapter 2 and displayed in very small print on Figures 2-3 through 2-9. They are not presented in any summary tables, either in the FS or in the PP, where they could readily be seen by the reader. While the calculated risks for these sites after remediation are low (based on the chosen residential farmer with one well drilled), the public is entitled to see the whole story on the amounts of plutonium involved, and I suspect that the public perception about leaving that much plutonium in the near-surface soil will be very unfavorable.

I could not find any explicit development of the rationale for removing only 2 ft. of soil from Z-9 trench in either the FS or the PP. While some interesting data displays of plutonium concentration as a function of depth are presented in Appendix F of the FS, no documentation of an analysis of these data for Z-9 for the purpose of selecting an acceptable excavation depth is presented in either the FS or the PP. Without some analyses in the FS to support the preferred 2 ft. removal choice, that choice appears to be rather arbitrary. Lack of any data displays in the PP that could provide bases for the remediation choices make it impossible for the reader to understand and evaluate the efficacy of the preferred remediation choices

The manner in which the costs for each of the waste site groups are presented make it impossible for the reader to examine the estimated cost to remediate any given waste site via any of the possible options. The estimated costs for remediation via the preferred option for the individual waste sites within each of the groupings (high salt, low salt, cesium, etc.) are collapsed into one set of numbers for each group so the reader cannot see the estimated cost of cleanup for any individual site, nor are costs for the options not preferred presented. The way in which the costs for each of the waste site groups are presented make it impossible for the reader to determine what the individual cost elements (incremental cost per ft. of excavation, the volumes of material packaged for either WIPP or ERDF disposal, and the disposal costs for those volumes) are estimated to be at each waste site. The numbers are presented this way in the FS, so the individual waste site information is not presented anywhere

Displaying the estimated costs in terms of present worth of future expenditures is very misleading, when attempting to compare remediation alternatives and options. The total cost of an alternative or option (including on-going costs far into the future) should be presented in terms of constant dollars. Otherwise, choices that have large cumulative costs over a very long time will appear to be less expensive than choices that cost more now and have no long-term

future costs. Thus, comparisons based on present worth analyses bias selection toward solutions that cost less today, but can have very large long-term costs.

Overall, the proposed plan provides neither the appropriate/sufficient information in the appropriate structure to permit the reader to conclude that the most appropriate remediation actions have been selected.

Commenter #74:

Oregon Dept of Energy 7/19/11

Comment A:

Oregon appreciates the opportunity to review and comment on the *Draft Proposed Plan for the Remediation of the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units*, DOE/RL-2009-117, Revision 0. Oregon has provided formal comments related to these waste sites for the past four and a half years, beginning with the *Remedial Investigation Report* (Draft A and Rev. 0) on December 14, 2006 and November 15, 2007, and continuing with the *Feasibility Study* (Draft B, Reissue) on July 10, 2009. Our previous comments focused in large part on objections to the U.S. Department of Energy's (DOE) findings that leaving all wastes in these waste sites beneath engineered caps would be protective. Oregon was and is joined by many stakeholders in this view. We urge the Tri-Parties to revisit and consider our earlier written comments as the Tri-Parties finalize the *Proposed Plan* and develop a Record of Decision.

Comment C:

Z-Ditches and the Low-Salt Waste Groups: We support the Tri-Parties' preferred remedial alternatives for the "Z-Ditches Waste Group" (Remove-Treat-Dispose (RTD)) and the "Low-Salt Waste Group" (RTD Option C).

Settling Tanks Waste Group

For the "Settling Tanks Waste Group," we support the preferred remedial alternative, but request clarification. The preferred alternative indicates only removal of the sludge, followed by stabilization of the tanks. No mention is made of the 210 gallons of contaminated plutonium-laden liquid waste in the Z-361 Settling Tank. We presume the liquid would be removed and treated with the sludge (especially since it would not be possible to stabilize the tank if it contained liquid). The *final Proposed Plan* should specifically detail the proposed removal, processing and disposition of this liquid.

Pipelines Waste Group

We support the preferred alternative (RTD) for the "Pipelines Waste Group," provided this includes the entire extent of the pipelines from the originating facilities to termination. The

preferred alternative says that pipelines “outside the footprint of the selected remedy” would be excavated and disposed. The Tri-Parties should clarify the language in the final *Proposed Plan* to encompass all of the pipelines as indicated above.

Comment K: We support continued operation of the soil vapor extraction system to treat carbon tetrachloride contaminated soils within these Operable Units.

Oregon shares the goal of protective and cost effective cleanup of Hanford, and welcomes the opportunity to help craft this important plan with our comments. Please contact Dale Engstrom, of my staff (503-378-5584), with any questions or comments.

Commenter #79

Richard Smith, 7/25/11

Comment B:

The manner in which the costs for each of the waste site groups are presented make it impossible for the reader to examine the estimated cost to remediate any given waste site via any of the possible options. The estimated costs for remediation via the preferred option for the individual waste sites within each of the groupings (high salt, low salt, cesium, etc.) are collapsed into one set of numbers for each group so the reader cannot see the estimated cost of cleanup for any individual site, nor are costs for the options not preferred presented. The way in which the costs for each of the waste site groups are presented make it impossible for the reader to determine what the individual cost elements (incremental cost per ft. of excavation, the volumes of material packaged for either WIPP or ERDF disposal, and the disposal costs for those volumes) are estimated to be at each waste site. The numbers are presented this way in the FS, so the individual waste site information is not presented anywhere.

Displaying the estimated costs in terms of present worth of future expenditures is very misleading, when attempting to compare remediation alternatives and options. The total cost of an alternative or option (including on-going costs far into the future) should be presented in terms of constant dollars. Otherwise, choices that have large cumulative costs over a very long time will appear to be less expensive than choices that cost more now and have no long-term future costs. Thus, comparisons based on present worth analyses bias selection toward solutions that cost less today, but can have very large long-term costs.

Overall, the proposed plan provides neither the appropriate/sufficient information in the appropriate structure to permit the reader to conclude that the most appropriate remediation actions have been selected.

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Commenter #86:

Hafiz Heartsun, 7/28/11

Comment A:

I attended the public hearing last night in Hood River. I made oral comments, and I have further comments now:

I understand that RTD is the preferred treatment alternative for the most contaminated sites. However, I asked what the "approved disposal" method was and received vague answers. It appeared to me that there was no disposal method.

I went to talk to "JD" from DOE afterwards to clarify. He said that the less concentrated waste will be buried in a gigantic landfill at Hanford, supposedly securely lined to prevent leeching into the ground. More concentrated waste will be sent to WIPP in N.M.

I inquired about DOE's other recent proposal to ship GTCC waste to Hanford from existing and planned nuclear power plants. I have heard the proposed volume of waste will equal 2 semi-truck loads every day for 20 years, and an equal amount of less than class C waste. I asked how would this vast volume of high level waste would be disposed of if high level waste is now being sent offsite to WIPP. Furthermore WIPP is for defense related waste only and not commercially produced. JD had no answer and nervously indicated that it was out of his department. He could not offer me someplace to find out.

During the introduction to the public hearing, JD said that the decisions were based on effective clean up, not on cost.. However, when I talked to him "off-the-record" afterward and pressed for details about disposal methods he reverted to a position that he was rather powerless to affect how waste was disposed of and that ultimately all the decisions were made on the basis of money. Apparently, there is NO deep geological repository for high level commercial waste and none is forthcoming soon, perhaps ever.

Commenter #107:

Marshall Goldberg, 8/11/11 via US Mail

Comment C:

All cleanup removals should be accompanied by constant monitoring of radioactive and toxic chemical levels to assure adequate remediation. Levels of excavation should not be finitely determined ahead of removal in an arbitrary fashion based on uncertain projections.

Commenter #109:

Dvija Michael Bertish

Comment D:

Comments Received During Public Comment Period on the Proposed Plan for the Remediation of 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6

3) Cleanup of noted contaminants must be accelerated in order to achieve deadlines and thresholds for storage at facilities such as WIPP. If proper deep soil cleanup cannot be achieved due to timing or deep underground storage limitations, then DOE must identify these problems to the public immediately.

Commenter #111:

Confederated Tribes and Bands of the Yakama Nation ERWM

Comment M:

The cost tables are also very difficult to understand. In some cases the total cost is less than the capital cost (see the RTD alternative on Table 7); in other cases the total cost exceeds the capital cost when the O&M cost is zero (see Table 11). The FS reports, where these costs are developed, are not particularly helpful in understanding how the costs were built up. Detailed cost documentation should be provided.

The Yakama Nation ERWM Program looks forward to dialog on these concerns and comments. If you have any questions, please contact me at (509) 945-6741, or Dave Rowland at (509) 582-3466 or (509) 945-4488.

Comment O:

The ERWM Program does not support deferral of remediation of contaminants to the Deep Vadose Zone OU. We request USDOE include remediation of all contaminants associated with the 200-PW-1, -3, and -6 OUs within the same decision document (DOE/RL-2009-117, Draft A).

Comment Q:

Human Health Risk: Risks to Native American populations from both soil and groundwater exposure indicates exceedances. Results indicate Yakama Nation non-cancer hazards would remain above 1HQ for the tap water and produce pathways due to hexavalent chromium and TCE, and risks would remain above 10^{-4} for the produce pathway due to technetium-99.

- The contaminant of potential concern list is too limited, and requires further explanation as to the process for how they were selected.
- Native American exposure scenarios should be applied to the development of Preliminary Remediation Goals (PRGs). The proposed plan provides no indication that Native Americans are factored into the decision-making process.
- Irrigation should be included in the evaluation, as the irrigation scenario will affect contamination in soil and groundwater beneath the waste sites.
- Particulate inhalation and dermal contact should be included for the soil pathway, not just ingestion.
- 100% risk to the Yakama Nation from waste sites, soils, and groundwater, is unacceptable and should be addressed in the proposed plan. Appendix G, Native American Human Health Risk Assessment, from the Feasibility Study for the 200 Area Process Water (DOE/RL-2007-27, Draft C) concluded (page G-vii) that *"Risks to Native American populations are at the maximum risk possible (approaching 1, or 100 percent), indicating that exposures to soil at the two waste sites and groundwater beneath the waste sites represent a significant risk should they occur in the future."*

Comment U:

The ERWM Program disagrees with the statement that there are no significant differences in risks or hazards between the subsistence farmer and the two Native American exposure scenarios. They have unique exposure pathways and exposure rates, and much higher risks (as shown in DOE/RL-2007-27, Draft C, Appendix G). Furthermore we disagree with the statement

'Although not quantified, future concentration reductions will be significant for all contaminants due to the planned groundwater remediation activities.'

- A disconnect appears between industrial worker and future subsistence farmer scenario exposure durations. Text states industrial worker scenario long-term duration is from 25-70 years and future subsistence farmer scenario occurs in 150 years. The ERWM Program requests USDOE recalculated future subsistence farmer scenario risks as occurring in 50 years. Include the inhalation pathway along with direct contact and ingestion.

Comment W:

Cost Analysis: Costs are not fully represented. Several proposed alternatives will include post-ROD sampling activities. These costs are not included. Uncertainty regarding the extent of contamination at each waste site is so high; impact is expected to affect both costs and duration of remedial alternatives. The ERWM Program requests USDOE revise cost analysis to include sampling activity costs where alternatives state they would be required. We would like to see a realistic life-cycle cost analysis (1000 years) which includes IC failures.

Remedial Alternatives: Statements that implementation of remedy(s) will require careful planning due to waste site location or infer that some technologies will have additional implementability issues is mute. Please provide just the facts. Issues of concern include:

- Use of terminology of '*remove significant portion of plutonium based on an evaluation of soil contaminant concentration with depth*' is misleading. It appears that USDOE has decided removal of a significant portion can be only 51% waste removal.
- Piping components are presented as separate waste site groups.
- None of the RTD options presented clearly identifies excavation depths to meet requirement of no cumulative excess lifetime cancer risk from multiple non-radiological carcinogens greater than 1×10^{-5} risk levels.
- Transuranic Waste Cleanup: We note that the SVE system would continue to operate at present waste sites containing transuranic wastes (216-Z-1A Tile Field, 216-Z-9 Trench, and 216-Z-18 Crib) yet RTD activities would not commence until after completion of SVE.
- Preliminary Remediation Goals: It is not adequate to calculate PRGs based only an industrial worker exposure scenario. PRGs should also be determined for Native American and other residential scenarios to properly factor these groups into the decision-making process.
- What is an individual HQ? Does that refer to an individual species, contaminant, etc.?
- It is not clear when screening or background concentrations are used; these may be very different values. Clarify the usage and be explicit about the uncertainty associated with selecting these values.
- The calculation of PRGs is inadequate. It is not appropriate that certain contaminants are not calculated / presented (Table 5) because they were either not detected, not above screening levels, or did not exceed EPA's less-protective target risk threshold of 10^{-4} for the subsistence farmer scenario because:
 - This does not represent (and therefore) protect Native Americans.
 - Some contaminants were not even evaluated at certain sites.
 - It is not clear whether detection limits were below screening levels.

Comment Z:

It is not acceptable to the ERWM Program that RDT activities would not commence until after completion of SVE as this could jeopardize completion of the M-16 milestone requirements.

Comment CC:

The ERWM Program requests any future land use decisions will need to assume that the Yakama Nation ERWM will exercise its treaty rights on the land.

Comment GG:

216-Z-1D Ditch (Northern Portion): Our review of the *Feasibility Study for the 200-CW-5 Cooling Water Operable Unit-DOE/RL-2004-24, Draft C, REISSUE*, found high values near the northern head wall of the ditches which may indicate that Plutonium metal particles were included in one or more of the area's accidental releases. Figure 6-2 from the Feasibility Study (DOE/RL-2004-24, REV 0), shows a significant quantity of plutonium and/or americium at the north end of the Z-Ditches. The remedy should include these soils in the RTD remedy. The plutonium and

Comment JJ:

The proposed No Action alternative for this portion of the 216-Z Ditches does not support unrestricted use and unlimited exposure; IC would be required to ensure this. Combine this with concerns regarding the incompleteness of chemical contaminate data and USDOE's stated need for confirmatory sampling, the ERWM Program requests the preferred alternative be RTD of all shallow contaminated soils should confirmatory sampling indicate exceedances of industrial cleanup levels.

Comment NN:

Settling Tanks Waste Group: Investigation information identified no significant contamination in the soil column, suggesting that no leaks occurred. However, this remains uncertain. The preferred alternative only removes contaminated tank contents but would require long-term IC to prevent intrusions. The ERWM Program does not support any actions (i.e. tank stabilization) which preclude decontamination and removal of tanks on the Hanford Facility. The ERWM Program supports characterization and removal of tank contents and its disposal either at WIPP or in ERDF. We request subsequent tank(s) removal(s) (including associated tank systems equipment) with soil sampling beneath the tanks to confirm no leaks.

Comment OO:

Other Waste Sites Group: Although there are no direct measurements of plutonium concentrations available, the 216-Z-10 Injection/Reverse Well received significant amounts of plutonium containing liquids. The 216-Z-8 French Drain received several magnitudes less volume of plutonium. Characterization data indicates the transuranic constituents are located within sixteen (16) feet of the bottom of the drain structure. The preferred No Action Alternative ignores requirements that the implementations of remedies that eliminate, reduce, or control the risks to human health and the environment. The ERWM Program requests removal, treatment, and disposal of the 216-Z-8 French Drain and associated structures and pipeline. The ERWM Program recommends further technical evaluations of reverse well closure alternatives and plutonium stabilization (e.g. jet grouting)

Comment PP:

Attachment 2: Yakama Nation Comments on the *Native American Human Health Risk Assessment* for the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units (Appendix G of DOE/RL-2007-27 Revision 0, Feasibility Study, as cited in DOE/RL-2009-117 Revision 0, Proposed Plan)

As part of the Yakama Nation's review of the *Proposed Plan for the Remediation of the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units* (DOE/RL-2009-117 Revision 0), the Yakama Nation reviewed the *Feasibility Study for the Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit* (DOE/RL-2007-27, Draft C) Appendix G, which is the *Native American Human Health Risk Assessment*, and offers the following comments. These issues ultimately affect conclusions made in the Feasibility Study, which are carried forward into the Proposed Plan (DOE/RL-2009-117 Revision 0).

GENERAL COMMENTS

1. The assumption that the target risk level (10^{-4}) is the only important factor to be derived from a risk assessment is misleading. To fully inform decision makers, it is important to characterize risks for all users, including Native Americans and the general public, from all chemicals, all pathways, and all routes of exposure in a clear and transparent manner. The authors conclude that eliminating contaminants from the risk assessment would not change the "risk assessment conclusions." This is not entirely appropriate since preliminary remedial goals will be set for clean up based on cumulative chemical exposure from all pathways. These chemicals may be in areas that do not include the "risk drivers." The authors are making risk management decisions which should not be included in the baseline risk assessment.

Comment QQ:

2. Native American risks are not just a reflection of exposures. The risks to Native Americans from contamination and physical disturbances as a result of hazardous substances at the Hanford Site include lifestyle losses that may not be quantified. This is not a "hypothetical" Native American population. DOE was provided data on tribal lifeways that are specific to the Yakama Nation. The statement that "cleanup concentration goals and decisions will not be based on potential Native American future exposure, consistent with the current industrial nature of the site" should be deleted. The statement reflects a risk management decision and not appropriate for the risk assessment.

Comment RR:

3. The use of subjective and value-laden language in describing the risk estimates is misleading and misrepresents the state of knowledge regarding risks to Native American populations from exposure to contaminants at the Hanford Site. When there is little knowledge of the processes being assessed, risk assessors cannot state whether risks have been over- or underestimated. The risk assessors should discuss the relative merits of each of the assumptions and parameters with a qualitative or quantitative statement of confidence in the measured or modeled value.

The risks for Native American exposures are estimated to exceed 1/100 or 0.01 probability. These high risks that are projected for the Native American exposures require the risk assessor to use an alternative model. The linear multistage model that is normally used for estimating carcinogenic risks is not appropriate for risks that exceed

a probability of 0.01. The authors of this assessment paraphrase the EPA guidance incorrectly. They should quote the exact language from the guidance:

“However, this linear equation is valid only at low risk levels (i.e., below estimated risks of 0.01). For sites where chemical intakes might be high (i.e., risk above 0.01), an alternate calculation equation should be used. The one-hit equation, which is consistent with the linear low-dose model ... should be used instead” (*Risk Assessment Guidance for Superfund Volume1 Human Health Evaluation Manual (Part A): Interim Final* [EPA/540/1-89/002]).

Comment SS:

4. The outcome of a risk assessment is strongly influenced by the site characterization. In this case the weaknesses in the site characterization greatly exceed the uncertainties in the Native American data on exposure patterns. Some of the weaknesses in site characterization, discussed below, are:
 - Selection of Chemicals of Concern
 - High detection limits
 - Inadequate sampling and data analysis of soil (and soil gas)
 - Inadequate sampling and analysis of groundwater
 - Elimination of exposure pathways without adequate documentation

Selection of Chemicals of Concern. The authors acknowledge that the screening methodology used to select chemicals of concern may not have been adequately protective for Native American exposures. Certain chemicals may have been eliminated from the risk assessments that are relevant to Native American exposures.

- a. Discussions in the uncertainty section do not include the list of chemicals that were eliminated. Therefore, it is not possible to ascertain the impact on the risks to Native Americans from these additional exposures. The authors state that “safety factors” in the screening criteria should protect Native Americans. However, this is not known. These factors were included to address limitations in toxicity or exposure but not with respect to alternative scenarios. The authors should have calculated screening factors with the Native American exposures that were provided to them. They could then state with some certainty what chemicals were eliminated that may be relevant to risks to Tribal members.
- b. All groundwater target levels should be risk-based. Use of MCLs, other regulatory limits, or proposed cleanup levels is not appropriate for risk assessment. MCLs and/or MTCA cleanup levels are not appropriate for screening in the risk assessment. Risk-based screening levels should be used for screening.
- c. Background concentrations should not be used for screening out contaminants. All contaminants should be evaluated in the risk assessment. The discussion of appropriate actions relevant to background concentrations may be discussed in the uncertainty section and in the RI/FS.

High detection limits. Detection limits should have been based on risk-based screening values for exposure. Thus, they would have been designed to assure that the measured concentrations were adequate for estimating risks.

Inadequate sampling and data analysis of soil and soil gas. Sampling is inadequate because of biased soil sampling, the lack of soil gas data, and incomplete vapor migration considerations.

- a. Biased soil sampling: Risk estimates were based on small areas specific to operations or perhaps clean up decisions; however they do not address the likely exposure that should be considered in a baseline risk assessment. Stating that soil sampling locations were biased is a true statement. However, the conjecture that health risks have not been underestimated is misleading. The contaminant distribution will vary depending on a number of factors, including but not limited to known sources.

The authors state that “selected waste sites were too small to support significant amounts of wild game or plants...” Thus, they acknowledge the weakness in the risk estimates for populations that may inhabit this site (people, animals, or plants). Tribal people do not rely on small management units for their quality of life. They rely on the natural habitats that will remain after this site is “cleaned up.” These site boundaries are not realistic for evaluating ecological or human health risks. A site-wide cumulative assessment is more appropriate. Thus, the risk estimates do not provide an accurate assessment of risks to Native peoples or anyone who may move about this site. Without addressing all of waste sites with broad area exposure point concentrations, this is not a complete assessment. Cleanup levels cannot be set for areas where samples were not collected. This risk assessment is not an assessment of Native American peoples since it was limited to small management units.

Since shallow soil characterization was limited, it is not clear whether data showed lower concentrations in the surface soils, or the assumption was made that surface soils had “not been impacted,” or the assumption was made due to early removal of contaminated surface soil. Please explain how you interpolate samples for depths that were not sampled. Explain why the excavated soil concentrations were modified by mixing. Use the soil concentration at maximum exposure since this provides the best estimate of how much needs to be treated.

- b. The lack of soil gas data is a serious weakness in the risk assessment. This would suggest that risks may be underestimated for Native Americans who may inhabit this site.
- c. The vapor migration section is very confusing. There is a soil vapor extraction system operating, so there must have been significant concentrations that needed to be removed or reduced. If a soil vapor extraction system has been operating, how were the operating parameters determined for the extraction

system? How is the vapor extraction system operating without determining a level of protection?

How did you calculate the vaporization rate for non-volatile contaminants? This is inconsistent with previous discussions of the difficulty of calculating the vaporization rate

Inadequate sampling and analysis of groundwater. The authors state that the groundwater data are robust because of the number of samples. However, they do not address the sample locations, sample frequency, quality of wells, and other factors that affect the groundwater measurements.

Using filtered data for groundwater is a major weakness in the risk assessment. The estimates of risk for people who drink the water cannot exclude chemicals that may adhere to particulate matter. Thus, the risk assessors cannot state that the risks are overestimated for the drinking water pathway.

The exposure point concentration for groundwater is expressed as a percentile rather than the 95% upper confidence limit (UCL). The data should have been characterized with the 95% UCL estimate. The percentiles may be used to illustrate the variability in the data, but they are not the appropriate measure for risk assessment.

Elimination of exposure pathways without adequate documentation. The risk assessors determined that certain exposure pathways were insignificant (e.g., irrigation, dust inhalation, inhalation during showering). However, there are no data or evidence to support this conclusion. Unless there is supporting documentation, all pathways should have been included in the risk assessment.

There is uncertainty in the risk estimate based on exposure to contaminants during sweatlodge activity. Discuss the relative merits of each of the assumptions and parameters with a qualitative or quantitative measure of confidence in the measured or modeled value. When you have little knowledge of the processes that you are assessing, you cannot state whether you have over- or underestimated the risks. If you specifically exclude a pathway (e.g., non-volatile inhalation) you may be underestimating risks.

Comment TT:

5. A presumption of remediation is not appropriate for a baseline risk assessment. Importantly:
 - a. Institutional controls are not a remedy and should not be referenced in a baseline risk assessment (according to EPA's definition of baseline risk).
 - b. Natural degradation is not a remedy. Remediation should not be discussed in the baseline risk assessment. The assumption that groundwater will be treated and, therefore, the risks will be reduced is not appropriate. Eventually, remedial actions will ultimately reduce risks from all possible pathways. Groundwater should not be treated any differently than other pathways in the baseline risk assessment. The purpose of a baseline risk assessment is to provide decision makers and the public with information

regarding risks from exposure to contaminants at the site under current and future non-remediated conditions.

Comment UU:

SPECIFIC COMMENTS

1. Page G-v, lines 2-5. Explain in detail how soil gas data were evaluated "semi-quantitatively".
"In addition to soil data, screening-level soil gas data collected from the subsurface of the 216-Z-1A Tile Field were evaluated semi-quantitatively"

Comment VV:

2. Page G-vi, lines 6-7 and Page G-20, lines 38-40. Explain "minimally exposed" related to native plants and animals. The site should be assumed to be open to residential exposures throughout the contaminated areas. This restriction to "minimal exposure" is not consistent with the presence of contamination.
"...were assumed to be minimally exposed...."

Comment WW:

3. Page G-xiii, lines 17-26. This statement regarding the need to use an alternative model to estimate risks from exposure to carcinogens at very high doses is very important. It also illustrates the extremely high exposures that Native Americans may experience at this site.

Comment XX:

4. Page G-11, lines 42-43. Describe and give the reference for the uranium “health-based levels” that were compared to concentrations detected in groundwater.
“...radioactive isotopes of uranium have either not been detected in recent groundwater monitoring rounds or have been detected at concentrations well below health-based levels...”

Comment YY:

5. Page G-20, lines 3-4. Describe in detail the assumptions and parameters that were used to model the groundwater plumes that may reach the Columbia River.
“...conservative modeling indicates that groundwater plumes may reach the Columbia River in 75 years...”

Comment ZZ:

6. Page G-20, lines 12-13. The size of the site cannot act as a buffer. Contamination may spread to the edge and beyond the Hanford facility, such as into the Columbia River.
“The large overall size of the Hanford Site...provides a buffer...”

Comment AAA:

7. Page G-21, line 41. Give the justification for using Oregon and Alaska State documents (ODEQ 2000 and ADEC 2005) as references for surface soil horizons.

Comment BBB:

8. Page G-23 lines 22-23. Describe the evidence supporting the conclusion that cattle would not be exposed to contaminated soil.
“...cattle are not pastured on impacted soil but do eat fodder that has been watered with groundwater.”

Comment CCC:

9. Page G-27 lines 17-18. Regarding use of half the MRL for non-detects, what about the previous discussion of the model for estimating non-detects provided on Page G-24? Connect the two discussions.

Comment DDD:

10. Page G-30, lines 34-35. Expand on the concept of Henry's Law not holding true to a sweatlodge, including an explanation of the assumptions that are needed for calculating the vaporization rate for non-volatile chemicals.

"...Henry's Law approach does not hold true in a sweatlodge. A large portion of the humidity is likely due to aerosols."

Comment EEE:

11. Page G-31, lines 40-42. The data for this exposure scenario were provided by the Yakama Nation based on the survey of their people. You cannot dispute this value in this Native American risk assessment.

"...7 hours/day does not appear to be a reasonable maximum over a 70-year exposure time, but more likely represents more of a worst-case value."

Comment FFF:

12. Page G-32, lines 32-33. Since there was no percentage given for the fraction of fruits and vegetables from the site, it is more appropriate to create a range, whereby an understanding of the affect of 100% vs. 50% could be described; 50% is probably too low.

Comment GGG:

13. Page G-33, lines 1-7. Since the CTUIR did not report a fraction of beef ingestion from the site; a range of rates should be used to reflect uncertainty.

Comment HHH:

14. Page G-93, lines 15-25. Define "conservative." The terminology used to describe the uncertainty in the risk estimates is confusing. The "type I error" is usually discussed when describing statistical inferences.

Comment III:

15. Page G-94 line 2-3. The authors assume the data from 1992 and 1993 are adequate for a risk assessment in 2010. Explain the uncertainty in the sampling and analytical methods employed during the 1992 and 1993 sampling events.

Comment: JJJ:

16. Page G-94 line 6. Sampling just for “known sources of constituents” limits the adequacy of the data. There may be break-down products or other compounds that were used at the site. It is important to do a full characterization of all possible contaminants (e.g., contract lab priority pollutants).

Comment KKK:

17. Page G-95 lines 1-3. One detected value in a small sample size is significant. Aroclor and thorium data cannot be excluded from the risk estimates.
“...would not significantly change the cumulative risk totals.”
“... the total sample numbers are only 10 and 4...”

Comment LLL:

18. Page G-103 lines 28-29. Describe the data that exceed the 90th percentile. The risk estimates are not complete without addressing these high end values.
“Because only 10 percent of the data exceed the 90th percentile values, these very high concentrations are few and represent a very limited areal extent.”

Comment MMM:

19. Page G-104, lines 31-32. The statement that “...the greater the UFs and tendency to overestimate the toxicity...” is misleading. Uncertainty factors are designed to recognize a lack of knowledge or variability in toxicity estimates. They are not designed as an overestimate of toxicity. The guidance states:

These uncertainty factors take into account the variability and uncertainty that are reflected in possible differences between test animals and humans (generally 10-fold or 10x) and variability within the human population (generally another 10x); the UFs are multiplied together: $10 \times 10 = 100x$. If a LOAEL is used, another uncertainty factor, generally 10x, is also used. In the absence of key toxicity data (duration or key effects), an extra uncertainty factor(s) may also be employed (EPA, IRIS).

Comment NNN:

20. Page G-105, lines 3-5. Provide the complete references for Health Canada and the Netherlands.
“...through a genotoxic mechanism (e.g., Health Canada and the Netherlands).”

Comment 000:

21. Page G-106, lines 32-34. The risk assessment is not a decision-maker. This decision should have been vetted through EPA since the authors are deviating from the EPA recommended value. The assessment should include estimates with CalEPA and EPA recommended values.

"because of the criticisms that the health assessment document has received, this risk assessment has selected the CalEPA SF values as more appropriate..."

Comment PPP:

22. Page G-109, line 41. This paragraph should be deleted: *"...a third consideration regarding large dose estimates is the effect of multiple contaminants..."* It is judgmental and not based on an objective review of the uncertainty of multiple chemical exposures. There is justification for summing chemicals with similar mechanisms of action or disease outcomes, such as carcinogenesis and neurotoxicity (EPA/630/R-00/002 August 2000 Supplementary Guidance for Conducting Health Risk Assessment of Chemical Mixtures).

Comment QQQ:

23. Page G-129, line 32. Explain in detail how the list of chemicals derived in the Remedial Investigation was refined in the risk assessment.
"The risk assessment refined the RI list using only the last 5 years of data (2001 through 2005) to represent current conditions..."

Commenter #114

Robert Watkins

Comment B:

In general, I agree with the remediation alternatives proposed. I simply wish to increase the amount of contamination that could be removed at a small additional cost.

Commenter #115

Hanford Advisory Board

Comment:

June 3, 2011

Scott Samuelson, Manager

U.S. Department of Energy, Office of River Protection

P.O. Box 450 (H6-60)

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Re: PW-1/3/6 and CW-5 Operable Units

Dear Messrs. Samuelson, McCormick and Faulk,

Background

The draft “Proposed Plan for the Remediation of the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units” (Draft Plan) discusses the proposed remediation of 22 waste sites within the 200 Area of the Central Plateau. The 200-PW-3 Operable Unit (Cesium Sites) includes four Plutonium Uranium Extraction Plant cribs and one unplanned release, all containing primarily cesium-137 in the 200 East Area. The remaining 17 waste sites (PW-1, PW-6) are cribs, ditches, and other miscellaneous release sites associated with the plutonium recovery activities in the 200 West Area. The nature and extent of the nitrate plume and technetium-99 contamination is not understood.

The Hanford Advisory Board (Board) adopted Advice #207 outlining criteria for development of this Draft Plan. The Board’s commitment to the values, considerations and criteria in that advice is unchanged.

Comment F:

The Board advises DOE to utilize a RTD approach when a high concentration of a radionuclide exists. This approach is consistent with established Board values.

Comment H:

The Board advises a policy to conduct RTD concurrently with vapor extraction efforts to ensure meeting Tri-Party Agreement milestones.

Comment J:

The Board advises the Tri-Party agencies to hold public meetings to discuss the draft "Proposed Plan for the Remediation of the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units.

Commenter #116

Nez Perce Tribal Executive Committee

Comment D:

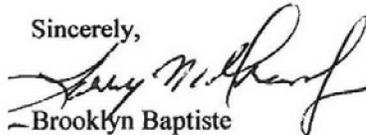
- mobile isotopes such as neptunium-237.
- * Use of surface barriers may impede carbon tetrachloride removal from the vadose soil using new soil vapor extraction wells and DNAPL from the aquifer using bio-remediation. Surface remediation should be planned with consideration of all subsurface remediation.
 - * When surface barriers are employed, we expect subsurface barriers to be employed to retard the lateral movement of moisture in the subsurface, and we expect a robust vadose zone and groundwater monitoring program to ensure that the barrier is fulfilling the expectations.
 - * NPT doesn't believe that using in-situ vitrification is a practical approach to the remediation of these waste sites due to the depth and volume of contamination underneath the waste site, and the state of development of the technology.

Comment H:

- * Our specific comments on each individual waste site are listed in Attachment A.

ERWM would appreciate timely inclusion in the development of the remediation activities in these Operable Units. Please contact John Stanfill of our staff, at (208) 621-3748, or johns@nezperce.org for inclusion into an open decision-making process and close coordination to expedite the work needed to remediate the 200 West Area to protect the Nez Perce Tribe's reserved treaty rights and the Columbia River.

Sincerely,



Brooklyn Baptiste

Attachment A

Specific Comments on the Proposed Plan for the Remediation of the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units, DOE/RL-2009-117, DRAFT A and Feasibility Study for the Plutonium/Organic-Rich Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units, DOE/RL-2007-27, Draft C.

216-Z-1, Z-2, Z-3 Cribs and Z-1A Tile Field

We believe that there was substantially more plutonium released at the 216-Z-1A Crib and tile field than has been reported. The Feasibility Study and RHO-SA-131 indicate that 57 kg of plutonium and 1 kg of Am-241 were released at this site. Based on our kriging of the area that encompasses only the B and C sections of the 216-Z-1A tile field, we estimate that the vadose zone contains 71 kg of plutonium (Figure A-1). RHO-SA-113 reported that a total of 27.4 kg of plutonium was discharged in the “B” and “C” sections. It is worthy of note that our kriging estimate for Am-241 for the whole tile field is approximately 0.5 kg (Figure A-2).

We recommend soil excavation to a maximum depth of 55 ft below ground surface (bgs) which should remove all actinides with activities greater than 100 nanoCi/g. After treatment to reduce volume, these actinides should be disposed at WIPP.

Figure A-1: Visualization of the plutonium underneath the 216-Z-1, Z-2, Z-3 Cribs and Z-1A Tile Field viewed from the west.

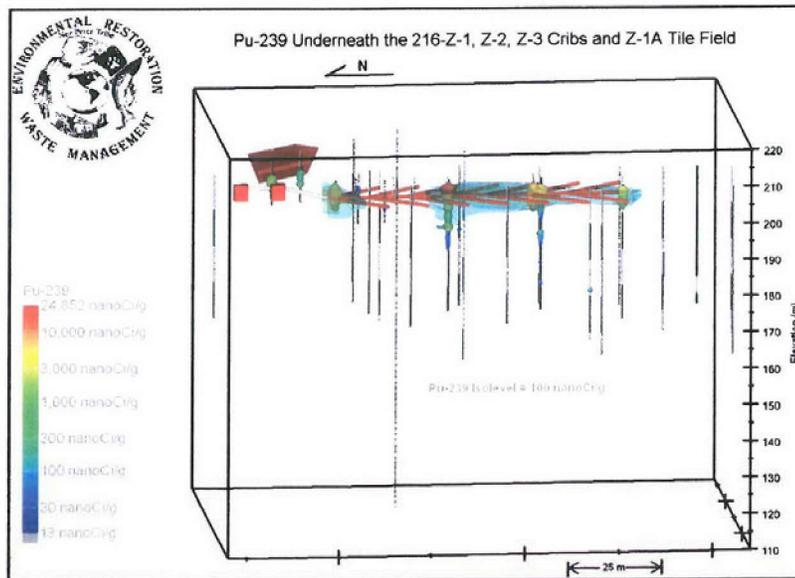
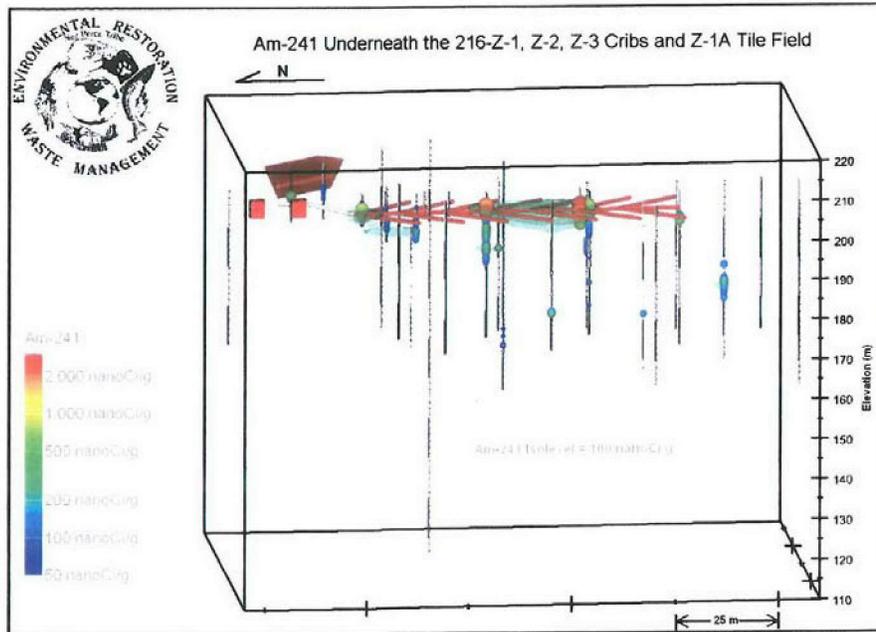


Figure A-2: Visualization of the americium-241 underneath the 216-Z-1, Z-2, Z-3 Cribs and Z-1A Tile Field viewed from the west.



Logging results at the 299-W18-159 borehole (Figure A-3), which is located near the central distributor pipe, indicate neutron count rates greater than 1,000 per second at ten feet below the surface. Neutrons have a relatively high relative biological effectiveness, and are roughly ten times more effective at causing cancers compared to photon or beta radiation of equivalent radiation exposure. The risk scenarios should include a section on neutron and neutron-gamma ray activation exposure before a final remedy is selected.

Figure A-4: Visualization of the americium-241 underneath the 216-Z-9 Trench viewed from the southeast.

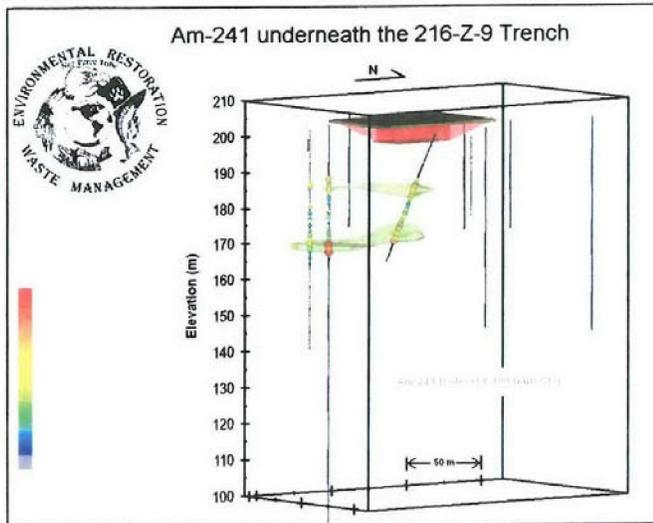


Figure A-5: Visualization of the neptunium-237 underneath the 216-Z-9 Trench and the top of the Cold Creek carbonate unit (caliche) viewed from the southwest. Geologic contacts are from PNNL-16103.

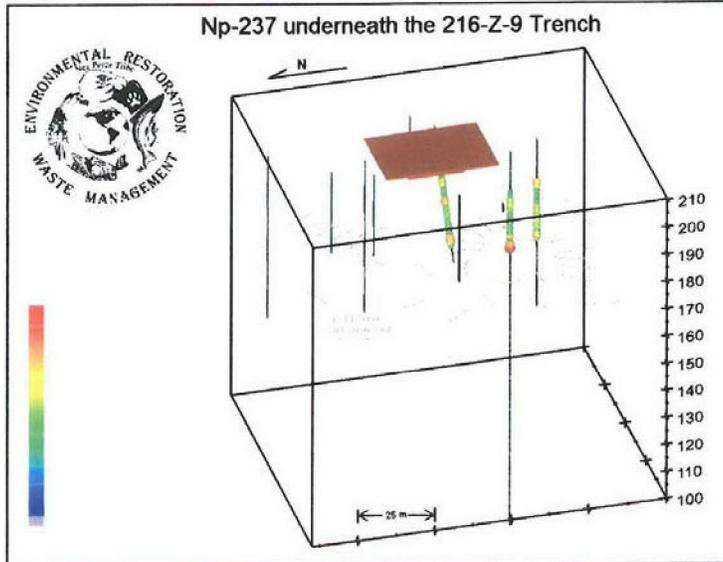
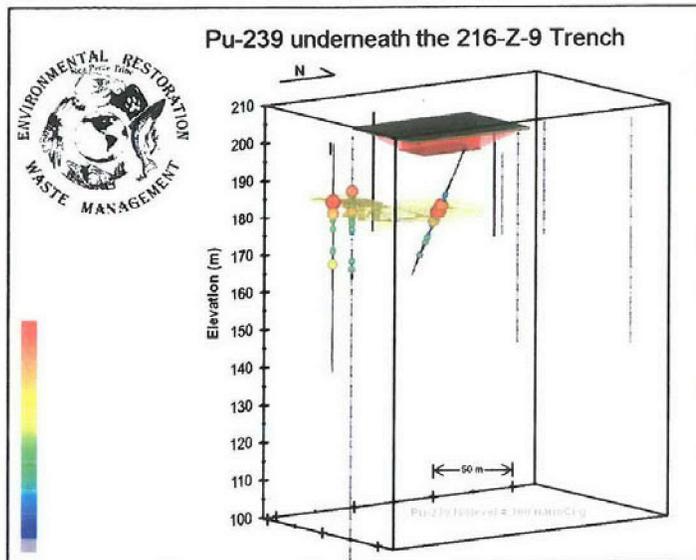


Figure A-6: Visualization of the plutonium-239 underneath the 216-Z-9 Trench viewed from the southeast.



Carbon tetrachloride dense non-aqueous phase liquid (DNAPL) is likely present in the aquifer below 216-Z-9 trench. 216-Z-9 site modeling shows between 0 and 135,000 kg of carbon tetrachloride DNAPL in the aquifer below 216-Z-9 in 1993. Although this range is large it is considered valid by the EM-22 Remediation System Evaluation of the 200-ZP-1/PW-1 groundwater pump and treat system, Review Report: Feasibility Study Strategies and Remedial System Performance Improvement for the 200-ZP-1/PW-1 Operable Units at Hanford. The upper end of the large range is supported by inclusion of all surfactant like chemical components (DBBP and TBP) that were disposed with carbon tetrachloride in the Z complex. These additives increase the initial infiltration rate in the soil/trench bottom and reduce lateral spreading once in the vadose zone (Nellis, S.R. et al. 2009).

In addition, the rapid evaporation (20-80%) of the large amount of carbon tetrachloride suggested in DOE/RL-2007-22 is not computed correctly due to the lack of consideration of accelerated organic infiltration and by the incorrect assumption that the heavier carbon tetrachloride phase would float on the lighter water phase in the trench allowing more evaporation. The vast majority of the prompt carbon tetrachloride evaporation losses are minimized due to the DBBP and TBP components of the process discharges since these components enhance the organic phase's ability to wet water saturated soil.

The likely presence of significant carbon tetrachloride DNAPL in the aquifer would require the extensive use of subsurface bio-remediation in addition to the pump and treat system. A test plan for this type of remediation is outlined in SWG-48064 (2010). Bio-remediation for aquifer

DNAPL should be incorporated into surface and near surface remediation plans to minimize interference in deployment.

216-Z-12 Crib

Unlike other Z waste sites, the plutonium-239 (activities greater than 25 nanoCi/g) underneath the 216-Z-12 Crib appears to be located within 10 ft of the distribution pipe (Figure A-7). The distribution of plutonium underneath the crib supports DOE's contention that in some cases plutonium is relatively immobile since this crib released more than 74 million gallons of waste to the vadose zone.

The assertion that 100% of the plutonium with activities greater than 100 pCi/g underneath the 216-Z-12 Crib is within 24 ft of the surface, on page 5-19 (Figure 5-5) of the Feasibility Study, is incorrect. Logging results from borehole 299-W18-181 (Figure A-8) indicate that plutonium-239 at activities of 100 nanoCi/g has reached 32 ft bgs (35 ft log depth). Thus, the cost of the remove, treat and dispose options 3D and 3E need to be recalculated to account for the plutonium below 24 ft bgs.

Figure A-7: Visualization of the plutonium-239 underneath the 216-Z-12 Crib viewed from the west.

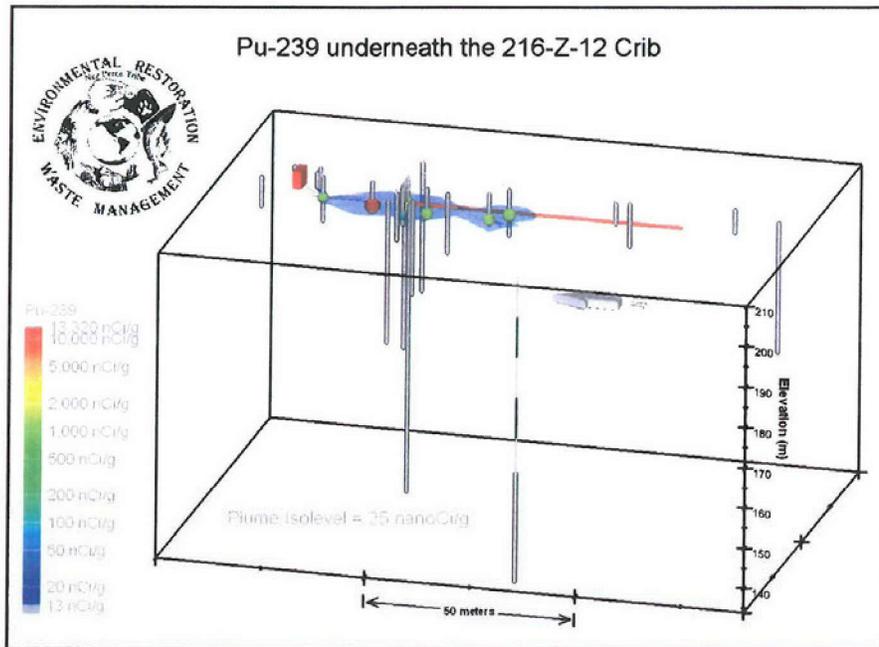
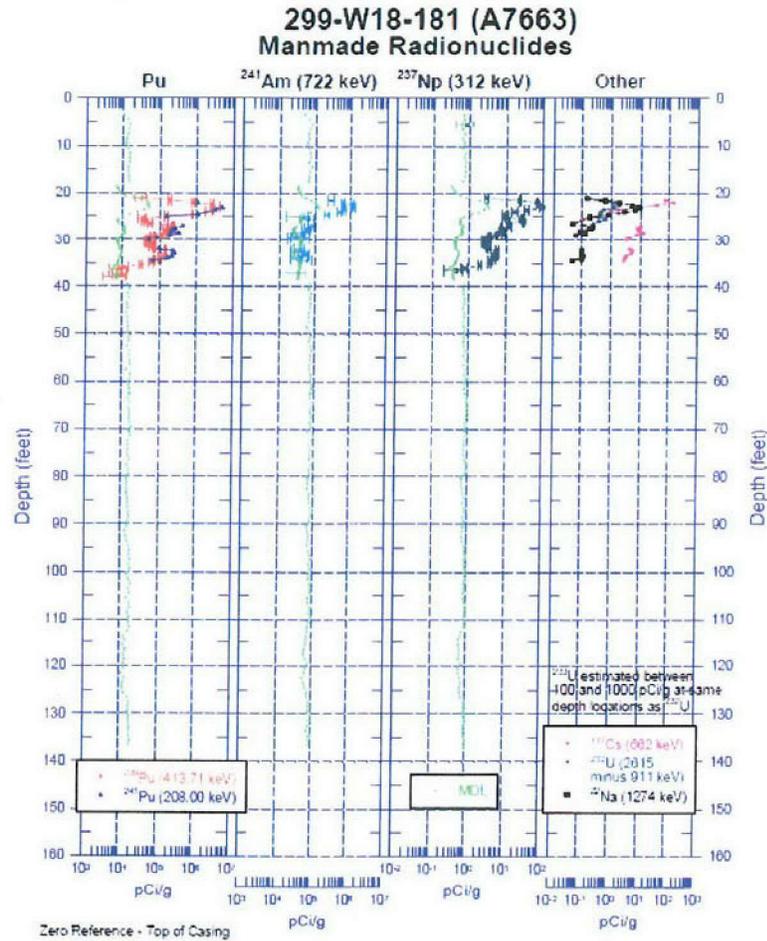
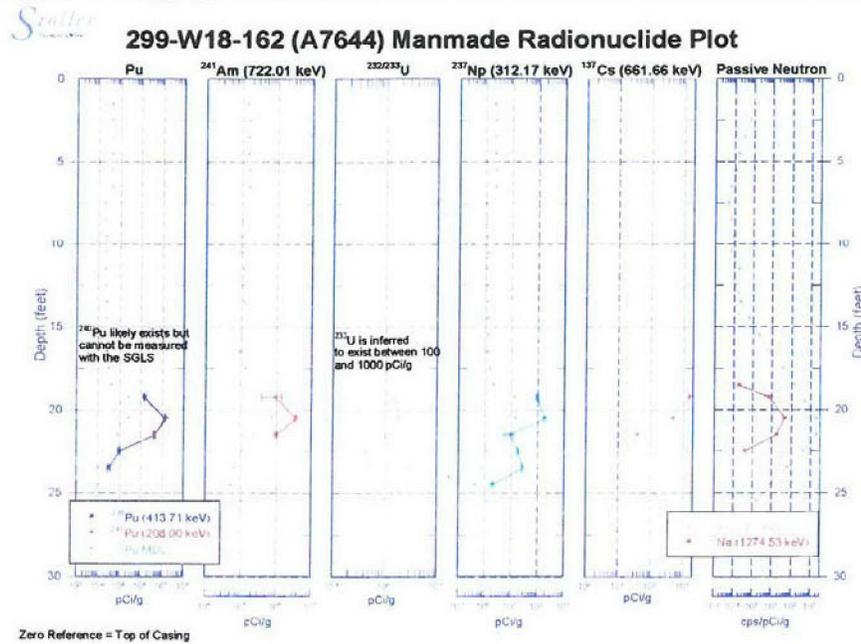


Figure A-8: Logging results for borehole 299-W18-181 from HGLP-LDR-084, Rev. 0



Logging results at the 299-W18-162 borehole (Figure A-9), which is located near the waste distribution pipe, indicate neutron count rates greater than 1,000 per second at 21 ft log depth. Neutrons have a relatively high relative biological effectiveness, and are roughly ten times more effective at causing cancers compared to photon or beta radiation of equivalent radiation exposure. The risk scenarios should include a section on neutron and neutron-gamma ray activation exposure before a final remedy is selected.

Figure A-9: Logging results for borehole 299-W18-162 from HGLP-LDR-211, Rev. 0



216-Z-18 Crib

The distribution of actinides underneath the 216-Z-18 Crib needs additional characterization. Over one million gallons of waste was released at this crib, which drove actinides deep into the vadose zone and to the south and east beyond the footprint of the 216-Z-18 Crib (Figure A-10). In addition to boreholes 299-W18-9 and -10, which were reported in the Feasibility Study (p. 2-59), boreholes 299-W18-11, -93, -94, and -96 detected radiation above background as shown in Figure A-9 (DOE/RL-91-58).

Pending the outcome of additional characterization, we recommend soil excavation to a maximum depth of 61 ft bgs, which should remove all actinides with activities greater than 100 nanoCi/g. After treatment to reduce volume, these actinides should be disposed at WIPP.

Figure A-10: Elevated gamma radiation isopach map of the 216-Z-18 Crib from DOE/RL-91-58.

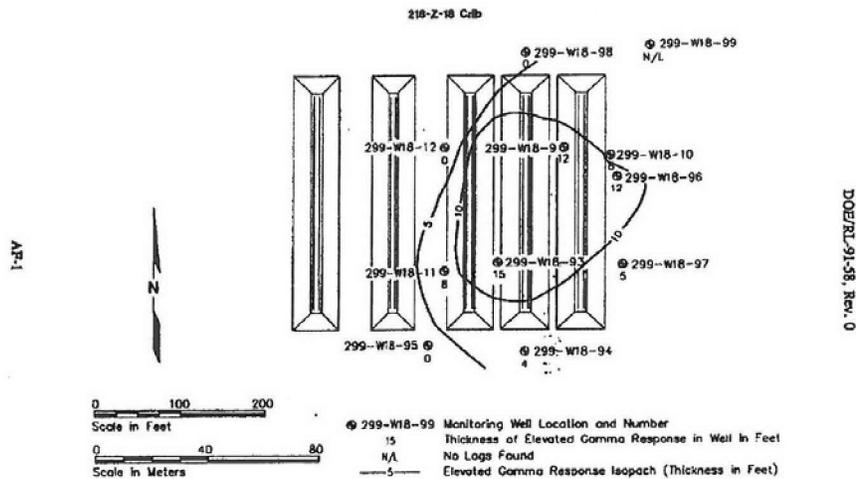


Figure A-1. Elevated Gamma Radiation Isopach Map of the 216-Z-18 Crib.

References

DOE/RL-91-58, 1992. Z Plant Source Aggregate Area Management Study Report, Rev. 0, United States Department of Energy, Richland Operations Office, Richland, Washington.

Nellis, S.R. et al., 2009. Surface and Interfacial Properties of Nonaqueous-Phase Liquid Mixtures Released to the Subsurface at the Hanford Site, Vadose Zone Journal 2009, v. 8, p. 343-351.

PNNL-16103, 2006. Borehole Geologic Data for the 216-Z Crib Facilities A Status of Data Assembled through the Hanford Borehole Geologic Information System (HBGIS), Rev. 0, Pacific Northwest National Laboratory operated by Battelle for the United States Department of Energy, Richland, Washington.

RHO-SA-131, 1979. Transuranic distribution Beneath A Retired Underground Disposal Facility, Hanford Site, Rockwell Hanford Operations, Richland, Washington.

SGW-42004, 2009. Summary Report for Selected Boreholes Within the 216-Z--1A Tile Field, 216-Z-9 Trench, and 216-Z-12 Crib, Rev. 0, CH2MHILL Plateau Remediation Co., Richland, Washington.

SGW-48064, 2010. Test Plan Supporting the Evaluation of In Situ Bioremediation in the 200 West Area, Rev. 0, CH2MHILL Plateau Remediation Co., Richland, Washington.

Commenter #117

Columbia Riverkeeper, 8/31/11 via e-mail

Comment A:

On behalf of Columbia Riverkeeper, please accept the following public comments on the proposed plan for the remediation of the PW-1,3,6 and CW-5 waste sites in Hanford's 200 Area.

I. COLUMBIA RIVERKEEPER'S COMMITMENT TO PROMPT, EFFECTIVE CLEANUP AT HANFORD

Columbia Riverkeeper is a 501(c)(3) nonprofit organization with thousands of members in Washington and Oregon. Our mission is to protect and restore the Columbia River, from its headwaters to the Pacific Ocean. Since 1989, Columbia Riverkeeper has played an active role in monitoring and improving cleanup activities at the Hanford Nuclear Reservation (Hanford). A legacy of the Cold War, the Hanford site continues to leach radioactive pollution into the Columbia River. Hanford's legacy is not a local issue. Nuclear contamination from Hanford threatens the Pacific Northwest's people, a world-renowned salmon fishery, and countless other cultural and natural resources. Hanford's contamination will pose a risk to the public and the environment for thousands of years.

Each summer Columbia Riverkeeper leads a series of kayak trips on the Hanford Reach of the Columbia River. During these trips, Columbia Riverkeeper's staff and members tour areas of the Hanford Reach that are currently being polluted by excessive levels of radioactive contaminants. The Hanford Reach is particularly unique because it is the last free-flowing stretch of the Columbia River. For example, during trips in 2010 and 2011, Riverkeeper's staff and members observed salmon &/or steelhead while kayaking past the Hanford site. On these educational tours, our members learn about the Endangered Species Act-listed salmon and steelhead that spawn, rear, and migrate in the Hanford Reach. Columbia Riverkeeper and its members recognize that soil pollution at the Hanford site poses a long-term threat to the Columbia River for future generations.

Columbia Riverkeeper's staff and members are dedicated to a long-term solution for Hanford cleanup, and we strongly urge U.S. DOE and the other Tri-Party agencies to withdraw and rework the proposed plan for the cleanup of the PW-1,3,6 & CW-5 waste sites in the 200 Area.

Comment C:

The proposed plan fails to protect the public, the environment, and the long-term health of the Columbia River by leaving large quantities of plutonium, cesium, and other pollutants in the soil.

Comment D:

U.S. DOE is considering alternatives for the removal and immobilization of radioactive and chemical contamination in four waste sites in Hanford's 200 Area. For decades, U.S. DOE disposed of large volumes of liquid radioactive and chemical waste that were generated from the production and processing of plutonium. Liquid wastes were discharged into ditches, cribs, French drains, and tanks that allowed contamination to directly enter soils in the 200 Area.

Contamination has penetrated deep into the soils in some areas, and some pollutants have reached groundwater.

The Proposed Plan (—plan||) is based on U.S. DOE’s Remedial Investigation Report from 2006 & 2007, and the ensuing Feasibility Study from July, 2009. The U.S. DOE has received many comments in previous discussions and hearings about the proposed remediation of these waste sites, and the agency has identified preferred alternatives for six different waste groups: Z Ditches, High-Salt, Low-Salt, Settling Tanks, Cesium-137, and Other Sites. Our comments are largely focused on the High-Salt and Cesium-137 sites, areas where the Tri-Parties have already received extensive input from the public, the Hanford Advisory Board, and other agencies.

The high-salt waste sites include three subsurface engineered waste sites: 216-Z-9 Trench, 216-Z-1A Tile Field, and 216-Z-18 Crib. The high-salt waste sites received highly acidic aqueous waste streams from Recovery of Uranium and Plutonium by Extraction (RECUPLEX) facility or the Plutonium Reclamation Facility solvent extraction system, and their primary contaminants include plutonium, americium, and carbon tetrachloride.

In these high-salt waste sites, U.S. DOE has proposed to remove, treat, and dispose (RTD) the structures that were used to convey liquid radioactive and chemical waste into the soil. The Plan also proposes to continue the operation of the soil vapor extraction system for a key chemical contaminant, carbon tetrachloride. In addition to this RTD and soil vapor extraction effort, U.S. DOE proposes to excavate only 2 feet of soil beneath the waste structure. U.S. DOE proposes to cap the high-salt waste sites with evapotranspiration (ET) barriers.

In public hearings on the proposed plan, U.S. EPA estimated that this proposal will leave roughly 50 percent of the plutonium contamination in the soil.i U.S. DOE estimates that excavation to a depth of 2 feet will remove the —highest concentrations of contaminated soils.|| U.S. DOE and the other Tri-Party agencies additionally argue that the deployment of ET barriers will prevent infiltration and deprive the contamination of a motive force to drive contamination deeper in the soil towards groundwater and ultimately the Columbia River. Furthermore, U.S. DOE and other Tri-Party agencies propose to control access and use of the site —in perpetuity,|| to avoid deep excavation, irrigation, or any other non-industrial uses of the Central Plateau’s Inner Area.ii

U.S. DOE proposes to take a novel approach to the remediation of the cesium-137 waste group. The cesium group of waste sites received process water from Plutonium and Uranium Extraction (PUREX) Plant operations. On these sites, U.S. DOE and other Tri-Party agencies propose to —maintain and enhance|| soil cover to achieve a 15-foot depth of soil protection. Again, the Tri-Party agencies rely on long-term institutional controls over the access and use of the cesium sites for a period of 300 years or more, after which most of the cesium-137 will have undergone radioactive decay. In essence, U.S. DOE proposes to heap soil over cesium-contaminated areas, a —new approach||, according to the U.S. EPA.iii

Comment E

B. Threats Posed by Contaminants in Proposed Cleanup Areas

Large amounts of plutonium, cesium, carbon tetrachloride, PCB’s, americium, radium and other contaminants are present in many areas that are proposed for cleanup. These radionuclides and

chemicals pose a long-term risk to the environment and human health. Plutonium has a half-life of 24,000 years. A minimum of ten half-lives must transpire in order for contamination to undergo sufficient radioactive decay to adequately ensure that the pollutant is essentially gone. In the case of plutonium, the contamination in these waste sites will remain dangerous for 240,000 years. Americium, another contaminant of concern in multiple waste sites discussed in the proposed plan, has a half-life of 7,400 years.

Plutonium is an extremely hazardous carcinogen, one of the most dangerous substances on the planet to human health. Plutonium's carcinogenicity arises from alpha radiation that, when emitted from plutonium particles that have been ingested or inhaled into the human body, does enormous damage to neighboring cells. Once inside the body, plutonium can harm the liver, bone surfaces, bone marrow, and other soft tissues. Plutonium is also dangerous to non-human animal life. Because of plutonium's long half-life and the danger it poses to human health and the environment, plutonium is designated for disposal as transuranic (TRU) waste in a deep geologic repository when it is present in elevated concentrations in the soil (100 nCi/g). The current available destination for TRU waste is the Waste Isolation Pilot Project (WIPP) in New Mexico.

Plutonium has already penetrated deep into the soil at Hanford. For example, plutonium has been detected at depths exceeding 120 feet in soils beneath the high-salt waste areas. Additionally, the U.S. DOE's Tank Closure & Waste Management EIS (TC/WM EIS) identifies plutonium as a high-risk contaminant that could impact human health and the environment for thousands of years. Indeed, the TC/WM EIS estimated that peak risk from plutonium contamination to American Indian resident/farmers living in the River corridor could approach 1/100 cancer deaths.^{iv}

Radioactive cesium has a half-life of 30 years. Cesium behaves similarly to potassium in the human body, and so it becomes widely distributed if ingested and can cause extensive cell damage and cancer. Cesium can also become incorporated into plant and non-human animal life, as evidenced by the discovery of a highly cesium-contaminated rabbit on the Hanford site in late 2010.^v Although cesium is much less long-lived than americium and plutonium, radiation from cesium wastes is more externally dangerous than the aforementioned transuranic elements. For this reason, the proposed plan assumes the efficacy of institutional controls (denying any people or animals access below a 15' soil depth). To remain protective, institutional control of the site will have to remain effective for over 300 years. A loss of control of these sites could result in exposure of humans to radioactive cesium and the release of this radionuclide into the surrounding environment.

Chemical contamination of the PW-1,3,6 and CW-5 waste sites presents a long-term threat to human health and the environment, in addition to the radioactive pollution risk from cesium, plutonium, and other radionuclides. For example, large quantities of carbon tetrachloride are present in these liquid waste sites because carbon tetrachloride was used in a mixture of other organic compounds in order to extract plutonium.

Carbon tetrachloride plume in 2135. Source: TC/WM EIS. CCl₄ pollution will continue to reach the Columbia River for over 100 years if cleanup actions are ineffective.

Carbon tetrachloride is the most widespread organic contaminant at the Hanford site.vi Over four square miles of groundwater at the Hanford site are already contaminated by carbon tetrachloride at levels that exceed drinking water standards.vii Carbon tetrachloride is acutely toxic to humans, and it can cause cancer after more prolonged exposure. U.S. DOE proposes to continue its vapor extraction effort. U.S. DOE's own modeling shows that, if this is ineffective, CCl₄ will pose a major risk to the Columbia River for over 100 years. (See graphic above from TC/WM EIS).viii

Comment M:

C. U.S. DOE does not present an adequate range of alternatives for cleanup of high-salt plutonium-laden waste sites.

U.S. DOE must present a reasonable range of alternatives for its proposed cleanup of highly contaminated waste sites in Hanford's 200 area. The public has identified, and U.S. DOE has not evaluated, reasonable alternatives that U.S. DOE should evaluate before proceeding with its proposed plan. The U.S. DOE presents more thorough RTD approaches as excessively expensive, and states that the —balancing criteria|| of cleanup cost allows U.S. DOE to select alternatives that leave large amounts of plutonium and cesium contamination in place. Yet, the U.S. DOE fails to look at RTD approaches at soil depths that exceed 2 feet but are less than RTD Option C.

Specifically, the U.S. DOE proposes to excavate only 2 feet of soil beneath the bottom of high-salt plutonium waste sites. As noted above, U.S. EPA estimates that this will leave large quantities of plutonium in the soils at these waste sites – roughly half of the plutonium in these waste sites. While RTD Option C & E present the best available alternatives for excavating plutonium-laden soils, they involve RTD to a depth of dozens of feet. The U.S. DOE analysis jumps from 2 feet to dozens of feet of excavation without explaining how excavation of the intervening depths might be effective. U.S. DOE must provide the public with a reasonable explanation for stopping at 2 feet. Does digging 5 feet, 10 feet, or at other intermediate depths achieve a much higher level of plutonium retrieval? If so, U.S. DOE must seriously evaluate these alternatives.

Comment Q:

Failure to Consult Under Section 7 of the Endangered Species Act.

USDOE is excessively confident that plutonium, cesium and other chemical and radiological pollution will be isolated from the environment under the proposed plan. U.S. DOE's preferred alternative will leave highly dangerous contamination in the soil, and rely on a combination of surface barriers and institutional controls to prevent the contamination from entering the environment. If mobilized in groundwater or excavated by humans, animals, or geologic events, contamination in the soil at Hanford could cause dramatic harm to federally protected species. In particular, because of the extremely long-lived nature of plutonium and the known issues with carbon tetrachloride in groundwater, Columbia River salmon species – which are federally protected – will likely be impacted by U.S. DOE's plan.

As Columbia Riverkeeper has noted in many previous comments, USDOE is required to consult with the federal expert agencies when a federal action at Hanford may affect federally-listed endangered or threatened species. See Columbia Riverkeeper Comment on USDOE Mercury Storage at Hanford (Aug. 2009); Columbia Riverkeeper Comment to USDOE on Tri-Party Agreement Proposed Changes and Consent Decree (Dec. 2009); Columbia Riverkeeper

Comment on USDOE Tank Closure Waste Management Environmental Impact Statement (May 2010). Pursuant to Section 7 of the Endangered Species Act (ESA), USDOE must consult with the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) to determine how the proposed action may affect any threatened or endangered species in the Hanford Reach of the Columbia River.

i. Endangered and Threatened Salmon and Steelhead in the Hanford Reach.

Among the forty-three species of fish present in the Hanford Reach are several endangered species, including the Upper Columbia River spring-run Chinook salmon and steelhead ESUs. For thousands of years, the Columbia River supported the most abundant salmon runs on Earth.^{xvi} Beginning in the late 1990s, the National Marine Fisheries Services listed thirteen stocks of migratory salmonids as threatened or endangered under the Endangered Species Act. These fish spend part of their life-cycle in the Columbia River and its tributaries and part of their life in the Pacific Ocean, eventually returning to the Columbia to reproduce and die.

The Hanford Reach is well documented as the only remaining significant spawning ground for the fall run Chinook salmon on the mainstem of the Columbia River.^{xvii} According to the U.S. Fish and Wildlife Service, "[t]he [Hanford] Reach contains islands, riffles, gravel bars, oxbow ponds, and backwater sloughs that support some of the most productive spawning areas in the Northwest, including the largest remaining stock of wild fall Chinook salmon in the Columbia River."^{xviii} The fall Chinook salmon that spawn and rear throughout the Hanford Reach support in-river commercial and tribal fisheries, commercial fisheries in the North Pacific Ocean, and sport fisheries.^{xix}

In addition to fall run Chinook salmon, the Hanford Reach also supports over forty other species of fish, including sturgeon, steelhead, and bull trout. The prevalence of endangered and threatened fish in the Hanford Reach raises serious questions about the current and future impacts of Hanford's pollution legacy and USDOE's decisions that impact how much pollution will enter the Columbia for generations. Importantly, strontium-90, uranium, chromium and other contaminants are documented entering salmon spawning grounds along the Hanford Reach.^{xx} By leaving significant quantities of highly dangerous contamination like plutonium in the soil at Hanford, and making the false assumption that these pollutants will remain immobile, U.S. DOE is exacerbating the risk to Columbia River fish.

ii. USDOE Must Consult Under ESA § 7.

Section 7 of the Endangered Species Act (ESA), the heart of the ESA's requirements for federal actions, imposes strict substantive and procedural duties on federal agencies to ensure that their activities do not cause jeopardy to listed species or adverse modification to their critical habitat. 16 U.S.C. § 1536(a)(2). Not satisfied that federal agencies possessed the requisite expertise, Congress added a strict procedural requirement: that the determination of whether any federal action would be likely to result in jeopardy or adverse modification would be made—in consultation with and with the assistance of [the Services].^{||} *Id.* This mandatory consultation is the key to section 7; in fact, Congress titled Section 7, —Interagency Cooperation.^{||}

Section 7 embodies another safeguard to protect against substantive jeopardy. Section 7 requires federal agencies—action and expert agencies alike—to use the best available scientific information in meeting their section 7 obligations. The agencies are generally the repositories of the best scientific evidence given their role in listing threatened and endangered species, in conducting section 7 consultations, in issuing incidental take permits and statements, and in developing recovery plans.

The ESA mandates consultations to ensure that an agency action —is not likely to jeopardize the continued existence of any|| listed species or adversely modify critical habitat. 16 U.S.C. § 1536(a)(2). Regulations require such consultations whenever an action —may affect|| a listed species. See 50 C.F.R. § 402.14. Where an action is —likely to adversely effect|| a listed species, the agency must conduct formal consultation with the National Marine Fisheries Service (NMFS) and/or the U.S. Fish and Wildlife Service (USFWS) (collectively —the Services||). The end product of formal consultation is a biological opinion in which the Services determine whether the action will cause jeopardy to the species or adversely modify designated critical habitat. 16 U.S.C. § 1536(b).

In their joint consultation regulations, NMFS and the FWS established a preliminary review that can be used to sidestep formal consultation in limited situations. For all actions that —may affect|| a listed species, the action agency must determine whether the action is —likely to adversely affect|| or —not likely to adversely affect|| the listed species. 50 C.F.R. § 402.14(a)–(b). An action that is —likely to adversely affect|| a listed species or its critical habitat must undergo formal consultation that culminates with the services' issuance of a biological opinion that complies with the ESA and regulatory requirements. *Id.* §§ 402.02, 402.14(a).

Under the joint regulations, a —not likely to adversely affect|| determination can lead instead to an informal consultation, which consists of all discussions and communications between the agencies and ends with the Services' written concurrence in that determination. *Id.* § 402.13. If the expert agency does not concur, the action is deemed —likely to adversely affect|| and the agencies must conduct a formal consultation. *Id.* §§ 402.02, 402.14(a). Use of informal consultation is optional in those instances where it is available.

An agency may avoid —consultation only when it has determined the proposed action is unlikely to adversely affect the protected species or habitat and the [expert agency] concurs with that determination.|| *Tinoqui-Chalola Council of Kitanemuk v. U.S. Dept. of Energy*, 232 F.3d 1300, 1306 (9th Cir. 2000) (citing 50 C.F.R. § 402.14(b)). In this case, because of the highly dangerous, potentially mobile, and long-lived nature of contaminants in the PW-1,3,6 and CW-5 sites, U.S. DOE should consult with the USFWS and NMFS about the potential impacts on federally protected species.

Question 1: Has USDOE initiated Section 7 consultation with NMFS and/or the USFWS regarding the proposed action?

Question 2: If USDOE has not initiated Section 7 consultation, does USDOE intend to initiate Section 7 consultation? Please explain.

Question 3: If USDOE has not and does not intend to initiate Section 7 consultation, please explain the agency's rationale for not consulting with the Services under the ESA.

Comment R:

CONCLUSION: USDOE MUST SIGNIFICANTLY REVISE AND IMPROVE ITS PLAN FOR REMEDIATION OF THE PW-1,3,6 AND CW-5 WASTE SITES IN HANFORD'S CENTRAL PLATEAU.

Thank you in advance for considering Columbia Riverkeeper's comments on the proposed plan for remediation of liquid waste disposal sites in the Central Plateau. We strongly urge USDOE and the other Tri-Party agencies to proceed with a remove-treat-dispose approach for plutonium and cesium-polluted sites and to rework its plan for cleanup of high-salt waste sites and cesium waste sites. If the Tri-Party agencies have any questions or would like to discuss these public comments, please contact Columbia Riverkeeper at dan@columbiariverkeeper.org or (503) 890-2441 to arrange a meeting.

Commenter #118

Ruth Williams

Comment A:

I have been reading about your plan to skim a couple of feet of toxic waste from the bottom of these storage sites and leave most of the waste mixed into the soil. According to your own science the remaining toxins will seep in the ground water, poison the river, and cause illnesses including cancer, and death, plus the environmental damage to fish and wildlife. The National Academy of Science has spoken out against this plan with far more authority than I can.

However, as a tax-paying, voting, responsible American I need an explanation for this. Every day we do things, some mandated by law, to protect our environment. We sort our trash and keep toxic substances out, we drive cleaner cars, we avoid garden chemicals, we don't pour any chemicals down the drain, we conserve resources, etc., etc. Communities across the country are spending billions on ecological conservation and restoration and cleaner construction practices. But meanwhile, our own US DOE intends to poison Hanford the Columbia River for the foreseeable future. This is mind boggling!

Commenter #120

Hanford Challenge

Comment A:

Background:

Hanford is a 586 square mile nuclear waste site in southeastern Washington. Hanford's contamination is a remnant of WWII and Cold War plutonium production for atomic weapons. The U.S. taxpayer has spent an estimated \$5.5 trillion to produce its nuclear arsenal, according to the Brookings Institute.¹

This comment is in response to the Department Of Energy's (DOE) proposal that outlines the cleanup options for 22 waste sites that are within the boundaries of 4 "operable units" in the 200 area of the Hanford Site. The operable units are called PW – 1, 3, and 6 and CW-5. The 22

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waste sites are grouped into 6 waste groups based on the type of liquid waste they received. The proposal shows different options for cleaning up these waste sites and the preferences of DOE's favorites. These options are listed by waste group.

The draft "Proposed Plan for the Remediation of the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units" (Draft Plan) discusses the proposed remediation of 22 waste sites within the 200 Area of the Central Plateau. The 200-PW-3 Operable Unit (Cesium Sites) includes four Plutonium Uranium Extraction Plant cribs and one unplanned release, all containing primarily cesium-137 in the 200 East Area.

The contamination came from liquid waste that was generated during plutonium production in various buildings on the Central Plateau. The contamination contains both plutonium and radioactive cesium. Plutonium-239 has a half-life of 24,100 years, and will be dangerous for 240,000 years. Cesium-137 has a half-life of 30 years, and will be dangerous for 300 years. Hanford Challenge is concerned about the health dangers of plutonium and cesium, both of which present health concerns when people are exposed to these elements, even in microscopic quantities. As for plutonium-229, a quarter of a million years may as well be "forever." We need to ensure that future generations are protected from these contaminants. Picking the most protective cleanup option and putting the contamination in a location that is isolated from the biosphere is the only ethical and defensible option.

¹ *Atomic Audit, The Costs and Consequences of U.S. Nuclear Weapons Since 1940*, Stephen I. Schwartz, Brookings Institution Press, 1998.

Commenter #120 Hanford Challenge

Comment C:

DOE's Proposal Outlines the Following Cleanup Options:

No Action: *Leave the waste where it lies. Do nothing.*

Maintain and Enhance the Existing Soil Cover: *Add more soil and plants. Landscape the top of the waste site.*

Engineered Safety Barrier: *Leave the contamination where it is, but with a barrier of basalt rock at least 15ft deep separating the contaminated soil from the surface soil.*

In Situ Vitrification: *Melt the contaminated soil together with glass and put it back in the ground and cover it with clean soil.*

Removal Treatment and Disposal (RTD): *Remove a portion of the waste*, treat it when necessary, and dispose of it at either Hanford's Environmental Restoration Disposal Facility, which is a large lined landfill on the Central Plateau, or send it to New Mexico's Waste Isolation Pilot Project where deep salt caverns are used to store plutonium contaminated waste.*

Removing a portion of the waste is defined in the 4 following ways:

- *removal of the top 2ft of contaminated soil,*
- *removal of the top 15ft of contaminated soil,*

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- *removing soil until a certain concentration of the plutonium is gone,*
- *removing soil with concentrations resulting in a direct contact risk greater than a one cancer per one thousand exposure risk level.*

DOE's Preferred Alternative:

Z-Ditches: *Remove, Treat and Dispose (RTD) of waste and dispose of it at Hanford's lined landfill (ERDF).*

High-Salt: *Remove, Treat and Dispose (RTD) 2ft of contaminated soil and send it to New Mexico's salt caverns at WIPP.*

Low-Salt: *Remove, Treat and Dispose (RTD) what DOE estimates will be 90% of the plutonium and send it to New Mexico's salt caverns at WIPP.*

Cesium-137: *Maintain and Enhance the Existing Soil Cover, expensive landscaping.*

Settling Tanks: *Remove, Treat and Dispose (RTD) of sludge from the tanks send to WIPP or ERDF depending on what they find. Stabilize the tanks.*

Pipelines: *Remove, Treat and Dispose (RTD) Dig them up and assess the soil underneath the pipes to see if they have leaked.*

DOE's Preferred Alternative Scenario Would:

Leave more than 50% of the plutonium in the soil.

Leave the Cesium and put a dirt cap over the sites containing Cesium.

Comment I:

The Board (HAB) advises a policy to conduct RTD concurrently with vapor extraction efforts to ensure meeting Tri-Party Agreement milestones.

Commenter #121

Heart of America Northwest and Heart of America Northwest Research Center

Comment F:

Background

Starting in the 1940's, the federal Energy Department (USDOE) created tremendous volumes of liquid waste from the production of plutonium at various plants on Hanford's Central Plateau for our nation's nuclear weapons program. These liquid waste discharges were billions of gallons – equal to days of flow of the Columbia River. The Central Plateau is where long-term waste management and cleanup has and will undoubtedly last for decades. The proposed plan covers just 21 waste sites on the Central Plateau. Soil and groundwater have been contaminated at Hanford and the overall health of humans and the environment is at risk. The plan provides cleanup options for the waste sites and lists the preferred plan from the Energy Department for the waste sites.

In sum, the proposed plan would “cover-up” with dirt, rather than clean-up, massive amounts of Plutonium, highly radioactive Cesium, and a slew of toxic chemicals.

The proposed plan also fails to consider the combined (“cumulative”) impact of numerous other waste sites and landfills on the Central Plateau with similar wastes. In total, all the different types of waste sites on the Central Plateau have enough Plutonium to make 130 nuclear weapons. Thus, whatever is decided for these liquid waste discharge sites, will set a precedent for future decisions... The total cumulative impact and risk will be far greater than just the risk from these waste sites if USDOE is allowed to leave half of the Plutonium and all of the Cesium and chemicals at many of these waste sites:

Comment H:

USDOE’s proposed cleanup plans:

Plutonium Discharge cribs and trenches:

- Remove only contamination 2’ below the bottom of the trench or drain in “High Salt” waste sites with chemicals as well as Pu. *Would leave more than 50% of the Pu in the soil below.* The Pu left below is the more mobile Pu which has already shown it will move through soil due to solvents and “preferential pathways”. At “low salt” (low chemical solvent) sites, 90% of Pu would be removed by digging deeper.

PW-3 Cesium (highly radioactive) Sites in 200 East Area (see map, over):

- *leave the Cesium and put a dirt cap over the sites.* Cs137 has a 30 year half-life. Most radioactivity will be gone in 300 years. Organic chemicals, other radionuclides would remain. Rejected alternative to remove 15’ deep.

Tanks with Plutonium, Americium and chemical sludges:

- remove contents, leave tanks in place and redispense waste without treatment. Leaving tanks or landfilling wastes designated “extremely hazardous waste” violates WA State hazardous waste law. Agencies seek to circumvent using federal Superfund rules rather than closing with cleanup under WA and federal hazardous waste laws. State hazardous waste laws require characterizing wastes remaining, monitoring, and removal of waste to extent practicable as remedy.

Comment L:

USDOE issued a draft Tank Closure and Waste Management EIS, which cost \$50 million to prepare, in 2010. The draft included a cumulative impact analysis extending out ten thousand years, but it had serious holes and flaws which were commented upon. The Final TCWMEIS has yet to be issued. If it fixes these flaws, it would provide the public and decision makers with the critical information needed to understand if capping and leaving wastes as proposed in this Plan would have unacceptably high impacts in conjunction with similar waste sites.

Without the TCWMEIS, this plan can not legally proceed. Although EPA has interpreted Superfund, CERCLA, as allowing decisions to proceed based on RIFSEs being considered as a replacement to the NEPA EIS, the CERCLA documents lack the cumulative impact analyses required, and lack the long term examination of impacts to human health and the environment over ten thousand years.

But we do not need to resolve the dispute over whether CERCLA allows the agencies to replace an EIS with a CERCLA RIFS to have a legal requirement for an EIS apply to these units and waste sites.

These units are subject to formal legal closure under both Washington's Hazardous Waste Management Act (HWMA, RCW Chapt.105) and the federal RCRA hazardous waste law. Many of these units stored and managed hazardous wastes after 1985 subjecting them to RCRA permitting for closure, including the requirements for an EIS under State SEPA (RCW Chapter 43.21C)– indeed, some still store and manage hazardous wastes; e.g., the settling tanks.

Commenter #124

Confederated Tribes of the Umatilla Indian Reservation

Comment A:

The Confederated Tribes of the Umatilla Indian Reservation (CTUIR), Department of Science and Engineering (DOSE), appreciates the opportunity to comment on the Proposed Plan (DOE/RL-2009-117) for cleanup of the 200-CW-5 and 200-PW-1, 200-PW-3, and 200-PW-6 (200-PW-1,3,6) Operable Units.

There no greater issue of greater importance to the CTUIR than protection of, and respect for, the treaty-reserved rights. The Hanford Site lies within the ceded area of the CTUIR, within which the CTUIR retains rights to access and use the natural resources, including the protection of human health. As was stated in the proposed plan, remedial action is needed since contamination at these sites exceeds risk thresholds values for human health, the environment, and future industrial use. However, the CTUIR disagrees with the suggested level of cleanup or protection that the proposed plan offers as the preferred alternatives.

Comment F:

Blending

Apparently, cost is being used as the major argument on why the waste should not be removed. If the waste could be disposed of in ERDF, the costs are estimated at \$100 per cubic meter. But removal of the contamination is estimated to generate TRU waste. This transuranic waste would have to be disposed of at the WIPP facility, and the DOE Proposed Plan estimates this disposal cost at \$44,000 per cubic meter (page 31). As an alternative, the waste from the Z-Ditches would be mixed with clean soil to allow disposal at the ERDF. The CTUIR strongly disagrees with the blending of contaminated soils with clean soils. The volume of waste should be reduced, not increased for convenience.

Comment I:

Regarding the 200-PW-1 and 200-PW-6 settling tanks, the option of removing the waste, but leaving the tanks in place and grouting them, leaves another attractive nuisance

situation. Presently, the value of steel does not justify the effort of recovering it from a grouted tank. However, this assumption cannot be made for some future economy. If past history is capable of providing any insight into the future, one need only to look at the Medieval trade of Damascus steel blades in order to appreciate the potential attractive nuisance that abandoned buried steel tanks may pose to a future society.

Comment K:

Tank Removal

For the settling tanks waste group, the sludge removal alternative was evaluated and found it to be protective of human health (page 42). However the CTUIR would also like to see the tanks themselves removed rather than having them grouted in place for stabilization. Even though some of the pipelines that will be removed as part of this cleanup effort may be a part of another operable unit (page 18), the settling tanks should also be removed. The CTUIR believe that all pipelines and tanks should be removed as the individual sites are remediated; no matter what operable unit they belong.

General Comments

Commenter #7:

Alera Walker

Comment C:

And, also, I have something to say to the representatives from the EPA. It is interesting to hear this evening that this proposal isn't designed to protect the public, but rather it's to protect the workers. And so that was -- that was great that that came out here. But I thought that the EPA was supposed to be concerned with groundwater contamination and concerned with the people who have to live around here in the future. The reason why I thought so is because it's not just called the Environmental Agency. It's the Environmental Protection Agency. And so that's why you guys at the EPA, the people depend on you to protect us when something terrible happens to our environment, and we trust you to make decisions that are a matter of life and death.

Comment E:

And I guess, also, if you people at the EPA really enjoy having have this power over life and death, you might want to consider leaving the Environmental Protection Agency and joining the military instead because, in the military, you can kill people legally.

Commenter #8:

Nancy Morris

Comment C:

I don't even know at this point if you've reached glassification in any of the waste. There's not even a standard stability across the board at this point with the waste of plutonium. And the kind of energy that's being expended doesn't even equal the kind that was exhibited for the Manhattan Project that gave us the weapons of mass destruction that left us with this nightmare legacy. And that should be changed and recognized that we have nuclear power plants all around the United States, around the world, and plutonium is ever-present with us.

We have to be able to deal with this in some fashion within our immediate generation and be realistic that we may not be available to answer questions a hundred years from now.

And I'd like to end with one quote. This is from Dr. Kathleen Dean Moore who's an ethics professor at OSU. "We have an affirmative moral responsibility, individual and collectively, to leave the future of world rich in life- giving possibilities as a world we inherited."

Commenter #9:

Margaret Swartzman

Comment B:

We have -- we've learned through other places the tremendous human cost of our nuclear idiocy. I mean, we can look at Chernobyl and all of the horrors of the people in Russia that -- that live with, for generations for -- none of their -- I mean, forests that cannot be entered for, what,

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five generations, maybe more. I mean, we don't want that to be happening in Portland, along the Columbia River.

We must -- it's not a roof on a house that we're suddenly having to find the money to put on the house in order to preserve it. It's -- it's greater than that. And we mustn't lose sight of that no matter the difficulty of our financial times, no matter the difficulty of our political times. This is too central to our humanity. And that's all I can say. I mean, you know what I'm referring to. And you know that -- that this is unborn children we haven't even -- we can't even imagine them yet.

Commenter #10:

Jacqueline Sorkin

Comment A:

My name is Jacqueline Sorkin, and Gerry asked me to put a face to the word cancer. And I'm -- I'm hearing a lot of things about how we're putting carcinogenics into the groundwater, and it scares the hell out of me because I've been living with cancer for over 30 years. And I probably will not be around when this all comes to a head, and that's okay too. But the groundwater will be contaminated, and there will be truck route exposures, too, and there will be carcinogens at the truck routes, you know, if we make a repository.

Anyway, cancer risks from radiation are higher, especially for children and women, than previously estimated. 15 millirem of annual dose is now projected to cause eight fatal cancers for every 10,000 adult males exposed. The risk to children is three to ten times higher. The fatal risk to children using the groundwater, including Native Americans exercising their treaty rights to live and use the resources at Hanford, will be over 2 percent.

If the Department of Energy goes ahead with its plan, there'll be an increase in cancer risk to future generations using the groundwater tenfold. Exposure to even an extra one millirem per day would be expected to cause an increase in fatal cancers of about 2 percent for an exposed adult male and three to ten times that risk for a child.

Commenter #15

Dave Berger

Comment G:

I will end with a joke. Okay? When I was in Tibet, the old saying was that the Tibetan monks around the monastery feed the dogs because they are afraid that bad monks will come back as dogs. It is sort of an insurance policy. Well, I sure as hell don't want to come back as an ant at Hanford.

Commenter #21:

Keith Harding

Comment A:

Hanford is our father's curse on us, and how we deal with it or don't deal with it is our curse on our kids and grand kids.

If you are a student of history, you will find a lot of stuff written down that passed generations of humans didn't care much about future generations. They said things like: What the hell did the future ever do for us? Or they will deal with it when they get here. And you will also find comments such as Thomas Jefferson in his first inaugural address of 1801 where he said: All their actions at that time should be -- the impact on the thousandth generation into the future should be considered. What they do in 1801 should be considered a thousand generations into the future, and if that is 25 years per generation, that is 25,000 years.

I have been attending these meetings for over 20 years now, and nuclear science and chemical science is not my expertise at all. So I sit and listen and listen to the agency people, and the contractors speak, and a lot of the folks seem very sincere. JD, you sounded very sincere tonight. There has been some that did not sound so sincere. I do know that it is real easy, and I sit and think and listen. So I try to say something that might be a different twist on it that might be a way to get into the agency's mind.

And I do know there is a phenomenon of simply becoming a functionary in an agency -- I worked in government for 20 years. I know something about it -- to become a functionary and to pace yourself through it and get to the retirement. And we have seen several of the characters before you do exactly that, and now they are nicely retired with their benefits.

I want to really see it get drilled in, bolted and riveted into the agency because this agency and the AEC before DOE was the villain, and it still is. We need a real deep track record to develop.

Commenter #25:

Male Speaker

Comment:

I would like to observe that in my lifetime nuclear power has gone from being too cheap to meter to too expensive to calculate.

These things you are talking about is all downstream costs of nuclear power, and you have been struggling with this problem with all of our scientific advancement. Apparently, you know, we are just on top of the world. We can do anything, and yet still there is no -- what is it -- approved disposal method. And there appears to be no approved disposal method in the near future. Now DOE, our wonderful steward, is proposing to bring thousands of truckloads of highly-radioactive waste to Hanford with no idea what they are going to do once they get it there. This doesn't sound like thousands years of stewardship to me.

Given the long-term failures of Hanford's tri-party agreement to realistically clean up what has gone before or plan for what will go on in the future, it seems to me that DOE should be giving us a break and you, a government agency, need to be taking the lead to the rest of the government to get off of their crazy crackpot idea and stop nuclear power. It is not sustainable. It gets more expensive every year. It is insanely expensive, and there is no end in sight for this. And for you to sit around and do your own little one box job -- my job description. I am not going farther -- is irresponsible and, to me, inhuman.

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The bigger picture is nuclear power is insane, and you with your expertise and your experience need to take a political stand and explain this to the political do-dos and those people who have fat pockets who are getting lined with more nuclear power plants and make it a no-go option. This is not a sustainable or scientifically -- not scientifically sustainable way to boil water and make electricity. It must stop.

There are much simpler, cheaper ways, and to continue on this path, just have our little meeting saying, "What should we do with this? What should we do with that," I mean you are just nickel- and-diming us death. You guys have the information to have the big picture.

Take it. Run with it. You are our employees. That is what I am challenging you to do.

Commenter #31:

Paige Knight

Comment F:

Saving pennies at the expense of present and future citizens is a pound foolish -- anyhow it's -- thank you. In here I have a parenthetical, note the increasing threats to our health and cost of healthcare right now. We, of the Pacific Northwest, have had to fight for every advancement in cleanup of the site. As we slowly move forward in the cleanup, new plans continually arise to bring more waste here and to do less than that which provides health safety and the future for the region and its inhabitants.

Commenter #33

Dvija Michael Bertish

Comment A:

I want to address the risk-based decision making which I understand is important regarding trying problem solve what steps you do first and in what order. However, I want to remind everybody that within the past century, some Japanese ancestors placed signage on the shores of Japan and said, "Don't build here," because of tsunami warnings and everybody forgot about that and built their reactors. And then, again, more modernly, they were told, if you do, bury them so nothing happens and those decisions were disregarded. So risk-based assessment planning long term failed in that regard and now we have contaminated oceans and food an uninhabitable areas and if you're going to pay those people \$9,000 in total for lost property that is tragic.

Commenter #36:

Chris

Comment A:

My name is Chris and I'm a physician here, living First I'd like to speak for Mother Earth. I am very small. She's big. What a mess. You made it clean it up. Okay. Now, back to me the doctor. I'm psychiatrist. We have suffered tremendously from denial. Denial is caused by fear which leads to a disconnect with thinking and feeling and it leads to paralysis, lack of action. And have we not seen a lot of inaction in cleaning up Hanford. Now, it is so encouraging to me to see that

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denial appears to be wearing thin. It's wearing thin because people keep you know, nagging, and saying, you know, nothing is not okay.

Comment D:

The antidote to fear is love and respect for all life. So back to the Mother, could we all respect and love all life, taking into account that we are very small. We can only think ahead seven generations, maybe.

Commenter #38:

Audience Member

Comment A:

I have a few quick points. What I'd like you to define and educate us about the effects of all of this on us as it gets more in the Columbia. The health effects, the salmon, the river, can our kids swim in it, all that kind of stuff. What exactly are we looking at if we only do a minimum.

Comment C:

Also I think we should develop alternative energy

Commenter #43:

Lloyd Marbet

Comment B:

Risk-based decision making brought us Fukushima. It also is bringing us the clean up of Fukushima, unfortunately. What are they doing? Raising the standards exposure for the people, when, in fact, they should be removing people.

In fact, we even asked Japan to remove people, evacuate people beyond the areas of the contamination that we're now understanding is taking place from this accident.

Commenter #45:

Laura Feldman

Comment B:

But the bottom line for me is that I want to stress stewardship. I saw a Frontline program last night about the atomic artists in Japan. I was really inspired because these are young courageous artists who actually some of their pieces take place actually inside of Fukushima or Fuji, one of the plants. They're really courageous and what they are helping the Japanese people do is reconfigure a different way being on this planet. They're now faced with it. They have to figure it out. So you know, it's huge. It's just huge and the Japanese are having to learn how to live differently immediately, now, as we really do too. I mean, that's Fukushima times 50 -- I mean 100 miles up the river and I think it's an nuclear holocaust waiting to happen.

And actually, it's happening now and we need to engage people and not at these crappy hearings where I'm presented with information I can't possibly integrate really. Stewardship needs to be happening at all levels and I think artists and Shamans and psychologists and

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anybody who will step into this breach and help us connect with this issue. Help all of us connect with this issue so we take ownership. Become stewards. We all have to be together on this. And, you know, in terms of the government telling you what you're doing, I mean, we've been lied to and it's a very challenging process and we all need to take responsibility. But I highly suggest that you go and check out the Frontline program that aired last night about the atomic artists, Chim Pom, I think they're called.

Commenter #46:

Sophia

Comment A:

We used to live in Zillah, Washington, which is close to the Hanford waste site and now we are homeowners here in Portland. And I'm no expert in all the confusing terminology and all the technology that you shared in presentations with us tonight. So what I can offer to you is the consequences of human exposure to radiation. When the Chernobyl accident happened, I was a very young girl in a children's theater group in Sweden. And we raised money to bring a few of the orphan children of Chernobyl to a lake for a weekend. Spending that weekend with those children of Chernobyl is never ever going to be something that will leave my memory. There was no way for us to tell who were boys and who were girls. These children were my age, at the time. They had no hair. They had no skin color. They looked like tiny, dying old men. And it is my expert opinion that no amount of dollars saving is worth the risk of reducing a hopeful child to ghost-like dying body.

Commenter #47:

Joel Garbin

Comment A:

I both work in the storm water industry and also I'm President of a non-profit called the New Energy Movement. We educate about what is going on behind the scenes in breaks for energy technologies that generally aren't reported on by the media. Our congress is inactive and ignorant of these things. And, you know, unfortunately, our own U.S. Department of Energy has been a blockade against the information release of a lot of these things, much less of active support. So we've seen it in a very recent case where an inventor of cold fusion based technology, has now been embraced by the Greek government who is actively building three new manufacturing facilities for that process that could have been embrace by the American government. Well, it was not because that particular inventor recognized that it's not welcome here. This has been going on, this type of lobbying industry based partnership that keeps disruptive technologies in a good way at bay has been really pathetic and a disservice to our citizens and it continues. So even though men and women of integrity with the highest intent, and I do respect, and I believe you that you're at work here. There are bad seeds much higher up in the U.S. Departments of Energy. In fact, there is a book out here that I encourage you to pick up about break through energy technologies.

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Commenter #51:

Audience Member

Comment:

I just wanted to quickly register my opposition to the absolutely pitiful plan. I'm thinking about while still having decided against the 12,000 truckloads. I was floored that this even came up before that decision was even made. I wish I could give you suggestions but I'm the secretary of a hospital and I think I do my job okay. And I hope that you do your job okay, but clearly, clearly it is not. Two feet is pitiful and this being the hottest spot in the Western hemisphere, I can't imagine that you could show your faces at international conventions that address this sort of thing. I know in Sweden, they would laugh at us, I mean, we would be ran off this planet if we really, honestly looked at this. I tried to explain where I was going to my eight-year-old daughter before I came here, and even she clearly understood that this terrible, terrible idea. Thank you.

Commenter #66

Chris Pew, Portland meeting

Comment C:

It should be the goal of the DOE to find a way to work within its constraints (ie. budgetary, scientific, etc..) to clean up the site, dispose and treat the harmful toxins; to ensure that this land will pose NO threat to humans or the environment, NOW or in the FUTURE.

Commenter #69:

no name, index card

Comment B:

You propose "RTD" yet you have NO "Appropriate Disposal" method only sending to repository in N.M. "RTD" is ineffective if there is no "D" There is no plan for how to dispose of the additional 1000's of truckloads you are proposing.

Toxic "forever"

Volume too much

Long – Dist – to NM –endangers life to move it

DOE must advocate elimination of Nuclear Power & Weapons

Commenter #70:

Patrick Wicks, 7/5/11

Comment:

What is ET in the term "physical ET barrier" in the subject message today?

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Commenter #72:

Don Meyers 7/12/11

Comment B:

During past years, I have transmitted my comments on this approach to Hanford Cleanup Contractors, DOE Richland Operations, Wash. State DOE, State of Wash state and national political leaders, Hanford Advisory Council, National DOE Secretary, Atomic Heritage of Manhattan Project, and the National Park Service. Over those past 22 years, the main resistance to my comments was that the Alternate Approach would not meet the requirements of the Tri Party Agreement. Requests to revisit the TPA and reconsider how its strict requirements should be applied were not heeded. Reconsidering must be based on lessons learned from attempted cleanup methods used to date. Much is learned from the hazardous/radiological characteristics of retrieved waste, and the procedures and equipment used during those efforts. Optimization of the Hanford Cleanup would save time and thereby less risk to public and environment, and reduce cost that could be used to operate Hanford Site historical monuments for public tours. The monuments would be isolated from the touring public, who could learn the history of Hanford's role in the Manhattan Project. An example is the B Reactor Museum, already in place and thoroughly enjoyed by public on DOE tours. Other sites and facilities have been visited by public on DOE Hanford Site tours.

A few of my comment transmittals follow as examples of optimizing cleanup and generating more monuments, thereby preserving the history of the Hanford Site for Public visits, possibly as a "Hanford Nuclear National Park. I plan to mail you two other comments that pertain to our Long Term Stewardship of the Hanford. Sorry for the lengthy and repetitive nature of these transmittals.

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~May, 2007

Hi Doc Hastings,

I have been commenting on the Hanford Cleanup approach and progress now for about 18 years (since I left the Tank Waste Retrieval group in 1989). My comments have been to simplify the cleanup approach which would considerably reduce the cost and expedite the highest risk part of cleanup effort. My alternate approach has been rejected all those years because constituent reviewers say, "the Tri Party Agreement (TPA) requirements/guidelines cannot be changed". I always take offense to this reasoning since DOE has spent all this time and taxpayers' money trying to cleanup exactly as the TPA requirements read. All they talk about in the Tri City Herald is DOE/constituents revisiting the TPA to change milestone dates to those that can be met!

From experience gained through the past 18 years of cleanup effort, it must be obvious by now to DOE, Wash. State Politicians, Hanford Contractors, Hanford Advisory Board, Tribes and other Stakeholders of the Columbia River Corridor, that we can and must technically revisit the TPA requirements. The inefficiencies and lessons learned from Hanford Cleanup to date (due to worker radiation exposure, added R/A waste generated, characteristics of retrieved waste, and physical difficulties, space constraints and equipment development problems) must be applied to the TPA . We

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should not have to restore the Hanford site to its natural state! Maybe Congress would be quicker to approve Hanford Cleanup's funding needs, if needs are more realistically based on results of a technical revisit of TPA requirements?

Furthermore, Cleanup should leave one complete set of support facilities as monuments to compliment the B Reactor Museum National Landmark, and tell all of Hanford's part in the Manhattan Project. This would support our government's effort to preserve that Atomic Heritage!

I am resubmitting the summarized comments which I presented at the meeting of several nuclear site advisory board representatives held in Richland (April 2008). Thank you for any consideration you can provide to hopefully expedite and optimize the Hanford Cleanup effort.

Don Meyers Ph: 509-586-4244

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Don Meyers

4/24/08

HANFORD CLEANUP / TPA / DOE / CONGRESS

The Hanford Cleanup has progressed for nearly 20 years now, under the requirements of the Tri Party Agreement. The original 1940s Hanford effort to perform Plutonium production and processing of radioactive waste had to be accomplished by rules established and agreed-on by governmental, nuclear regulatory, engineering, construction, and operating contractor organizations working together. They surely took into consideration the safety of public, groundwater and Columbia River to the best technical knowledge in those years. Now, some 45 years later, the start of Hanford Cleanup effort was upgraded to meet environmental safety rules of the new TPA requirements, mainly to restore the Hanford reservation to its original natural state. This has required the retrieving, handling and repackaging of previously disposed waste while generating more waste and subjecting workers to more danger and radiation exposure. The cost of this approach is astronomical and both cost and schedule are growing at a faster rate each year.

It appears Congress/DOE hesitates to approve "required" funding levels and schedule, because of doubt that Hanford Cleanup is being accomplished in an expedient manner to realistic requirements which are consistent with safety of our Public and Environment. Revisiting the TPA requirements now and applying "lessons learned" can show what true and realistic extent of cleanup is required. This would reassure DOE/Congress to expedite approval of funding, especially for the crucial River Protection portion of the Cleanup. The true needs of the Vitrification Plant capability must also be verified in the same manner, and considering any redirection of the cleanup approach. Right now, we must convincingly sell the DOE/Congress that cleanup at the Site is done safely, cost effectively, and timely as its honest basis for our funding requests. Revisiting the TPA requirements to ensure a realistic extent of cleanup with possible redirection of approach would convince DOE/Congress that we are doing it the best way it can be done!

Back in the early 1990s, an Alternate Approach was suggested to expedite especially the River Protection cleanup aspects by removing liquid/slurry wastes from Radioactive storage tanks, basins, trenches, cribs, etc. by proven processes using established procedures and equipment. That retrieved waste would be processed at the Vit Plant or at existing evaporator facilities used in past years. The

remaining solid waste would be dried, and other radioactive and contaminated equipment, scrap, soil and aggregate added to fill up the voided volumes. Each filled waste storage volume would be isolated from the public, groundwater, and environment with protective caps and fenced in as "Cleanup Monuments". Reactor Buildings would be cleaned of highly radioactive solid and liquid wastes, and isolated from the public and environment in that similar way. The Cleanup Monuments would be visited by the public on clean roads and grounds all over the Site. Tourists and visitors could learn from activated speakers, just what role each monument played in the Hanford Plutonium Production effort. What a great way to preserve the Hanford Project history and share it with the national public.

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Don Meyers

April 25, 2008

PROPOSED HANFORD CLEANUP PLAN OF ACTION

The Hanford Cleanup effort needs to do a "selling job" to Congress/DOE that convinces our Government we are doing cleanup the best way for Our Country and the Columbia River Corridor. Then getting our required funding and priority from DOE and Congress will happen in the best interest for all. This Sell can be done by:

1. Looking closely at how/why 1940's Project designed/disposed of R/A waste
2. Looking at Lessons Learned during first 20 years of Hanford Cleanup
3. Considering the New Knowledge/Experience that has been established
4. Looking/analyzing Sampling Data and trends in Public exposure limits
5. Revisit strict Tri Party Agreement for more realistic application or changes
6. Look at various Alternative Approaches with proven methods/equipment
7. Agreeing on and updating TPA for expedited "best way for all" Cleanup
8. Completing Hanford Cleanup with River/Groundwater protection top priority
9. Establishing Cleanup Monuments isolated from, but visited/enjoyed by Public
10. Preserving the overall Hanford History and Manhattan Project Heritage by establishing a "Hanford Nuclear National Park"

The Hanford Cleanup must result as an excellent effort like most other past projects carried out at Hanford for the DOE and U.S. Government. The Hanford effort must provide the example of proven methods for use at other cleanup sites. It's not a matter of fewer jobs and losing workers, but of using all our experienced workers to get done right and expeditiously! When our Cleanup is done right, we'll protect the Public, our Environment and our Country by Reducing Risk, and both Saving Time and Reducing Cost significantly. As in the past, Hanford Site will be awarded new Energy Projects from DOE, to do right here where the Public accepts having nuclear work done.

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With recent talk of building new nuclear power reactors again, Hanford might even get some full scale power producing plants. That could result in a regional "Nuclear Power Park" here after all, since losing that chance 25 years ago?

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Commenter #73:

John Ritter 7/15/11

Comment:

Amazing, This has been going on for just too long.....It is time to clean -up the mess at Hanford completely as promised.

Commenter #75:

John Ritter, 7/20/11

Comment:

IT HAS BEEN PROMISED FOR TOO LONG-----IT IS TIME TO CLEAN-UP HANFORD, AND STOP THE RISK OF A SEVERE ACCIDENT WHICH WOULD DESTROY THE COLUMBIA RIVER GORGE--
----OUR NATION'S LARGEST NATIONAL SCENIC AREA.....

Commenter #82:

Ed Martiszus, 7/25/11

Comment B:

The talk of enough Pu in the ground to make 70 nuclear bombs means would mean that 70 x8kg would equal 560 kg, which could cause 140,000,000-560,000,000 cases of cancer over 250,000 years. That would be at a dose of 1 micron to 4 microns. The cost of treating the cancers and other debilitating diseases, costs of travel to be treated, stress on patients and families, loss of income, would be more than the cost of cleaning up the Pu, Cs, other radionuclides and solvents. We also have human rights issues of violation of due process, that is being exposed and sickened and subjected to suffering and death without any arrest for any crime, court decision or sentencing. The issue of genocide against the Yakama Nation, in relation to the lands and waters of the Columbia River also must not be ignored. I must disagree with the US DOE position in interspecies solidarity with the salmon. elk, lamprey, tules, eagles, ospreys and all the other plants and animals that had a nice uncontaminated life before the Hanford crime was perpetrated on the Columbia River valley. To walk away from radioactive and chemical contamination is not only poor environmental and fiscal policy but would be criminally negligent. Thank you for letting me post my opinion.

Commenter #83:

Kathy McCullough, 7/27/11

Comment A:

I could not attend last night's meeting, but I want my voice heard.

Speaking for my neighbors in Sherman County and all along the Columbia Gorge, we are all incredibly worried about Hanford and the waste stored there. We have already lost loved ones due to the contamination as "downwinders," and we shouldn't have to plead our case. It just makes good sense to clean up **everything, to the best of our capability**. This is a priority - not a case of waiting until the unforeseen happens. It is scary to most of us to know that our groundwater is already contaminated.

Comment C:

All three of my dads died of service connected deaths, including leukemia from the early bomb tests. This cleanup is the least the government can do for their survivors. To me, this is very personal. I don't want my children and grandchildren threatened by nuclear waste.

Our fathers paid the ultimate price - please do the right thing for their future generations.

Commenter #87:

Paige Knight, 7/28/11

Comment A:

The United States Department of Energy promised the citizens of the Pacific Northwest, in 1989, that they would clean up the vast contamination of the Hanford Nuclear Reservation which, for the past half century has compromised the health and safety of people who have lived in the region and who have relied on the great Columbia River to provide water for inhabitants, animals, biota and crops. We are owed this after the sacrifices many have made in living with the production of plutonium, a deadly element.

This plutonium has already entered the Columbia River and, as evidenced in your reference guide, is a continuing threat to the ground water and Columbia River. Plutonium has a half life of 24,000 years, meaning it will take 240,000 years for it to decay. *In the early days of clean up of the site the public was told that it would take 1,000 or more years for the plutonium that contaminates this 10 square miles and more of the Hanford site to reach the Columbia. A few years later, we were informed that new samples and studies indicated it was moving far more quickly than that. *

Comment E:

We in the Pacific Northwest have had to fight for every advancement in clean up of the site. As we slowly move forward in the cleanup, new plans continually arise to bring more waste here, to cap the site, to do less than that which provides health, safety and a future for the region and its inhabitants. It is impossible to promise that no one will live in the central plateau area in the decades to come. That is not the answer. We want a "surgical" approach to this cleanup effort. We have been promised.

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Commenter #88:

Lynn Bergeron, 7/29/11

Comment A:

THIS IS ONE OF THE SEVERAL ISSUES I LOSE SLEEP OVER. WE'RE ALL SITTING DUCKS. NEVER, IN THIS COUNTRY IN MY LIFETIME, HAVE WE HAD TO WORRY ABOUT BOMBING RAIDS. BUT THE FACT IS, WE LIVE WITH SEVERAL TICKING BOMBS - HANFORD IS ONE. ANYONE WHO DOESN'T HAVE HIS HEAD IN THE SAND LIVES WITH THE CONSTANT BACKGROUND STRESS OF THE ROULETTE GAME NONE OF US ENTERED AT WILL.

Commenter #90:

Margaret Comfort, 7/30/11

Comment A:

The presenters, J.D. Dowell and Emerald Laija, at the Wednesday July, 27th public forum for the Proposed Clean Up Actions at Hanford Waste Sites indicated that vitrification is a currently available procedure for containing radiation waste at that site. The toxic waste there is currently "contained" in earthen trenches that are very much at very high risk for leaking into the Columbia River. The vitrification option is the only one that contains the waste and allows it to be removed to a "safer" site. Vitrify it now, do not wait for mythical "future technology" to clean up a current crisis. Do this now. Do not wait.

A nuclear disaster of greater proportions than any the world has yet seen will be the result when this toxic waste enters the greatest river in north America. The current "containment" is not enough to protect the health and safety people or any living thing from the harm that lurks there.

Comment C:

Stop importing more toxic waste to Hanford, military waste or civilian. This is a site way too near to a huge river that flows into a huge water basin that reaches deep into the states of Washington and Oregon. Ultimately this water then carries what hasn't been deposited on the banks of these basins, to the oceans of our world. Safe water is life. Without safe water the world cannot live. Do not waste time with charts and cheaper choices that pretend to reduce the risks. Cheaper choices are unacceptable for the health and safety of the tax payers you pretend to protect from the fear of nuclear poisoning.

Vitrify the toxins now. We are told this technology is in place. This toxic waste is way more dangerous to all of us than the bombs created by our government to "protect" us from an enemy. This waste is the enemy within. Do not sweep it under the dirt where it is impossible to contain it. Your job is to securely and completely contain toxic waste "at all costs to protect human health and safety".

Simple logic and long known information must be respected and acted upon with swiftness and prudence to remove the threat carefully and completely. Are we still so primitive a civilization that we consciously foul our own water and pretend not to know the consequences?

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Commenter #92:

Jim Stringfellow, 8/1/11

Comment:

My name is Jim Stringfellow. I spend a considerable amount of recreational time in the Columbia River down in the Columbia River Gorge.

I am concerned with what I have heard with the cleanup at Hanford in regards to Z trenches. I know there are other issues to worry about with cleanups there, but a friend had recently brought this one to my attention. How can I be sure myself and my family are not at risk playing in the waters of the Columbia River?

Commenter #103

Mike Conlan, 7/15/11

Comment B:

NO more radioactive or chemical waste added to the Hanford mess !!!

HOW CAN YOU EVEN THINK ABOUT MORE NUCLEAR PLANTS ???

Commenter #106:

Jack Lunden, 8/4/11 via US Mail

Comment C:

In regard to transporting "GTCC" wastes for storage @ Hanford, this is simply unacceptable. These wastes need to go to a deep geological repository.

Commenter #109:

Dvija Michael Bertish

Comment I:

8) DOE proposes that the Hanford site is being designed as a national park and recreation area, and topical cosmetic cleanup actions have been planned to facilitate this goal.

Rosemere requests that these cosmetic plans be shelved, and that all resources be attributed to accelerated and complete cleanup of any and all contaminants at the site.

Commenter #110:

Comment:

Watch for my Email Comments too!

7/12/11
Hi Paula, these are other two comments I wanted Gary Peterson and you to have. Gary has seen some of this before? I can't attend the 7/19 session. Thanks, Don Mayers 586-4244

7/12/11
Hi Paula, these are other two comments I wanted Gary Peterson and you to have. Gary has seen some of this before? I can't attend the 7/19 session. Thanks, Don Mayers 586-4244

Subj: Comments to Chris Smith's Request for Public Comments
Date: 3/3/03 10:30:37 PM Pacific Standard Time
From: Bogeyandbobby@aol.com
To: jodi.giles@co.benton.wa.us, jroberson@doehq.gov, JeffMarkey@mail.house.gov, senator_murray@murray.senate.gov, emailago@atg.wa.gov, Secretary@hq.doe.gov, Rost461@ecy.wa.gov, Jennifer_L_Sands@rl.gov, governor.locke@wa.gov, pmabie@enviroissues.cp, Hanford_Advisory_Board@rl.gov, Richard_A_Holten@RL.gov, GRogers522, Julie_A_Goeckner@rl.gov, DavidM4@atg.wa.gov, Bryan_L_Foley@rl.gov, gwen@crehst.org, hale_pa@leg.wa.gov, longterm_stewardship[@rl.gov, holdercarl@hotmail.com
CC: Bogeyandbobby
To Distribution.
My following comments to Chris Smith on "Changes to Cleanup Decisions on the Columbia River Corridor", are transmitted to you Representatives of the Hanford Cleanup Effort for your consideration and information. I strongly believe there are some very good overall ideas for Hanford Site restoration in my comments. They are based on my strong interest in this latest "Changes to Cleanup Decisions", and my past Email transmittals to you that suggested an Alternate Approach be considered. That Approach would expedite cleanup of River Corridor to minimize risk of contamination of the groundwater or the Columbia River.
Chris Smith,
Sorry for the overall lengthy nature of my comments, but I have been very interested in the total Hanford Cleanup for the last 15 years or so!

In response to the DOE/ROO request for Public Comment on “Changes to Cleanup Decisions on the Columbia River Corridor”, my enthusiasm for this approach is apparent from my comments as below. The Tri Party Agencies have taken a big step toward a more realistic cleanup approach (i.e. level of risk vs: extent of effort).

The proposed “significant change to the scope, schedule or cost of cleanup” appears to be a genuine effort to revisit applicable Regulatory Requirements now specified in the Tri Party Agreement. For now, this only applies to the extent of cleaning up the 100-N Area land, and with the added proposal that all future irrigation of that land be prohibited. It follows that any other reactor/processing site cleanup efforts that pose an “extensive effort with no additional protection to the Groundwater or the Columbia River” (or Public or Environment) would also justify revisiting appropriate Regulatory Requirements. Any other extensive cleanup efforts with no additional protection to the Columbia River, Public or Environment would also justify the same consideration.

In the past, I have often proposed that DOE, Hanford Contractors, Wash. State Ecology, Tribes and Stakeholders revisit the Nuclear Regulatory Requirements for Environmental Cleanup as applicable to the Hanford Site. The purpose being to finalize cleanup of Hanford Land, not to “Original Condition”(for unlimited Public use) as stated in the Tri Party Agreement, but to perform the Cleanup to extent there is no realistic hazard to our water, the public and the environment. The remaining “No Risk Contamination” would be disposed of in-place and isolated from the Public as fenced-in sites. All Fenced Cleanup Sites would be included as Monuments in a proposed “Hanford Nuclear National Park”, which would also include the Hanford Reach Monument, B Reactor Museum, CREHST, and FFTF (either operational or cleaned up). The remaining part of Hanford land would be available for Public uses either irrigated or not as determined by Tri Party Agencies. This approach would optimize the Vitrification Plant facility scope and processing effort to only that for readily retrievable, high risk waste. Overall, this would result in very significant savings in Time, Risk and Cost to the United States Government! This savings would be realized many times based our large number of national cleanup sites.

It seems we will bankrupt our country in trying to cleanup Hanford, then repeat the process at all other national and commercial reactor cleanup sites in the same costly manner! All stakeholders should be most interested in spending otherwise wasted cleanup funds on important national issues regarding our citizens needs. As Cleanup progresses, it is obvious that removing all waste from tanks, basins, burial grounds and structures is no longer feasible. We must review the in-storage waste forms as they now exist, then be sure the Tri Party Agreement and Nuclear Regulatory Requirements still apply for safe storage and removal. Also:

1. How realistic are the risks to the environment, river corridor and the public in its present state?
2. How difficult is removal of all non-pumpable waste from each tank with the existing physical and radiological properties?
3. How feasible to leave waste in-situ in some existing storage/disposal sites?
4. What words of the TPA and/or Regulatory Reqmts need to be re-interpreted or changed to ensure low risk, timely and cost effective cleanup?

My views on overall Hanford Site Preservation cover environmentally safe cleanup, historical preservation and future utilization of land and facilities. That proposed approach is to ensure cost effective efforts on FFTF, Hanford Cleanup and Hanford Museums/National Parks. My general comments above are based on the following information – hopefully to be read and taken into consideration for this current “Changes” effort. This proposed Hanford Nuclear National Park approach applies to the Overall Hanford Cleanup and “Long Term Stewardship Program”.

D. MEYERS' COMMENTS ON LONG TERM STEWARDSHIP PROGRAM

Great title for effort to ensure Hanford's facilities are demolished, secured and further utilized while preserving the overall Atomic History of Hanford! This being accomplished without endangering our water, the public and the environment, while fully utilizing existing facilities to benefit the Tri City Area, Washington State, and our National Government. My comments on the 3 points of Approach for Long Term Stewardship are addressed as follows:

1. Management of Leftover Contamination
 - A. Concentrate cleanup effort and funding completely on the River Protection Part of Hanford Cleanup. Do it RIGHT NOW! -- at considerably lower total cost, elapsed time, and risk to the Public and Environment. Could probably complete for only \$5 to 10 BILLION and in 5 to 10 YEARS!! --- Let development of the Vitrification Plant be a parallel effort -- Vit Plant problems must not delay the River Protection part of Hanford Cleanup!!
 - B. Ensure all Radioactive Waste is DRIED UP
 1. Forget about total clean out of tank waste -- remove liquid and leave solids.
 2. Stir tank liquid/sludge waste into slurry in a safe manner using proven, standard, existing equipment/procedures
 3. Pump tank slurry to Evaporator and process, dry out remaining sludge/mud and leave in tank
 4. Stir, transfer and process basin liquid/sludge, in proven manner similar to tank waste in (2) above
 5. Dryout basin sludge/mud/trash items and leave in basin -- cover to confine contamination
 6. Remove liquid waste from cribs/other holding areas in manner similar to tanks/basins.
 7. Dispose of Hanford Site contaminated structural and equipment items by placing in dried-out waste tanks, basins and old process buildings (canyons, reactors), while filling voids with contaminated soil, etc.
- C. Remove High Level Radioactive PU/TRU waste (e.g. fissile and irradiated component) from old process buildings and basins, and transfer into surface fuel storage/disposal using safe, reliable and proven transfer/handling methods. For insignificant amounts of High Level PU/TRU, dry out and leave/dispose of in-place within secured/covered facilities.
- D. Keep Low Level Radioactive PU/TRU in existing containers and storage in Hanford facilities until transfer to Permanent Nevada Disposal Facilities.
- E. Leave Low Risk Radioactive/Hazardous waste in storage and disposal structures intact to maximum extent possible, and fill structures with other dry waste like contaminated soil, equipment and materials. Seal/cover the filled structures and facilities for permanent in-place disposal of these waste.
- F. Permanently cover/enclose the filled tanks, basins and buildings so rainwater can't contact contamination and leach to the groundwater or the Columbia River.

2. Protection of the Hanford Site's Cultural, Biological and Natural Resources

A. Cleanup Monuments

1. Install security fences around permanent cleaned-up waste Areas and building sites to isolate from Public.
2. Declare each fenced-in site a FEDERAL MONUMENT (like B-Reactor Museum).
3. Each fenced site would have Tourist actuated audio stations providing description and history of that particular site -- all sites combined would help tell the Hanford Production Story!
4. The cleaned-up Hanford Site would contain clean public roads and mostly usable lands, with Cleanup Monuments fenced in.
5. The cleaned-up site Custodian would ensure that in future, if any existing radioactive contamination gets into the groundwater and Columbia River, that it proceeds only at diminishing and acceptable rates.

B. B Reactor Museum

This Museum has already proved itself invaluable for tourist understanding about the Hanford Production Reactor's operation. Historical remains are preserved to display various aspects of the reactor's operation and production of the Plutonium. Excellent verbal descriptions are provided on walk-thru tours.

C. Hanford Reach National Monument

This unique part of the Hanford Site has preserved the original condition of the Hanford town, Columbia River and surrounding areas. It is apparent there are little adverse affects on the vegetation and wildlife activity on this reservation-type area.

D. CREHST (Columbia River Exhibition of History, Science & Technology)

This special museum houses the overall history of the Hanford Atomic activities, with remnants, photos, stories and documented articles to show, display and tell the detailed history of personnel, facilities and way of life at Hanford.

E. FFTF (Fast Flux Test Facility)

The FFTF Project was successful from the first proposals thru design, research & development, construction, plant acceptance testing and initial operation. This facility has been self sustaining as evidenced by its good operating record over the past 20 years of operation. That was possible by performing its own remote maintenance on radioactive equipment utilizing the remote capability of the Interim Examination & Maintenance Cell.

The "fast reactor" (fast neutrons greatly shorten irradiation time) lets materials be irradiated faster to predict long term radiation affects for future materials and energy development. In the same fast reactor environment, FFTF can quickly produce radio-isotopes which are required for medical applications including early detection, treatment and cure of cancer patients. The FFTF has already provided materials research to expedite improvement of reactor plants around the world. The "new generation" of nuclear reactors being considered will require the advanced testing capability of the FFTF.

3. Reuse of the Hanford Site's Assets

It is apparent that combining the B Reactor Museum, CREHST, and Hanford Reach National Monument efforts, with the upcoming "Hanford Cleanup Monuments" into one overall Hanford Nuclear National Park could result in great savings. Presently our Hanford Site Projects continue to compete for DOE funding and priority which results in increased time, cost and risk.

The total Cleaned-Up Hanford Site would consist of the Cleanup Monuments, with clean roads and lands accessible to the Public. The Cleanup Monuments, B Reactor Museum, CREHST, the Hanford Reach and the FFTF could combine to make up the Hanford Nuclear National Park with all historical aspects preserved. That history would span from initial Hanford construction days to present energy and medical research capability provided by the FFTF Fast Breeder Research Facility. Tourists could visit all these Monuments and Museums to view and hear the overall Hanford Atomic History.

It was bad enough to lose our Hanford Nuclear Power Park when the successful Fast Breeder Reactor Program was terminated in the 1980's. That started with cancellation of the Clinch River Breeder Reactor Plant, then the planned Full Scale Demonstration plants in New England states and our four Fast Breeder Power Production Plants here at Hanford. We could have furnished electrical power to whole Pacific Northwest – possibly even the West Coast! For just bringing Enriched Uranium into the Nuclear Power Park, recycling the spent fast breeder fuel, and processing the radioactive waste (all within the Power Park site!) and sending clean electrical power out of the Park. A series of about 5 or 6 Nuclear Parks across the U.S. could have provided most of our national electrical energy needs – without depending on foreign supplies!

Let's not lose this chance for an Economical Hanford Cleanup and National Monument to preserve the atomic age history at Hanford for our Nation. Nuclear Energy is good – we just need to deal realistically with processing the radioactive waste products. We can take pride in displaying such a successful and high quality facility as the FFTF, and still use it as an important medical, materials, and energy research tool!

Tuesday, April 26, 2005 America Online: Bogeyandbobby

Commenter #111

Confederated Tribes and Bands of the Yakama Nation ERWM

Comment P:

Comments Received During Public Comment Period on the Proposed Plan for the Remediation of 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6

We reiterate our concern that USDOE still lacks a comprehensive, integrated approach to the vadose zone. We believe that USDOE should perform interim and concurrent actions concerning the groundwater and the vadose zone to ensure that the cleanup of the source sites reduces risks to levels that are protective of Tribal subsistence uses without relying on long-term stewardship and permanent institutional controls.

We reiterate our recommendation that USDOE consider the following in developing a systematic approach to vadose zone cleanup:

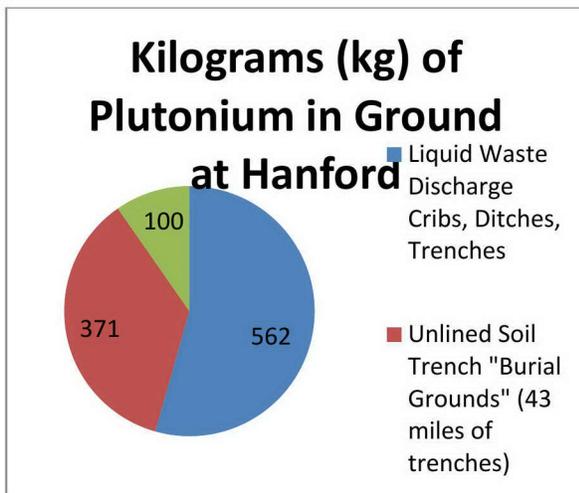
- Potential future impacts from the deep vadose zone to groundwater and to the confined aquifer in 200 areas
 - Use of more publically available and advanced models for doing modeling to determine potential level of risk to human health and the environment.
 - Pursue an independent review of treatability technologies to apply to the deep vadose zone contamination problem.
-
- DOE should ensure that sufficient and additional funding is directed to address the vadose zone contamination problem.

ⁱ Draft TCWMEIS Table U-2.

ⁱⁱ Source: Robert Alvarez, citing same TCWMEIS data presented in this presentation

Commenter #121

Heart of America Northwest and Heart of America Northwest Research Center



Comment G:

Quantity of Plutonium (Pu) required to make one nuclear weapon: 8 Kgⁱⁱ

The liquid waste discharge “cribs”, ditches, “French drains” & trenches on Hanford’s Central Plateau have enough Plutonium (Pu) to make 70 nuclear weapons.ⁱⁱ

43 miles of unlined soil trenches (“burial grounds”) into which “solid” radioactive & chemical wastes were dumped have enough Plutonium to make another 46 nuclear weapons. USDOE is supposed to submit a cleanup plan for the trenches in 2017.

The leaking, unlined commercial radioactive waste dump, run by “US Ecology, Inc.”) for WA State, has 12 A-Bombs’ worth of Plutonium. WA State has also proposed leaving wastes under a dirt cap, instead of finding where wastes are and removing.

Commenter #123

Lisa Rife

Comment:

To whom it may (or should) concern,

We have been trying to address the serious problem that has resulted from years of dumping nuclear waste from Hanford into Washington soil. Like so many issues we face, this problem has inevitable, far reaching impact on Washington's water, the food we grow, and ultimately the consequences will be disastrous for the health of our citizens. We have had no say in the dumping of this waste, and many are not even aware of its existence. To subject people to such danger, while using their own tax dollars to maintain what could ultimately kill them is unconscionable. There are much safer, greener, and more cost effective ways to develop power. I urge you to recognize what is at stake here, **clean up all of the waste, not just half**, and focus your energy and our tax dollars on an alternative source of power that does not produce waste that is unsafe.