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DOE/RL-2009-117
Draft A

Proposed Plan for the Remediation of the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units

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

U.S. DEPARTMENT OF ENERGY | Richland Operations Office

P.O. Box 550
Richland, Washington 99352

Approved for Public Release;
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U.S. Department of Energy, Richland Operations Office
U.S. Environmental Protection Agency
Washington State Department of Ecology

Public Comment Period
Month Day – Month Day / Year

How You Can Participate:

Read this Proposed Plan and review related documents in the Administrative Record.

Read the Hanford Site Cleanup Completion Framework to understand how this Proposed Plan fits within the overall cleanup of Hanford at http://www.hanford.gov/page.cfm/OfficialDocuments.

Comment on this Proposed Plan by mail, e-mail, or fax on or before (Date).

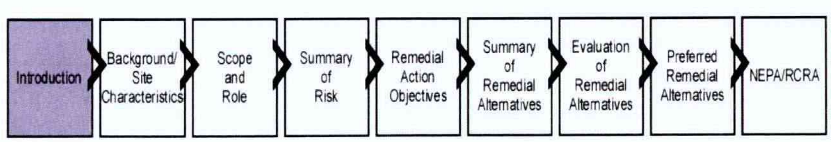
See page XX for more information about public involvement and contact information.

Inside this Plan

Figure 1. The 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units are located within the 200 East Area (foreground) and the 200 West Area (background). On the horizon, Mt. Adams is on the left and Mt. Rainier is on the right.

The *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* **(CERCLA)** (Section 117[a]) and the **National Oil and Hazardous Substances Pollution Contingency Plan (NCP)** (Section 300.430[f][2]) contain requirements that call for the solicitation of review comments from the public when a remedial action is proposed for the cleanup of a waste site. This **Proposed Plan** for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units (OUs) has been prepared to fulfill these requirements. Your input is needed to help the Tri-Parties select the best remedial actions.

The Proposed Plan is divided into nine sections as shown in the following navigational graphic. The relationship of each section within the document is shown in graphic form.



INTRODUCTION

The U.S. Department of Energy (DOE) has completed its investigation and prepared this Proposed Plan, which describes the **preferred alternatives** for the remediation of the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OU waste sites (Figure 1) and associated pipelines located on the Central Plateau of the Hanford Site near Richland, Washington. These four OUs consist of 22 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. The following three government agencies are responsible for the cleanup of the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs:

- DOE, the lead agency responsible for performing the investigation and all subsequent remedial action
- U.S. Environmental Protection Agency (EPA), the lead regulatory agency
- Washington State Department of Ecology (Ecology), the non-lead regulatory agency

These agencies are referred to as the Tri-Parties under the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al., 1989), which is commonly called the **Tri-Party Agreement**.

The steps in the CERCLA decision documentation process are shown in Figure 2. The preparation of **Remedial Investigation (RI) and Feasibility Study (FS)** reports is the first step in the process. The preparation of the Proposed Plan is the second step and is based on detailed information contained in the RI/FS reports.

In the third step, the Tri-Parties will solicit input from the Tribal Nations and the public regarding the preferred remedial alternatives, which are described in this Proposed Plan. This Proposed Plan and the supporting RI and FS reports can help reviewers develop a better understanding of the OUs and provide input on the preferred remedial alternatives. The documents and other reports discussed in this Proposed Plan are available online in the Hanford Site **Administrative Record** identified in the References section and at the public information repositories identified in the Community Participation section, in accordance with the *Hanford Site Tri-Party Agreement Public Involvement Community Relations Plan*, hereafter called the "**Community Relations Plan**" (Ecology et al., 2002). The Tribal Nations and the public also are encouraged to read DOE's *Hanford Site Cleanup Completion Framework* (DOE/RL-2009-10), which provides the context of the preferred alternatives described herein relative to the overall cleanup of the Hanford Site.

Figure 2. The CERCLA Documentation Process

Comments received from the Tribal Nations and the public regarding the preferred alternatives will assist the Tri-Parties in selecting a final decision on the preferred alternatives (fourth step) that will be taken to clean up the contamination associated with the four OUs described in this Proposed Plan. Instructions and opportunities for providing input are presented in the Community Participation section at the end of this Proposed Plan. After Tri-Party consideration of the comments received, a **Record of Decision (ROD)** (fifth step) will be issued identifying the final cleanup remedies selected for implementation, including a summary of responses to comments.

The preferred alternatives presented for public comment are based on the respective RI and FS reports for the OUs described in this Proposed Plan. The RI and FS findings for the 200-CW-5 OU were published in the following reports:

- DOE/RL-2003-11, *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-CS-1 Steam Condensate Group Operable Units*
- DOE/RL-2004-24, *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:

- DOE/RL-2006-51, *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*
- DOE/RL-2007-27, *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*

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 for unrestricted land use. One possible scenario for unrestricted land use could potentially 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. While unrestricted land use is not anticipated, it does provide the basis for determining the need to clean up the sites. Remedial alternatives for cleaning up are evaluated using an industrial worker exposure scenario, consistent with the industrial land use of the area.

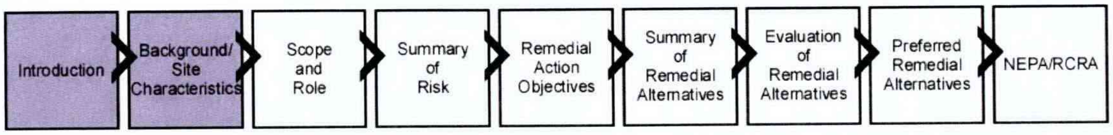
The following remedial action alternatives were evaluated in the feasibility studies:

- No Action
- Maintain Existing Soil Cover and Institutional Controls (MESC/IC)
- Engineered Surface Barrier (Barrier)
- In Situ Vitrification (ISV)
- Removal, Treatment, and Disposal (RTD)
- Combinations of several of the above alternatives

An existing remedial alternative, soil vapor extraction (SVE), has been used as an effective interim remedy since 1992 to remove volatile organic compounds (VOCs), such as carbon tetrachloride from **vadose zone** soil beneath three waste sites (216-Z-1A, 216-Z-9, and 216-Z-18) associated with the 200-PW-1 OU. SVE is the preferred presumptive remedy for removing volatile organic compounds from the subsurface (EPA 540/F-96/008). SVE removes contaminants from the vadose zone soil by inducing air flow through the soil. The collected soil vapor from the subsurface is treated prior to discharge. SVE will continue to be used as part of the preferred alternative at the three previously identified waste sites.

Preferred Remedial Alternatives

The Tri-Parties are proposing, as part of the preferred alternatives, a targeted excavation of contaminated soil and debris located beneath the plutonium-containing (200-PW-1 and 200-PW-6 OUs) and cooling water (200-CW-5 OU) waste sites and to dispose of the contaminated soils and debris in approved onsite and offsite disposal facilities. For waste sites that do not contain plutonium but contain other radiological contaminants such as cesium-137, which decays in a relatively short period of time (half life is ~30 years) (200-PW-3 OU), a 4.6 m (15 ft) thick soil cover will be constructed. Pipelines associated with the waste sites will be removed. To mitigate the potential for exposure to contamination left in place, institutional controls will be included as part of the preferred alternatives. All preferred alternatives in this Proposed Plan will be protective of human health and the environment and meet statutory requirements for remedy selection and compliance with **Applicable or Relevant and Appropriate Requirements (ARARs).**



BACKGROUND/SITE CHARACTERISTICS

This section provides background information on the Hanford Site and the four OUs described in this Proposed Plan. Additional information on previous investigations, contaminant background, and previous public involvement is provided.

Hanford Site Background

The Hanford Site, managed by DOE, encompasses approximately 1,517 km^2 (586 mi^2) in the Columbia Basin of south-central Washington State (Figure 3). In 1942, during World War II, Hanford was selected by the leaders of the Manhattan Project as the site for building the first production-scale nuclear reactors to produce **plutonium** for nuclear weapons. The Site was chosen because of its remoteness at the time, the availability of water from the Columbia River, and access to electricity from hydropower plants at the Bonneville and Grand Coulee Dams. The Hanford Site's plutonium production mission continued throughout the Cold War period until the early 1990s.

In July 1989, EPA placed the 100, 200, 300, and 1100 Areas of the Hanford Site (Figure 3) on its **National Priority List (NPL)** (40 CFR 300, Appendix B). Since that time, the Hanford Site's mission has focused on environmental cleanup. The NPL is the list of national priorities among the known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the U.S. The list is intended to guide the EPA in determining waste sites that warrant further investigation (available at: http://www.epa.gov/superfund/sites/npl/). The Tri-Party Agreement was also signed in 1989, ushering in the cleanup mission for the Hanford Site.

Operable Units Background

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 22 waste sites comprising the four OUs, which are located in the Inner Area.

The 200 Area, which consists of 200 West and 200 East, contains approximately 800 waste sites and includes waste management facilities and inactive irradiated nuclear fuel reprocessing facilities such as the **Plutonium Finishing Plant (PFP)**. Of the four OUs that are the subject of this Proposed Plan, three (200-CW-5, 200-PW-1, and 200-PW-6) are located in the 200 West Area (Figure 4) and one (200-PW-3) is located in the 200 East Area (Figure 5).

The 200-PW-1 and 200-PW-6 OUs in 200 West Area and the 200-PW-3 OU 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. At times, some of the liquid waste may have drained laterally rather than downward.

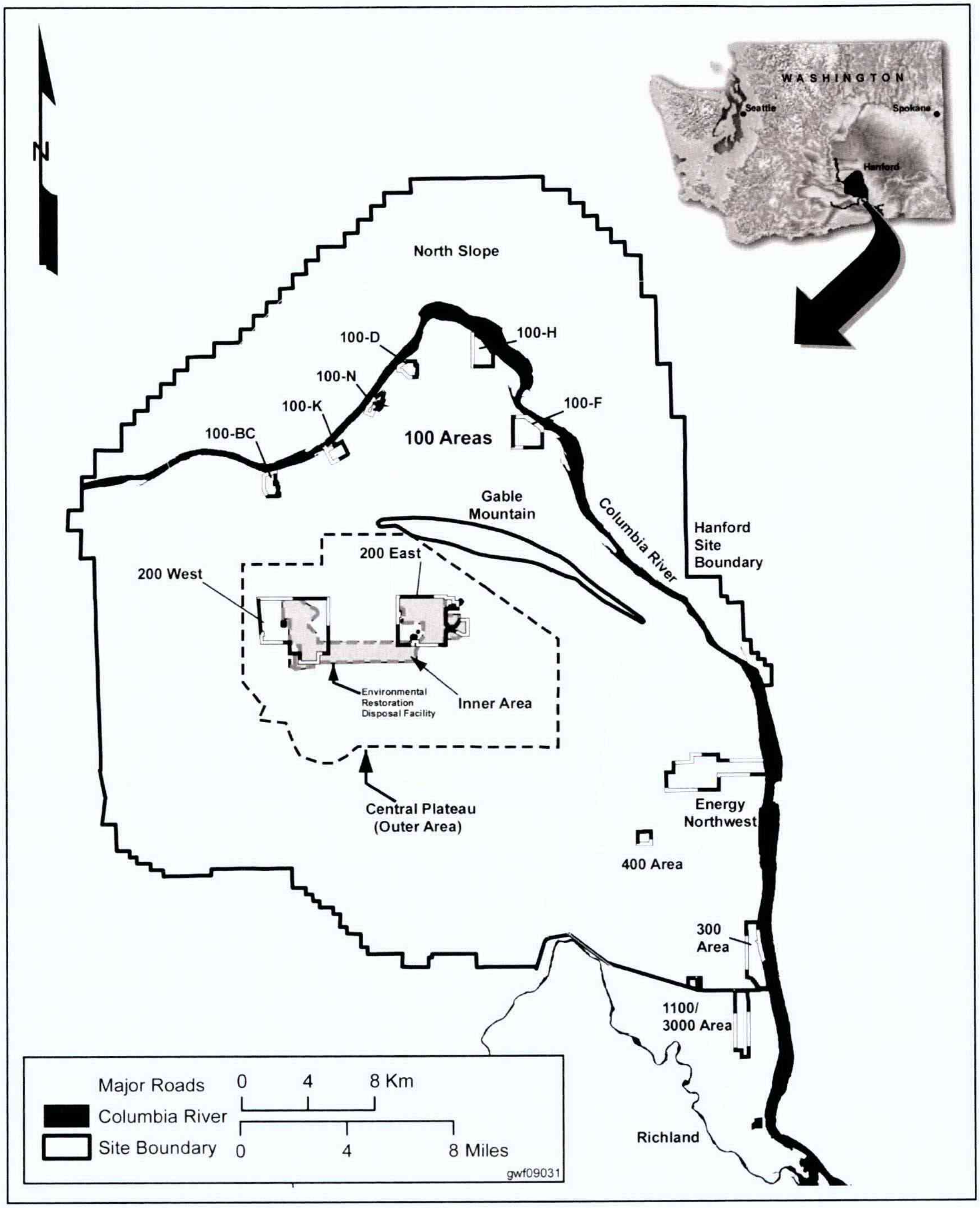
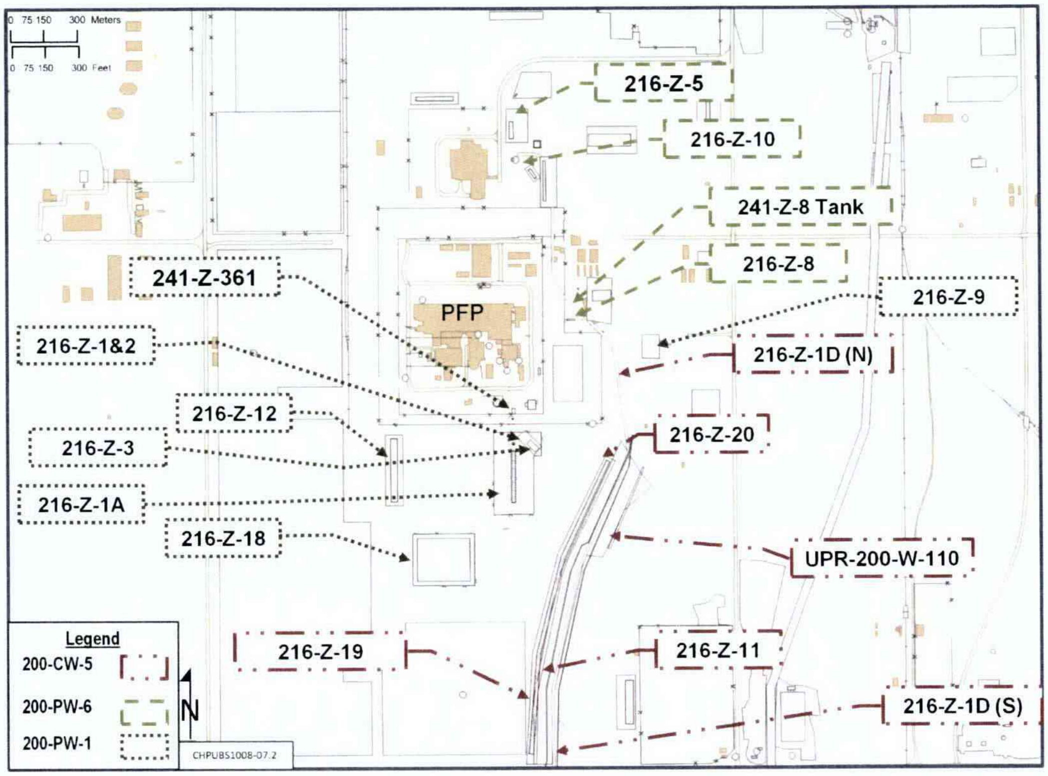
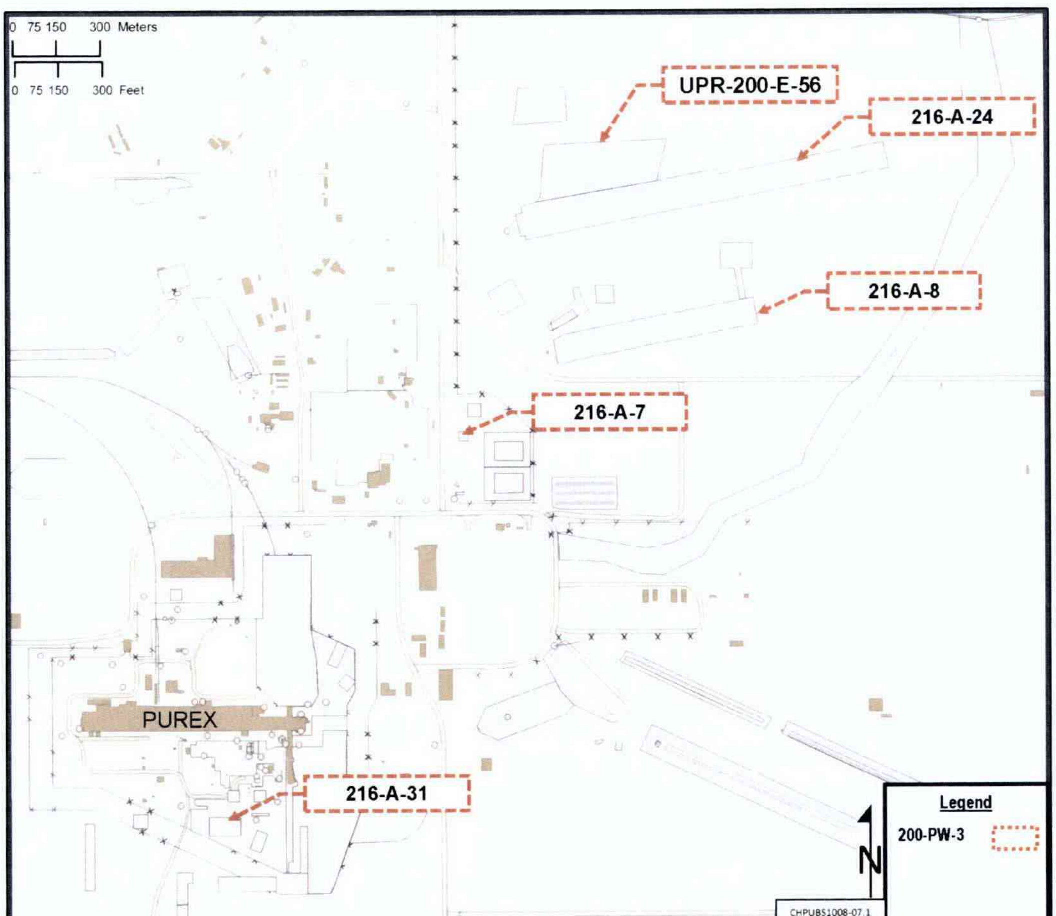


Figure 3. Hanford Site with Inner and Outer Area



1 *Figure 4. Location of the 200-CW-5, 200-PW-1, and 200-PW-6 OUs Waste Sites in the 200 West Area*



2 *Figure 5. Location of the 200-PW-3 OU Waste Sites in the 200 East Area*

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 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 were constructed along parallel routes. A tile field (216-Z-20) was constructed as a liquid waste disposal site to replace the initial three ditches. The **Unplanned Release (UPR)** site occurred as a single-use disposal site.

Sources of Contamination

Large volumes of liquid waste were generated from the production 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. In addition, soil located adjacent to some of the disposal structures may be contaminated if the liquid waste spread laterally. However, 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 and deeper than 4.6 m (15 ft) below the existing ground surface (bgs). There are nine waste sites, out of 22, that contain contamination above 4.6 m (15 ft) bgs: one within the 200-PW-1 OU (216-Z-1A); three within the 200-PW-3 OU (216-A-7, 216-A-8, and UPR-200-E-56); and five within the 200-CW-5 OU (216-Z-1D, 216-Z-11, 216-Z-19, 216-Z-20, and UPR-200-W-110).

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 has been implemented under a ROD for 200-ZP-1 OU. The potential was evaluated for contamination from the soils in the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs to migrate to the groundwater and contribute to the existing groundwater contamination. 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. The potential groundwater threat at 200-PW-1 OU is being addressed by continued use of the existing SVE system.

Technetium-99 and nitrate were detected in soil samples collected during the drilling of three wells (two at 216-Z-9 and one at 216-A-8) during sampling for the RI for the 200-PW-1, 200-PW-3 and 200-PW-6 OUs. There is some uncertainty associated with the analytical data because it is not considered to be representative of current conditions; therefore, there is uncertainty about the nature and extent of the technetium-99 and nitrate contamination at the 200-PW-1, 200-PW-3, and 200-PW-6 OUs, and additional sampling is needed to draw conclusions about a potential threat to groundwater. For the 200-CW-5 OU, technetium-99 was not detected and nitrate was detected at low levels, so these contaminants were not identified as a threat to groundwater.

Previous Investigations

The RI for the 200-CW-5 OU (DOE/RL-2003-11) was conducted in accordance with the RI/FS Work Plan (DOE/RL-99-66) and associated Sampling and Analysis Plan (DOE/RL-2002-24). The RI identified chemical and radionuclide **contaminants of potential concern (COPC)** that exist in shallow soils near the bottom of the waste sites.

The RI for the 200-PW-1, 200-PW-3, and 200-PW-6 OUs (DOE/RL-2006-51) was conducted in accordance with the RI/FS Work Plan (DOE/RL-2001-01) to characterize the nature and extent of chemical and radiological contamination and physical conditions in the vadose zone underlying three waste sites: the 216-Z-1A Tile Field, the 216-Z-9 Trench, and the 216-A-8 Crib. The RI summarizes the characterization data for all of the waste sites in the three OUs.

Previous Remediation

Several interim actions have been conducted to mitigate risks posed by the waste sites: (1) a remediation system (i.e., SVE) for carbon tetrachloride was constructed and is in operation, (2) some plutonium-contaminated soils were removed, (3) covers were placed over certain waste units, and (4) remedial technologies were tested at certain waste sites. Each of the interim remedies is briefly summarized below.

Remediation of carbon tetrachloride: Carbon tetrachloride was found in the vadose zone and the aquifer beneath the 200 West Area in the mid-1980s. Additional vadose zone and groundwater monitoring results indicated that the contamination was widespread. In 1990, DOE and EPA proceeded with detailed planning required to implement an interim action consisting of SVE for removing carbon tetrachloride contamination from the soil in the vadose zone at 200-PW-1 OU. 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 VOCs in the vadose zone away from the 216-Z-9 Trench, the 216-Z-1A Tile Field, and the 216-Z-18 Crib. The three SVE systems were used continuously at full-scale at each of the three sites from 1992 through 1997. From 1998 through 2008, only one SVE system was in use; typically, the system was operated from April through September, and was alternated between the 216-Z-9 Trench Well Field and the combined 216-Z-1A Tile Field/216-Z-18 Crib Well Field. Beginning in 2009 and currently, two SVE systems are operated for 6 months each year—one at the 216-Z-9 Trench and one at the 216-Z-1A Tile Field/216-Z-18 Crib Well Field.

Between April 1991 and September 2009, approximately 81,000 kg (179,000 lb) of carbon tetrachloride has been 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*). Remediation using SVE is continuing, and will continue to be used as an interim remedial action for several waste sites to remove carbon tetrachloride and other volatile organic compounds in the vadose zone beneath 200-PW-1 OU. The SVE system will continue to be operated until the performance data indicates the soil vapor concentration of carbon tetrachloride and other VOCs is protective of the groundwater beneath the site.

The cleanup of the existing groundwater contamination below the 200-PW-1 OU is being performed under an Interim Action ROD, signed in 1995, and will continue as required by the final ROD for the 200-ZP-1 OU signed in 2008.

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 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, pumpable liquids were removed from the 241-Z-261 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 ISV test project, resulting in the formation of a 408,000 kg (450 ton) block of vitrified contaminated soil.

Previous Public Involvement

The Tribal Nations, the public, and the Hanford Advisory Board (HAB) have been informed of the status of remedial action through regular updates and placement of documents in the Administrative Record. Updates on the performance of the ongoing interim action to address carbon tetrachloride contamination at the 200-PW-1 OU through SVE are one example.

The 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 (HAB 207, *Criteria for Development of the Proposed Plan for 200-PW-1, 3, and 6*). The comments received generally expressed a preference for some removal of the plutonium-containing waste at the sites, regardless of the risk assessment result. Due to the extremely long half-life of plutonium (~24,100 years) and the concern regarding future risk, a number of comments questioned the protective ability of any remedy that left plutonium in place. Such a remedy may not provide the same confidence for protection far into the future as a remedy that included the excavation and disposal of plutonium-contaminated soil.

Previous draft versions of the Proposed Plan for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs and the respective RI/FS documents were shared with the Tribal Nations, the public, and the HAB for their consideration and input.

The Tri-Parties' Community Relations Plan 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.

Physical Site Background

The key physical site factors that influenced consideration of the preferred remedial alternatives include the following: (1) the location of the waste sites within the Central Plateau where they are adjacent to other long-term waste disposal facilities, (2) the depth between contaminated soil and groundwater at the waste sites (68 to 97 m [223 to 318 ft]), and (3) the semi-arid climate of the area with an average annual precipitation of 17 cm (6.8 in.).

The roads, buildings, and other facilities near the waste sites supported the previous production of nuclear weapons materials.

Under CERCLA, the reasonably anticipated future land use is industrial.

WASTE SITE/GROUP CHARACTERISTICS

A total of 22 **waste sites** are located within these four OUs. These sites represent the majority of Hanford's plutonium production wastewater sites. These waste sites were used to dispose of process wastewater, cooling water, and steam condensate that had been contaminated with plutonium and discharged to the shallow soil surface. In addition, several sites contain cesium-137 and other contaminants.

Figure 6. The 216-Z-9 Trench (beneath cover)

Some of the sites include timber- or culvert-supported void spaces. One site has a large void space enclosed by a concrete cover where liquid waste was discharged directly to the soil (Figure 6). Two sites are settling tanks where waste particles (sludge) accumulated before the waste liquids drained to other disposal sites. One site is a reverse well, where the liquid waste was discharged directly into the soil, and the other is an UPR site, where liquid waste drained laterally from an adjacent waste site.

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 (Table 1).

The evaluation of remedial alternatives is by waste group rather than by OU because of the similarities. Also described in Table 1 are the pipelines associated with the six waste groups.

The remainder of this section provides a more detailed description of the nature and extent of the contamination and the unique aspects of each waste group.

Table 1. Summary of Waste Sites Assigned to Each Waste Group

Operable Unit	Waste Site	Waste Group
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	Z-Ditches
200-PW-1	216-Z-1A Tile Field 216-Z-9-Trench 216-Z-18 Crib	High-Salt
200-PW-1 200-PW-6	216-Z-1 Crib 216-Z-2 Crib 216-Z-3 Crib 216-Z-12 Crib 216-Z-5 Crib	Low-Salt
200-PW-1 200-PW-6	241-Z-361 Settling Tank 241-Z-8 Settling Tank	Settling Tanks
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
200-PW-6	216-Z-8 French Drain 216-Z-10 Reverse Well	Other Sites
Pipelines*		
200-CW-5	200-W-207-PL (216-Z-19 Ditch)	Z-Ditches
200-PW-1	200-W-174-PL and 200-W-206-PL	High-Salt
200-PW-1	200-W-208-PL and 200-W-210-PL	Low-Salt
200-PW-1 and 200-PW-6	200-W-205-PL and 200-W-220-PL	Settling Tanks

* Pipelines associated with 200-PW-3 will be addressed under another OU.

Z-Ditches Waste Group (200 CW-5)

The Z-Ditches Waste Group is contained within the 200-CW-5 OU, which comprises three ditches (216-Z-1D, 216-Z-11, 216-Z-19); one tile field (216-Z-20); and an unplanned release site (UPR-200-W-110). These waste sites managed cooling water and steam condensate from the PFP. The PFP received nuclear materials and process streams from Hanford Site operations and was used to perform americium and plutonium separation and recovery operations. These operations generated large quantities of cooling water and steam condensate that was discharged to the Z-Ditches for transfer to the 216-U-10 Pond for disposal. The 216-Z-1D Ditch, 216-Z-11 Ditch, 216-Z-19 Ditch, and the 216-Z-20 Tile Field operated sequentially over a 50-year period (1944 through 1995).

The area traversed by the Z-ditches is 1,295 m (2,765 ft), including the 216-Z-1D north portion. A cross section of the ditches is shown in Figure 7. The 216-Z-20 Tile consists of a perforated PVC pipe set in 0.8 m (2.5 ft) of gravel in the bottom of the ditch. The other ditches were open trenches. The ditches and the tile field all had native soil at the base. The ditches have been backfilled and a stabilized cover, which is slightly above the surrounding topography, has been placed over them. The contamination is generally located beneath the bottom of the trenches.

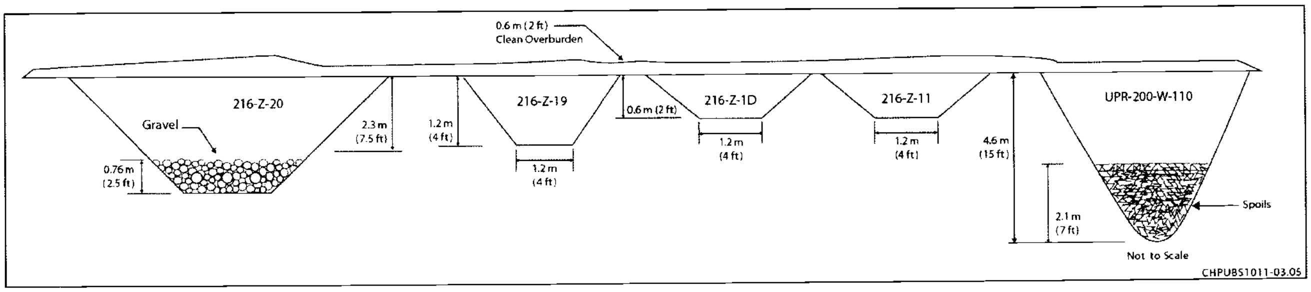


Figure 7. Z-Ditches

UPR-200-W-110 is a narrow, one-time use disposal trench located immediately east and parallel to 216-Z-11 Ditch. The trench was used to dispose of spoils containing 216-Z-1D ditch sediments and clean backfill. The trench is 129 m (425 ft) long. The bottom of the trench was filled with spoils material and then backfilled to grade.

The primary Z-Ditch contaminants are radionuclides (americium-241, plutonium-238, plutonium-239/240, cesium-137, and radium-226) and polychlorinated biphenyls (PCBs, also referred to as Aroclor).[1] In general, the highest concentrations of radioactive contaminants are located in shallow soils from approximately 0.6 m (2 ft) bgs to 4.1m (13.5 ft) bgs at the deepest location. The PCBs were found from 2.1 to 3.0 m (7 to 10 ft) bgs at one location in the 216-Z-11 Ditch. Sampling has confirmed that contamination decreases with depth.

High-Salt Waste Group (200-PW-1)

The three waste sites in the High-Salt Waste Group (the 216-Z-9 Trench, 216-Z-1A Tile Field, and 216-Z-18 Crib) primarily received waste from the **Recovery of Uranium and Plutonium by Extraction (RECUPLEX)** facility or the **Plutonium Reclamation Facility (PRF)** solvent extraction systems used for plutonium recovery. The waste streams were acidic and contained plutonium, americium, and a significant volume of organics (primarily carbon tetrachloride). During operation, extensive attempts were made to retain the plutonium in the extraction and reclamation facilities and to keep it from entering the waste streams.

The 216-Z-9 Trench is a rectangular, enclosed trench with a concrete cover supported by six columns (Figure 8). Liquid waste was discharged directly to the soil at the bottom. The 216-Z-1A Tile Field consists of distribution pipes made from vitrified clay (20 cm [8 in.]) placed in a gravel bed. The trench was backfilled with clean fill but not to the surrounding grade (Figure 9). The 216-Z-18 Crib consists of five separate parallel crib structures, each 3 × 63 m (10 ft × 207 ft), and 5.5 m (18 ft) deep (Figure 10). Each crib structure has two 8 cm (3 in.) diameter distribution pipes placed on a gravel bed, which is covered with gravel, a membrane, sand, and then backfilled to the surrounding grade.

[1] Aroclor 1254 and Aroclor 1260 were trade names for PCBs marketed by Monsanto Company from 1930 to 1977.

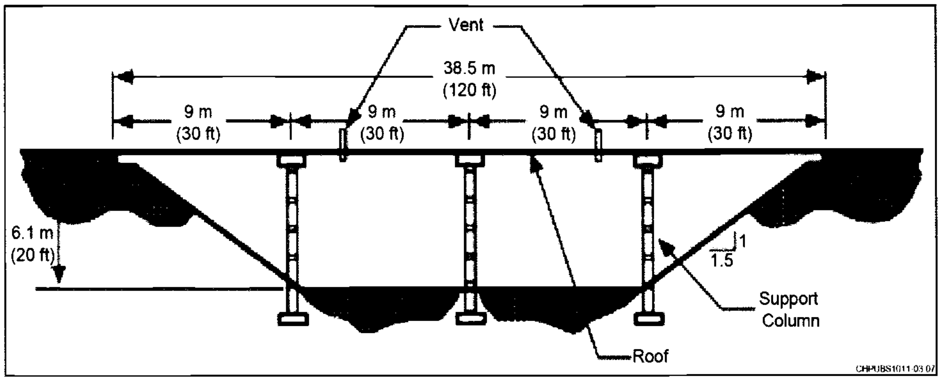


Figure 8. 216-Z-9 Trench

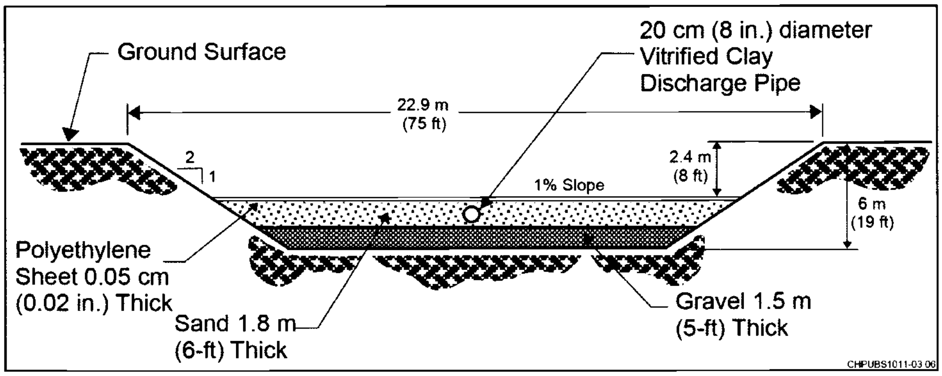


Figure 9. 216-Z-1A Tile Field

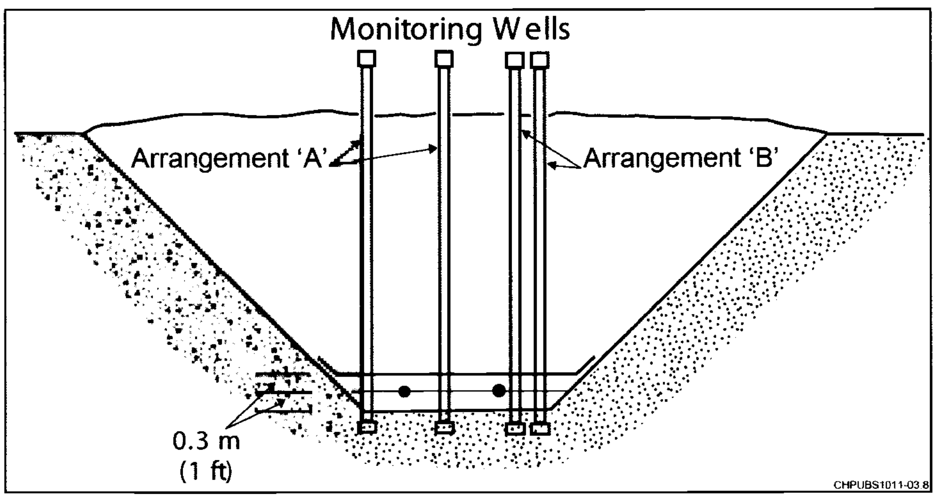


Figure 10. 216-Z-18 Crib

The plutonium and americium radionuclide contamination remains in the subsurface just below the bottom of the waste sites and is concentrated within the upper 6 m (20 ft) of soil but it has been found to a depth of 27.5 to 30.5 m (90 to 100 ft). However, the concentration of radionuclide contamination generally decreases with depth. Carbon tetrachloride remains in the soil column beneath these waste sites and is known to have contaminated groundwater. Since 1992, SVE has been used to minimize the migration of and recover carbon tetrachloride in the vadose zone at three sites (216-Z-9, 216-Z-1A, and 216-Z-18).

Low-Salt Waste Group (200-PW-1 and 200-PW-6)

The five waste sites in the Low-Salt Waste Group (216-Z-1 Crib, 216-Z-2 Crib, 216-Z-3 Crib, 216-Z-12 Crib, and 216-Z-5 Crib) primarily received neutral to basic aqueous waste streams from the Plutonium Isolation Facility or the PFP Complex.

The waste primarily contained plutonium and americium, with negligible amounts of organics. This aqueous waste, referred to as low-salt waste, was primarily a dilute sodium fluoride and sodium nitrate solution when it was discharged to the cribs. The waste streams were routed through the 241-Z-361 Settling Tank prior to discharge to the cribs.

The 216-Z-1 and 216-Z-2 Cribs consist of two open-bottom 3 square wooden boxes set in excavations, 6.4 m (21 ft) deep and then backfilled to the existing grade (Figure 11). The 216-Z-3 Crib consists of three long perforated corrugated metal culverts laid horizontally end to end (Figure 12).

The culverts were covered with asphalt roofing paper and then backfilled to grade. The 216-Z-12 Crib is rectangular and waste entered the crib through a 30 cm (12 in.) perforated pipe that ran the length of the crib (Figure 13). The pipe was covered with a polyethylene barrier and backfilled to grade. The 216-Z-5 Crib consists of two, in-line, interconnected deep wooden sump boxes that are open at the bottom and fed by the same transfer pipe (Figure 14). Each box was placed at the bottom of a rectangular excavation.

The contamination at the Low-Salt Waste Group remains near the bottom of the waste sites. Contaminant concentrations decrease rapidly with depth below the base of the waste site and radionuclide concentrations fall to levels associated with unrestricted use within 1.2 m (4 ft) below the bottom of the waste site or 7.6 m (25 ft) bgs.

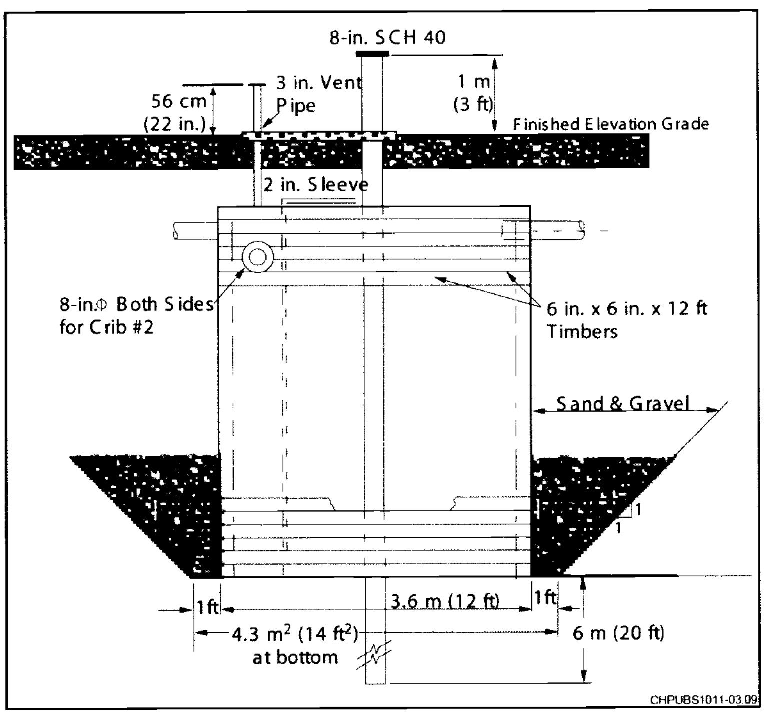


Figure 11. 216-Z-1 and 216-Z-2 Cribs

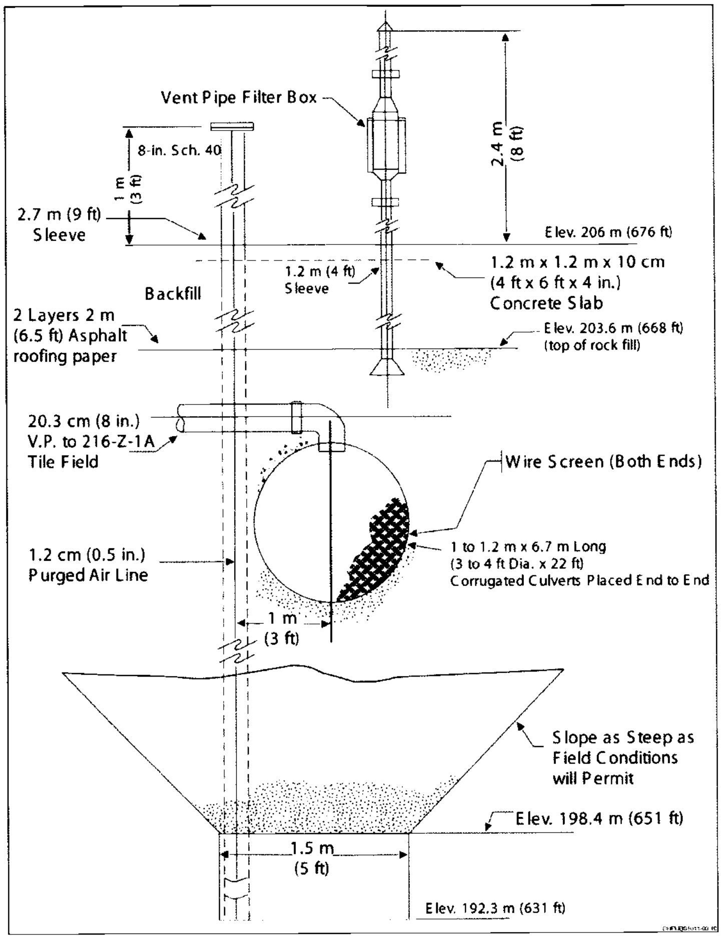


Figure 12. 216-Z-3 Crib

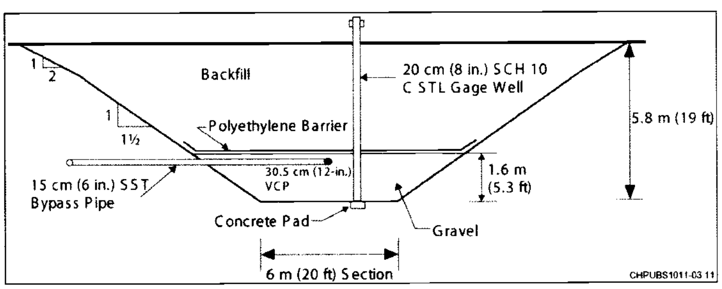


Figure 13. 216-Z-12 Crib

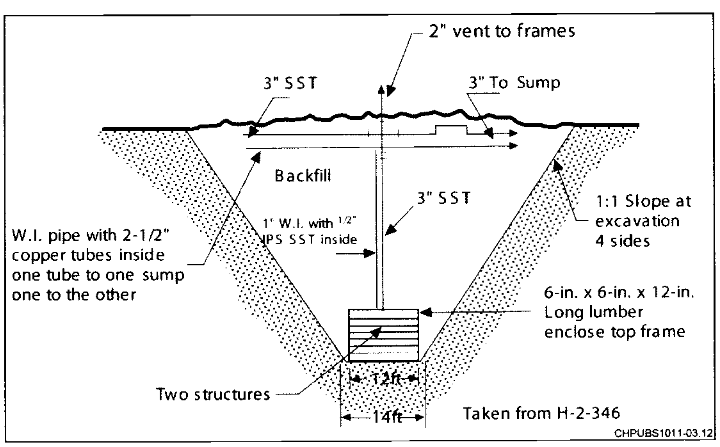


Figure 14. 216-Z-5 Crib

Settling Tanks Waste Group (200-PW-1 and 200-PW-6)

There are two waste sites in the Settling Tanks Waste Group (241-Z-361 and 241-Z-8) where waste particles (sludge) accumulated before the liquid waste drained to other disposal sites.

The 241-Z-361 Settling Tank was constructed with concrete and lined with steel (Figure 15). The 241-Z-8 Settling Tank was constructed of steel or wrought iron plate (Figure 16).

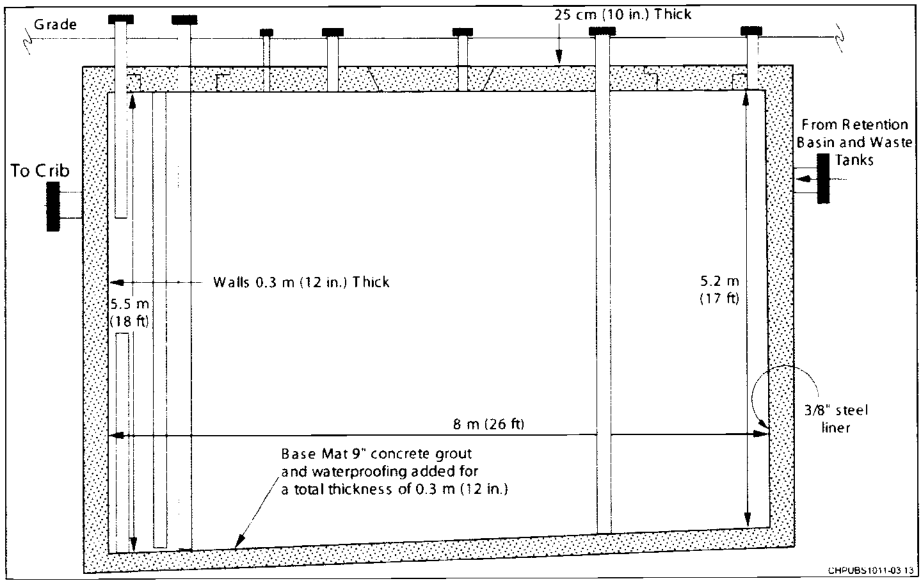


Figure 15. 241-Z-361 Settling Tank

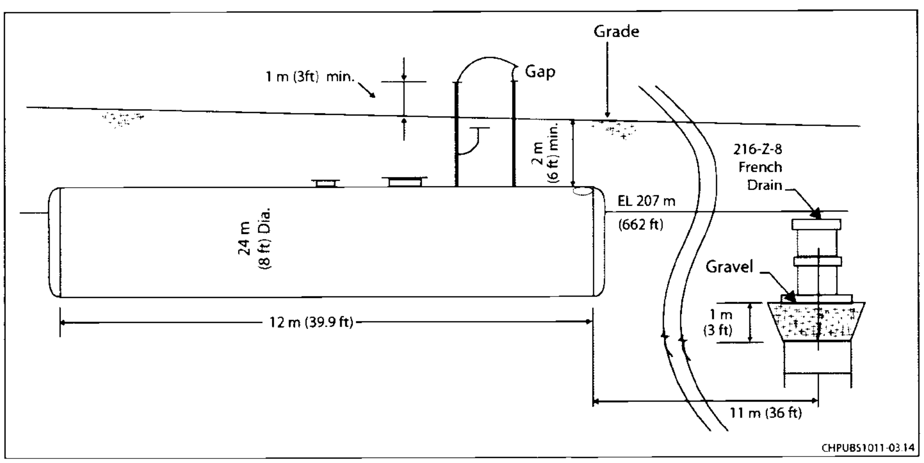


Figure 16. 241-Z-8 Settling Tank

Four of the cribs in the Low-Salt Waste Group were fed by the 241-Z-361 Settling Tank. The tank currently contains a mixture of sludge (75 m^3 [82 yd^3]) and liquid (800 L [210 gal]) waste. The 241-Z-8 Settling Tank received aqueous silica gel waste from back flushes of the feed filters at the RECUPLEX. No signs of leakage were found from either of the settling tanks in soil sampling and the liquid level has remained constant over the past several years.

Cesium-137 Waste Group (200-PW-3)

There are five waste sites in the Cesium-137 Waste Group (216-A-7, 216-A-8, 216-A-24, and 216-A-31 cribs; and the UPR-200-E-56 Unplanned Release). These waste sites are located in the 200 East Area. The four cribs received process water directly or indirectly derived from **Plutonium and Uranium Extraction (PUREX) Plant** operations.

The 216-A-8 Crib and the 216-A-24 Crib received condensate from waste storage tanks in tank farms associated with PUREX. The 216-A-7 Crib received sump waste from operations associated with PUREX and a one-time discharge of organic liquid waste from a PUREX chemical storage area. The 216-A-31 Crib received waste from PUREX. Waste streams discharged to these cribs contained fission products (primarily cesium-137), and both aqueous and non-aqueous phase organics. These contaminants are located in the sediment near the bottom of the waste sites. Confirmation samples collected from below the sediment are clean (i.e., not contaminated).

The UPR-200-E-56 Unplanned Release is an area where liquid waste that was discharged to the adjacent 216-A-24 Crib migrated laterally to the north on a caliche layer (i.e., a calcium-carbonate encrusted subsoil layer occurring in arid and semi-arid regions) located about 4.6 m (15 ft) bgs (Figure 17).

The 216-A-7 Crib was fed by a 15 cm (6 in.) diameter perforated pipe placed horizontally 3.0 m (10 ft) below grade (Figure 18). The 216-A-8 Crib was fed by a 61 cm (24 in.) diameter perforated distribution pipe located 2.6 to 3.5 m (8.5 to 11 ft) below the original grade along the length of the crib (Figure 19). The 216-A-24 Crib consists of four in-line sections separated by berms installed at increasingly lower elevations, which allowed the waste water from one section to enter the next section (Figure 20).

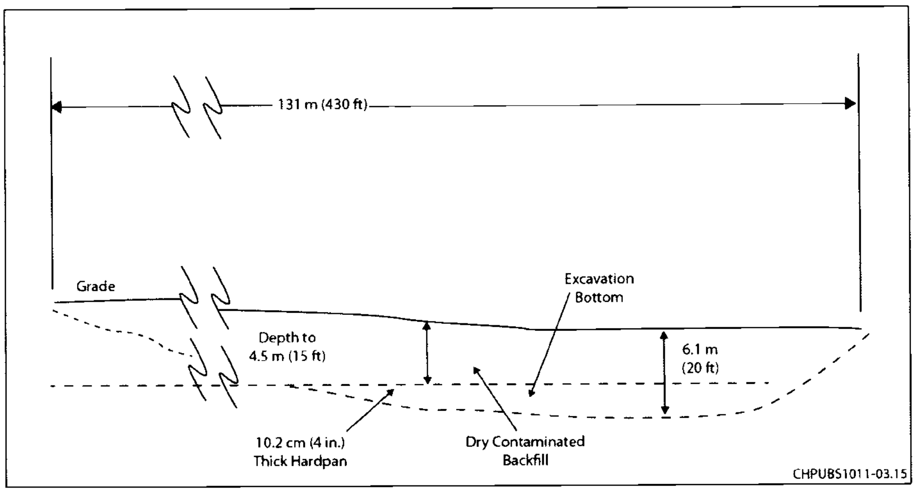


Figure 17. UPR-200-E-56 Unplanned Release (site schematic)

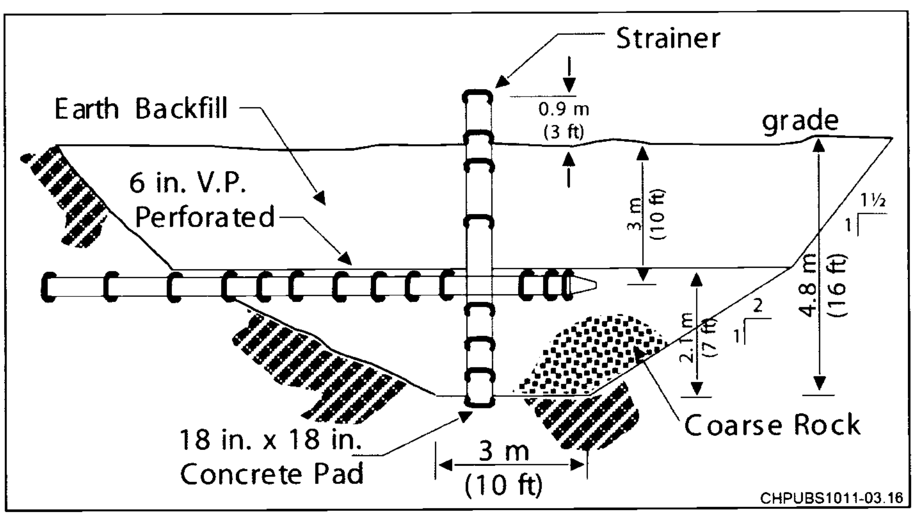


Figure 18. 216-A-7 Crib

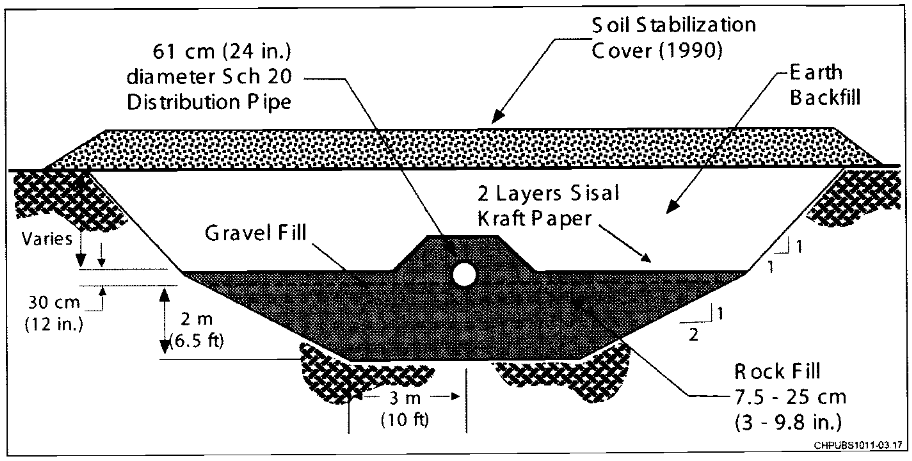


Figure 19. 216-A-8 Crib

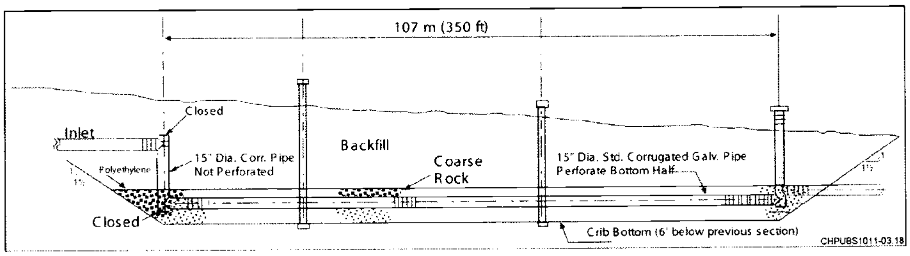


Figure 20. 216-A-24 Crib

The 216-A-24 crib was constructed with a 38 cm (15 in.) diameter perforated steel pipe placed horizontally below grade and backfilled. The 216-A-31 Crib consists of steel perforated distribution pipe was placed horizontally below grade (Figure 21).

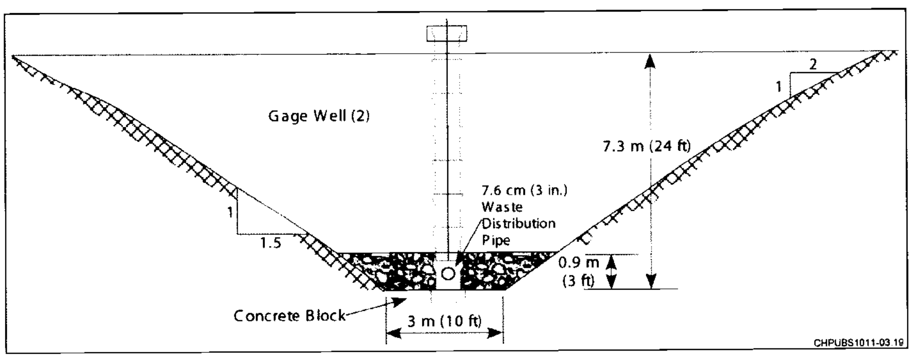


Figure 21. 216-A-31 Crib

Other Sites Waste Group (200-PW-6)

There are two waste sites in the Other Sites Waste Group (216-Z-8 French Drain and 216-Z-10 Injection/Reverse Well). These are waste sites that have limited contamination and do not pose a risk to human health and the environment. Liquid waste was discharged directly into the soil in the **injection/reverse well**. Overflow from the 241-Z-8 Settling Tank (~55,000 L [14,529 gal]) emptied into the 216-Z-8 French Drain. No **contaminants of concern (COCs)** were identified for this waste site based on sample results from the subsurface soils near the bottom of the 216-Z-8 French Drain (~5 m [~17 ft] bgs).

The 216-Z-10 Injection/Reverse Well received aqueous, neutral to basic process and laboratory waste (contaminated primarily with plutonium) from the Plutonium Isolation Facility (Figure 22). If there is any contamination present in the subsurface, it is located at the bottom of the well (45.7 m [150 ft]) and very near the well bore. No plutonium was detected in soil samples from three boreholes drilled within 4.6 m (15 ft) of the 216-Z-10 Injection/Reverse Well (two of the boreholes were drilled to a depth of 53.3 m [175 ft] and one well drilled to a depth of 54.2 m [178 ft]) below the bottom of the well). The 216-Z-10 Injection/Reverse Well consists of a 15 cm (6 in.) wide, 45.7 m (150 ft) deep well. The bottom 9.7 m (32 ft) of the pipe is perforated. The 216-Z-8 French Drain is constructed of long clay culverts stacked vertically underground and filled with gravel (Figure 23).

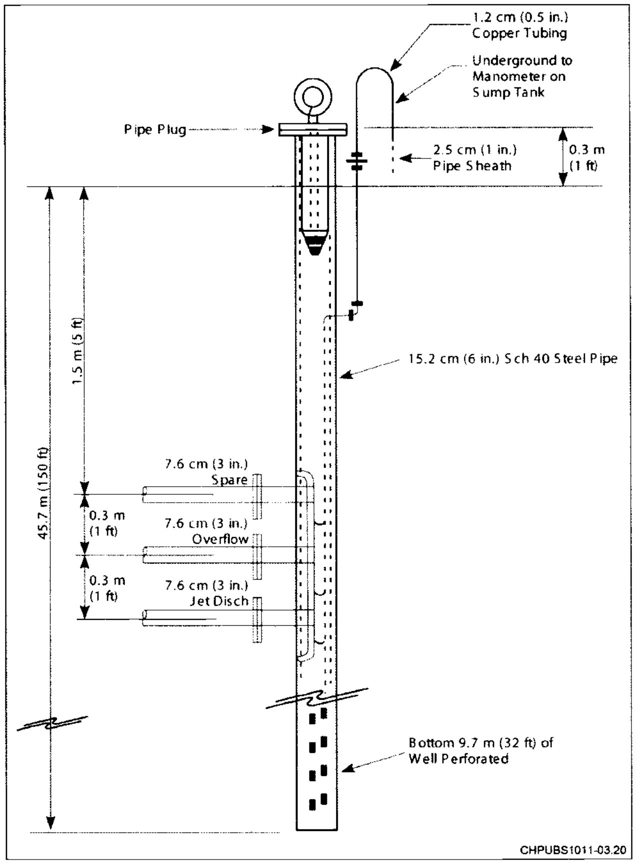


Figure 22. 216-Z-10 Injection/Reverse Well

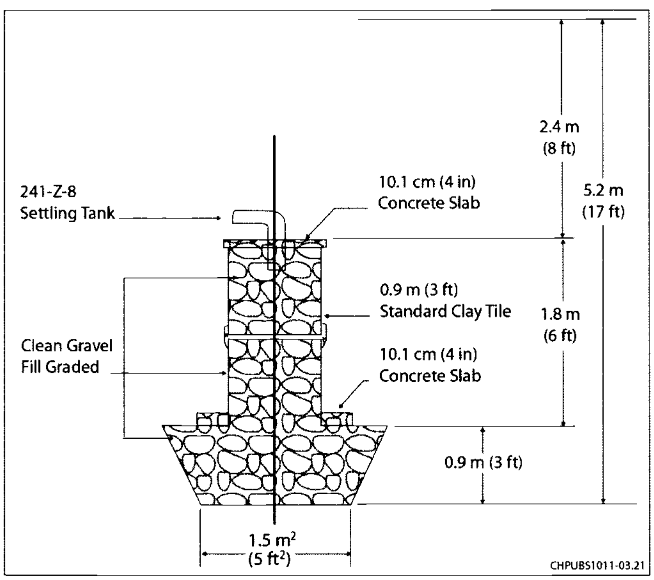
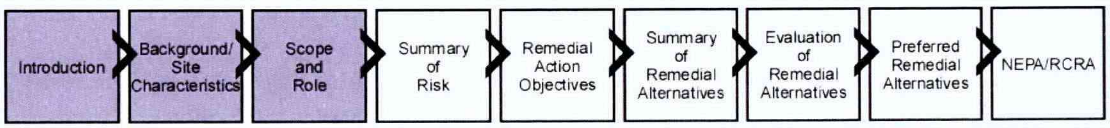


Figure 23. 216-Z-8 French Drain

Pipelines

Pipelines conveyed liquid waste from nuclear processing facilities to the disposal structures associated with the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs. The pipelines are not part of any other OU, are no longer in service, and will be removed as part of the remediation for each waste group. These pipelines are potentially contaminated. The pipelines include one for Z-Ditches Waste Group (200-W-207-PL), two for the High-Salt Waste Group (200-W-174-PL and 200-W-206-PL), two for the Low-Salt Waste Group (200-W-208-PL and 200-W-210-PL), and two for the Settling Tanks Waste Group (200-W-205-PL and 200-W-220-PL). The pipelines associated with 200-PW-3 will be addressed under another operable unit.

The pipelines are constructed of various materials, primarily stainless steel or vitrified clay pipe. Of the pipelines included in this decision, the largest portion (967 m [3,174 ft] out of a total length of 980 m [3,214 ft] of pipeline trenches) are buried at or less than 3 m (10 ft) bgs.



SCOPE AND ROLE

This section presents a description of how the remediation of the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs fits within the overall cleanup and risk management strategy for Hanford, which is described in the ***Hanford Site Cleanup Completion Framework*** (DOE/RL-2009-10), referred to hereafter as "Cleanup Completion Framework." The Cleanup Completion Framework describes the DOE vision for Central Plateau cleanup (Figure 24) and outlines the decisions needed to achieve this vision. The Cleanup Completion Framework addresses the area of the Hanford Site between the Columbia River and Highway 240. Figure 24 shows that the Central Plateau Area is divided into Inner Area and Outer Area components, and the relationship of the OUs in the Inner Area is shown in Figure 25.

The Cleanup Completion Framework involves steps to (1) contain and remediate contaminated groundwater, (2) implement a geographic cleanup approach that guides remedy selection from a plateau-wide perspective, (3) evaluate and deploy viable treatment methods for **deep vadose zone** contamination, and (4) conduct essential waste management operations in coordination with cleanup actions. One aspect of the Cleanup Completion Framework is to put in place a process to identify the "final footprint" for long-term waste management and containment of residual contamination. The overall cleanup objective is to make the final footprint of the Inner Area as small as practical. This "shrunken" area will remain under federal ownership and control for as long as a potential hazard exists. Outside the final footprint, the remainder of the Central Plateau (Figure 25) will be available for other uses, while being maintained under long-term federal ownership and control.

The Cleanup Completion Framework, and a related document, ***Central Plateau Cleanup Completion Strategy*** (DOE/RL-2009-81), set forth a cleanup approach that provides a framework and context for remedy selection for structures, soil, debris, and groundwater from a plateau-wide perspective. One of the key objectives in the *Completion Strategy* is to identify the process for establishing Hanford's final footprint for permanent waste

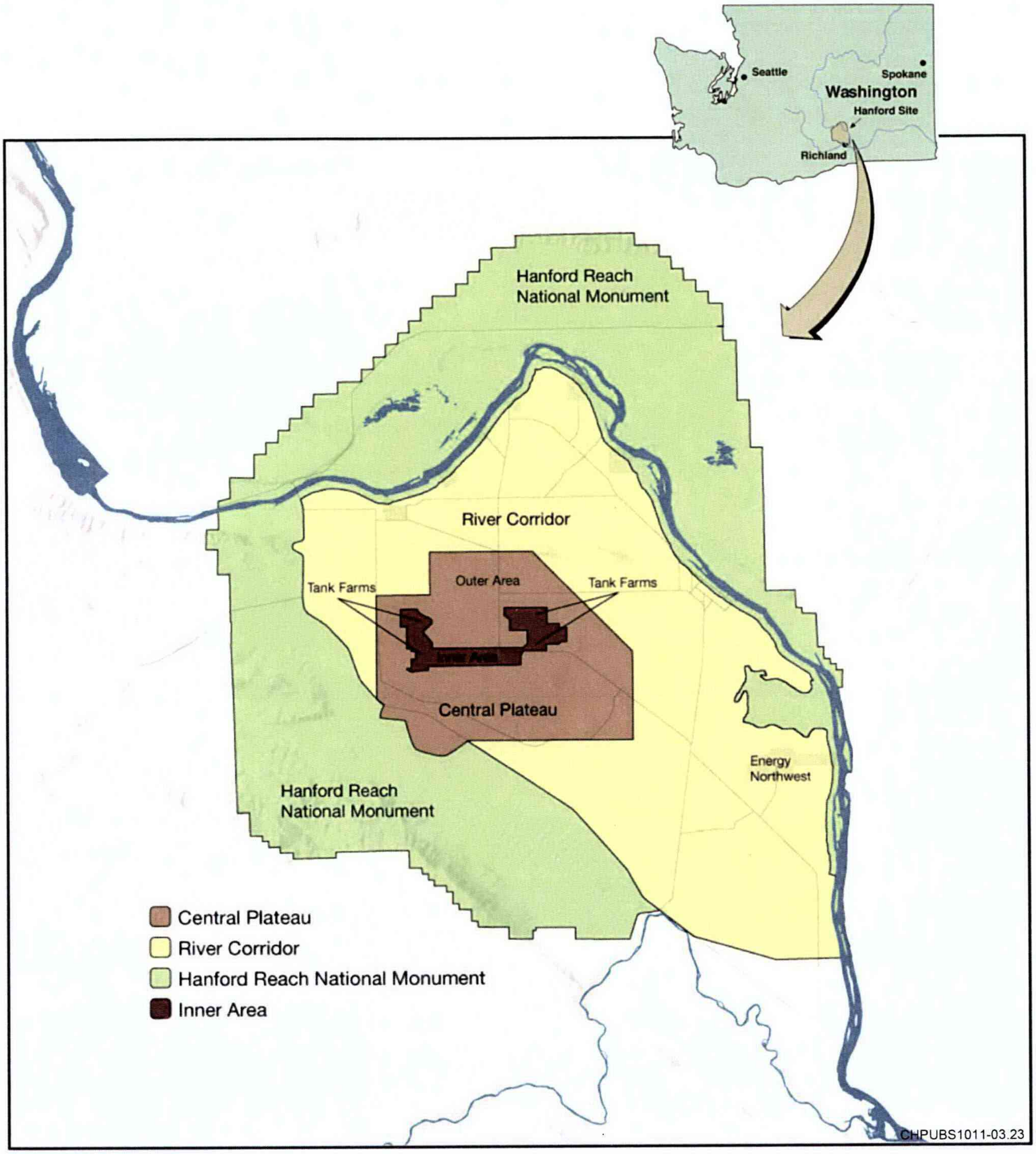
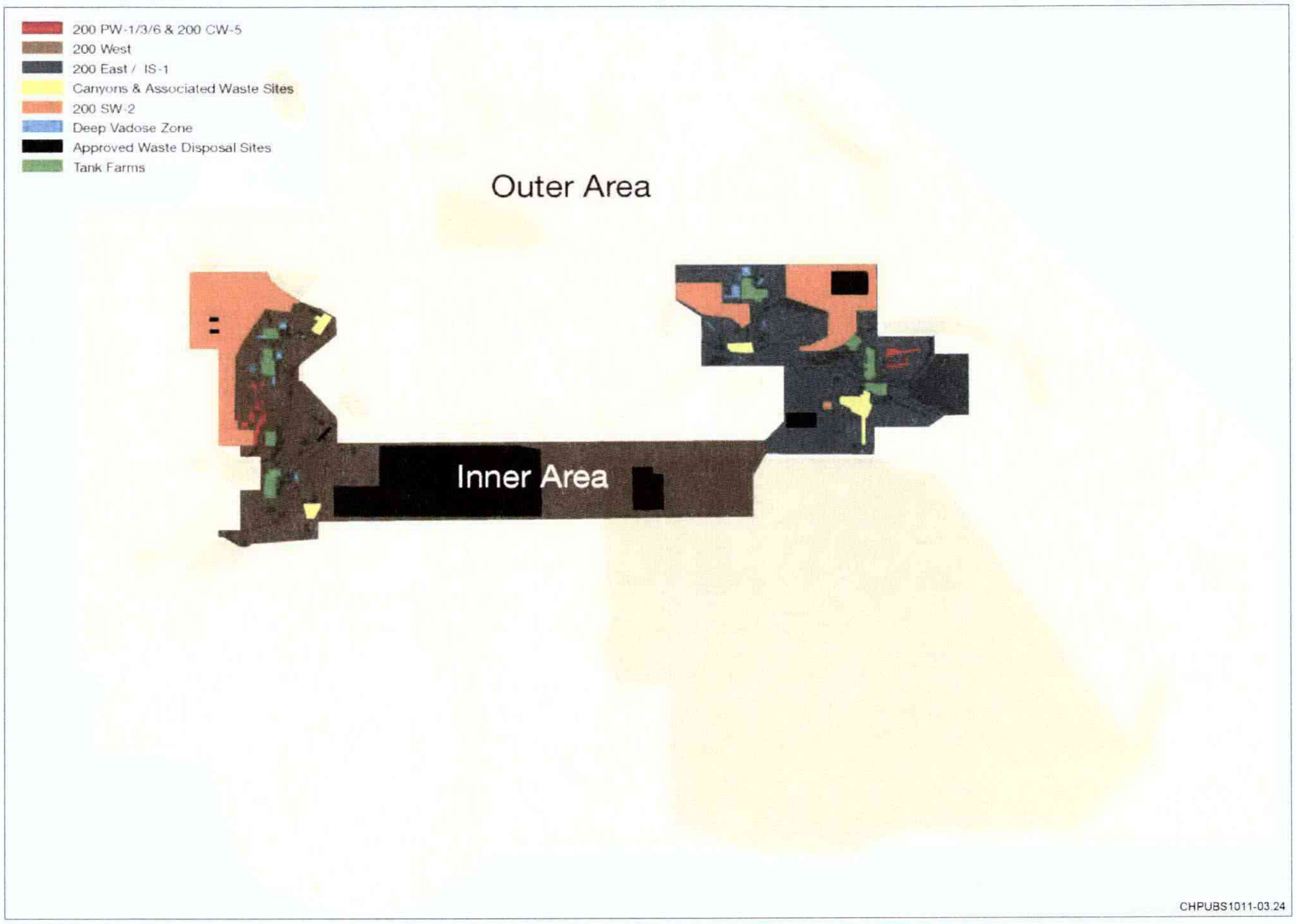


Figure 24. The Hanford Site and the Central Plateau



(Note: The four OUs addressed in this Proposed Plan are shown in red)

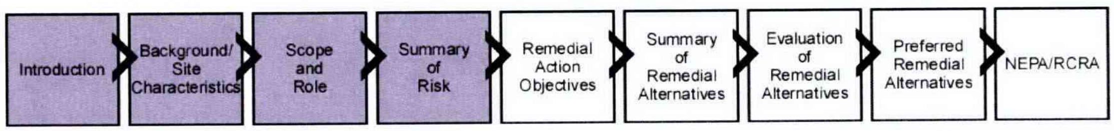
Figure 25. Inner and Outer Area on Central Plateau

management and containment of residual contamination on the Central Plateau. Accordingly, the *Completion Strategy* organizes the Central Plateau cleanup into the following three major components:

- ***The Inner Area*** is approximately 10 square miles in the middle of the Central Plateau encompassing the region where chemical processing and waste management activities occurred. This area is envisioned to be the smallest practical final cleanup footprint where waste management and containment of residual contamination will occur.
- ***The Outer Area*** is greater than 65 square miles 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).
- ***Groundwater Remediation*** is necessary for approximately 80 square miles of groundwater beneath the Hanford Site contaminated above drinking water standards because of past processing activities that occurred on the Central Plateau. Cleanup that started in 1995 is being expanded to contain contaminant plumes in the Central Plateau, remove contaminants, and restore groundwater to beneficial use.

This comprehensive cleanup approach, which is presented in both documents, was developed after discussions with Tribal Nations and the public and will help optimize Central Plateau readiness to use funding when it is available upon completion of River Corridor cleanup projects. The Tri-Parties considered comments received during these discussions and developed the structure and schedule for reaching cleanup decisions. This action resulted in a Tri-Party Agreement Change Package identifying a total of 11 future cleanup decisions for the Central Plateau, which was approved in October 2010. A Fact Sheet, *Proposed Changes to the Tri-Party Agreement for Central Plateau Cleanup Work* (Ecology et al., 2010), was issued by the Tri-Parties in May 2010, and is available from DOE's Hanford Cleanup Web Site and the Administrative Record. As part of the cleanup decisions, appropriate human health scenarios and corresponding environmental media cleanup levels will be established by the Tri-Parties with the intent to ensure protection of human health and the environment.

This Proposed Plan and the respective FS for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs were originally prepared in 2007 and use somewhat different assumptions and risk scenarios than those that may be used to make other Central Plateau cleanup decisions given the new agreement. However, all cleanup actions that are proposed for the Central Plateau, including those contained in this Proposed Plan, will be protective of human health and the environment, meet statutory requirements for remedy selection, and will be in compliance with ARARS.



SUMMARY OF RISK

This section describes the potential risks associated with the waste groups.

As part of the RI/FSs for the 200-CW-5 OU and the 200-PW-1, 200-PW-3, and 200-PW-6 OUs, two separate **baseline risk assessments** were prepared to estimate the human health and ecological risks associated with current and future site conditions. A baseline risk assessment is an analysis of the potential adverse health effects (current or future) caused by hazardous substance releases from a site in the absence of any actions to control or mitigate a release (i.e., under an assumption of no action). The results of the two baseline risk assessments are combined in this Proposed Plan to provide a single, integrated assessment of human health and ecological risks for the Z-Ditches (200-CW-5), 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) Waste Groups, and Other Sites. These waste sites are located in the Inner Area of the Central Plateau where the reasonably anticipated future land use is industrial, the groundwater is assumed to be potable, and surface water would only be potentially impacted through a groundwater connection.

Finally, an evaluation of the potential migration of contaminants located in the soil to the groundwater was done in two steps: (1) screening values were assessed and any exceedances were identified, and (2) a fate and transport model was completed.

Summary of Human Health Risks

The human health risk assessments for these waste sites were developed to quantitatively evaluate both the cancer risks and non-cancer health hazards from exposure to radionuclides and non-radioactive contaminants. The human health risk assessments considered exposures to these contaminants assuming no remediation and no institutional controls to limit reasonably anticipated future land uses that could occur at the waste sites. A range of human exposure scenarios was considered to help evaluate the need for a cleanup action, and to develop **Preliminary Remediation Goals (PRGs)**. The PRGs, which are described below, supported the development and evaluation of remedial alternatives for these waste sites.

Identification of Contaminants of Potential Concern

Several radionuclides were identified as contaminants of potential concern in soil at the waste sites described in this Proposed Plan. They include americium-241, cesium-137, europium-152, neptunium-237, nickel-63, plutonium-238, plutonium-239/240, radium-226, radium-228, strontium-90, thorium-228, thorium-230, thorium-232, and uranium-238. Non-radioactive contaminants identified as COPCs in soil included boron, carbon tetrachloride, mercury, and polychlorinated biphenyls (PCBs).

Exposure Assessment

Cancer risks and non-cancer health hazards were evaluated for a hypothetical subsistence farmer and an industrial worker. Consistent with EPA policy and guidance, cancer risks and non-cancer health hazards were evaluated for the reasonably maximally exposed (RME) individual. The goal of RME is to combine upper-bound and mid-range exposure factors to provide an exposure scenario that is both protective and reasonable; not the worst possible case (OSWER Directive 9285.6-03, 1991RAGS Appendix L, Page 2).

The subsistence farmer exposure 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 to groundwater beneath the waste site. The subsistence farmer exposure scenario was used to estimate risks assuming no action was taken to mitigate or control exposures. Risks estimated with the assumption of no action are called baseline risks. Baseline risks were estimated to determine if remedial action was warranted at these sites.

The unrestricted land use soil cleanup standards defined in WAC 173-340-740(3)(b) were used for non-radiological contaminants to represent unrestricted land use conditions in the Central Plateau. The unrestricted land use soil cleanup standards represent an acceptable target risk level of 1×10^{-6} for a resident who is exposed to non-radiological contaminants through incidental soil ingestion. Concentrations of non-radioactive 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 industrial worker exposure scenario assumes that the workplace is the key source of contaminant exposure and that the receptor could potentially be exposed to the contaminants in the shallow zone soil (i.e., less than 4.6 m [15 ft] bgs). Potential routes of exposure to soil include direct external exposure, incidental soil ingestion, dermal contact with soil, and inhalation of ambient vapors or dust generated from wind or maintenance activities. The industrial worker exposure scenario reflects the reasonably anticipated future land use at these sites, and was used to develop PRGs for waste sites where cleanup was determined to be needed.

Two exposure scenarios provided by Tribal Nations (Yakama Nation and the Confederated Tribes of the Umatilla Indian Reservation) were also evaluated and presented in the risk assessments to assist risk managers, the Tri-Party Agreement decision makers, and others interested in evaluating the alternatives presented in this Proposed Plan. The risk results for these exposure scenarios are similar to those presented for the subsistence farmer exposure. The details of these Tribal Nations risk evaluations are presented in Appendix F of the 200-CW-5 FS (DOE/RL-2004-24) and Appendix G of the 200-PW-1/3/6 FS (DOE/RL-2007-27).

Toxicity Assessment

A toxicity assessment determines the types of adverse health effects associated with contaminant exposures and the relationship between the magnitude of exposure (dose) and severity of adverse effects (response). Toxicity values published by EPA were combined with the results from the exposure assessment to assess cancer and non-cancer health effects. The resulting risk estimates are discussed in the Risk Characterization section.

Risk Characterization

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), Settling Tanks (200-PW-1 and 200-PW-6), and Cesium-137 (200-PW-3) waste groups exceed a 10^{-4} **excess lifetime cancer risk (ELCR)** for the subsistence farmer exposure scenario. A 10^{-4} ELCR is at the upper limit of EPA's target cancer risk range. With the exception of the 216-Z-8 French Drain, ELCR estimates were approximately 1,000-fold higher than the 10^{-4} upper limit of EPA's target cancer risk range. These estimated baseline human health risks are presented in Table 2.

Table 2. Summary of Baseline Human Health Risks Developed with the Subsistence Farmer Scenario

Contaminant	Excess Lifetime Cancer Risk (ELCR)	% Contribution
	216-Z-1A Tile Field (High-Salt)	
Americium-241	1.8E-03	~15%
Plutonium-239	8.0E-03	~67%
Plutonium-240	2.2E-03	~19%
Total ELCR	**1.2E-02**	
	216-Z-8 French Drain (Other)	
Americium-241	4.0E-07	2.8%
Plutonium-238	1.9E-07	1.3%
Plutonium-239	1.1E-05	79%
Plutonium-240	2.3E-06	17%
Total ELCR	**1.4E-05**	
	216-Z-9 Trench (High-Salt)	
Americium-241	6.5E-03	4.6%
Carbon Tetrachloride	4.8E-05	<1%
Europium-152	2.2E-04	<1%
Neptunium-237	1.6E-04	<1%
Nickel-63	5.9E-06	<1%
Plutonium-238	3.9E-05	<1%
Plutonium-239	1.1E-01	78%
Plutonium-240	2.4E-02	17%
Protactinium-231	3.1E-06	<1%
Radium-226	2.2E-04	<1%
Radium-228	3.2E-05	<1%
Strontium-90	1.1E-04	<1%
Thorium-228	5.8E-05	<1%
Total ELCR	**1.4E-01**	
	216-A-8 Crib (Cesium-137 Sites)	
Cesium-137	6.5E-01	~99%
Neptunium-237	3.3E-06	<1%

Table 2. Summary of Baseline Human Health Risks Developed with the Subsistence Farmer Scenario

Contaminant	Excess Lifetime Cancer Risk (ELCR)	% Contribution
Radium-228	6.6E-04	<1%
Thorium-228	2.8E-04	<1%
Total ELCR	**6.5E-01**	
	Z-Ditches	
Americium-241	1.2E-01	14%
Cesium-137	5.0E-02	5.6%
Plutonium-238	5.2E-04	<1%
Plutonium-239	1.3E-02	1.5%
Radium-226	7.1E-01	79%
Radium-228	4.7E-05	<1%
Strontium-90	3.3E-03	<1%
Thorium-228	4.6E-06	<1%
Thorium-230	9.8E-06	<1%
Thorium-232	1.1E-04	<1%
Uranium-238	1.2E-06	<1%
Total ELCR	**9.0E-01**	

Concentrations of non-radiological 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 3.

Table 3. Summary of Baseline Human Health Risks: Comparison to WAC 173-340-740(3)(b) Unrestricted Land Use Soil Cleanup Standards

Contaminant	Concentration in Soil (mg/kg)*	WAC 173-340-740 Carcinogen Cleanup Level (mg/kg)
	Z-Ditches	
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.

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). If the concentration in soil exceeds the soil cleanup standards, then remedial action at these waste sites might be needed to reduce risks from PCBs in soil.

The excess lifetime cancer risk results for the two Tribal exposure scenarios are similar to the risks presented in Table 2 for the subsistence farmer exposure scenario.

Summary of Ecological Risks

A screening-level ecological risk assessment was conducted for 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 Z-Ditches (200-CW-5) to identify contaminants, receptors, and exposure pathways that should be considered in the development of remedial alternatives. The process for estimating site-related ecological risks includes the following:

- *Problem Formulation*—a qualitative evaluation of contaminant release, migration, and fate; identification of COPCs; 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 also 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, many of these sites currently 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 means assuming 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. If contaminants might be present in shallow soil (less than 4.6 m [15 ft]) that is potentially accessible to ecological receptors, a potential exposure pathway was considered to be complete for that waste site. 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]).[2] This depth is based on unrestricted use where human activities could bring contamination to the biologically active zone. Based on the plant, animal, and insect species present at the Hanford Site, a depth of 3 m (10 ft) in soil or less represents a maximum depth of the biologically active zone, which could be penetrated by substantial root masses from deeply rooted plants and from which soils could be disturbed by insects or burrowing mammals. The physical dimensions of the waste sites and the distribution of soil contaminants detected in them were

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2 Note that under state of Washington regulations, sites with institutional controls that prevent excavation of deeper soils may have a point of compliance for protection of ecological receptors set at the "biologically active zone," which is assumed to be a depth of 6 ft in soil (WAC 173-340-7490[4][a]). However, the biologically active zone might be deeper at the Hanford Site, so the 15 ft standard point of compliance was used to identify potentially complete ecological exposure pathways for purposes of these screening-level ecological risk assessments.

compared to this biologically active zone. The results from this comparison indicated that potentially complete ecological exposure pathways could be present at several of the 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 Z-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 potential

- accumulation of radionuclides and inorganics by burrowing 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 non-radioactive 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 (BCG), developed by DOE using international consensus standards for protection of plants and wildlife from exposure to radiation. The ecological screening levels for non-radionuclides were Ecological Indicator Soil Concentrations developed by the state of Washington. Contaminant concentrations in soil found 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 (top 3 m [10 ft] in soil) 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 have been present within the top 3 m (10 ft) of soil at these sites. Therefore, for purposes of determining if cleanup action is needed, it was assumed 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 4.

Table 4. Comparison of Contaminant Concentrations in Soil to Ecological Screening Levels (Z-Ditches)

Contaminant	Units	Contaminant Concentration in Soil[a]	Ecological Screening Level[b]
		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	28.29	6,000

Table 4. Comparison of Contaminant Concentrations in Soil to Ecological Screening Levels (Z-Ditches)

Contaminant	Units	Contaminant Concentration in Soil[a]	Ecological Screening Level[b]
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 a Reasonable Maximum Exposure (RME) or the maximum concentration detected.

b. The ecological screening levels for non-radioactive contaminants are "Ecological Indicator Soil Concentrations for Protection of Terrestrial Plants and Animals," defined in WAC Table 749-3. 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.*

Risk Characterization

The results of the comparison of concentrations in soil to the ecological screening levels indicate either a need for further evaluation of ecological risks, or a need to cleanup waste sites to protect ecological receptors. In this case, the comparison was used to determine if remedial actions were needed to protect ecological receptors. While this comparison was performed only for the Z-Ditches, it is assumed that cleanup of the High-Salt, Low-Salt, Settling Tanks, and Cesium-137 waste sites also would be needed.

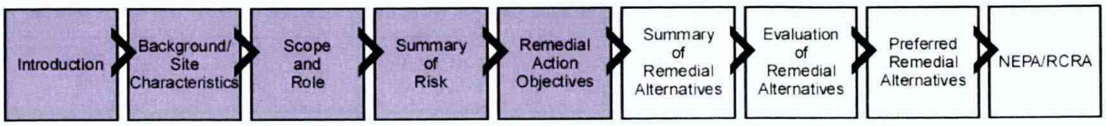
Summary of Groundwater Protection Evaluation

The potential migration of contaminants to groundwater was evaluated for the waste groups. For the Z-Ditches, the evaluation indicated that there were no contaminants that would migrate through the soil from the Z-Ditches that could impact groundwater above the federal maximum contaminant levels (MCLs) within 1,000 years (fate and transport models were run for 1,000 years per CERCLA guidance). For the remaining waste groups (High-Salt, Low-Salt, Settling Tanks, and Cesium-137), groundwater protection screening values were exceeded for numerous 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 High-Salt waste sites (216-Z-1A Tile Field, 216-Z-9 Trench, and 216-Z-18 Crib) and impact groundwater above the federal MCLs within 1,000 years. In addition, technetium-99 was the only radionuclide and nitrate was the only non-radioactive contaminant that was retained as potential groundwater contaminants.

Identification of Contaminants of Concern

Based on the results of this evaluation, the list of COCs for soils for the Z-Ditches (200-CW-5), 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 Other Sites waste groups include: americium-241, cesium-137, plutonium-239/240, radium-226, strontium-90, PCBs, boron, and mercury for protection of human health and the ecological receptors. Four additional contaminants were identified for 200-PW-1 and/or 200-PW-6 for protection of groundwater: carbon tetrachloride, methylene chloride, technetium-99, and nitrate.

Radiological COCs for protection of human health were identified by the comparison of Exposure Point Concentrations (EPCs) to PRGs developed for the industrial worker exposure scenario that correspond to an ELCR of 10^{-4}. The industrial worker receptor is exposed to radiological contaminants through external gamma radiation, incidental soil ingestion, and inhalation of dust. Non-radiological COCs for protection of human health were identified by the comparison of EPCs to PRGs based on the WAC 173-340-745(5)(b), "Standard Method C industrial soil cleanup levels" that will achieve an ELCR of 10^{-5} or a non-cancer hazard quotient of 1. The industrial worker exposure scenario represents reasonably anticipated future land use in the Central Plateau.



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. The industrial worker scenario was considered in developing the RAOs and PRGs. The RAOs, which are listed below, are descriptions of what the remedial action is expected to accomplish and are used to evaluate the various remedial alternatives and long-term protectiveness.

- RAO-1—Prevent or mitigate 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 or mitigate unacceptable risk to human and ecological receptors associated with non-radiological 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 restoring and protecting the beneficial uses of groundwater, including protecting the Columbia River from adverse impacts.

Preliminary Remediation Goals

The PRGs are risk-based values for specific contaminant and exposure pathways that estimate contaminant concentrations to be protective of human health, the environment, and groundwater (Table 5).

- The human health PRGs for radiological COCs are based on the industrial worker exposure scenario (i.e., RME) that will achieve an ELCR of 10^{-4}.
- The PRGs for non-radiological COCs are WAC 173-340-745(5)(b), "Standard Method C industrial soil cleanup levels," that will achieve an ELCR of 10^{-5} or a non-cancer hazard quotient of 1.
- The PRGs for protection of ecological receptors from exposure to radiological COCs are based on a dose rate of 0.1 rad/day and non-radiological COCs are from WAC 173-340-7490, Table 749-3, "Terrestrial ecological evaluation procedures," which are based on an individual ecological hazard quotient of 1.
- The remediation goals will be used to assess the effectiveness of the identified remedial alternatives in meeting the RAOs. To support the RAO for protection of groundwater, soil cleanup goals for soils exposed during the removal, treatment, and disposal remedies at the High-Salt and Low-Salt sites are provided in Table 5. These interim PRGs are set using the screening levels for groundwater protection or background concentrations. These values are preliminary and alternative values may be developed as further data on the nature and extent of the mobile constituents such as technetium-99 and nitrate are gathered. The PRGs for protection of groundwater do not apply to RTD of the Z-Ditches Waste Group, as no contaminants were identified as COCs for groundwater protection. The groundwater protection COCs will be evaluated during the verification and confirmation sampling for all the sites, including those in the Z-Ditches group.

Table 5. COCs and Preliminary Remediation Goals for Soil Based on a Risk of 10^{-4} to 10^{-6}

COCs	Human Health (Industrial Exposure Scenario)	Protection of Groundwater	Ecological
Plutonium-239-240	2,900 pCi/g	Not calculated[a]	6,000 pCi/g
Americium-241	940 pCi/g	Not calculated[a]	4,000 pCi/g
Cesium-137	18 pCi/g	Not calculated[a]	20 pCi/g
Radium-226	4 pCi/g	Not calculated[a]	50 pCi/g
Strontium-90	1,970 pCi/g	Not calculated[a]	20 pCi/g
PCBs	66 mg/kg	Not calculated[a]	0.65
Boron	700,000 mg/kg	Not calculated[a]	0.5 mg/kg
Mercury	560 mg/kg	Not calculated[a]	0.1 mg/kg
Carbon Tetrachloride	Not presented[b]	0.0315[c] mg/kg	Not presented[d]
Methylene Chloride	Not presented[b]	0.0218 mg/kg	Not presented[d]
Technetium-99	Not presented[b]	3.6 pCi/g	Not presented[d]
Nitrate	Not presented[b]	176 mg/kg[e]	Not presented[d]

Notes:

a. PRG not calculated because this contaminant was not identified as a threat to groundwater based on screening values and fate and transport modeling.

b. PRG not presented because these contaminants were not identified as a COPC for protection of human health. These contaminants were either not detected in the top 4.6 m (15 ft) of soil or did not exceed EPA's upper target risk threshold of 10^{-4} for the subsistence farmer scenario.

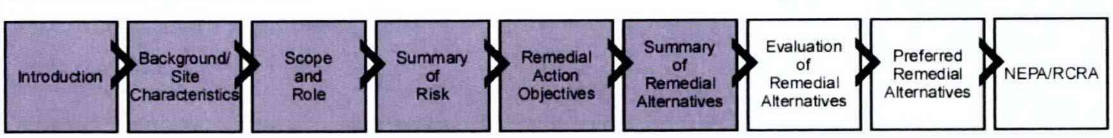
c. Carbon tetrachloride screening value calculated from the EPA Soil-Water partition equation with a groundwater protection level of 3.4 μg/L.

d. PRG not presented because this contaminant was not identified as COPC for the ecological risk assessment, as it was not detected in the top 4.6 m (15 ft) or the concentrations were below screening levels.

e. Value based on WAC 173-340-747 (3)(a) screening value.

To achieve the RAO for protection of groundwater, the SVE will be operated until it is no longer effective in removing carbon tetrachloride and other VOCs from the vadose zone. The cleanup goal for carbon tetrachloride in the vadose zone is based on achieving a condition where the amount of carbon tetrachloride that could migrate to the groundwater is minimized and, therefore, protective of the underlying groundwater. Groundwater beneath the site is being remediated under another ROD (200-ZP-1) and the SVE system will be operated as long as necessary to avoid recontamination of groundwater that has been remediated under the 200-ZP-1 ROD.

Because the nature and extent of nitrate and technetium-99 at 200-PW-1 and 200-PW-6 is not sufficiently understood at this time to select a remedy, post-ROD sampling will be performed to address these mobile contaminants. If an unacceptable risk that cannot be addressed by the proposed remedy is identified, remediation of the technetium-99 and/or nitrate will be addressed under the Deep Vadose Zone OU, 200-DV-1.



SUMMARY OF REMEDIAL ALTERNATIVES

This section describes the remedial alternatives for attaining the identified RAOs described in the previous section. The FS for the Z-Ditches, High-Salt, Low-Salt, Settling Tanks, Cesium-137, and Other Sites waste groups and pipelines considered a broad range of remedial alternatives developed from candidate remedial technologies and process options based on their effectiveness, implementability, and relative cost for attaining the RAOs at each of the waste groups. The following are the selected options:

No Action. This alternative would leave a waste site "as is" (i.e., in its current state). No distinguishing protectiveness or implementation features would be associated with this alternative. The National Contingency Plan requires consideration of a No Action alternative to provide a baseline to compare against other alternatives. The RAOs would only be met if the current waste site risks and conditions are protective of human health and the environment.

Maintain Existing Soil Cover and Institutional Controls (MESC/IC). This alternative would include the maintenance of existing soil covers and any additional clean fill (as appropriate) to isolate the waste from direct contact exposure. Institutional controls (e.g., land use restrictions) would be used to limit access or intrusion by humans and to protect the site from ecological receptors. This alternative would leave all contamination in place along with long-term monitoring to demonstrate that contamination is contained. An analysis of the MESC/IC alternative was only evaluated for the Z-Ditches Waste Group, which contain cesium-137 contamination, which has a half life of approximately 30 years.

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. The evapotranspiration barrier component was added to the evaluation in response to Tribal Nations and public concerns expressed during the April 2008 workshop and HAB advice. For waste sites containing long-lived plutonium contamination, a physical barrier component would be added into the design to reduce inadvertent access to the contamination; this component would include a 1.3 m (4 ft) thick layer of coarse, fractured basalt rock. Waste sites constructed with voids would have these voids filled with material that would prevent collapse of the structure. The Barrier alternative provides no treatment for radionuclides, but prevents and controls exposure through engineering and institutional controls.

In Situ Vitrification (ISV). 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. Melting and then solidifying the contaminated soil reduces the volume within the treated area 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. In areas where the glass block would be within 4.6 m (15 ft) of the ground surface, a barrier would be placed over the site to break the direct exposure pathway to the block. This alternative would require institutional controls for monitoring ISV treatment and barrier performance, waste isolation, and intrusion prevention. At waste sites that contain plutonium and americium, the vitrified glass block would mitigate the direct contact pathway (inhalation, ingestion, and external radiation) and would melt the top 6 m (20 ft) of soil.

There are some limitations to applying ISV, as follows:

- ISV has only been previously applied at smaller sites; therefore, there are scale-up issues that would need to be addressed. In addition, multiple melts would be required to convert the large volume of plutonium contamination to a glass block.

- Current ISV technology would be limited to the upper 7.6 m (25 ft), whereas, contamination has been detected at greater depths, which may require additional technological development and testing.
- The effectiveness of the melts would need to be demonstrated prior to full implementation to assure that ISV would be able to address the very high concentrations of radionuclides (plutonium and cesium-137) found at the base of each waste site.
- The infrastructure for bringing electricity to the waste sites and the amount of electricity required for the large number of melts was not included as part of the cost estimates. If ISV is selected as a remedy, these costs would be determined during design.
- ISV would not reduce the mobility of plutonium in the subsurface because it is not mobile under current and anticipated conditions.
- ISV would not reduce the toxicity of plutonium.

Removal, Treatment, and Disposal (RTD). This alternative would remove a portion of the contaminated soil, sludge, and/or debris; treat the waste to meet disposal criteria (if necessary); and then dispose of the waste.

For the Z-Ditches Waste Group, this alternative is intended to reduce risk by removing contamination that exceeds RAOs. For cost-estimating purposes, it is assumed that the soil excavated from these sites can be removed and packaged so they meet the waste acceptance criteria for disposal in **Environmental Restoration Disposal Facility (ERDF)**.

Initially, only one RTD option was developed for the High-Salt and Low-Salt Waste Groups (i.e., a portion of the plutonium contaminated soils would be excavated from the High-Salt and Low-Salt waste sites); however, based on comments received from the Tribal Nations, the public during the April 2008 workshop, and HAB advice, five RTD options were developed to accommodate a range of removal objectives. Only four of the RTD options were retained in this Proposed Plan.

- Option A—Remove the highest concentrations of contaminated soils to 0.6 m (2 ft) below the bottom of a waste site. (See Table 6 for proposed excavation depths for each waste group.)
- 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) and three Cesium-137 waste sites (216-A-7, 216-A-8, and UPR-200-E-56). (See Table 6 for proposed excavation depths for each waste group.)
- Option C—Remove a significant portion of plutonium contamination based on an evaluation of soil contaminant concentration with depth. (See Table 6 for proposed excavation depths for each waste group.)
- Option E—Remove contaminated soils with concentrations resulting in a direct contact risk greater than a 10^{-4} risk level (in the subsistence farmer risk scenario) so that long-term institutional controls at a waste site are not necessary. (See Table 6 for proposed excavation depths for each waste group.)

Option D was evaluated and discussed in the FS but is not retained in this Proposed Plan 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. In addition, Option E is the bounding alternative for the 10^{-4} risk level for unrestricted land use.

Table 6 summarizes the removal depths per waste site for the removal options outlined in this Proposed Plan.

Table 6. Summary of Removal Depths Below Ground Surface for the Four RTD Options for 200-PW-1, 200-PW-3, and 200-PW-6 OUs

Waste Site	Removal Depth for RTD Options, m (ft) Below Current Ground Surface			
	A	B	C	E
High-Salt Waste Group (200-PW-1 OU)				
216-Z-1A	6.1 (20)	7 (23)	11 (36)	27.4 (90)
216-Z-9	7 (23)	NA*	11 (36)	27.4 (90)
216-Z-18	6.1 (20)	NA*	11 (36)	27.4 (90)
Low-Salt Waste Group (200-PW-1 and 200-PW-6 OUs)				
216-Z-1	7 (23)	NA*	7.6 (25)	7.6 (25)
216-Z-2	7 (23)	NA*	7.6 (25)	7.6 (25)
216-Z-3	9.5 (31)	NA*	10.1 (33)	10.1 (33)
216-Z-5	6.1 (20)	NA*	6.7 (22)	6.7 (22)
216-Z-12	6.7 (22)	NA*	7.3 (24)	7.3 (24)
Settling Tanks Waste Group (200-PW-1 and 200-PW-6 OUs)				
241-Z-361	Remove sludge from settling tank and backfill empty tank.			
241-Z-8	Remove sludge from settling tank and backfill empty tank.			
Cesium-137 Waste Group (200-PW-3 OU)				
216-A-7	NA	4.6 (15)	6.1 (20)	NA
216-A-8	NA	4.6 (15)	7 (23)	NA
216-A-24	NA	NA*	6.1 (20)	NA
UPR-200-E-56	NA	4.6 (15)	6.1 (20)	NA
216-A-31	NA	NA*	8.5 (28)	NA
Other Waste Sites Group (200-PW-6 OU)				
216-Z-8	NA	NA*	NA	NA
216-Z-10	NA	NA*	NA	NA

Option A–Remove the highest concentrations of contaminated soils to 0.6 m (2 ft) below the base of a waste site.

Option B–Remove contaminated soils that could be a direct contact risk to industrial workers and that are less than 4.6 m (15 ft) below the current ground surface.

Option C–Remove a significant portion of plutonium contamination (or cesium-137 contamination) using an evaluation of soil contaminant concentration with depth.

Option E–Remove contaminated soils with greater than a 10^{-4} risk level so that long-term institutional controls at a waste site are not necessary.

* Option B only applies to the High-Salt Waste Group and 216-A-7, 216-A-8, and UPR-200-E-56 in the Cesium-137 Waste Group. The other sites would not be addressed under this option because all of the contamination is located deeper than 4.6 m (15 ft).

NA = not applicable to this waste site

Combination of Alternatives. This alternative uses a combination of several alternatives (2 through 5) as possible remedial alternatives.

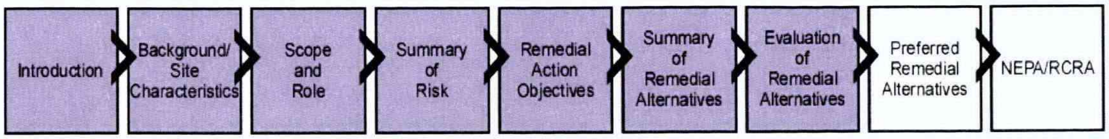
Soil Vapor Extraction. Carbon tetrachloride and other VOCs are currently being removed from the soil using SVE. Wells are used to access the subsurface and a vacuum is applied to draw contaminated soil vapor into the well and then up to the surface for treatment. As part of the treatment, granular activated carbon is used to treat the extracted vapor, followed by the offsite thermal treatment of the granular activated carbon. The ongoing SVE interim action at the High-Salt waste sites began in 1992 and has been effective in removing carbon tetrachloride from the vadose zone. Soil vapor monitoring results indicate that the concentrations of carbon tetrachloride and other VOCs continue to decline in the subsurface.

The High-Salt Waste Group resides above the 200-ZP-1 groundwater OU. Currently, the 200-ZP-1 OU has active monitoring and an active groundwater pump and treatment system operating to remove volatile contaminants from the groundwater. Continued use of the existing SVE system at the three High-Salt sites is proposed as a component of the preferred alternative to address the volatile contaminants in the vadose zone and to minimize further contamination of the groundwater associated with 200-ZP-1 OU. SVE will achieve the RAO-3 for protection of groundwater from carbon tetrachloride and other VOCs in the soil beneath these sites.

Common Elements. Elements common to all of the above alternatives include the following:

- Institutional controls, including administrative and access controls, will continue as long as risks remain that make a waste site unsuitable for unrestricted use.
- Post-ROD sampling will be performed to confirm that cleanup goals have been achieved where RTD is the selected remedy. This includes sampling to confirm that the remedy selected is appropriate for the nature and extent of contamination for those waste sites that were evaluated by comparison to the representative waste sites in the RI report.
- In conjunction with waste site confirmation sampling to be done to assure cleanup is achieved, additional sampling is proposed at the 200-PW-1, 200-PW-3, and 200-PW-6 OUs for technetium-99 and nitrate after the ROD has been issued. The results of the sampling, which will be used to determine the nature and extent of contamination, if any, of technetium-99 and nitrate will dictate whether the preferred remedy will address these contaminants and can be implemented as part of the preferred alternatives described here, or if these contaminants need to be deferred to the deep vadose zone OU (200-DV-1). Regardless of which OU prescribes the remedy for technetium-99 and nitrate, human health and the environment will be protected.
- Additional post-ROD sampling is also proposed in conjunction with the confirmation sampling at 200-CW-5 OU to determine if nitrate, for which limited information is available, could pose a threat to groundwater. If there is a threat to groundwater from the nitrate and the preferred alternative cannot assure that human health and the environment are protected, then the vadose zone area of nitrate contamination will be deferred to the deep vadose zone OU (200-DV-1). Regardless of which OU prescribes the remedy for nitrate contamination at 200-CW-5, human health and the environment will be protected.
- Above-grade structures at the 216-Z-9 Trench, which were used to support the soil mining conducted from 1976 through 1977, will be removed and disposed. The below-grade soil mining equipment will be left in place for the barrier alternative but will be removed and disposed under the ISV and RTD alternatives.
- Monitoring wells that, because of their proximity to a waste site, cannot be integrated into a remedial alternative selected for a waste site, will be properly decommissioned in accordance with WAC 173-160-381.
- Environmental surveillance and groundwater monitoring will be conducted to evaluate the effectiveness of the remedy for remedial alternatives that leave residual contamination above risk levels and make a waste site unsuitable for unrestricted use. The evaluations and cost estimates included institutional controls, maintenance, and monitoring for 1,000 years at the plutonium waste sites as required by CERCLA and for 350 years at the cesium-137 waste sites because of the relatively short half-life of cesium.

- The sludge and liquid contents of the Settling Tanks at the 200-PW-1 and 200-PW-6 OUs will be removed, stabilized, and disposed of at an approved disposal facility.



EVALUATION OF REMEDIAL ALTERNATIVES

This section presents the remedial alternatives that were considered in the previous section for each waste group and then presents the preferred alternative.

The *CERCLA evaluation process* is used to identify preferred remedial alternatives. After identifying a set of remedial alternatives, the next step in the CERCLA process is to evaluate each remedial alternative against nine CERCLA criteria (Figure 26). The nine criteria are divided into three groups (Threshold Criteria, Balancing Criteria, and Modifying Criteria). The threshold and balancing criteria are used to evaluate the remedial alternatives, which consider the nature and extent of contamination at each waste site or waste group, as well as the reasonably anticipated future land use for the sites. The preferred alternatives were developed based on this evaluation. For several sites, as described in this section, the preferred alternative was changed to reflect consideration of comments received earlier in the CERCLA process. Early community participation during a public workshop in April 2008 and HAB advice provided comments that were used as part of the modifying criterion by which the alternatives presented in this Proposed Plan were evaluated.

A preferred alternative's ability to meet the criterion of community acceptance (a modifying criterion) can be completed only after the public review and comment period, which will be initiated with this document. Further participation will be sought from Tribal Nations, the public, and the HAB during review and comment on the preferred alternatives described in this Proposed Plan.

After completion of the formal public comment period of the preferred remedial alternatives described in this Proposed Plan, the Tri-Parties will consider the public comments prior to issuing a ROD for the waste groups. The comments that are received (i.e., community acceptance) are part of the modifying criteria as shown in Figure 26, numbers 8 and 9.

WASTE GROUPS

The remedial alternatives for the 22 waste sites within the six waste groups are described as follows.

Z-Ditches Waste Group (200-CW-5)

The Z-Ditches Waste Group is associated with waste sites that managed cooling water and steam condensate from the Plutonium Finishing Plant. A more detailed evaluation of the alternatives for the Z-Ditches is presented in Chapter 7 of the 200-CW-5 OU FS (DOE/RL-2004-24). Table 7 presents the results of this evaluation. Because of the Z-Ditches proximity to each other, the alternatives were evaluated as one combined unit against the CERCLA criteria for all of the waste sites except the north portion of the 216-Z-1D Ditch where the No Action alternative is warranted. For the evaluation of feasibility study alternatives, the waste site group was divided into three work areas (Figure 27), which allowed consideration of a combination of alternatives that could be used to apply different approaches to different ditch sections.

CERCLA Evaluation Criteria

THRESHOLD CRITERIA

Threshold criteria mean that only those remedial alternatives that provide adequate protection of human health and the environment and comply with ARARs are eligible for selection:

1. **Overall Protection of Human Health and the Environment** is the primary objective of the remedial action and determines whether an alternative provides adequate overall protection of human health and the environment. This criterion must be met for all remedial actions.

2. **Compliance with Applicable or Relevant and Appropriate Requirements** addresses whether an alternative meets federal and state statutes or provides grounds for a waiver. This criterion must be met for a remedial alternative to be eligible for consideration.

BALANCING CRITERIA

Balancing criteria help describe technical and cost trade-offs among the various remedial alternatives:

3. **Long-Term Effectiveness and Permanence** refers to the ability of a remedy to protect human health and the environment over time, after remedial action objectives have been met.

4. **Reduction of Toxicity, Mobility, or Volume through Treatment** means the alternative is evaluated for its ability to reduce the toxicity, mobility, and volume of the hazards at a site.

5. **Short-Term Effectiveness** refers to an evaluation of the speed with which the remedy can be successful and also takes into consideration any adverse impacts on human health and the environment that may result during the construction and implementation phase of the remedial action.

6. **Implementability** refers to the technical and administrative feasibility of a remedial action, including the availability of materials and services needed to implement the selection.

7. **Cost** refers to an evaluation of the costs of each alternative.

MODIFYING CRITERIA

Modifying criteria can only be considered after public comment is received on the proposed remedy:

8. **State Acceptance** indicates whether the state concurs with, opposes, or has no comment on the proposed remedial action.

9. **Community Acceptance** assesses the public response to the proposed remedial action. Although public comment is an important part of the decision-making process, EPA is required by law to balance community concerns with the above criteria.

Figure 26. CERCLA Evaluation Criteria

Table 7. Comparative Analysis Summary for the Z-Ditches Waste Group

	Threshold Criteria		Balancing Criteria				
Alternatives	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction in Toxicity, Mobility, and Volume Through Treatment	Short-Term Effectiveness	Implementability	Cost (Present Worth in $ million) [a,b]
216-Z-1D Ditch (South Portion), 216-Z-11 Ditch, 216-Z-19 Ditch, 216-Z-20 Tile Field, and UPR-200-W-110 Unplanned Release							
No Action	No	No	Not Ranked[c]				--
MESC/IC	No	No	Not Ranked[c]				--
RTD	Yes	Yes	○	●	◐	◐	$58.1
Barrier	Yes	Yes	◐	●	○	○	$19.6
ISV/RTD/Barrier	Yes	Yes	○	◐[d]	◐	●	$318
ISV/Barrier	Yes	Yes	◐	◐[d]	◐	●	$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 percent 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. Additional cost information (capital, O&M) is presented in FS.

c. The No Action and MESC/IC alternatives are not ranked because they do not meet the threshold criteria.

d. Rated "performs moderately well" for this criterion overall. ISV applies only to Work Area 2. No treatment of contaminants in Work Areas 1 or 3.

ARAR = Applicable or Relevant and Appropriate Requirements

ISV = In Situ Vitrification

MESC/IC = Maintain Existing Soil Cover and Institutional Controls

Evaluation Metric

● = performs less well against the criterion relative to the other alternatives with significant disadvantages or uncertainty

◐ = performs moderately well against the criterion relative to the other alternatives with some disadvantages or uncertainty

○ = performs very well against the criterion relative to the other alternatives with minor disadvantages or uncertainty

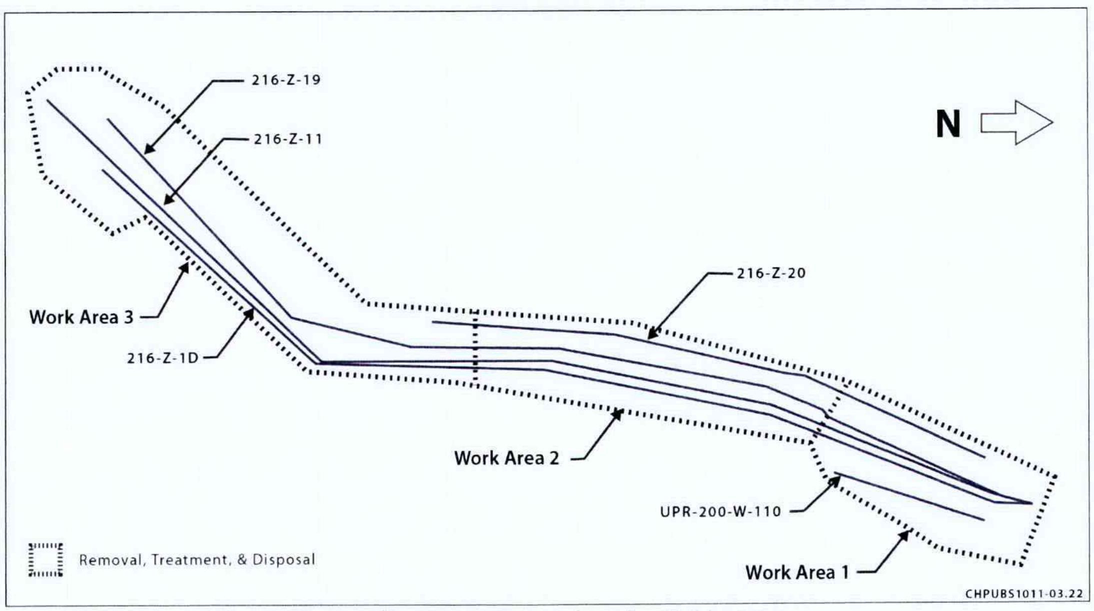


Figure 27. Generalized Waste Site Work Areas for the Z-Ditches

Four of the five 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 and compliance with ARARs. The No Action and MESC/IC alternatives are not protective of human health and the environment and were not retained.

The RTD alternative provides the greatest long-term effectiveness because it removes contaminants from the ground and disposes of them in an approved facility. The contaminated material would have to meet the waste acceptance criteria of the disposal facility (i.e., ERDF, which has an approved ROD). The barrier decreases the mobility of contaminants, but requires long-term maintenance to remain effective.

The ISV/RTD/Barrier and ISV/Barrier alternatives rank moderately well for reduction in toxicity, mobility, and volume through treatment because both alternatives treat contaminated material (i.e., PCBs) using vitrification to reduce mobility. ISV does not reduce the mobility of plutonium and americium because they currently are not mobile under existing or anticipated conditions. In addition, the barrier would be placed over the area where ISV was applied to provide additional protection of human health and the environment.

The Barrier alternative ranks highest for short-term effectiveness because it provides lower potential for worker and environmental exposure to contaminants and lower overall risk than alternatives that excavate contaminated material, which could potentially result in an exposure. In addition, a Barrier can be constructed in a relatively short time frame compared to the other alternatives (ISV or RTD).

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 it requires excavation with transportation and disposal at an appropriate disposal facility such as ERDF. The alternatives incorporating ISV are ranked low because of the necessary improvements to the electrical system to deliver sufficient energy to the waste sites and because the scale of the ISV is greater than has ever been attempted.

The Barrier alternative is the lowest cost alternative, RTD is the next lowest cost alternative, which is followed by the combination alternatives, ISV/Barrier and ISV/RTD/Barrier.

The Preferred Alternative

The preferred alternative for the Z-Ditches, with the exception of the north portion of 216-Z-1D Ditch, is the RTD alternative. This alternative provides for removal, treatment, and disposal of site contamination. The waste generated by implementing the alternative is expected to be low-level, which can be disposed of in ERDF. The basis for selecting this alternative is that it reduces site risk through removal of contamination from the waste sites. This alternative would meet RAO-1 and -2 by removing contamination and placing the contaminated soil in ERDF, which will eventually isolate it from the environment through an engineered barrier. This alternative meets RAO-3 by removing contamination above the PRGs that could potentially impact groundwater. This alternative will provide a cost-effective balance between long-term protection and permanence and short-term risk. Excavation of shallow contamination with onsite disposal is readily implementable. This alternative is cost-effective relative to other alternatives, based on the reduction of overall site risk achieved and reduction of the cost of long-term institutional controls.

The preferred alternative for the north portion of the 216-Z-1D Ditch is the No Action alternative because current risk values derived from soil contamination concentrations at this site are below the risk range considered protective of human health and the environment based on the reasonably anticipated future land use (e.g., industrial). Further, the waste sites are currently protective without implementing institutional controls because the calculated risk values are protective of human health and the environment.

High-Salt Waste Group (200-PW-1)

The High-Salt Waste Group received liquid waste containing plutonium as well as carbon tetrachloride and other liquid volatile organic compounds. Table 8 presents the results of the detailed evaluation of alternatives for the three waste sites in the High-Salt Waste Group. A more detailed evaluation of the alternatives for the High-Salt waste sites is presented in Chapter 7 of DOE/RL-2007-27. All the alternatives except the No Action alternative include continued operation of the SVE system for removal of carbon tetrachloride and other volatile organic compounds. The SVE system was initially installed under an Expedited Response Action to remove the carbon tetrachloride.

Table 8. Comparative Analysis Summary for the High-Salt Waste Group

	Threshold Criteria		Balancing Criteria				
Alternatives	**Overall Protection of Human Health and the Environment**	**Compliance with ARARs**	**Long-Term Effectiveness and Permanence**	**Reduction in Toxicity, Mobility, and Volume Through Treatment**	**Short-Term Effectiveness**	**Implementability**	**Cost[a] (Present Worth in $ million)**
216-Z-1A Tile Field, 216-Z-9 Trench, and 216-Z-18 Crib							
No Action	No	No	Not Ranked[b]				--
Barrier	Yes	Yes	◐	◐[c]	○	○	$19.1
ISV[d]	Yes	Yes	◐	◐[c]	◐	●	$94.0
RTD (Option A)	Yes	Yes	◐	◐[c]	◐	◐	$112
RTD (Option B)	Yes	Yes	◐[e]	◐[c]	◐	◐	$69.5
RTD (Option C)	Yes	Yes	◐	◐[c]	◐	◐	$642
RTD (Option E)	Yes	Yes	○	◐[c]	◐	●	$896

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 and include estimated Waste Isolation Pilot Plant disposal costs.

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

c. Carbon tetrachloride and other volatile organic compounds removed by SVE are subject to treatment.

d. Uncontaminated soil located above the contaminated material would be excavated prior to application of ISV and backfilled after completion.

e. Applies to 216-Z-1A ONLY because the waste is shallower than 4.6 m (15 ft). The costs presented for Option B do not include remediation of 216-Z-9 and 216-Z-18. Additional investigation may indicate waste at these sites is shallower than 4.6 m (15 ft).Therefore, if a need is identified to address these additional sites, the costs for remediation may be similar to the remedial costs associated with Option A.

Evaluation Metric

● = performs less well against the criterion relative to the other alternatives with significant disadvantages or uncertainty

◐ = performs moderately well against the criterion relative to the other alternatives with some disadvantages or uncertainty

○ = performs very well against the criterion relative to the other alternatives with minor disadvantages or uncertainty

Table 6 summarizes the removal depths for the four RTD Options (A, B, C, and E) considered for the High-Salt Waste Group. Within the High-Salt Waste Group, only the 216-Z-1A Tile Field was determined to have soil contamination identified within 4.6 m (15 ft) of the current ground surface. Construction features and data evaluation of the other sites (216-Z-9 and 216-Z-18) led to the assumption that contamination at these sites is located at depths greater than 4.6 m (15 ft); however, additional analysis following completion of the FS indicated that 216-Z-9 and 216-Z-18 may have contamination at depths less than 4.6 m (15 ft) bgs. Therefore, the scope and the cost of remediation of these sites, along with 216-Z-1A, may result in higher costs than those presented in

Table 8 if Option B is selected as the remedial alternative for the High-Salt Waste Group. The 216-Z-9 and 216-Z-18 waste sites would be sampled post-ROD to verify the presence or absence of contamination shallower than 4.6 m (15 ft) bgs and these sites would be remediated by RTD of the shallow contaminated soil, if required.

The Barrier, ISV, and RTD options meet the RAO-1 and -2 for protection of the industrial worker, which is consistent with the industrial land use.

The Barrier is protective of human health and the environment through the use of evapotranspiration and physical barriers to minimize the potential for an exposure. ISV is protective of human health and the environment because it would break the exposure pathway. The RTD alternatives remove contamination to varying depths to minimize the potential for an exposure. The excavated material would have to meet the waste acceptance criteria of the disposal facility. Each of these alternatives, except RTD (Option E), will require long-term institutional controls to maintain protectiveness. All alternatives would include continuing operation of the SVE system. The No Action and MESC/IC alternatives are not protective of human health and the environment and do not meet their respective ARARs.

The RTD alternatives provide varying amounts of long-term effectiveness because they remove different amounts of contaminants from the ground; however, institutional controls would still be required for all RTD options except E.

The Barrier, ISV, and RTD alternatives do not reduce the mobility of plutonium and americium as they currently are not mobile under existing or anticipated conditions; however, the SVE system would be continued under each alternative. Therefore, each alternative ranks as performing moderately well for reduction in toxicity, mobility, and volume through treatment. The Barrier, ISV, and RTD alternatives rank equal for short-term effectiveness and require between 11 and 16 years to implement. The Barrier is expected to take 11 years and, thus, was ranked higher.

The Barrier alternative would be the simplest to construct and operate. The ISV system would require upgrading the existing electrical infrastructure and would be more difficult to implement, due to unproven ability to work on such a large project scale. The RTD alternative varies in difficulty depending on the excavation depth but under any option the excavations will require contaminated material handling requirements for worker safety and environmental protection. The RTD Option E is ranked lower for implementability than the other options since the excavation depth is greater than the other RTD options. The Barrier, ISV, and RTD alternatives propose to continue using SVE to remove the carbon tetrachloride and other volatile organic compounds from soil beneath the High-Salt Waste Group and then treat the contaminated soil vapor with granular activated carbon. The SVE component will be expanded as needed under these alternatives to include areas that have not been remediated by the current SVE system. In addition, post-ROD sampling for technetium-99 and nitrate will be performed to evaluate the nature and extent of mobile contaminants for groundwater protection.

The Barrier alternative has the lowest cost followed by RTD Option B, ISV, and RTD Options A, C, and E.

The costs associated with final disposal include estimated costs for disposal at the **Waste Isolation Pilot Plant (WIPP)** for any **transuranic waste** that is generated. To provide an estimate of the total project costs for comparison of alternatives, an estimate of the WIPP disposal cost is made and included in the cost information for the High-Salt, Low-Salt, and Settling Tanks waste groups. The average disposal cost is $44,000 per cubic meter versus about $100 per cubic meter for disposal in ERDF. The disposal of contaminated material has characterization, transportation, placement and monitoring requirements. The disposal cost for contaminated soils at WIPP is considerably higher than for ERDF because of the increased costs associated with transportation, placement, and monitoring of waste. In addition, the major uncertainty that impacts the cost and duration of the RTD alternative is the quantity of contaminated soil at the High-Salt waste group that will require disposal.

The RTD alternative is estimated to take from 1 to 5 years to complete depending on the removal, treatment, and disposal depth. Soil remediation will begin after successful completion of the SVE remedial action, which for cost-estimating purposes was estimated as operating for another 10 years. RTD of the contaminated soil could not begin until the SVE is complete because the SVE extraction soils are co-located in the area of the contaminated soils that would be excavated.

Because RTD Options A and 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 eliminating contamination above 4.6 m (15 ft) bgs, the exposure pathway is interrupted for human health for the industrial worker scenario and ecological receptors. While excavating to depths greater than 4.6 m (15 ft) bgs would reduce the mass of plutonium, it provides no additional beneficial protection to groundwater, human health, or ecological receptors (under the reasonably anticipated future land use). Groundwater protection for volatile organic compounds is achieved for the High-Salt Waste Group through continued operation of the SVE system.

The Preferred Alternative

The preferred alternative for the High-Salt Waste Group is RTD (Option A) consisting of excavation of the highest concentrations of contaminated soils to 0.6 m (2 ft) below the base of the waste site (6 to 7 m [20 to 23 ft] total depth bgs), removal of the structures associated with these waste sites, backfill the excavation with clean fill, construction of a physical evapotranspiration barrier over the sites, and institutional controls. In addition, as part of the preferred alternative, the SVE system would continue to be operated for treatment of the carbon tetrachloride soil contamination at the High-Salt Waste Group.

RTD Option A was selected over RTD Option C because the incremental cost of retrieving and disposing of the additional quantity of contaminated soils under Option C is disproportionate to the human health and environmental risks posed. The potential risk reduction benefits of additional retrieval are realized only under certain aspects of an unrestricted use scenario. Such a land use is inconsistent with the reasonably anticipated future land use.

Based on incorporation of the modifying criterion, the agencies identified a preferred alternative that is a higher cost than the Barrier alternative. The Barrier alternative was identified from the application of the CERCLA evaluation process considering only the threshold and balancing criteria. The modifying criterion of community acceptance was based on comments from the Tribal Nations and the public at the April 2008 public workshop and HAB advice received to date. RTD Option A would meet RAO-1 and -2 by removing contamination from the subsurface. Because residual contamination would be left in place after the RTD remedial action was completed, an evapotranspiration barrier is proposed to 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. The SVE portion of the remedial alternative will meet RAO-3 by ensuring that VOC contamination does not reach the groundwater. The SVE component to the preferred alternative reduces risk and is cost effective.

Post-ROD sampling for technetium-99 and nitrate will be performed to determine the nature and extent of mobile contaminants to ensure groundwater protection. If an unacceptable risk is identified, remediation of the technetium-99 and/or nitrate will be addressed under the Deep Vadose Zone OU, 200-DV-1. This combination of alternatives also includes addressing the associated pipelines, well decommissioning, institutional controls, and site monitoring. Also included in the preferred alternative is the removal and disposal of the abovegrade structures at the 216-Z-9 Trench. In addition, the NCP requires site reviews of the remedial action every 5 years.

Low-Salt Waste Group (200-PW-1 and 200-PW-6)

The five waste sites in the Low-Salt waste group primarily received neutral to basic aqueous waste streams from the Plutonium Isolation Facility or the PFP Complex. Table 9 presents the results of an evaluation of remedial alternatives for the five waste sites in the Low-Salt waste group. Chapter 7 of DOE/RL-2007-27 describes a more detailed remedial alternative evaluation for the Low-Salt Waste Group.

Table 6 summarizes the removal depths for three of the five RTD alternatives considered for each waste site within the Low-Salt group. The RTD (Option B) alternative does not apply to any of the Low-Salt group sites; therefore, it has not been included in the summary in Table 9.

Table 9. Comparative Analysis Ranking Summary for the Low-Salt Waste Group

	Threshold Criteria		Balance Criteria				
Alternatives	**Overall Protection of Human Health and the Environment**	**Compliance with ARARs**	**Long-Term Effectiveness and Permanence**	**Reduction in Toxicity, Mobility, and Volume Through Treatment**	**Short-Term Effectiveness**	**Implementability**	**Cost[a] (Present Worth in $ million)**
216-Z-1 Crib, 216-Z-2 Crib, 216-Z-3 Crib, 216-Z-12 Crib and 216-Z-5 Crib							
No Action	No	No	Not Ranked[b]				--
Barrier	Yes	Yes	◐	●	○	○	$10.1
ISV	Yes	Yes	◐	●	◐	●	$23.7
RTD (Option A)	Yes	Yes	◐	●	◐	◐	$61.8
RTD (Option C)	Yes	Yes	○	●	◐	◐	$81.4
RTD (Option E)	Yes	Yes	○	●	◐	◐	$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 and include estimated WIPP disposal costs.

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

Evaluation Metric

● = performs less well against the criterion relative to the other alternatives with significant disadvantages or uncertainty

◐ = performs moderately well against the criterion relative to the other alternatives with some disadvantages or uncertainty

○ = performs very well against the criterion relative to the other alternatives with minor disadvantages or uncertainty

The Barrier, ISV, and RTD alternatives meet the threshold criteria for protection of human health and the environment and for compliance with ARARs.

RTD Options C and E rank high for long-term effectiveness because these options remove contamination to allow for unrestricted land use. The Barrier, ISV, and RTD Option A alternatives leave contamination in place and therefore rank only as performing moderately well. For any of the RTD alternatives, the excavated material would have to meet the waste acceptance criteria of the disposal facility. While the ISV is a viable treatment alternative for reducing the mobility of some contaminants, it is not effective in reducing the mobility of plutonium or americium, the primary contaminants of the Low-Salt Waste Group, because they are currently not mobile under existing or anticipated conditions. Therefore, all alternatives are rated low for this criterion.

The Barrier performs very well against the modifying criterion for short-term effectiveness because it can be constructed in the shortest time frame (approximately 2 years). The ISV and RTD alternatives are expected to take approximately 4 years to implement and were, therefore, rated as performing moderately well.

The Barrier alternative ranks highest for implementability criterion and would be the simplest to construct and operate. The ISV alternative would be more difficult to implement because of necessary improvements to the existing electrical infrastructure and for applying ISV technology on a relatively large soil mass. The RTD alternatives (Options A, C, and E) all rank moderately well against each other because each option is excavated to similar depths. Under any RTD option, the excavations will require contaminated material handling requirements for worker safety and environmental protection.

The disposal of contaminated material has characterization, transportation, placement, and monitoring requirements so the material can be disposed of properly. Disposal costs at WIPP are estimated at $44,000 per cubic meter. This is considerably higher than for disposal at ERDF because of the increased costs associated with transportation, placement, and monitoring of waste required. In addition, the major uncertainty that impacts the cost and duration of the RTD alternative is the quantity of contaminated soil at the Low-Salt Waste Group sites that will require disposal.

The Barrier alternative has the lowest cost, followed by the ISV, and then the RTD alternatives. The RTD (Option A) alternative has lower costs than the Option E because the excavation depth is less.

Based on the threshold and balancing criteria, the Barrier alternative rates highest. The Barrier alternative provides adequate protection of human health and the environment for the industrial land use. The RTD alternative options do not provide a significant risk reduction for the industrial land use and require excavation up to a depth of 10 m (33 ft) to provide a risk reduction to achieve unrestricted land use.

All the alternatives except No Action also include addressing associated pipelines, institutional controls, and site monitoring. In addition, the NCP requires site reviews of the remedial action every 5 years.

The Preferred Alternative

The RTD (Option C) alternative, which includes removal of a significant portion of plutonium contamination, physical barriers, and institutional controls, is the preferred alternative. Although a barrier alone would be adequate to address the CERCLA risks posed by this waste group, concerns raised by the public regarding the risk of leaving plutonium mass in place resulted in the selection of RTD (Option C) alternative.

The RTD (Option C) alternative requires 10.1 m (33 ft) of excavation, which is an additional 0.6 m (2 ft) of excavation beyond that for Option A, which excavates to a depth of 9.5 m (31 ft). The RTD (Options C and E) alternatives are equivalent because soils are removed to the same depth. Based on consideration of modifying criteria, the agencies have identified a preferred alternative that represents a higher cost than the alternative that was identified from the preliminary application of the CERCLA evaluation process considering threshold and balancing criteria. The modifying criterion of community acceptance is based on comments received from the Tribal Nations and the public at the April 2008 public workshop and HAB advice to date.

This alternative would remove an estimated 90 percent of the plutonium beneath these sites. It would meet RAO-1 and -2 by removing contamination and placing it in an approved disposal facility. Because some contamination would be left in place after RTD remedial action has been completed, an evapotranspiration barrier would be constructed over the waste sites to address concerns from the Tribal Nations and the public regarding uncertainties in the future mobility of the contaminants. This would meet RAO-3 by controlling the amount of precipitation that infiltrates into contaminated media, thereby reducing the potential for migration of contaminants to groundwater.

In addition, post-ROD sampling for technetium-99 and nitrate will be performed to evaluate the nature and extent of mobile contaminants to assure groundwater protection. This combination of alternatives also includes addressing associated pipelines, well decommissioning, institutional controls, and site monitoring. The NCP requires site reviews of the remedial action every 5 years.

Cesium-137 Waste Group (200-PW-3)

The four cribs and the unplanned release site comprising the Cesium-137 waste group received waste effluent derived directly or indirectly from PUREX operations. Table 10 presents the results of an evaluation of remedial alternatives for the five waste sites in the Cesium-137 waste group. Chapter 7 of DOE/RL-2007-27 describes a more detailed remedial alternative evaluation for the Cesium-137 Waste Group.

Table 10. Comparative Analysis Summary for the Cesium-137 Waste Group

Alternatives	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction in Toxicity, Mobility, and Volume Through Treatment	Short-Term Effectiveness	Implementability	Cost[a] (Present Worth in $ million)
216-A-7 Crib, 216-A-8 Crib, 216-A-24 Crib, 216-A-31 Crib and UPR-200-E-56 Unplanned Release							
No Action	No	No	Not Ranked[b]				--
Barrier	Yes	Yes	◐	●	○	○	$12.2
RTD (Option B)	Yes	Yes	◐[c]	●	◐	◐	$15.3
RTD (Option C)	Yes	Yes	◐	●	◐	◐	$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. The No Action alternative is not ranked because it does not meet the threshold criteria.

c. Applies to 216-A-24 and 216-A-31 ONLY because the waste is shallower than 4.6 m (15 ft). The costs presented for Option B do not include remediation of 216-A-7, 216-A-8, and UPR, 200-E-56. Additional investigation may indicate waste at these sites is shallower than 4.6 m (15 ft). Therefore, if a need is identified to address these additional sites, the costs for remediation may be similar to the remedial costs associated with Option C.

Evaluation Metric

● = performs less well against the criterion relative to the other alternatives with significant disadvantages or uncertainty

◐ = performs moderately well against the criterion relative to the other alternatives with some disadvantages or uncertainty

○ = performs very well against the criterion relative to the other alternatives with minor disadvantages or uncertainty

Table 6 summarizes the removal depths for the two RTD options considered for each waste site within the Cesium-137 waste group. Three of the five waste sites (216-A-7, 216-A-8, and UPR-200-E-56) have soil contamination within 4.6 m (15 ft) of the current ground surface; the other sites (216-A-24 and 216-A-31) would not be addressed under the RTD (Option B) alternative.

Construction features and data evaluation of the other sites (216-A-7, 216-A-8, and UPR-200-E-56) led to the assumption that contamination at these sites is located at depths greater than 4.6 m (15 ft); however, additional analysis following completion of the FS indicated that 216-A-7, 216-A-8, and UPR-200-E-56 may have contaminants at depths less than 4.6 m (15 ft) bgs. Therefore, the scope and the cost of remediation of these sites, along with 216-A-24 and 216-A-31, may result in higher costs than those presented in Table 10 if Option B is selected as the remedial alternative for the Cesium-137 Waste Group. The 216-A-7, 216-A-8, and UPR-200-E-56 waste sites would be sampled post-ROD to verify the presence or absence of contamination shallower than 4.6 m (15 ft) bgs and these sites would be remediated by RTD of the shallow contaminated soil, if required.

The Barrier and RTD alternatives meet the threshold criteria for protection of human health and the environment and compliance with ARARs. The Barrier and RTD alternatives provide generally equivalent long-term effectiveness because each leave waste in place and were ranked as performing moderately well. None of the alternatives are effective in reducing toxicity, mobility and volume because none of the alternatives perform any treatment and were ranked as performing less well. The Barrier alternative is anticipated to have the greatest short-term effectiveness because it can be constructed in approximately 1 year versus 2 years for the RTD options and was therefore ranked higher. The Barrier alternative ranks high for implementability because it poses the least risk to the remedial action workers and the environment because minimal, if any, contact with contaminated materials would be required. The RTD options are expected to have the greatest short-term risks to the remedial action workers and the environment because of the potential exposure to contaminated materials during excavation. The potential land area impacts, waste generated, soil and rock quantities needed for backfill, and evapotranspiration barriers all increase with the soil removal depth. RTD (Option B) removes approximately 460 cubic meters (600 cubic yards) of waste going to ERDF, and RTD (Option C) removes approximately 33,000 cubic meters (43,000 cubic yards) to ERDF.

The Barrier alternative also best satisfies the implementability criterion because it would be the simplest to construct. The RTD alternative is the more complicated alternative to implement and construct versus the Barrier. The removal, transport, and disposal could easily be expanded if soil contamination is discovered beyond the waste site footprint. The Barrier alternative has the lowest cost, followed by the RTD alternatives.

The Preferred Alternative

The preferred alternative for this waste group is a modification of the Barrier alternative. The proposed Barrier alternative maintains 4.6 m (15 ft) soil cover over each of the sites because it provides adequate risk protection and long-term management of the Cesium-137 Waste Group contamination through physical barriers and institutional controls. This alternative would meet RAO-1 and -2 by eliminating the direct contact exposure pathway. Cesium-137 has a half-life of approximately 30 years, so natural radiological decay can achieve substantial reductions in contaminant mass in a relatively short period of time. The costs estimated in the FS for the modified barrier alternative includes construction of an evapotranspiration barrier, which would be a greater cost than placement of sufficient soil to maintain a 4.6 m (15 ft) cover (e.g., Barrier); thus, the costs estimated in the FS provide an upper bound of the costs related to the preferred alternative. In addition, long-term operation and maintenance costs would be similar for either type of cover. This alternative also includes site monitoring. In addition, the NCP requires site reviews of the remedial action every 5 years. The proposed modified Barrier would meet RAO-3 because it would control the amount of precipitation that infiltrates into contaminated media, thereby reducing the migration of contaminants to groundwater.

Settling Tanks Waste Group (200-PW-1 and 200-PW-6)

The 241-Z-361 Settling Tank contains 800 L (210 gal) of liquid and 75 m^3 (82 yd^3) of sludge. Table 11 presents the results of an evaluation of the remedial alternatives for the Settling Tanks waste group. Chapter 7 of DOE/RL-2007-27 describes a more detailed remedial alternative evaluation for the two settling tank sites.

The removal of the sludge from the settling tanks will require significant contaminated material handling requirements for worker safety and environmental protection. It may also require some form of pretreatment before it can be shipped to, or received by, WIPP or ERDF and according to WAC regulations. It is anticipated that 1 to 2 years will be needed to complete the remediation of the settling tanks.

Table 11. Comparative Analysis Ranking Summary for the Settling Tanks Waste Group

Alternatives	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction in Toxicity, Mobility, and Volume Through Treatment	Short-Term Effectiveness	Implementability	Cost[a] (Present Worth in $ million)
241-Z-361 Settling Tanks and 241-Z-8 Settling Tank							
No Action	No	No	Not Ranked[b]				--
RTD – Remove Tank Contents	Yes	Yes	○	●	◐	◐	$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 and include estimated WIPP disposal costs.

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

Evaluation Metric

● = performs less well against the criterion relative to the other alternatives with significant disadvantages or uncertainty.

◐ = performs moderately well against the criterion relative to the other alternatives with some disadvantages or uncertainty.

○ = performs very well against the criterion relative to the other alternatives with minor disadvantages or uncertainty.

The Preferred Alternative

The RTD alternative is the preferred alternative because it would remove contaminated sludge and liquid containing plutonium and americium. The sludge would be stabilized and then disposed either offsite at the WIPP, if the sludge is transuranic waste, or in ERDF, if it is low level waste. The empty tanks would be backfilled with a suitable fill material that reduces the potential for collapse. This alternative would meet RAO-1, -2, and -3 by removing contamination from the subsurface. This alternative reduces risk and attains the RAOs in about 1 to 2 years. Pipelines associated with the settling tanks would be removed as part of the preferred alternative.

Other Sites Waste Group (216-Z-8 French Drain and 216-Z-10 Injection/Reverse Well)

The No Action alternative provides adequate protection of human health and the environment at the 216-Z-8 French Drain and the 216-Z-10 Injection/Reverse Well because current risk levels at these sites are within or below the CERCLA acceptable excess cancer risk range of 10^{-4} to 10^{-6} assuming unrestricted land use.

The Preferred Alternative

The No Action alternative is the preferred alternative because soil contamination concentrations at these sites are below the risk range considered protective of human health and the environment. The balancing criteria were not evaluated against the preferred alternative because no remediation is required at these sites (Table 12). The 216-Z-10 Injection/Reverse Well will be decommissioned to comply with Washington State regulations.

Table 12. Comparative Analysis Ranking Summary for the Other Sites Waste Group

Alternatives	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction in Toxicity, Mobility, and Volume Through Treatment	Short-Term Effectiveness	Implementability	Cost[a] (Present Worth in $ million)
216-Z-8 French Drain, 216-Z-10 Injection/Reverse Well							
No Action	Yes	Yes	Not Ranked[b]				$0.16

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 and include estimated WIPP disposal costs.

b. The No Action alternative is not ranked because the alternative meets all criteria through No Action.

Pipelines

Specific pipelines connected to the waste sites will be remediated as part of the remedial decision for 200-PW-1, 200-PW-6, and 200-CW-5 OUs. The pipelines conveyed the waste liquids to the waste sites and, thus, are potentially contaminated with the same constituents found at the waste sites. The pipelines are constructed of various materials, primarily stainless steel or vitrified clay pipe. Of the pipelines included in this decision, the largest portion (967 m [3,174 ft] out of a total length of 980 m [3,214 ft] of pipeline trenches) are buried at, or less than, 3 m (10 ft) bgs. Removal, treatment, disposal, and isolation of the pipelines were evaluated as remedial alternatives (Appendix H of DOE/RL-2007-27).

In situ stabilization of the pipelines, where grout is pumped into the pipelines, was considered as a possible alternative. It did not meet the threshold criteria and was not retained. Any releases present outside the walls of the pipelines from leaks would not be remediated as part of the grouting. Therefore, this alternative does not stabilize or immobilize contaminants located outside the pipe walls and is not protective of human health and the environment.

Significant uncertainties exist related to the possible residues remaining in the specific pipelines evaluated for this decision and whether leaks or other releases have occurred; therefore, the RTD alternative was evaluated to take advantage of the observational approach and reduce vadose zone uncertainties. The cost for RTD of the pipeline to be addressed as part of this decision is $4.9 million.

Pipelines to a depth of 3 m (10 ft) and associated soils impacted by pipeline leaks exceeding PRGs will be excavated and disposed of at an approved facility. An observational approach based on the frequency of leaks and the presence of residual contamination in the shallower sections would be used to make decisions about the remaining length of the pipelines, located deeper than 3 m (10 ft) bgs. However, it is likely that the remaining lengths of pipelines, which are located adjacent to the waste sites, will be removed as part of the preferred alternative (i.e., RTD). This alternative would meet RAO-1 and -2 by removing contamination from the subsurface. It would meet RAO-3 because the contamination would be removed, thereby, eliminating potential groundwater impacts.

The Preferred Alternative

The RTD alternative is the preferred alternative for the pipelines included in this decision. Pipelines to a depth of 3 m (10 ft) and associated soils impacted by pipeline leaks exceeding PRGs would be excavated and disposed of onsite in ERDF. An observational approach based on the frequency of leaks and the presence of residual contamination in the shallower sections would be used to make decisions about the remaining length of the pipelines, deeper than 3 m (10 ft) bgs. Table 13 presents the results of the evaluation of the alternatives for the Pipelines.

Table 13. Comparative Analysis Ranking Summary for the Pipelines

Alternatives	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction in Toxicity, Mobility, and Volume Through Treatment	Short-Term Effectiveness	Implementability	Cost[a] (Present Worth in $ million)
Pipelines							
No Action	No	No	Not Ranked[b]				--
In Situ Stabilization	No	No	Not Ranked[c]				
RTD up to 3 m (10 ft) bgs	Yes	Yes	○	●	◐	◐	$4.9

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 and include estimated WIPP disposal costs.

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

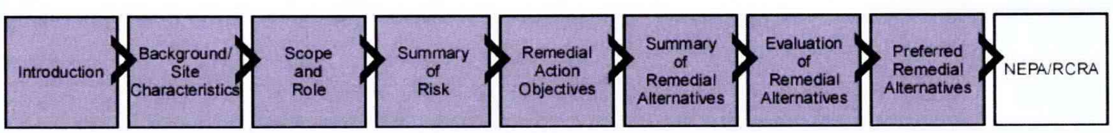
c. In Situ Stabilization is not ranked because it does not meet threshold criteria.

Evaluation Metric

● = performs less well against the criterion relative to the other alternatives with significant disadvantages or uncertainty.

◐ = performs moderately well against the criterion relative to the other alternatives with some disadvantages or uncertainty.

○ = performs very well against the criterion relative to the other alternatives with minor disadvantages or uncertainty.



PREFERRED REMEDIAL ALTERNATIVES

This section summarizes the preferred alternatives for each of the waste groups. Based on the comparative evaluation in the previous section ("Evaluation of Alternatives"), the preferred alternatives are summarized in Table 14.

The preferred alternative portion of this table is divided into two columns: (1) Prior to Public Consultation, and (2) Following Public Consultation. As discussed in the previous section, strict application of the CERCLA Evaluation Criteria dictates that the Community Acceptance Criterion, the last criterion under the Modifying Criteria group (Figure 26), can only be completed after the public review and comment period for this Proposed Plan is completed. However, the Tri-Party Agreement encourages input by Tribal Nations and the public, often while a decision document is in preparation. That is the case with this Proposed Plan, which used input from the April 2008 public workshop and input from the HAB. Therefore, the Community Acceptance Criterion was used in evaluating the alternatives. This input is reflected in the "Following Public Consultation" column of Table 14. This approach does not preclude the consideration of comments received while this Proposed Plan is out for public review, as discussed in the Community Participation section found on page 51 of this document.

Table 14. Summary of Preferred Alternatives

Waste Group	Preferred Alternative	
	Prior to Public Consultation	Following Public Consultation
Z-Ditches	Removal, Treatment (if needed), and Disposal	Removal, Treatment (if needed), and Disposal
High-Salt	SVE and Engineered Surface Barrier	SVE and Removal, Treatment (if needed), and Disposal
Low-Salt	Engineered Surface Barrier	Removal, Treatment (if needed), and Disposal
Cesium-137	Maintain 4.6 m (15 ft) of Soil Cover	Maintain 4.6 m (15 ft) of Soil Cover
Settling Tanks	Removal of Contents, Treatment (if needed), and Disposal	Removal of Contents, Treatment (if needed), and Disposal
Other	No Further Action	No Further Action
Pipelines (and associated soil)	Removal, Treatment of Soil (if needed), and Disposal	Removal, Treatment of Soil (if needed), and Disposal

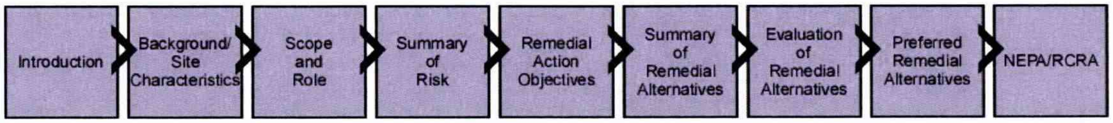
SVE = Soil Vapor Extraction

The set of preferred alternatives include the following common items:

- Institutional and administrative controls, as long as risks remain that make waste sites unsuitable for unrestricted use.
- Additional sampling is proposed at the 200-PW-1, 200-PW-3, and 200-PW-6 OUs for technetium-99 and nitrate after the ROD has been issued. The results of the sampling, which will be used to determine the nature and extent of contamination, if any, of technetium-99 and nitrate will dictate whether the preferred remedy will effectively address these contaminants and can be implemented as part of the preferred alternatives described here, or if these contaminants need to be deferred to the deep vadose zone OU (200-DV-1). Regardless of which OU prescribes the remedy for technetium-99 and nitrate, human health and the environment will be protected.
- Additional sampling is also proposed in conjunction with the confirmation sampling at 200-CW-5 to determine if nitrate, for which limited information is available, could pose a threat to groundwater. If there is a threat to groundwater from the nitrate and the preferred alternative cannot assure that human health and the environment are protected, then the vadose zone area of nitrate contamination will be deferred to the deep vadose zone OU (200-DV-1). Regardless of which OU prescribes the remedy for nitrate contamination at 200-CW-5, human health and the environment will be protected.
- Pipelines associated with the waste groups will be removed and disposed of, along with any contaminated soil due to leakage.
- Above-ground structures at the 216-Z-9 Trench (Figure 8) used to support soil mining will be removed; the below-grade equipment will be left in place under the Barrier alternative, but will be removed and disposed of under the RTD (removal, treatment, and disposal alternative).
- Environmental surveillance and groundwater monitoring will be conducted to evaluate the effectiveness of the preferred alternatives that leave residual contamination, which makes waste sites unsuitable for unrestricted use. These activities include institutional controls, maintenance, and monitoring for 1,000 years at plutonium waste sites and for 350 years at the Cesium-137 waste sites.
- The RTD alternative sites will be backfilled and graded to match surrounding topography.

- The SVE system will continue to operate until the shutdown criteria are met at the three sites.

Based on information available at this time, the Tri-Parties conclude that the preferred alternative and proposed actions would be protective of human health and the environment, comply with ARARs, be cost-effective, and use long-term solutions and alternative treatment technologies to the maximum extent practicable. The preferred alternative and proposed actions may be modified or changed by the Tri-Parties in response to public comment or new information that becomes available after this Proposed Plan is released.



NATIONAL ENVIRONMENTAL POLICY ACT VALUES

Under DOE's CERCLA/NEPA Policy, established in 1994, DOE relies on the CERCLA process for review of actions to be taken under CERCLA (i.e., no separate NEPA document or NEPA process is ordinarily required [Cook 2002]). NEPA values are incorporated into DOE's CERCLA documentation (DOE O 451.1b Chg 1); NEPA values include (but are not limited to) consideration of the cumulative, ecological, cultural, historical, and socioeconomic impacts of the proposed remedial action. NEPA values were incorporated into the analysis in the respective feasibility studies and the conclusions will be included in the CERCLA ROD.

For the remedies evaluated in this Proposed Plan, environmental impacts include temporary short-term disturbance (e.g., increased traffic, noise levels, and fugitive dust) of approximately 1 km^2 (0.4 mi^2, 240 ac) for a disturbed industrial area that has low to marginal habitat quality.

Irreversible and irretrievable commitments of resources could result from a RTD and/or Barrier alternative that would use natural resource materials (sand, gravel, silty loam, and basalt) in the construction. NEPA values related to the use of these natural resource materials would be addressed in the remedial design/remedial action work plan.

Long-term impacts identified for the remedies include potential aesthetic and visual impacts, should the barriers or backfilled areas not be adequately contoured and vegetated to blend with the surrounding area. The DOE expects minimal or no impacts to air quality; other natural, cultural, and historical resources; transportation; socioeconomic values; or disadvantaged communities concerned with environmental justice.

RCRA CORRECTIVE ACTION

In accordance with the Tri-Party Agreement, past practice site cleanup (remediation) is intended to satisfy both CERCLA remedial action and RCRA corrective action requirements. In addition to fulfilling CERCLA requirements, this preferred remedial action is intended to fulfill DOE's corrective action obligations under RCRA and Washington State's *Hazardous Waste Management Act*. The Tri-Parties agreed that the selected preferred alternative (i.e., remedy) would satisfy the requirements of both CERCLA and RCRA corrective action.

Although this is not a ***Model Toxics Control Act*** cleanup, the state of Washington has concluded that this Proposed Plan fulfills its seven standards for a final remedy:

1. Protect human health and the environment.
2. Comply with the cleanup standards.
3. Comply with applicable state and federal laws.

4. Provide for compliance monitoring.
5. Use the permanent solution to the maximum extent practicable.
6. Provide for a reasonable restoration timeframe.
7. Consider public concerns.

COMMUNITY PARTICIPATION

Public input is a key element in the DOE's decision-making process. Tribal Nations and the public are encouraged to read and provide comments on any of the alternatives presented in this Proposed Plan, including the preferred alternatives. The public comment period for this Proposed Plan extends from MMMM DD, 2010, through MMMM DD, 2010. Comments on the preferred alternatives, other alternatives, or any element of this Proposed Plan will be accepted through MMMM DD, 2010. Comments are sent to:

Paula Call, Department of Energy, Richland Operations Office
Mail: P.O. Box 550, A7-75
Richland, WA 99352
Fax: 509.372.3548
Email: xxxxxxx@rl.gov

At this time, no public meeting has been scheduled. To request a meeting in your area, please contact Paula Call no later than MMMM DD, 2010.

After the public comment period, DOE will consider the comments regarding the Proposed Plan and information gathered during the comment period and then make a decision. The preferred alternatives could be modified or another alternative selected. The DOE and EPA will then prepare a CERCLA ROD. This ROD will identify the chosen alternative (i.e., remedy) and include a responsiveness summary containing agency responses to the comments received during the public comment period.

(Month) Public Comment Period						
SUN	**MON**	**TUE**	**WED**	**THU**	**FRI**	**SAT**
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	28	30	31			

Location of Public Information Repositories

Hanford Public Information Repository Locations

Administrative Record and Public Information Repository:
2440 Stevens Center Place,
Room 1101, Richland, WA
Phone: 509-376-2530
Web site address:
http://www2.hanford.gov/arpir/

Portland
Portland State University
Bradford Price and Millar Library
1975 SW Park Avenue
Portland, OR
Attn: Claudia Weston (503) 725-4542
Map: http://www.pdx.edu/map.html

Seattle
University of Washington
Suzallo Library
Government Publications Division
Seattle, WA
Attn: David Maack (206) 543-4664
Map: http://tinyurl.com/m8ebj

Richland
U.S. Department of Energy Public Reading Room
Washington State University, Tri-Cities
Consolidated Information Center,
Room 101-L
2770 University Drive, Richland, WA
Attn: Janice Parthree (509) 372-7443
Map: http://tinyurl.com/2axam2

Spokane
Gonzaga University Foley Center
East 502 Boone, Spokane, WA
Attn: Linda Pierce (509) 323-3834
Map: http://tinyurl.com/2c6bpm

SIDEBAR ITEMS

Administrative Record: The collection of information, including reports, public comments, and correspondence, used by the Agencies to select or modify an interim or final remedial action. A list of locations where the Administrative Record is available appears in the Community Participation section of this Proposed Plan.

Applicable or Relevant and Appropriate Requirements (ARARs): ARARs represent the body of federal and state laws, regulations, and standards governing environmental protection and facility siting that are either applicable or relevant and appropriate for the situation and must be met when cleaning up sites.

Baseline Risk Assessment: A study that identifies which contaminants are present in an area and assesses the risk they pose to human health and the environment if no remedial action is taken.

Community Relations Plan: The Community Relations Plan outlines the public participation processes implemented by the Tri-Parties under authority of the Tri-Party Agreement, and identifies several ways the public can participate in the Hanford Site cleanup decision-making process.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 **(CERCLA):** Also known as the Superfund Act, CERCLA is the federal law that establishes a program to identify, evaluate, and remediate sites where hazardous substances may have been released (e.g., leaked, spilled, or dumped) to the environment.

Contaminant of Concern (COC): A radionuclide or a chemical that exceeds risk threshold values in the BRA.

Contaminant of Potential Concern (COPC): COPCs are hazardous substances that have been found, or are likely to be present in waste site or groundwater operable units that could cause adverse health effects to receptors. The effects are dependent upon the amount of the contaminant present, the toxicity of the contaminant, and how the contaminant is contacted. COPCs are evaluated to develop a list of contaminants that should be considered for remediation and to screen out contaminants that are unlikely to be a threat to human health and the environment.

Crib, Tile Field, and French Drain: A near-surface underground structure designed to receive liquid waste that can percolate directly into the soil.

Debris: Building or construction material that has been demolished.

Environmental Restoration Disposal Facility (ERDF): The ERDF is the Hanford Site's state and federally approved disposal facility for most hazardous (radioactive and non-radioactive) waste and contaminated environmental media generated under a CERCLA response action.

Evapotranspiration: The portion of precipitation returned to the air through direct evaporation and by transpiration of vegetation.

Excess Lifetime Cancer Risk (ELCR): An individual experiencing the reasonable maximum exposure has (for the Hanford Site) a less than 1 in 10,000 chance of developing cancer as a result of site-related exposure.

Hazard Quotient: A hazard quotient is a numerical expression that indicates whether the concentration of a chemical is likely to result in specific adverse effects.

In Situ Vitrification (ISV): ISV is a process that converts contaminated soil into glass using high temperatures, producing an unleachable medium that prevents release of contaminants to the environment.

Injection/Reverse Well: A well designed to receive liquid waste that will percolate into the vadose zone.

Institutional Controls (IC): Administrative measures to protect human health and the environment from exposure to contamination. Institutional controls are maintained until requirements are met for safe, unrestricted land use.

***Model Toxics Control Act*:** The Model Toxics Control Act (RCW 70.105D) provides state standards that set cleanup regulations (WAC 173-340) for protection of human health and the environment. The standards and requirements established to implement the Act are published in Chapter 173-340 of the WAC.

***National Environmental Policy Act of 1969* (NEPA):** The National Environmental Policy Act (NEPA) is a U.S. environmental law that requires federal agencies to integrate environmental values into their decision-making processes by considering the environmental impacts of their proposed actions and reasonable alternatives to those actions.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP): The first National Contingency Plan (NCP) was developed and published in 1968 to cope with potential spills in U.S. waters. Following the passage of Superfund legislation in 1980, the NCP was expanded to include the regulations covering releases at hazardous substance sites. In 1994, the NCP was revised to mirror the oil spill provisions of the *Oil Pollution Act of 1990*.

National Priorities List (NPL): A formal list of release/priority hazardous waste sites in the U.S., which are eligible for investigation and possible remediation (cleanup) under Superfund, also known as CERCLA (40 CFR 300, Appendix B). Sites are included on the list because of their potential risk to human health and the environment.

No Action: Sites that can be released for unrestricted land use because they pose no unacceptable risk. A No Action alternative is required to be considered under CERCLA. It can include monitoring.

Operable Unit (OU): A group of land disposal sites placed together for the purpose of performing a remedial investigation and feasibility study and subsequent cleanup actions. The primary criteria for placing a site into an operable unit include geographic proximity, similarity of waste characteristics and site type, and the possibility for economies of scale.

Plutonium : Plutonium is a toxic, heavy, radioactive metallic element; atomic number 94. There are 15 isotopes of plutonium; plutonium-239 is the most important isotope as it is fissile and is used in nuclear weapons and some reactors. Hanford plutonium was used in the first nuclear test explosion, Trinity, and in the atomic bomb dropped on Nagasaki, Japan, in 1945. Plutonium production at the Hanford Site formally ended in 1990. Plutonium has an extremely long half-life (~ 24,100 years) and is not mobile under current site conditions.

Plutonium and Uranium Extraction (PUREX) Plant: Also known as "A" Plant, PUREX was a separation process to recover plutonium and uranium that began operation in late 1955 and ran continuously until 1972. The plant was restarted in 1983 and ran intermittently until 1988.

Plutonium Finishing Plant (PFP): Also known as Z Plant, the PFP began operations in late 1949 to process plutonium nitrate solutions into plutonium oxide, plutonium nitrate, and plutonium metal. The PFP was also used to fabricate plutonium and for reprocessing scrap plutonium.

Plutonium Reclamation Facility (PRF): A facility for plutonium scrap recovery and solvent extraction purification processes.

Preferred Alternative: The remedial action selected after an evaluation of all alternatives that is protective of human health and the environment.

Preliminary Remediation Goal (PRG): A PRG is a risk-based value for specific contaminant and exposure pathways that establish contaminant concentrations that are protective of human health and the environment. PRGs are established during the feasibility study based on scientific information and are used as a target for remedial cleanup goals. Alternatives are developed and evaluated based on how well they meet the goals. Final remediation goals are set in the record of decision and are used during the remediation of a site.

Proposed Plan: Proposed plans are provided to the public by the responsible parties to present the preferred alternative and other alternatives analyzed for remedial actions at specific waste sites. Proposed plans are based on and summarize the remedial investigation/feasibility studies for specific sites.

Radionuclide: An unstable atom that emits excess energy (decays) in the form of radioactivity (rays or particles). Depending on the type and amount of decay, prolonged exposure may be harmful.

Record of Decision (ROD): A ROD is a legally binding public document that identifies the remedy that will be used at a group of sites and why it has been selected. The Responsiveness Summary in the ROD contains the public comments received on the proposed actions and the Agencies' responses.

Recovery of Uranium and Plutonium by Extraction (RECUPLEX): The RECUPLEX was an early batch plutonium purification process, which was replaced in 1964 by the Plutonium Reclamation Facility.

Remedial Action Objective (RAO): A RAO is a medium-specific (e.g., soil) or OU-specific goal for protecting human health and the environment that specifies the contaminant(s) of concern, the exposure route(s) and receptor(s).

Remedial Alternatives: General or specific actions that are evaluated to determine the extent to which they can eliminate or minimize threats posed by contaminants to human health and the environment, comply with environmental laws and regulations, and meet other selection criteria.

Remedial Investigation/Feasibility Study (RI/FS): The RI/FS process as outlined in this Proposed Plan represents the methodology that the Superfund program has established for characterizing the nature and extent of risks posed by uncontrolled hazardous waste sites and for evaluating potential remedial action options.

Remediation/Remedial Action: Actions performed to reduce potential harm to human health and the environment from radioactive or hazardous substances.

Removal, Treatment, and Disposal (RTD): A cleanup method where soil and debris are excavated in such a way that no contaminants above the approved remedial action goals or concentration for direct exposure and groundwater protection remain at the Site. Excavated material is treated (as necessary) and sent to an onsite or offsite engineered facility for disposal.

Soil Vapor Extraction (SVE): SVE is a process that removes volatile organic contaminants in the form of vapors from the soils above the water table. The vapors are removed by applying a vacuum.

Transuranic Waste*:* Waste material containing any alpha-emitting radionuclide with an atomic number greater than 92, a half-life longer than 20 years, and a concentration greater than 100 nCi/g at the time of assay.

Tri-Party Agreement: The U.S. Department of Energy (DOE), U.S. Environmental Protection Agency (EPA), and Washington State Department of Ecology (Ecology) signed the *Hanford Federal Facility Agreement and Consent Order*, or Tri-Party Agreement, on May 15, 1989. The Tri-Party Agreement, as updated and modified through formal change control, is a comprehensive cleanup and compliance agreement for achieving compliance with the CERCLA remedial action provisions and with the Resource Conservation and Recovery Act (RCRA) treatment, storage, and disposal unit regulations and corrective action provisions. More specifically, the Tri-Party Agreement (1) defines and prioritizes CERCLA and RCRA cleanup commitments, (2) establishes responsibilities, (3) provides a basis for budgeting, and (4) reflects a converted goal of achieving full regulatory compliance and remediation, with enforceable milestones.

Unplanned Release (UPR): An unplanned release is an unintentional release, including a spill of hazardous waste or a hazardous substance into the environment.

Vadose Zone and Deep Vadose Zone: The vadose zone is the unsaturated soil column between the land surface and the groundwater. The deep vadose zone is the region below the practical depth of surface remedy influence.

Waste Isolation Pilot Plant (WIPP): The WIPP is DOE's deep geologic repository to permanently dispose of the defense-related transuranic waste, which includes radioactive waste that contains high levels of elements such as plutonium and americium. WIPP is located in the desert outside of Carlsbad, New Mexico, and began disposal operations in 1999.

Waste Sites: Waste sites are contaminated or potentially contaminated sites from past operations. Contamination may be contained in environmental media (e.g., soil, groundwater) or in manmade structures or solid waste (e.g., debris).

REFERENCES

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