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DOE/RL-2004-26
DRAFT A

Proposed Plan for 200-CW-5, 200-CW-2, 200-CW-4 and 200-SC-1 Operable Units (Reissued)

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

United States
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DOE/RL-2004-26
DRAFT A

Proposed Plan for 200-CW-5, 200-CW-2, 200-CW-4 and 200-SC-1 Operable Units (Reissued)

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DOE/RL-2004-26, DRAFT A

PROPOSED PLAN FOR

THE 200-CW-5 (U POND AND Z DITCHES COOLING WATER WASTE GROUP), 200-CW-2 (S POND AND DITCHES COOLING WATER WASTE GROUP), 200-CW-4 (T POND AND DITCHES COOLING WATER WASTE GROUP), AND 200-SC-1 (STEAM CONDENSATE WASTE GROUP) OPERABLE UNITS.

HANFORD SITE
RICHLAND, WASHINGTON
OCTOBER 2004

INTRODUCTION

Environmental cleanup (remedial action) is needed at the 200-CW-5 U Pond and Z-Ditches Cooling Water Waste Group Operable Unit (OU), the 200-CW-2 S Pond and Ditches Cooling Water Waste Group OU, the 200-CW-4 T Pond and Ditches Cooling Water Waste Group OU, and the 200-SC-1 Steam Condensate Waste Group OU. The cleanup is needed to reduce risks to human health and the environment that are posed by contaminated soil and debris.

Remedial action for the 200-CW-5, 200-CW-2, 200-CW-4, and 200-SC-1 OU waste sites, shown in Figures 1 through 3 (at the end of this Proposed Plan), is required by the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA), also known as the Superfund, and by the *Resource Conservation and Liability Act of 1976* (RCRA). This document presents the Proposed Plan for the soil waste sites and associated structures. This document describes six cleanup alternatives and identifies the preferred remedies for the waste sites.

In presenting the remedial alternatives and preferred remedies for these waste sites, this plan references or highlights key information that can be found in greater detail in DOE/RL-2004-24, *Feasibility Study for the 200-CW-5 (U Pond / Z Ditches Cooling Water Waste Group), 200-CW-2 (S Pond and Ditches Cooling Water Waste Group), 200-CW-4 (T Pond and Ditches Cooling Water Waste Group), and 200-SC-1 (Steam Condensate Waste Group) Operable Units*, and other documents contained in the Administrative Record file. These documents may be reviewed to gain a more comprehensive understanding of the history, previous studies, and site descriptions that influence the selection of remedial alternatives and remedies.

This Proposed Plan, which serves as the public notice required by both CERCLA and RCRA, is issued by the U.S. Department of Energy (DOE), U.S. Environmental Protection Agency (EPA), and the Washington State Department of Ecology (Ecology). These three agencies – collectively known as the Tri-Parties – are proposing the preferred alternatives for these waste sites under the authority of CERCLA and RCRA and in accordance with the *Hanford Federal Facility Agreement and Consent Order*, also known as the Tri-Party Agreement (Ecology et. al. 1989).

HOW YOU CAN PARTICIPATE

The Tri-Parties are issuing this document as part of the public participation responsibilities under Section 117(a) of CERCLA. Final remedies will be selected only after the public comment period has ended and the comments received have been reviewed and considered. Therefore, the public is encouraged to review and comment on all of the alternatives presented in this document. If requested, the Tri-Parties will hold a public meeting to explain the content of this Proposed Plan and to obtain comments. Responses to comments will be presented in a responsiveness summary that will be part of the Record of Decision.

The "Community Participation" section of this document provides dates for the public review period and other information regarding public involvement.

Proposed Plan
The plan that presents the preferred alternatives for remedial action of waste sites to the public by the responsible parties. The proposed plan is developed based on the results of feasibility studies performed on the waste sites.

CERCLA
Comprehensive Environmental Response, Compensation, and Liability Act of 1980, commonly known as the Superfund.

Waste Sites
Sites that are contaminated or potentially contaminated from past operations. Contamination may be contained in environmental media, such as soil or groundwater, or in manmade structures or solid waste, such as debris.

RCRA
Resource Conservation and Recovery Act of 1976.

Feasibility Study
The CERCLA document used to evaluate potential remedial alternatives that could be used to address contamination problems.

Administrative Record
The files containing all the documents used to select a response action at a CERCLA remedial action site.

Remedial Alternative
General or specific actions that are evaluated to determine the extent to which they can eliminate or minimize threats to human health and the environment posed by contaminants.

EPA
U.S. Environmental Protection Agency

Ecology
Washington State Department of Ecology

DOE
U.S. Department of Energy

NEPA
National Environmental Policy Act of 1969. A Federal law that establishes a program to prevent and eliminate damage to the environment.

Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement)
An agreement and consent order among DOE, EPA, and Ecology that details the process to be used to address CERCLA, RCRA, and state requirements for cleaning up the Hanford Site.

Remedial Investigation.
A data collection activity under CERCLA that includes sampling and analysis to identify the nature and extent of contaminants at a waste site.

How will Contaminated Groundwater be Addressed?
The remediation of contaminated groundwater that may be beneath the 200-CW-5, 200-CW-2, 200-CW-4, and 200-SC-1 Operable Units will be addressed by the four groundwater operable units at the Hanford Site (200-UP-1 and 200-ZP-1 Operable Units in the 200 West Area and the 200-BP-5 and the 200-PO-1 Operable Units in the 200 East Area).

The DOE also is issuing this Proposed Plan as part of its responsibility under the *National Environmental Policy Act of 1969* (NEPA).

The Tri-Party Agreement addresses the need for the cleanup programs to integrate the requirements of CERCLA and RCRA to provide a standard approach to direct cleanup activities and to ensure that applicable regulatory requirements are met. Details of this integration are provided in Section 5.5 of the Tri-Party Agreement.

Overview of the Proposed Plan

This plan proposes remedial actions for 15 waste sites that are in the 200-CW-5 OU, 9 waste sites in the 200-CW-2 OU, 8 waste sites in the 200-CW-4 OU, and 16 waste sites in the 200-SC-1 OU. These waste sites received cooling water, steam condensate, and chemical sewer waste from several facilities in the 200 East and 200 West Areas. These waste streams consisted of water that ranged from acidic to basic and contained chemical and radiological contaminants.

For these waste sites, this Proposed Plan presents "source control" cleanup actions (in other words, actions that reduce risks by mitigating the source of the contamination). To identify preferred remedies, the Tri-Parties first evaluated the following range of alternatives:

- Alternative 1 – No Action
- Alternative 2 – Maintain Existing Soil Cover, Monitored Natural Attenuation, and Institutional Controls
- Alternative 3 – Removal, Treatment, and Disposal
- Alternative 4 – Capping
- Alternative 5 – Partial Removal, Treatment, and Disposal with Capping
- Alternative 6 – In Situ Vitrification.

Given the varying nature and extent of the contamination at the different waste sites, no single alternative could be applied to all of them. As discussed later in this document, Alternatives 1, 2, 3, and 4 have been identified as preferred alternatives to remediate different waste sites.

The combined present-value cost for implementing the preferred alternatives is estimated to be approximately $263 million. This estimate is based on a feasibility study-level estimate (refined cost estimates will be prepared based on the results of additional sampling and the remedial design; these refined cost estimates will be included in the remedial design report/remedial action work plan to be generated later). Appendix A provides individual present-value costs for each waste site.

The following sections of the Proposed Plan provide information regarding:

- The history of the 200-CW-5, 200-CW-2, 200-CW-4, and 200-SC-1 OUs
- The scope and role of the proposed actions, including strategies used to characterize the waste sites, and regulatory requirements and goals for the remedial actions
- Site risks
- Summaries and evaluations of remedial alternatives
- The preferred alternatives for the different waste sites
- Community participation.

SITE BACKGROUND

Hanford Site

The Hanford Site (Figure 1) is a 1517 km^2 (586-mi^2) Federal facility located in southeastern Washington State along the Columbia River. From 1943 to 1989, the primary mission of the Hanford Site was the production of nuclear materials for national defense. In July 1989, the 100, 200, 300, and 1100 Areas of the Hanford Site were placed on the National Priorities List (NPL) (40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," Appendix B) pursuant to CERCLA.

200 Areas

The 200 Areas are located in the central portion of the Hanford Site and are divided into three main areas: 200 East Area, 200 West Area, and 200 North Area. Operations in the 200 East and 200 West Areas were related to chemical separation, plutonium and uranium recovery, processing of fission products, and waste partitioning. Major chemical processes in the 200 Areas routed high-activity (radioactive) waste streams to systems of large underground tanks called tank farms. Lower activity liquid wastes were discharged to trenches, cribs, drains, and ponds, many of which were unlined. The 200 North Area formerly was used for interim storage and staging of irradiated fuel.

Waste sites in the 200-CW-5, 200-CW-2, 200-CW-4, and 200-SC-1 OUs received liquid waste streams (principally cooling water and steam condensate) containing varying concentrations of radionuclides and/or chemicals. Waste streams were received from six main areas:

- A, S, and T Plants – Performed plutonium separation from irradiated fuel rods.
- B Plant – Performed plutonium separation from irradiated fuel rods. Also carried out recovery of cesium, strontium, and rare earth metals.
- U Plant – Performed uranium recovery.
- Z Plant – Performed americium and plutonium separation and recovery.

The use of very large volumes of cooling water for steam condensation and process vessel cooling resulted in the generation of very large volumes of effluent; more than 90 percent of all liquids discharged to the soil column in the 200 Areas were from cooling water. The cooling water and steam condensate remained entirely separate from contaminated process liquids by physical barriers, which typically were the walls of a heating or cooling pipe coil. Steam and cooling water were circulated through coils inside process vessels to adjust the temperatures in the vessels. After exiting the process vessel, the spent steam was condensed with cooling water. The condensed steam and cooling water were released to plant sewers or piping systems that discharged to ditches and ponds.

Over time, coils that circulated steam and cooling water inside chemical process tanks were known to develop pinholes and hairline cracks because of the corrosive chemicals and high thermal gradients in these tanks. These minor defects usually did not lead to contamination of the steam and cooling water because the pressure

NPL
National Priorities List. A list of top-priority hazardous waste sites in the United States that are eligible for investigation and cleanup under Superfund (40 CFR 300, Appendix B).

CFR
Code of Federal Regulations

How do we know what contaminants are present at the waste site?
Waste sites within the 200 Areas have been characterized through a series of three investigations. (1) A scoping-level investigation (such as DOE/RL-92-05, B Plant Source Aggregate Area Management Study Report). (2) remedial investigations (such as DOE/RL-2000-35, 200-CW-1 Operable Unit Remedial Investigation Report), DOE/RL-2002-42, Remedial Investigation Report for the 200-TW-1 and 200-TW-2 Operable Units (Includes the 200-PW-5 Operable Unit), and 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-SC-1 Steam Condensate Group Operable Units. (3) The application of the analogous sites approach in the feasibility study (DOE/RL-2004-24). All of the representative sites have been sampled; the remaining sites have been characterized through process knowledge.

Ditches and Ponds
Low-level liquid wastes were typically discharged into drainage ditches. The wastes would then flow into one of several settling ponds. Wastes also were conveyed via process sewers and pipelines.

Retention Basins
Liquid wastes sometimes were discharged to retention ns. While the waste was J within the retention basin, workers would sample the liquid waste to determine whether it could be discharged to a ditch or pond.

Crib
An underground structure designed to receive liquid waste that can percolate into the soil directly.

Unplanned Release Area
Areas where accidental discharge of wastes occurred.

Control Structure
Control structures regulated the flow of liquid wastes through pipelines and ditches.

Characterization
Identification of the characteristics of a site through review of existing information and/or npling and analysis of environmental media and materials, to determine the nature and extent of contamination so that informed decisions can be made regarding the level of risk presented by the site, and the protective remedial action that is needed.

in the pipe coils was greater than the pressure in the process or condenser vessels. However, on occasions when the pressure in the coils was reduced or suspended, minor leakage through the flaws led to waste stream contamination. Other accidental releases from causes such as operator error also have contributed to contamination of the effluents discharged to the waste facilities in these OUs. Several waste sites also received sludge removed from retention basins within these OUs.

The waste sites in the 200-CW-5 OU primarily received cooling water from the Z Plant and U Plant and their supporting facilities. The 216-U-10 Pond was the final disposal site for most of these waste streams. The pond received 165 billion liters of water between 1944 and 1985 from a number of facilities by way of the 216-U-14 Ditch and the Z-Ditches.

The 200-CW-2 OU waste sites include steam condensate and cooling water disposal sites primarily used by operations conducted at the S Plant. The volume of waste directed to these OU waste sites is unknown.

Waste sites within the 200-CW-4 OU include the cooling water waste disposal sites used for the various activities and processes conducted at the T Plant complex. The waste streams were collected in the 207-T Retention Basin and discharged to the 216-T-4A and 216-T-4B Ponds by way of the 216-T-4-1 and 216-T-4-2 Ditches. More than 42 billion liters of liquids went to the ground at the 216-T-4A Pond and 216-T-4-1 Ditch between 1944 and 1972, while unknown, but much smaller, quantities of effluents were discharged to the 216-T-4B Pond and 216-T-4-2 Ditch.

Waste sites within the 200-SC-1 OU consist of cribs, retention basins, unplanned releases, pipelines, and control structures that received or transported steam condensate from a number of the large processing facilities in the 200 Areas. The volume of waste generated from these OU waste sites is unknown.

Additional background information on the history of operations, important waste-generating processes, and liquid waste disposal practices at the various processing areas is provided in the feasibility study (DOE/RL-2004-24).

SCOPE AND ROLE OF ACTION

This Proposed Plan presents remedial actions for contaminated soil, structures (such as concrete, retention basins), and debris (such as timbers) associated with liquid-waste disposal sites within the 200-CW-5, 200-CW-2, 200-CW-4, and 200-SC-1 OUs. The proposed remedial actions reduce potential threats to human health and the environment from waste site contaminants. Other than the requirement for the source control action to be protective of groundwater, the scope of this plan does not include remediation of groundwater that may be beneath these waste sites.

The scope and role, including identifying strategies and determining the requirements, limits, and goals for cleanup, are key elements of the action. These elements are discussed in the following sections. A key component of the overall strategy for actions in these OUs includes cleanup of waste sites, structures, and pipelines that represent some of the more highly contaminated waste sites at the Hanford Site. Measures will be employed to ensure that remediation is conducted in a cost-effective and integrated manner.

Analogous Site Approach

The characterization of the waste sites discussed in this plan employed the use of a streamlining process, called the analogous site approach. As detailed in DOE/RL-98-28, *200 Areas Remedial Investigation/Feasibility Study Implementation Plan – Environmental Restoration Program*, the analogous site approach streamlines the risk investigation process through the development of conceptual site models. Generated from sampling and analysis data for the representative sites, the conceptual site models form a basis for estimating risks and evaluating remedial alternatives for other waste sites. Thus, the waste sites identified in this Proposed Plan either have been sampled directly or were evaluated with the use of conceptual site models from representative sites that were sampled. However, additional sampling data will be collected concurrently with or after the Record of Decision (ROD) for these waste sites:

- Waste sites where no action was selected as the preferred remedy – Data collection will be conducted to verify that remediation goals have been met and that residual risk is at acceptable levels.
- Waste sites where maintain existing soil cover, monitored natural attenuation, and institutional controls was selected as the preferred remedy – Data collection will be conducted to confirm the site conceptual model.
- Waste sites where removal, treatment, and disposal was selected as the preferred remedy – Data collection will occur using an observational approach; samples will be taken from the open excavation as the removal progresses.
- Waste sites where capping was selected as the preferred alternative – Data collection will be conducted to support design activities, as well as to confirm the site conceptual model.
- Waste sites where partial removal, treatment, and disposal with capping was selected as the preferred remedy – Data collection will occur using an observational approach; samples will be taken from the open excavation as the removal progresses. Additional data collection may be conducted as necessary to support design activities for the capping portion of the alternative.
- Waste sites where in situ vitrification was selected as the preferred alternative – Data collection will be conducted to support design activities and to confirm the site conceptual model. If a cap over the vitrified material is needed, additional data collection may be conducted as necessary to support design activities for the capping portion of the alternative.

Representative Waste Sites and Conceptual Site Models

The conceptual site models used to characterize the waste sites evaluated in this plan were developed from sampling data taken from representative waste sites. The representative sites include the 216-U-10 Pond, the 216-U-14 Ditch, the 216-Z-11 Ditch, the 216-A-25 Pond, and the 216-T-26 Crib.

Table 1 identifies the representative sites, the analogous sites, and the rationale for applying the representative waste sites conceptual models to the analogous site. Appendix B provides summary information for all the waste sites.

Land Use

Part of the scope for the evaluations presented in this document involved calculating the site risks based on the reasonably anticipated future land use for the

Analogous Site Approach

Facilities have waste sites that are geologically similar, have similar process and waste disposal histories, and have similar contaminant inventories. In these situations, the analogous site approach can be used to reduce the amount of site characterization required to support remedial action decision making. Within each group of similar sites, a representative site(s) is selected for comprehensive field investigations, including sampling and analyses. Findings from site investigations at representative sites are used to develop a conceptual site model, which is applied to other "analogous" sites that were not sampled. The nature and extent of contamination at unsampled analogous sites are assumed to be similar to the nature and extent of contamination described by the conceptual site model for the representative site(s) that was sampled. Confirmatory sampling is completed before the remedial action is designed, to confirm the accuracy of the site conceptual model with respect to the unsampled analogous site.

Table 1. Conceptual Models, Analogous Sites, and Rationale for Application. (3 Pages)

Representative Site Conceptual Model	Analogous Sites	Rationale (Further Information in Appendix B)
216-U-10 Pond	216-S-16P Pond	♦ The waste sites received similar waste (i.e., cooling water from U Plant or S Plant facilities). ♦ The pond received process cooling water and steam from the 202-S Building (only Lobe #1 received 202-S waste). The 216-U-9 Ditch later was connected to the 216-S-16 Ditch to divert overflow from the 216-U-10 Pond to the 216-S-16 Pond.
	216-S-17 Pond	♦ The waste sites received similar waste (i.e., cooling water from U Plant or S Plant facilities). ♦ The pond received process cooling water from the following: 284-W Powerhouse, 231-Z Laboratory, 234-5Z Building, 2723-W Building, 2724-W Building, 221-U Building, 224-U Building, 241-U-110 Condenser Tank, and 242-S Evaporator Facilities via the 216-U-14 Ditch.
	216-T-4A Pond, 216-T-4B Pond	♦ The waste sites received similar waste (i.e., cooling water). ♦ The ponds received 221-T and 224-T process cooling water, 221-T steam condensate, 242-T Evaporator condenser cooling water and steam condensate, 2706-T decontamination waste, and 242-T condenser cooling water.
	216-U-9 Ditch, 216-U-11 Ditch	♦ These waste sites received process cooling water overflow from the 216-U-10 Pond and connect the 216-U-10 Pond with the 216-S-17 Pond. ♦ The contaminant distribution is expected to be very similar between the 216-U-10 Pond and the 216-U-9 and 216-U-11 Ditches because they receive waste from the 216-U-10 Pond.
	216-S-5 Crib, 216-S-6 Crib	♦ The waste sites received similar waste (i.e., cooling water from U Plant or S Plant facilities). ♦ The cribs received Reduction Oxidation Plant steam condensate with a low potential for contamination and process vessel cooling water and steam condensate water from the 202-S Building.
	216-A-6 Crib, 216-A-30 Crib, 216-A-37-2 Crib	♦ The waste sites received similar waste (i.e., cooling water from the 202-A Building). ♦ The cribs received steam condensate, equipment disposal tunnel floor drainage, water-filled door drainage, and slug storage basin overflow waste from the 202-A Building. The 216-A-6 Crib was used in conjunction with the 216-A-30 Crib.
	216-S-25 Crib	♦ The waste sites received similar waste (i.e., cooling water from U Plant or S Plant facilities). ♦ The crib received 242-S Evaporator process steam condensate and 216-U-1 and 216-U-2 groundwater pump-and-treat effluents.
	216-B-55 Crib	♦ The waste sites received similar waste (i.e., cooling water or steam condensate). ♦ The crib received steam condensate from the 221-B Building.
	216-S-172 Control Structure, 2904-S-160 Control Structure, 2904-S-170 Control Structure, 207-S Retention Basin	♦ The waste sites received similar waste (i.e., cooling water from U Plant or S Plant facilities). ♦ These waste sites received process cooling water and steam from the 202-S Building, to the 216-S-17 Pond and 216-S-16 Pond.
	2904-S-171 Control Structure	♦ The waste sites received similar waste (i.e., cooling water from U Plant or S Plant facilities). ♦ The control structure was used to measure and regulate the flow of process cooling water that was being routed to the 216-S-6 Crib.
	216-B-64 Retention Basin	♦ The unit has not been used except for an initial test. The source of effluent was planned to be diverted steam condensate from the 221-B Building; however, the basin never received waste.

Table 1. Conceptual Models, Analogous Sites, and Rationale for Application. (3 Pages)

Representative Site Conceptual Model	Analogous Sites	Rationale (Further Information in Appendix B)
	200-E-113 Process Sewer	♦ The waste sites received similar waste (i.e., cooling water or steam condensate). ♦ The process sewer transported steam condensate waste from the Plutonium-Uranium Extraction Plant to the 216-A-30 Crib or 216-A-6 Crib. Waste received is associated with the steel pipeline and adjacent contaminated soil from pipe leaks.
	UPR-200-E-19, UPR-200-E-21, UPR-200-E-29	♦ The waste sites received similar waste (i.e., cooling water or steam condensate). ♦ The source of the unplanned releases was 216-A-6 Crib steam condensate.
	UPR-200-W-124	♦ The waste sites received similar waste (i.e., cooling water from U Plant or S Plant facilities). ♦ The source of this unplanned release was cooling water from the 202-S Processing Facility.
216-U-14 Ditch	216-S-16D Ditch	♦ The waste sites received similar waste (i.e., cooling water from U Plant or S Plant facilities). ♦ The ditch connected the 202-S Building to the 216-S-16 Pond and 216-U-16 Pond. Contaminant inventory is included in the 216-S-16 Pond inventory.
	216-T-1 Ditch	♦ The waste sites received similar waste (i.e., cooling water or steam condensate). ♦ The ditch received miscellaneous waste from pilot experiments, decontamination waste, other waste from the 221-T Building, 271-T blow-down vessel cooling water, 221-T condensate from steam-heated radiators, and sodium hydroxide wash water (nonradioactive).
	216-T-4-1D Ditch	♦ The waste sites received similar waste (i.e., cooling water or steam condensate). ♦ The ditch received process cooling water from the 221-T and 224-T Buildings via the 207-T Retention Basin, steam condensate from the 221-T Building and 242-T Evaporator, and decontamination waste from the 2706-T Building.
	216-T-4-2 Ditch	♦ The waste sites received similar waste (i.e., cooling water or steam condensate). ♦ The ditch received 242-T Evaporator steam condensate and condenser cooling water, and nonradioactive wastewater from the 221-T Building air conditioning filter units and floor drains.
	216-W-LWC Crib, 200-W-102 Process Sewer	♦ The waste sites received similar waste (i.e., cooling water or steam condensate). ♦ The process sewer transported waste from the 216-W-LWC Crib and the 2723-W and 2724-W Laundry and Mask Cleaning Facilities to the 216-U-14 Ditch.
	207-U Retention Basin	♦ The waste sites received similar waste (i.e., cooling water from U Plant facilities). ♦ The retention basin received waste from the 221-U and 224-U Facilities where it was held for sampling and discharged to the 216-U-10 Pond via the 216-U-14 Ditch. The 207-U Retention Basin has been modified (by plugging the outlet line), converting the function of the basin into an evaporation pond to support receipt of 224-U Building and grounds storm water runoff.

Table 1. Conceptual Models, Analogous Sites, and Rationale for Application. (3 Pages)

Representative Site Conceptual Model	Analogous Sites	Rationale (Further Information in Appendix B)
	207-T Retention Basin	♦ The waste sites received similar waste (i.e., cooling water or steam condensate). ♦ The retention basin received T Plant process cooling and ventilation steam condensate, process cooling water from equipment jackets in 221-T and 224-T evaporator cooling water, and flow from the 221-TA Building via the 216-T-4-2 Ditch.
	216-T-12 Trench	♦ The waste sites received similar waste (i.e., cooling water or steam condensate). ♦ This waste site received contaminated sludge from the 207-T Retention Basin.
	200-W-84 Process Sewer	♦ The waste sites received similar waste (i.e., cooling water from U Plant facilities). ♦ The process sewer transported 221-U Plant process sewer waste to the 216-U-14 Ditch.
	200-W-88 Process Sewer	♦ The waste sites received similar waste (i.e., cooling water or steam condensate). ♦ The process sewer received cooling water, air conditioning condensate, and floor drain waste from 221-T, 224-T, and 242-T. The pipelines are associated with 221-T and 207-T.
	UPR-200-W-111, UPR-W-112	♦ The waste sites received similar waste (i.e., cooling water from U Plant facilities). ♦ These unplanned release areas received sludge removed from the 207-U Retention Basin.
216-Z-11 Ditch	216-Z-1D Ditch, 216-Z-19 Ditch, 216-Z-20 Crib, UPR 200-W-110	♦ The waste sites received similar waste (i.e., cooling water or steam condensate). ♦ These waste sites received waste from the Plutonium Finishing Plant 231-Z, 234-5Z, and 291-Z process sewers.
	207-Z Retention Basin	♦ The waste sites received similar waste (i.e., cooling water or steam condensate). ♦ The retention basin received steam condensate and cooling water from the Z Plant Complex (Plutonium Isolation Facility, Recovery of Uranium and Plutonium by Extraction Plant, 291-Stack) and released it to the 216-Z-1D and 216-Z-11 Ditches.
216-A-25 Pond	207-A North Retention Basin	♦ The waste sites received similar waste (i.e., cooling water or steam condensate). ♦ This waste site received steam condensate from the 242-A Evaporator, and then the waste was transferred to the 216-A 25 Crib or the 216-B-3 Pond.
216-T-26 Crib	216-T-36 Crib	♦ The waste sites received similar waste (i.e., cooling water or steam condensate). ♦ The crib received steam condensate, decontamination waste, and miscellaneous waste from the 221-T and 221-U Buildings, and 2706-T Building decontamination waste. The 216-T-36 Crib replaced the 216-T-26 Crib.
	200-W-79 Pipeline	♦ The waste sites received similar waste (i.e., cooling water or steam condensate). ♦ This waste site received waste from T Plant and U Plant effluent discharges to the 241-T-151 Diversion Box, then the 216-T-36 Crib.

Central Plateau of the Hanford Sites, which includes the 200 Areas. Alternatives address the requirements of the following anticipated land uses:

- Industrial-exclusive use for the next 50 years (through 2054) inside the core zone
- Industrial land use (non-DOE worker) after the next 50 years inside the core zone
- Native American uses consistent with treaty rights.
- No consumptive use of groundwater for the next 500 years.

In addition, risks were calculated considering the possibility of intruders beginning 150 years from now (2154) and continued until 2504 because of the increasingly possible loss of institutional control after that date. All the waste sites in these OUs are within the core zone.

These human risk exposure scenarios are consistent with the Hanford Advisory Board (HAB) Advice #132 (http://www.hanford.gov/boards/hab/advice/habadv-132.pdf). The scenarios also are consistent with the Tri-Party's identification of the use of a 150-year time frame in their response to the HAB Advice #132 (Klein et al. 2002, "Consensus Advice #132: Exposure Scenario Task Force on the 200 Area"). The DOE is expected to continue industrial-exclusive activities for at least 50 years, in accordance with DOE/EIS-0222-F, *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement* (HCP), and 64 FR 61615, "Record of Decision: Hanford Comprehensive Land-Use Plan Environmental Impact Statement."

Applicable or Relevant and Appropriate Requirements

Applicable or relevant and appropriate requirements (ARAR) are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations activated into law under Federal or state law that:

- Specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site
- Address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well-suited to the particular site.

The feasibility study addresses the ARARs for the waste sites in detail. As discussed in the following paragraphs, these ARARs are incorporated into the remedial action objectives (RAO) and preliminary remediation goals (PRG) that drive the evaluation of alternatives and the selection of preferred remedies.

Key ARARs identified for the remedy of these waste sites are as follows:

- WAC 173-340-745, "Soil Cleanup Standards for Industrial Properties"
- WAC 173-340-747, "Deriving Soil Concentrations for Ground Water Protection Evaluations."

Remedial Action Objectives

The RAOs for the waste sites were developed with consideration of reasonably anticipated future land use, conceptual site models, ARARs, and worker safety. The following RAOs were identified:

- RAO 1 – Prevent or mitigate risk to human health, ecological receptors, and natural resources associated with exposure to wastes or soil contaminated above potential ARARs or risk-based criteria by removing the source or eliminating the pathway.

ROD
Record of Decision. The formal document under CERCLA or NEPA in which the lead regulatory agency sets forth the selected remedial measure and provides the reasons for its selection.

Confirmatory Sampling
Sampling before or after the Record of Decision, but before the remedial design is completed, to confirm the accuracy of the conceptual site model used for remedial decision making.

HCP
Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement – DOE/EIS-0222-F

Industrial-Exclusive
A land-use designation under the HCP that applies to the 200 Areas core zone. Under this land-use designation, waste management activities would continue. This land use assumes an industrial worker scenario. This is an exposure scenario where the receptor works onsite on a full-time basis The designation assumes the land use at the 200 Area exposure pathways evaluated includes direct exposure to radiation, incidental ingestion of soil, and inhalation of resuspended dust and volatile constituents (exposure to groundwater is not considered).

Core Zone
The area in the middle of the Central Plateau that contains the current and future waste management activities (see Figure 1).

ARAR
'pplicable or relevant and ,ppropriate requirements. These cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or state law specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site.

PRG
Preliminary remediation goals. These are initial cleanup levels that are developed during the CERCLA decision-making process. PRGs may be refined in the Record of Decision to become final cleanup levels (that is, the remediation goals). A complete discussion of the PRGs is presented in the feasibility study DOE/RL-2004-24).

WAC
Washington Administrative Code

RAO
Remedial action objectives. These are general descriptions of what the remedial action will accomplish (such as prevent contaminant migration).

HI
Hazard Index is the sum of the ratios of contaminant exposure levels to the reference (regulatory) exposure level.

- RAO 2 - Mitigate migration of contaminants through the soil column to groundwater such that no further degradation of groundwater occurs because of leaching from soils in the waste sites.
- RAO 3 - Prevent migration of contaminants through the soil column to groundwater or reduce soil concentrations below WAC 173-340-747 groundwater protection criteria so that no further degradation of the groundwater occurs from contaminant leaching from soils.
- RAO 4 - Prevent destruction of significant cultural resources and sensitive wildlife habitat. Minimize the disruption of cultural resources and wildlife habitat in general and prevent adverse impacts to cultural resources and threatened or endangered species.
- RAO 5 - Provide conditions suitable for future industrial land use of the study area, including appropriate institutional controls and monitoring requirements, to reduce exposure to 15 mrem/yr or less for industrial workers.

These RAOs were used to develop the PRGs discussed in the next section, and will be finalized in the ROD.

Preliminary Remediation Goals

As described in the feasibility study, PRGs were developed for a comprehensive list of constituents to establish residual soil concentrations for individual contaminants that are protective of human health and the environment. The feasibility study screening process compared the observed constituent concentrations at the waste sites to the following concentrations:

- Naturally occurring levels
- Radiological dose exposure limits
- Cleanup levels consistent with WAC 173-340-745 and WAC 173-340-747
- Screening levels consistent with WAC 173-340-900, "Tables," Table 749-3.

Table 2 summarizes the PRGs for the contaminants of concern (COC) retained as part of this Proposed Plan. After public comment, the PRGs will be issued in the ROD for these waste sites as remediation goals or cleanup levels. Only those constituents that exceed one or more of a given criterion were retained as COCs. Numeric soil PRGs were developed independently for the protection of human health, the protection of ecological receptors, and the protection of groundwater. These PRGs, which were based on site parameters, then were compared to each other to identify the most restrictive value and select a PRG that is protective of all pathways. Although PRGs were developed for each potential contaminant, it should be emphasized that contaminants with PRGs will not necessarily be found at each waste site.

SUMMARY OF REMEDIATION OBJECTIVES

The human health and ecological risk assessments, which are fundamental to the scope and role of the actions in this Proposed Plan, were performed in accordance with the Tri-Parties response to HAB Advice #132 (Klein et al. 2002), with EPA guidance for conducting human health and ecological risk assessments, and with DOE/RL-91-40, *Hanford Past-Practice Strategy*. The past-practice strategy approach focuses the pre-remediation studies, such as remedial investigations, so that more resources can be allocated to the cleanup of waste sites. A conceptual site model was developed for the representative sites. Potential risks to human health and ecological receptors were evaluated in a risk assessment for the representative sites, as documented in the feasibility study (DOE/RL-2004-24).

Table 2. Summary of Soil Preliminary Remediation Goals.

Constituent	Overall PRG[a]	Constituent	Overall PRG[a]
216-U-10 Pond			
Cadmium	1.0 mg/kg	Cesium-137	20 pCi/g
Cyanide	0.8 mg/kg	Selenium-79	1.3 pCi/g
Selenium	0.3 mg/kg	Strontium-90	20 pCi/g
Manganese	512 mg/kg	Technetium-99	7.6 pCi/g
Uranium (total)	3.21 mg/kg	Uranium-233/234/235/238	(c)
Europium-154	10.3 pCi/g	--	--
216-U-14 Ditch			
Sulfate	1,000 mg/kg	Uranium-233/234/235/238	(c)
Cesium-137	20 pCi/g	Technetium-99	4.2 pCi/g
216-Z-11 Ditch			
Americium-241	335 pCi/g	Radium-226	7.03 pCi/g
Cesium-137	21 pCi/g	Nitrite	13 mg/kg
Plutonium-239	425 pCi/g	PCB (Aroclor-1254)	0.99 mg/kg
Plutonium-239/240	425 pCi/g	--	--
216-A-25 Pond			
Cesium-137	20 pCi/g	Strontium-90	20 pCi/g
216-T-26 Crib			
Cyanide	0.8 mg/kg	Plutonium-239/240	15,000
Nitrate (as nitrogen)	40 mg/kg	Uranium-233/234/238	(c)
Nitrite (as nitrogen)	4 mg/kg	Technetium-99	(c)
Americium-241	11,000 pCi/g	Strontium-90	220,000 pCi/g
Cesium-137	11,000 pCi/g	--	--

[a]Listed values represent the most restrictive soil PRG derived from evaluation of direct contact, groundwater protection, and terrestrial wildlife protection in accordance with DOE/RL-2004-24, *Feasibility Study for the 200-CW-5 (U Pond and Z Ditches Cooling Water Waste Group), 200-CW-2 (S Pond and Ditches Cooling Water Waste Group), 200-CW-4 (T Pond and Ditches Cooling Water Waste Group), and 200-SC-1 (Steam Condensate Waste Group) Operable Units.*

[b]Modeling predicts that this contaminant will not exceed groundwater MCL at this site.

[c]Constituent is considered mobile. The protection of groundwater is evaluated using fate and transport modeling based on site-specific conditions. Therefore, it is not possible to state PRG as a soil concentration. Modeling predicts that this contaminant will exceed groundwater MCL at this site.

MCL = maximum concentration limit.
mg = milligram.
pCi/g = picocurie/gram.
PCB = polychlorinated biphenyl.
PRG = preliminary remediation goal.

COC
Contaminants of concern. A list of radioactive and/or chemical constituents that are a risk to human health or the ... ironment.

Human Health Risk
Human health risk is evaluated in the feasibility study using an industrial land-use scenario. Risks are evaluated using contaminants in the soil from the ground surface to 4.6 m (15 ft) below the ground surface.

Groundwater Protection Risk Evaluation
Groundwater protection is evaluated for contaminants in the soil from the ground surface to the water table. This evaluation uses fate and transport modeling and comparison to risk-based standards to assess the potential for contaminants in the vadose zone to continue to impact groundwater or to impact groundwater in the future.

Ecological Risk ...ssessment
Ecological risk is evaluated for contaminants in the soil from the ground surface to 4.6 m (15 ft) deep. In the feasibility study, the contaminant concentrations in this zone are compared to risk-based screening levels.

Inadvertent Intruder Scenario
An exposure scenario in which the receptor (future rural residential intruder) resides within the waste site area and has planted a garden using the drill cuttings taken from a borehole drilled in that area. The scenario assumes that after 500 years of institutional controls, the intruder could unknowingly obtain access to the waste site area. Exposure pathways evaluated include direct exposure to radiation, ingestion of soil and garden produce, and inhalation of resuspended dust.

The Tri-Parties believe that remedial action is necessary at the waste sites addressed by this plan to protect the public health and welfare or the environment from actual or threatened releases of hazardous substances into the environment. Such a release, or threat of release, may present an imminent and substantial danger to public health, welfare, or the environment.

SUMMARY OF SITE RISKS

Risks were estimated based on the RAOs and in accordance with the Tri-Party response to HAB advice #132 (Klein et al. 2002, "Consensus Advice #132: Exposure Scenarios Task Force on the 200 Area"). The HAB advice was prepared subsequent to a series of Tri-Party- and HAB-sponsored public workshops. The Tri-Parties agreed to assess risks for the core zone of the 200 Areas using an industrial exposure scenario. The exposure scenario includes the assumption that groundwater under the 200 Areas will not be used for the foreseeable future. Findings of the risk evaluations indicate the following.

- At all of the representative waste sites except the 216-A-25 Pond and the 216-T-26 Crib, radioactive contaminants (e.g., cesium-137 and plutonium-239) exceed the criteria for the target dose of 15 mrem/year to an industrial user after 150 years of institutional control if the waste site cover is removed.
- Nonradionuclide contaminants in and around the representative waste sites are less than the industrial use criteria as defined in WAC 173-340-745(5), "Soil Cleanup Standards for Industrial Properties," "Method C Industrial Soil Cleanup Levels."
- Groundwater protection screening values (as identified in WAC 173-340-747) are exceeded for nonradionuclides and radionuclides at all five of the representative waste sites; however, modeling predicts that soil concentrations at only three of these waste sites (the 216-U-10 Pond, the 216-U-14 Ditch, and the 216-T-26 Crib) present a risk of impacting the underlying groundwater.[1]
- Ecological evaluations indicate that nonradionuclides (e.g., cadmium, selenium) and several radiological constituents (e.g., cesium-137 and strontium-90) exceed the ecological screening values for terrestrial wildlife populations at four of the representative waste sites. However, based on site-specific factors such as the availability of habitat and size of the site, only two of the representative waste sites (the 216-U-10 Pond and 216-A-25 Pond) present potential risks to terrestrial wildlife.
- Post-remediation, inadvertent intruder evaluations indicate that inadvertent intruders would receive doses in excess of 15 mrem/yr at two sites, the 216-Z-11 Ditches and the 216-T-26 Crib.

SUMMARY OF REMEDIAL ALTERNATIVES

As discussed in the feasibility study (DOE/RL-2004-24), remedial technologies were identified and evaluated based on their ability to reduce potential risks to human health and the environment at the waste sites. Collective experience gained from previous studies and evaluations of cleanup methods at the Hanford Site were used to identify

[1] A dose limit of 15 mrem/year generally will achieve the U.S. Environmental Protection Agency excess lifetime cancer risk threshold, which ranges between 1×10^{-6} to 1×10^{-4}.

technologies that would be carried forward to develop remedial alternatives to address the RAOs. For the waste sites, six remedial alternatives were identified for detailed and comparative analyses. The alternatives evaluated in the feasibility study consist of the following.

- **Alternative 1: No Action.** When this alternative is selected, no further action is taken at the site.
- **Alternative 2: Maintain Existing Soil Cover, Monitored Natural Attenuation, and Institutional Controls.** When this alternative is selected, existing soil covers (for example, the current soils that have been placed over the waste site to stabilize it, as well as the clean fill placed during construction of the waste site) are maintained as needed to continue to provide protection from intrusion by biological receptors and humans. In addition, institutional controls (such as deed restrictions, land use zoning, barriers, and excavation permits) are put in place to further prevent human access to the site. Where appropriate, monitored natural attenuation (such as the decay of radionuclides) is accounted for because this is an ongoing process that reduces risk over time. Monitoring would be conducted to demonstrate that natural attenuation is occurring and that contamination is being contained as the concentrations decrease.
- **Alternative 3: Removal, Treatment, and Disposal.** When this alternative is selected, soil and structures with constituent concentrations greater than the PRGs are excavated, using the observational approach. Because contamination levels at the majority of the waste sites pose a significant dose threat to workers, conventional techniques cannot be used for excavation activities. To excavate these waste sites, additional protections are required to protect the workers, the environment in the area, and the public that could be exposed near roads or facilities. These extra protections slow the excavation process and increase the cost. Excavated material that contains concentrations greater than the PRGs will be containerized on site and transported to the Environmental Restoration Disposal Facility (ERDF) for disposal in accordance with that facility's established waste acceptance criteria. Any material that exceeds the disposal facility waste acceptance criteria would be stored on site (consistent with storage requirements) until the material is treated to meet ERDF waste acceptance criteria. In the case of waste with greater than 100 nanocuries per gram (nci/g) transuranic constituents, this waste will be stored until the material can be shipped to an appropriate facility, such as the Waste Isolation Pilot Plant (WIPP). The contaminated material is characterized and segregated during the excavation process and before being transported for disposal. Excavation would continue until all contaminated material exceeding the cleanup goal was removed. The site then would be backfilled with clean material.
- **Alternative 4: Capping.** When this alternative is selected, a surface barrier (such as a Hanford Barrier or an evapotranspiration barrier) is built over the contaminated waste site, thus "capping" the site to prevent water from infiltrating into the waste and to prevent intrusion by human or ecological receptors. Institutional controls (such as deed restrictions, land use zoning, and excavation permits) are required to minimize the potential for exposure to contamination and to ensure the integrity of the cap. Performance monitoring is included as a part of

Institutional Controls
Nonengineered controls, such as administrative and/or legal controls, that minimize the potential for exposure to contamination by limiting land or resource use. The State of Washington also considers physical controls, such as fencing and signs, to be institutional controls.

Monitored Natural Attenuation
The monitoring of a decrease in concentration of a contaminant caused by natural processes such as radioactive decay, oxidation/reduction, biodegradation, and/or sorption.

Removal, Treatment, and Disposal
A cleanup method where soil and debris are excavated so that no contaminants remain at the site above the approved remediation goals. Excavated material is treated (as necessary) and sent to an onsite or an offsite engineered facility for disposal.

Observational Approach
A method of planning, designing, and implementing a remedial action that uses a limited amount of initial field sampling data to create a general understanding of the site conditions sufficient to proceed with cleanup. For some sites, this method is considered more cost- and time-effective than traditional methods that require large amounts of initial data to make detailed plans and designs for remedial actions.

ERDF
ironmental Restoration posal Facility. This is the Hanford Site's disposal facility for most waste and contaminated environmental media generated under a CERCLA response action.

Waste Acceptance Criteria
The criteria defined for the acceptance of waste for disposal at an engineered disposal facility.

In Situ Vitrification
A waste treatment process where the soil is melted into a glass-like form by applying an electrical current through electrodes installed around the waste. Contaminants are permanently bound into the resulting soil matrix or are destroyed because of the high temperatures associated with the vitrification process.

The Nine CERCLA Criteria
Threshold Criteria:
- Overall protection of human health and the environment
- Compliance with ARARs

Balancing Criteria
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost

Modifying Criteria
- State acceptance
- Community acceptance.

this alternative to ensure that the cap is performing as expected, and groundwater monitoring is included to watch for movement of more mobile contaminants.

- **Alternative 5: Partial Removal, Treatment, and Disposal with Capping.** When this alternative is selected, a portion of the subsurface soil associated with higher contaminant concentrations is removed, thereby reducing the industrial and/or intruder risk and ecological risk associated with the contaminated zone at the bottom of the waste site. This alternative is similar to Alternative 3, except that contaminants are not removed to the same depth as those in Alternative 3. Once the contamination has been removed, a cap similar to the cap described in Alternative 4 would be built in and over the excavation to provide protection to the groundwater from contaminants that remain deeper in the soil column. This alternative would reduce the risks to potential intruders past the assumed 150 years of active institutional controls and would provide protection of the groundwater. Performance monitoring is included as a part of this alternative to ensure that the cap is performing as expected, and groundwater monitoring is included to watch for movement of more mobile contaminants.
- **Alternative 6: In Situ Vitrification.** This alternative is only applicable to the 216-Z-11 Ditch and its analogous sites except the 207-Z Retention Basin. When this alternative is selected, waste site soil associated with higher contaminants is vitrified by inserting electrodes around the waste and applying an electric current sufficient to melt the soil. A glass-like (vitrified) mass would remain in place, thereby reducing the mobility of contaminants within the vitrified mass. Short-term worker risk is minimized by directing any vapors generated from the vitrification process to an onsite offgas treatment system where these vapors are treated and released in a controlled manner. Once the contamination is captured, a simplified cap would be built to provide protection from radiation dose from the vitrified soil. Performance monitoring is included as a part of this alternative to ensure that the remedial action (including the cap) is performing as expected, and groundwater monitoring is included to monitor movement of more mobile contaminants.

CERCLA EVALUATION CRITERIA AND PROCESS

As a critical part of the evaluation process, the alternatives are evaluated against nine CERCLA criteria.

The first two criteria, overall protection of human health and the environment and compliance with ARARs, are **threshold criteria**. Alternatives that do not protect human health and the environment or that do not comply with ARARs (or justify a waiver) do not meet statutory requirements and are eliminated from further consideration in the feasibility study.

The next five criteria (long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost) are **balancing criteria** on which the remedy selection is based.

The final two criteria, state and community acceptance, are **modifying criteria**. In the case of this Proposed Plan, the State already concurs with the proposed alternatives outlined, and the plan identifies the preferred remedies that already have been accepted by the Tri-Parties. A preferred remedy's ability to meet the criterion of community acceptance, however, can be evaluated only after the public review and comment period for this Proposed Plan.

Using the two CERCLA threshold criteria and the five balancing criteria, the following general conclusions may be drawn:

- For waste sites that have a potential to adversely impact groundwater because of contaminants at significant depth, there is a preference for selecting the capping alternative. The selection of an engineered barrier (capping) would minimize the exposure pathways between potential human and environmental receptors and the contaminants and would limit infiltration. This means that the capping alternative would best meet the objective of no further degradation.
- For shallow, low-volume waste sites, there is a preference for the removal, treatment, and disposal alternative to reduce the exposure to and mobility of the contamination via long-term isolation in an onsite regulated disposal facility. In this case, removing the contaminants and placing them in a disposal facility eliminates the exposure pathways to potential human and environmental receptors. This alternative limits long-term stewardship of waste sites.
- For shallow, high-volume waste sites, there is a preference for the capping alternative or the removal, treatment, and disposal alternative, depending on balancing evaluation criteria.
- The partial removal, treatment, and disposal with capping alternative is useful only for sites with both shallow and deep contamination. For such sites, the partial removal, treatment, and disposal with capping alternative would be compared with the capping alternative to determine which alternative best balances the CERCLA criteria.
- For sites with relatively shallow, high concentrations of transuranic radionuclides, there is a preference for selecting the in situ vitrification alternative or the capping alternative, depending on the balancing evaluation criteria.

NEPA values encompass a range of environmental concerns:

- Transportation impacts
- Air quality
- Natural, cultural, and historical resources
- Noise, visual, and aesthetic effects
- Socioeconomic impacts
- Environmental justice
- Cumulative impacts (direct and indirect)
- Mitigation
- Irreversible and irretrievable commitment of resources.

NEPA VALUES

The *Secretarial Policy on the National Environmental Policy Act* (DOE 1994) and DOE O 451.1A, *National Environmental Policy Act Compliance Program*, require that CERCLA documents incorporate NEPA values, such as analysis of cumulative, offsite, ecological, and socioeconomic impacts to the extent practicable, in lieu of preparing separate NEPA documentation for CERCLA activities. The NEPA process is intended to help Federal agencies:

- Make decisions that are based on understanding environmental consequences
- Take actions that protect, restore, and enhance the environment.

The NEPA-related impacts that have been considered for these waste sites include transportation impacts; air quality; natural, cultural, and historical resources; noise, visual, and aesthetic effects; socioeconomic impacts; environmental justice; cumulative impacts (direct and indirect); mitigation; and irreversible and irretrievable commitment of resources. Details of this evaluation are contained in the feasibility study (DOE/RL-2004-24).

SUMMARY OF ALTERNATIVE EVALUATIONS AND PREFERRED ALTERNATIVES

Alternative 4, Capping, is the preferred alternative for representative site 216-U-10 Pond and its analogous sites except as noted below. The contaminants of concern include cadmium, cyanide, manganese, selenium, total uranium, cesium-137, selenium-79, strontium-90, isotopic uranium, and technetium-99.

Alternative 3, Removal, Treatment, and Disposal, is the preferred alternative for all control structures, 207-S Retention Basin and 200-E-113 Process Sewer.

Alternative 1, No Action, is the preferred alternative for analogous waste site 216-B-64 Retention Basin. This alternative is chosen because this retention basin did not receive waste.

The remedial alternatives developed in the feasibility study are evaluated for each representative site and its associated analogous waste sites. CERCLA typically requires evaluation of a "no action" alternative as a baseline for comparison to other alternatives.

Representative Site 216-U-10 Pond and its Analogous Sites

The 216-U-10 Pond is the representative site for the following waste sites:

- 216-S-16P Pond
- 216-S-17 Pond
- 216-T-4A Pond
- 216-T-4B Pond
- 216-U-9 Ditch
- 216-U-11 Ditch
- 216-S-5 Crib
- 216-S-6 Crib
- 216-A-6 Crib
- 216-A-30 Crib
- 216-S-25 Crib
- 216-A-37-2 Crib
- 216-B-55 Crib
- 216-S-172 Control Structure
- 2904-S-160 Control Structure
- 2904-S-170 Control Structure
- 2904-S-171 Control Structure
- 207-S Retention Basin
- 216-B-64 Retention Basin
- 200-E-113 Process Sewer
- UPR-200-E-19
- UPR-200-E-21
- UPR-200-E-29
- UPR-200-W-124

"UPR" is an abbreviation for "Unplanned Release."

The conceptual site model for these sites is presented in Table 1, with further information specific to each waste site provided in Appendix B.

Based on data obtained during past investigations, modeling predicts that groundwater is not protected because cyanide, uranium, selenium-79, and technetium-99 may reach the groundwater in concentrations that exceed Federal standards. The top of the contamination is about 0.6 m (2 ft) below ground surface and extends to a depth of 64 m (210 ft) (see Figure 4). Because a clean soil cover exists at the site, these contaminants do not currently pose a risk to Hanford Site workers; however, these concentrations would pose unacceptable risks if humans (e.g., construction workers) or burrowing animals were to dig into the contaminated soil zone. If no clean cover were present at the representative site, it is estimated that contaminants would take up to 280 years to naturally decrease to levels that would be safe for human and ecological receptors.

ALTERNATIVE EVALUATIONS

The following provides an alternative evaluation discussion specific to each CERCLA criterion. A summary is provided in Table 3. Alternative 6, In Situ Vitrification, does not apply to this representative site and associated analogous sites.

Overall Protection of Human Health and the Environment - Alternative 4, Capping, is chosen as the preferred alternative for the 216-U-10 Pond and its analogous sites except the four control structures, 207-S Retention Basin and 200-E-113 Process Sewer (Alternative 3) and the 216-B-64 Retention Basin (Alternative 1). These waste sites obtain protection of human health and the environment through the implementation of Alternative 4 because of the following.

- The exposure pathway is removed through the placement of a barrier/cap.
- Infiltration is reduced, which supports the protection of groundwater.

Table 3. Preferred Alternative for the Representative Site 216-U-10 Pond and its Analogous Waste Sites.[e] (8 Pages)

Comparison of Alternatives - Representative Site 216-U-10 Pond and Associated Analogous Sites					
	Alternatives				
Criteria for Representative and Analogous Waste Sites	① No Action	② MESC, MNA, IC[a]	③ RTD[b]	④ Capping	⑤ RTD Capping[d]
Representative Site 216-U-10 Pond				☑	
Threshold Criteria					
Overall protection	☐	☐	☑	☑	☑
Compliance with ARARs	☐	☐	☑	☑	☑
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◇	◈
Short-term effectiveness	◈	◈	◇	◆	◈
Reduction in TMV[c]	◇	◇	◆	◇	◈
Implementability	◈	◈	◇	◆	◈
Cost (in thousands)					
Capital costs	$0	$16	$1,811,601	$30,097	$116,300
Non-discounted costs	$0	$666,591	$0	$107,400	$185,157
Total present worth	$0	$13,765	$1,811,601	$46,064	$130,523
Analogous Site 216-S-16P Pond				☑	
Threshold Criteria					
Overall protection	☐	☐	☑	☑	☑
Compliance with ARARs	☐	☐	☑	☑	☑
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◇	◈
Short-term effectiveness	◈	◈	◇	◆	◈
Reduction in TMV	◇	◇	◆	◇	◈
Implementability	◈	◈	◇	◆	◈
Cost (in thousands)					
Capital costs	$0	$17	$1,869,572	$31,120	$122,580
Non-discounted costs	$0	$68,495	$0	$111,047	$195,148
Total present worth	$0	$14,158	$1,869,572	$47,629	$137,569
Analogous Site Group 216-S-17 Pond and UPR-200-W-124				☑	
Threshold Criteria					
Overall protection	☐	☐	☑	☑	☑
Compliance with ARARs	☐	☐	☑	☑	☑
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◇	◈
Short-term effectiveness	◈	◈	◇	◆	◈
Reduction in TMV	◇	◇	◆	◇	◈
Implementability	◈	◈	◇	◆	◈
Cost (in thousands)					
Capital costs	$0	$11	$1,338,773	$21,128	$83,387
Non-discounted costs	$0	$58,692	$0	$75,569	$132,930
Total present worth	$0	$12,146	$1,338,773	$32,389	$93,637

Table 3. Preferred Alternative for the Representative Site 216-U-10 Pond and its Analogous Waste Sites.[e] (8 Pages)

Comparison of Alternatives - Representative Site 216-U-10 Pond and Associated Analogous Sites					
	Alternatives				
Criteria for Representative and Analogous Waste Sites	① No Action	② MESC, MNA, IC[a]	③ RTD[b]	④ Capping	⑤ RTD Capping[d]
Analogous Site 216-T-4A Pond				☑	
Threshold Criteria					
Overall protection	☐	☐	☑	☑	☑
Compliance with ARARs	☐	☐	☑	☑	☑
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◇	◈
Short-term effectiveness	◈	◈	◇	◆	◈
Reduction in TMV	◇	◇	◆	◇	◈
Implementability	◈	◈	◇	◆	◈
Cost (in thousands)					
Capital costs	$0	$13	$1,581,528	$24,890	$98,274
Non-discounted costs	$0	$55,797	$0	$88,805	$156,441
Total present worth	$0	$11,532	$1,581,528	$38,091	$110,287
Analogous Site 216-T-4B Pond				☑	
Threshold Criteria					
Overall protection	☐	☐	☑	☑	☑
Compliance with ARARs	☐	☐	☑	☑	☑
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◇	◈
Short-term effectiveness	◈	◈	◇	◆	◈
Reduction in TMV	◇	◇	◆	◇	◈
Implementability	◈	◈	◇	◆	◈
Cost (in thousands)					
Capital costs	$0	$1	$219,204	$1,505	$6,280
Non-discounted costs	$0	$6,682	$0	$5,460	$10,088
Total present worth	$0	$1,391	$219,204	$2,330	$7,075
Analogous Site 216-U-9 Ditch				☑	
Threshold Criteria					
Overall protection	☐	☐	☑	☑	☑
Compliance with ARARs	☐	☐	☑	☑	☑
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◇	◈
Short-term effectiveness	◈	◈	◇	◆	◈
Reduction in TMV	◇	◇	◆	◇	◈
Implementability	◈	◈	◇	◆	◈
Cost (in thousands)					

Table 3. Preferred Alternative for the Representative Site 216-U-10 Pond and its Analogous Waste Sites.[e] (8 Pages)

Comparison of Alternatives - Representative Site 216-U-10 Pond and Associated Analogous Sites					
	Alternatives				
Criteria for Representative and Analogous Waste Sites	① No Action	② MESC, MNA, IC[a]	③ RTD[b]	④ Capping	⑤ RTD Capping[d]
Capital costs	$0	$0.3	$554,350	$482	$3,605
Non-discounted costs	$0	$4,358	$0	$1,930	$5,870
Total present worth	$0	$915	$554,350	$777	$4,085
Analogous Site 216-U-11 Ditch				☑	
Threshold Criteria					
Overall protection	☐	☐	☑	☑	☑
Compliance with ARARs	☐	☐	☑	☑	☑
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◇	◈
Short-term effectiveness	◈	◈	◇	◆	◈
Reduction in TMV	◇	◇	◆	◇	◈
Implementability	◈	◈	◇	◆	◈
Cost (in thousands)					
Capital costs	$0	$0.4	$699,278	$843	$5,466
Non-discounted costs	$0	$4,980	$0	$3,138	$8,830
Total present worth	$0	$1,043	$699,278	$1,329	$6,173
Analogous Site 216-S-5 Crib				☑	
Threshold Criteria					
Overall protection	☐	☐	☑	☑	☑
Compliance with ARARs	☐	☐	☑	☑	☑
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◇	◈
Short-term effectiveness	◈	◈	◇	◆	◈
Reduction in TMV	◇	◇	◆	◇	◈
Implementability	◈	◈	◇	◆	◈
Cost (in thousands)					
Capital costs	$0	$0.5	$182,972	$1,023	$4,187
Non-discounted costs	$0	$5,235	$0	$3,781	$6,795
Total present worth	$0	$1,096	$182,972	$1,605	$4,738
Analogous Site 216-S-6 Crib				☑	
Threshold Criteria					
Overall protection	☐	☐	☑	☑	☑
Compliance with ARARs	☐	☐	☑	☑	☑
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◇	◈
Short-term effectiveness	◈	◈	◇	◆	◈
Reduction in TMV	◇	◇	◆	◇	◈

Table 3. Preferred Alternative for the Representative Site 216-U-10 Pond and its Analogous Waste Sites.[e] (8 Pages)

Comparison of Alternatives - Representative Site 216-U-10 Pond and Associated Analogous Sites					
	Alternatives				
Criteria for Representative and Analogous Waste Sites	① No Action	② MESC, MNA, IC[c]	③ RTD[b]	④ Capping	⑤ RTD Capping[d]
Implementability	◈	◈	◇	◆	◈
Cost (in thousands)					
Capital costs	$0	$0.5	$182,972	$1,023	$4187
Non-discounted costs	$0	$5,235	$0	$3,781	$6,795
Total present worth	$0	$1,096	$182,972	$1,605	$4,738
Analogous Site Group Consisting of 216-A-6 Crib, UPR-200-E-19, UPR-200-E-21, and UPR-200-E-29				☑	
Threshold Criteria					
Overall protection	☐	☐	☑	☑	☑
Compliance with ARARs	☐	☐	☑	☑	☑
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◇	◈
Short-term effectiveness	◈	◈	◇	◆	◈
Reduction in TMV	◇	◇	◆	◇	◈
Implementability	◈	◈	◇	◆	◈
Cost (in thousands)					
Capital costs	$0	$0.1	$117,754	$241	$1,047
Non-discounted costs	$0	$3,864	$0	$2,019	$2,307
Total present worth	$0	$821	$117,754	$729	$1,241
Analogous Site 216-A-30 Crib				☑	
Threshold Criteria					
Overall protection	☐	☐	☑	☑	☑
Compliance with ARARs	☐	☐	☑	☑	☑
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◇	◈
Short-term effectiveness	◈	◈	◇	◆	◈
Reduction in TMV	◇	◇	◆	◇	◈
Implementability	◈	◈	◇	◆	◈
Cost (in thousands)					
Capital costs	$0	$0.2	$277,175	$331	$1.977
Non-discounted costs	$0	$3,912	$0	$1,848	$3,198
Total present worth	$0	$815	$277,175	$677	$2,234
Analogous Site 216-S-25 Crib				☑	
Threshold Criteria					
Overall protection	☐	☐	☑	☑	☑
Compliance with ARARs	☐	☐	☑	☑	☑

Table 3. Preferred Alternative for the Representative Site 216-U-10 Pond and its Analogous Waste Sites.[e] (8 Pages)

Comparison of Alternatives - Representative Site 216-U-10 Pond and Associated Analogous Sites					
	Alternatives				
Criteria for Representative and Analogous Waste Sites	① No Action	② MESC, MNA, IC[a]	③ RTD[b]	④ Capping	⑤ RTD Capping[d]
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◇	◈
Short-term effectiveness	◈	◈	◇	◆	◈
Reduction in TMV	◇	◇	◆	◇	◈
Implementability	◈	◈	◇	◆	◈
Cost (in thousands)					
Capital costs	$0	$4	$592,393	$7,615	$30,354
Non-discounted costs	$0	$22,941	$0	$27,272	$48,425
Total present worth	$0	$4,752	$592,393	$11,684	$34,096
Analogous Site 216-A-37-2 Crib				☑	
Threshold Criteria					
Overall protection	☐	☐	☑	☑	☑
Compliance with ARARs	☐	☐	☑	☑	☑
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◇	◈
Short-term effectiveness	◈	◈	◇	◆	◈
Reduction in TMV	◇	◇	◆	◇	◈
Implementability	◈	◈	◇	◆	◈
Cost (in thousands)					
Capital costs	$0	$0.2	$277,175	$331	$1,977
Non-discounted costs	$0	$3,808	$0	$1,849	$3,198
Total present worth	$0	$815	$277,175	$677	$2,234
Analogous Site 216-B-55 Crib				☑	
Threshold Criteria					
Overall protection	☐	☐	☑	☑	☑
Compliance with ARARs	☐	☐	☑	☑	☑
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◇	◈
Short-term effectiveness	◈	◈	◇	◆	◈
Reduction in TMV	◇	◇	◆	◇	◈
Implementability	◈	◈	◇	◆	◈
Cost (in thousands)					
Capital costs	$0	$0.1	$186,595	$181	$1,163
Non-discounted costs	$0	$3,692	$0	$1,863	$3,198
Total present worth	$0	$771	$186,595	$682	$1,325

Table 3. Preferred Alternative for the Representative Site 216-U-10 Pond and its Analogous Waste Sites.[e] (8 Pages)

Comparison of Alternatives - Representative Site 216-U-10 Pond and Associated Analogous Sites					
	Alternatives				
Criteria for Representative and Analogous Waste Sites	① No Action	② MESC, MNA, IC[a]	③ RTD[b]	④ Capping	⑤ RTD/ Capping[d]
Analogous Site 216-S-172 Control Structure			☑		N/A
Threshold Criteria					
Overall protection	☐	☐	☑	☑	
Compliance with ARARs	☐	☐	☑	☑	
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◇	
Short-term effectiveness	◈	◈	◈	◆	
Reduction in TMV	◇	◇	◆	◈	
Implementability	◈	◈	◈	◆	
Cost (in thousands)					
Capital costs	$0	$0.1	$238	$3	
Non-discounted costs	$0	$3,540	$0	$1,930	
Total present worth	$0	$746	$238	$702	
Analogous Site 2904-S-160 Control Structure			☑		N/A
Threshold Criteria					
Overall protection	☐	☐	☑	☑	
Compliance with ARARs	☐	☐	☑	☑	
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◈	
Short-term effectiveness	◈	◈	◈	◆	
Reduction in TMV	◇	◇	◆	◈	
Implementability	◈	◈	◈	◆	
Cost (in thousands)					
Capital costs	$0	$0.1	$238	$3	
Non-discounted costs	$0	$3,540	$0	$1,930	
Total present worth	$0	$746	$238	$702	
Analogous Site 2904-S-170 Control Structure			☑		N/A
Threshold Criteria					
Overall protection	☐	☐	☑	☑	
Compliance with ARARs	☐	☐	☑	☑	
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◈	
Short-term effectiveness	◈	◈	◈	◆	
Reduction in TMV	◇	◇	◆	◈	
Implementability	◈	◈	◈	◆	
Cost (in thousands)					

Table 3. Preferred Alternative for the Representative Site 216-U-10 Pond and its Analogous Waste Sites.[e] (8 Pages)

Comparison of Alternatives - Representative Site 216-U-10 Pond and Associated Analogous Sites					
	Alternatives				
Criteria for Representative and Analogous Waste Sites	① No Action	② MESC, MNA, IC[a]	③ RTD[b]	④ Capping	⑤ RTD Capping[d]
Capital costs	$0	$0.1	$238	$3	
Non-discounted costs	$0	$3,486	$0	$1,876	
Total present worth	$0	$730	$238	$686	
Analogous Site 2904-S-171 Control Structure			☑		N/A
Threshold Criteria					
Overall protection	☐	☐	☑	☑	
Compliance with ARARs	☐	☐	☑	☑	
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◈	
Short-term effectiveness	◈	◈	◈	◆	
Reduction in TMV	◇	◇	◆	◈	
Implementability	◈	◈	◈	◆	
Cost (in thousands)					
Capital costs	$0	$0.1	$238	$3	
Non-discounted costs	$0	$3,540	$0	$1,930	
Total present worth	$0	$746	$238	$702	
Analogous Site 207-S Retention Basin				☑	N/A
Threshold Criteria					
Overall protection	☐	☐	☑	☑	
Compliance with ARARs	☐	☐	☑	☑	
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◇	
Short-term effectiveness	◈	◈	◇	◆	
Reduction in TMV	◇	◇	◆	◇	
Implementability	◈	◈	◇	◆	
Cost (in thousands)					
Capital costs	$0	$0.2	$2,510	$391	
Non-discounted costs	$0	$4,177	$0	$1,930	
Total present worth	$0	$877	$2,510	$702	
Analogous Site 216-B-64 Retention Basin	☑				N/A
Threshold Criteria					
Overall protection	☑	☑	☑	☑	
Compliance with ARARs	☑	☑	☑	☑	
Balancing Criteria					
Long-term effectiveness	◆	◈	◈	◈	
Short-term effectiveness	◆	◈	◇	◈	

Table 3. Preferred Alternative for the Representative Site 216-U-10 Pond and its Analogous Waste Sites.[e] (8 Pages)

Comparison of Alternatives - Representative Site 216-U-10 Pond and Associated Analogous Sites					
	Alternatives				
Criteria for Representative and Analogous Waste Sites	① No Action	② MESC, MNA, IC[a]	③ RTD[b]	④ Capping	⑤ RTD Capping[d]
Reduction in TMV	◆	◇	◈	◇	
Implementability	◆	◈	◇	◈	
Cost (in thousands)					
Capital costs	$0	$0.1	$1,044	$150	
Non-discounted costs	$0	$3,683	$0	$1,863	
Total present worth	$0	$769	$1,044	$682	
Analogous Site 200-E-113 Process Sewer			**☑**		N/A
Threshold Criteria					
Overall protection	☐	☐	☑	☑	
Compliance with ARARs	☐	☐	☑	☑	
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◇	
Short-term effectiveness	◈	◈	◇	◆	
Reduction in TMV	◇	◇	◆	◇	
Implementability	◈	◈	◇	◆	
Cost (in thousands)					
Capital costs	$0	$0.1	$467	$60	
Non-discounted costs	$0	$3,480	$0	$1,848	
Total present worth	$0	$726	$467	$677	

[a]Maintain existing soil cover, monitored natural attenuation, and institutional controls.
[b]Removal, treatment, and disposal.
[c]Toxicity, mobility, or volume through treatment.
[d]Partial removal, treatment, and disposal with capping.
[e]The choice of the preferred alternative is based on information at the writing of this feasibility study. The preferred alternative may be revised based on future characterization efforts at the analogous sites.

☑ = Indicates the preferred alternative (e).
☑ = Yes, meets criterion.
☐ = No, does not meet criterion.
◆ = High: best satisfies evaluation guidelines.
◈ = Moderate: partially satisfies evaluation guidelines.
◇ = Low: least satisfies evaluation guidelines.

ARAR = applicable or relevant and appropriate requirement.
IC = institutional controls.
MESC = maintain existing soil cover.
MNA = monitored natural attenuation.
N/A = not applicable.
RTD = removal, treatment, and disposal.
TMV = toxicity, mobility, or volume through treatment.

- Intrusion is reduced by the design of the barrier, which would include an intrusion protection layer.
- Institutional controls provide limitations on use around the barrier.

Alternative 3, Removal, Treatment, and Disposal, and Alternative 5, Partial Removal, Treatment, and Disposal with Capping, also would be protective of human health, the environment, and groundwater by removing contaminants and disposing of them in an engineered facility.

Removal of the control structures achieves overall protection of human health and the environment through the implementation of Alternative 3. Although detailed characterization has not been performed on control structures, they are assumed to have little leakage and therefore no deep contamination that would require capping to protect groundwater.

Alternative 2 would not be protective of the 216-U-10 Pond or any of its other analogous sites because constituents are anticipated to remain at concentrations greater than the PRGs, even past 500 years. Alternative 1 is expected to be protective at the 216-B-64 Retention Basin because this retention basin has never received waste. Conversely, Alternative 1 is not protective of any of the other waste sites because constituents remain above the PRGs.

Compliance with ARARs – Except for the 216-B-64 Retention Basin, Alternatives 1 and 2 do not comply with ARARs because the waste sites currently exceed the RAOs. ARARs are met for Alternatives 3, 4, and 5. Alternative 3 meets the ARARs through the removal of contaminated material. Alternative 5 meets the ARARs by removing the portion of the subsurface soil associated with higher contaminant concentrations and placing a soil barrier over remaining residual contamination. Alternative 4 meets the ARARs through placement of an engineered barrier, which eliminates the exposure pathway and limits infiltration to protect groundwater.

Long-Term Effectiveness and Permanence – Except for the 216-B-64 Retention Basin, Alternatives 1 and 2 do not provide long-term effectiveness or permanence because contaminants are not remediated and could remain for more than 500 years. It is assumed that the enforcement of institutional controls could not be ensured past this time frame.

Alternative 3 is a permanent solution, because it removes all the contaminants from the site.

Alternatives 4 and 5 also are effective in the long term. Alternative 4 provides long-term effectiveness by reducing exposure using an engineered barrier and incorporating intrusion barriers to limit access by the receptors during the time necessary for the residual risk of contaminants to decrease to acceptable levels through natural radioactive decay (280 years). Groundwater monitoring would be required to show no further degradation based on the elevated concentrations of contaminants that could impact groundwater. Alternative 5 provides long-term protectiveness by removing near-surface contamination and providing a cap to protect groundwater and the inadvertent intruder.

Short-Term Effectiveness – Alternative 1 would be effective for worker protection in the short term because this alternative does not involve any remedial actions. Alternatives 2 and 4 would be more effective in the short term than Alternatives 3 and 5, predominantly because of their lower risk to remediation workers. Alternatives 3 and 5 would involve excavating contaminated soil and debris, which would create potential contaminant exposures to short-term workers during excavation and transportation of the materials. Under Alternatives 3 and 5, workers would be exposed to a cumulative dose of approximately 1.4 rem during the excavation of the 216-U-10 Pond. The capping alternative results in a lower dose associated only with removal of aboveground structures, such as pipes. Risks to workers from potential exposure to contaminated soil and fugitive dust would be greater with Alternatives 3 and 5 than with Alternative 4. Short-term impacts to vegetation and wildlife are minimal for Alternatives 1 and 2, are minimal to moderate for Alternative 4 because of impacts to borrow areas, and moderate to high for Alternatives 3 and 5 because of impacts to borrow areas and the large areas that would be excavated.

Reduction of Toxicity, Mobility, or Volume Through Treatment - Treatment is included as an element of Alternatives 3 and 5, but is not anticipated because constituents are expected to meet the disposal facility waste acceptance criteria. As such, reduction in toxicity, mobility, or volume of the contaminants will not be realized except through natural attenuation. All of the alternatives incorporate natural attenuation in the form of radioactive decay, which ultimately results in reduced toxicity and volume. Alternatives 3 and 5 provide an additional perceived reduction because these alternatives include a physical action that places the contaminants in a more managed environment, thereby reducing the forces (e.g., infiltration) that drive the contaminants toward groundwater. However, given the long half lives of technetium and uranium, performance of the onsite disposal facility cannot be determined during the decay cycle of these contaminants.

Implementability - Alternative 1 would be implemented easily because no action is performed. Alternative 2 is currently in use for all of the waste sites. The waste sites are in surveillance and monitoring programs and are posted with signs and/or fenced. Access to the waste sites also is controlled through Hanford Site access requirements, an excavation permit program, and a radiation work area permit program. The addition of monitoring wells or boreholes is easily implementable. Alternative 3 is considered more difficult to implement because of the depths (64 m [210 ft]) of excavation that would be required. The high contamination levels in the soil at some waste sites would result in cumulative dose levels as high as 1.4 rem to workers and would require special techniques and protections to maintain these doses at an acceptable level. Approximately 31 million m^3 (41 million yd^3) of waste would be generated to meet the PRGs through excavation and disposal of the 216-U-10 Pond and its analogous sites. This volume is more than five times the current capacity of the ERDF. Excavation is not practicable or cost-effective at these depths and volumes. Alternative 5 will require the excavation of 2 million m^3 (2.7 million yd^3) of soil, much less than Alternative 3 but still half the present remaining capacity of the ERDF. Alternative 4 is considered easily implementable. Capping is a well-known and commonly used remedy for waste sites around the world. A barrier has been implemented at the Hanford Site and other types of barriers have been approved and implemented at other western arid sites. These barriers are easy to construct and maintain.

Cost - Capital costs and operating and maintenance costs are provided in Table 3. The listed present worth is based on a discount rate of 3.2 percent. The costs in Table 3 associated with Alternative 3 include excavation of the contaminated material to a depth of 64 m (210 ft). The costs associated with Alternative 4 are for an engineered barrier that provides protection for potential industrial users. The costs associated with Alternative 5 consist of excavation of contaminated soils up to a depth of 4.6 m (15 ft), followed by a soil barrier.

PREFERRED ALTERNATIVES

- The preferred alternative for the 216-U-10 Pond, 216-S-16P Pond, 216-S-17 Pond, 216-T-4A Pond, 216-T-4B Pond, 216-U-9 Ditch, 216-U-11 Ditch, 216-S-5 Crib, 216-S-6 Crib, 216-A-6 Crib, 216-A-30 Crib, 216-S-25 Crib, 216-A-37-2 Crib, 216-B-55 Crib, and unplanned release sites UPR-200-E-19, UPR-200-E-21, UPR-200-E-29, and UPR-200-W-124 is Alternative 4, Capping. This alternative is protective of human health, the environment, groundwater, and workers. It is implementable and cost-effective.
- The preferred alternative for the 216-S-172 Control Structure, 2904-S-160 Control Structure, 2904-S-170 Control Structure, 2904-S-171 Control Structure, 207-S Retention Basin, and 200-E-113 Process Sewer is Alternative 3, Removal, Treatment, and Disposal. This alternative is protective of human health, the environment, groundwater, and workers. It is implementable and cost-effective.
- The preferred alternative for the 216-B-64 Retention Basin is Alternative 1, No Action. No risk to human health, the environment, the groundwater, and the workers is anticipated from this site because this retention basin did not receive waste.

The Tri-Parties believe that the preferred alternatives are protective of human health and the environment, comply with ARARs, use permanent solutions, protect workers, and are cost-effective.

Representative Site 216-U-14 Ditch and its Analogous Waste Sites

Alternative 3, Removal, Treatment, and Disposal, is the preferred alternative for representative site 216-U-14 Ditch and its analogous sites. The contaminants of concern include cesium-137, uranium, and technetium-99.

The 216-U-14 Ditch is the representative site for the following waste sites:

- 216-S-16-D Ditch
- 216-T-1 Ditch
- 216-T-4-1D Ditch
- 216-T-4-2 Ditch
- 216-W-LWC Crib
- 207-U Retention Basin
- 207-T Retention Basin
- 216-T-12 Trench
- 200-W-84 Process Sewer
- 200-W-88 Process Sewer
- 200-W-102 Process Sewer
- UPR 200-W-111
- UPR 200-W-112

The conceptual site model for these sites is presented in Table 1, with further information specific to each waste site provided in Appendix B.

Based on data obtained during past investigations, modeling predicts that groundwater is not protected because uranium and technetium-99 may reach the groundwater in concentrations that exceed Federal standards. However, concentrations are predicted to decrease below maximum contaminant levels within the 150-year period of active institutional control. The top of the contamination is found about 2.8 m (9 ft) below ground surface and extends to a depth of 61 m (200 ft) (see Figure 5). Because a clean soil cover exists at the site, these contaminants do not currently pose a risk to Hanford Site workers; however, these concentrations would pose unacceptable risks if humans (e.g., construction workers) were to dig into the contaminated soil zone. If no clean cover were present at the site, it is estimated that contaminants would take up to 210 years to naturally decrease to levels that would be safe for humans. Although contaminant concentrations exceed screening levels that are protective of terrestrial wildlife, site-specific factors such as the size of the site and the presence of a clean soil cover suggest minimal ecological risks under current conditions.

ALTERNATIVE EVALUATIONS

The following provides an alternative evaluation discussion specific to each CERCLA criterion. A summary is provided in Table 4. Alternative 5, Partial Removal, Treatment, and Disposal with Capping, does not apply to this representative site and associated analogous sites because protection from deeper contamination is not required (because groundwater protection will be achieved within the period of institutional control by natural attenuation); therefore, only near-surface contamination needs to be excavated. In addition, Alternative 5 is identical to Alternative 3. Alternative 6, In Situ Vitrification, does not apply to this representative site and associated analogous sites.

Overall Protection of Human Health and the Environment – Alternative 3, Removal, Treatment, and Disposal, is chosen as the preferred alternative for the 216-U-14 Ditch and its analogous sites. These waste sites obtain protection of human health and the environment through the implementation of Alternative 3 because this alternative removes COCs from the site and sends them to the ERDF for disposal.

Alternative 4 also would be expected to be protective of these sites by placement of an engineered barrier, which eliminates exposure, reduces infiltration, and provides for intrusion protection.

Alternative 2 would provide overall protection of human health and the environment for sites that show protection of groundwater and achieve human health and environmental protection within 500 years. Because the viability of institutional controls cannot be ensured past 500 years, this alternative fails to meet this criterion for sites with long-lived contaminants such as plutonium, technetium, and uranium, because the waste sites would have contamination that would not attenuate to acceptable levels within 500 years. Similarly, Alternative 1 would not be protective of either the 216-U-14 Ditch or any of its analogous sites.

Compliance with ARARs – Alternatives 1 and 2 do not comply with ARARs because the waste sites currently exceed the RAOs. ARARs are met for Alternatives 3 and 4. Alternative 3 meets the ARARs through the removal of contaminated material. Alternative 4 meets the ARARs through placement of an engineered barrier, which eliminates the exposure pathway and limits infiltration to protect groundwater.

Long-Term Effectiveness and Permanence – Alternatives 1 and 2 do not provide long-term effectiveness or permanence because contaminants are not remediated and could remain for more than 500 years. It is assumed that the enforcement of institutional controls could not be ensured past this time frame.

Alternative 3 is a permanent solution, because it removes COCs from the sites.

Alternative 4 provides long-term effectiveness by reducing exposure using an engineered barrier and incorporating intrusion barriers to limit access by the receptors during the time necessary for the residual risk of contaminants to decrease to acceptable levels through natural radioactive decay (210 years). Groundwater

Table 4. Preferred Alternative for the Representative Site 216-U-14 Ditch and its Analogous Waste Sites.[e] (4 Pages)

Comparison of Alternatives - Representative Site 216-U-14 Ditch and Associated Analogous Sites					
Criteria for Representative and Analogous Waste Sites	Alternatives				
	① No Action	② MESC, MNA, IC[a]	③ RTD[b]	④ Capping	⑤ RTD/ Capping[d]
Representative Site 216-U-14 Ditch			☑		N/A
Threshold Criteria					
Overall protection	☐	☐	☑	☑	
Compliance with ARARs	☐	☐	☑	☑	
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◈	
Short-term effectiveness	◈	◈	◈	◆	
Reduction in TMV[c]	◇	◇	◆	◈	
Implementability	◈	◈	◆	◈	
Cost (in thousands)					
Capital costs	$0	$16	$3,702	$0	
Non-discounted costs	$0	$4,377	$0	$40,528	
Total present worth	$0	$918	$3,702	$17,497	
Analogous Site 216-S-16D Ditch			☑		N/A
Threshold Criteria					
Overall protection	☐	☐	☑	☑	
Compliance with ARARs	☐	☐	☑	☑	
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◈	
Short-term effectiveness	◈	◈	◈	◆	
Reduction in TMV	◇	◇	◆	◈	
Implementability	◈	◈	◆	◈	
Cost (in thousands)					
Capital costs	$0	$5	$1,363	$3,438	
Non-discounted costs	$0	$3,750	$0	$12,212	
Total present worth	$0	$789	$1,363	$5,260	
Analogous Site 216-T-1 Ditch			☑		N/A
Threshold Criteria					
Overall protection	☐	☐	☑	☑	
Compliance with ARARs	☐	☐	☑	☑	
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◈	
Short-term effectiveness	◈	◈	◈	◆	
Reduction in TMV	◇	◇	◆	◈	
Implementability	◈	◈	◆	◈	
Cost (in thousands)					
Capital costs	$0	$4	$977	$3,438	
Non-discounted costs	$0	$3,530	$0	$9,812	
Total present worth	$0	$738	$977	$4,230	

Table 4. Preferred Alternative for the Representative Site 216-U-14 Ditch and its Analogous Waste Sites.[e] (4 Pages)

Comparison of Alternatives - Representative Site 216-U-14 Ditch and Associated Analogous Sites					
Criteria for Representative and Analogous Waste Sites	Alternatives				
	① No Action	② MESC, MNA, IC[a]	③ RTD[b]	④ Capping	⑤ RTD/ Capping[d]
Analogous Site Group Consisting of 216-T-4-1D Ditch and 216-T-4-2 Ditch			☑		N/A
Threshold Criteria					
Overall protection	☐	☐	☑	☑	
Compliance with ARARs	☐	☐	☑	☑	
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◈	
Short-term effectiveness	◈	◈	◈	◆	
Reduction in TMV	◇	◇	◆	◈	
Implementability	◈	◈	◆	◈	
Cost (in thousands)					
Capital costs	$0	$15	$3,243	$10,521	
Non-discounted costs	$0	$4,200	$0	$37,090	
Total present worth	$0	$882	$3,243	$16,012	
Analogous Site 216-W-LWC Crib			☑		N/A
Threshold Criteria					
Overall protection	☐	☐	☑	☑	
Compliance with ARARs	☐	☐	☑	☑	
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◈	
Short-term effectiveness	◈	◈	◈	◆	
Reduction in TMV	◇	◇	◆	◈	
Implementability	◈	◈	◆	◈	
Cost (in thousands)					
Capital costs	$0	$56	$2,588	$40,381	
Non-discounted costs	$0	$7,115	$0	$141,940	
Total present worth	$0	$1,510	$2,588	$61,333	
Analogous Site Group Consisting of 207-U Retention Basin, UPR-200-W-111, and UPR-200-W-112			☑		N/A
Threshold Criteria					
Overall protection	☐	☐	☑	☑	
Compliance with ARARs	☐	☐	☑	☑	
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◈	
Short-term effectiveness	◈	◈	◈	◆	
Reduction in TMV	◇	◇	◆	◈	
Implementability	◈	◈	◆	◈	
Cost (in thousands)					
Capital costs	$0	$26	$4,362	$18,420	
Non-discounted costs	$0	$5,077	$0	$64,941	
Total present worth	$0	$1,072	$4,362	$28,035	

Table 4. Preferred Alternative for the Representative Site 216-U-14 Ditch and its Analogous Waste Sites.[e] (4 Pages)

Comparison of Alternatives - Representative Site 216-U-14 Ditch and Associated Analogous Sites					
Criteria for Representative and Analogous Waste Sites	Alternatives				
	① No Action	② MESC, MNA, IC[a]	③ RTD[b]	④ Capping	⑤ RTD/ Capping[d]
Analogous Site 207-T Retention Basin			☑		N/A
Threshold Criteria					
Overall protection	☐	☐	☑	☑	
Compliance with ARARs	☐	☐	☑	☑	
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◈	
Short-term effectiveness	◈	◈	◈	◆	
Reduction in TMV	◇	◇	◆	◈	
Implementability	◈	◈	◆	◈	
Cost (in thousands)					
Capital costs	$0	$21	$4,180	$15,315	
Non-discounted costs	$0	$4,565	$0	$53,881	
Total present worth	$0	$952	$4,180	$23,276	
Analogous Site 216-T-12 Trench			☑		N/A
Threshold Criteria					
Overall protection	☐	☐	☑	☑	
Compliance with ARARs	☐	☐	☑	☑	
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◇	
Short-term effectiveness	◈	◈	◇	◆	
Reduction in TMV	◇	◇	◆	◇	
Implementability	◈	◈	◇	◆	
Cost (in thousands)					
Capital costs	$0	$0.1	$238	$80	
Non-discounted costs	$0	$3,471	$0	$1,860	
Total present worth	$0	$725	$238	$681	
Analogous Site 200-W-84 Process Sewer			☑		N/A
Threshold Criteria					
Overall protection	☐	☐	☑	☑	
Compliance with ARARs	☐	☐	☑	☑	
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◈	
Short-term effectiveness	◈	◈	◈	◆	
Reduction in TMV	◇	◇	◆	◈	
Implementability	◈	◈	◆	◈	
Cost (in thousands)					
Capital costs	$0	$3	$238	$1,199	
Non-discounted costs	$0	$3,537	$0	$7,085	
Total present worth	$0	$742	$238	$3,049	

Table 4. Preferred Alternative for the Representative Site 216-U-14 Ditch and its Analogous Waste Sites.[e] (4 Pages)

Comparison of Alternatives - Representative Site 216-U-14 Ditch and Associated Analogous Sites					
Criteria for Representative and Analogous Waste Sites	Alternatives				
	① No Action	② MESC, MNA, IC[a]	③ RTD[b]	④ Capping	⑤ RTD/ Capping[d]
Analogous Site 200-W-88 Process Sewer			☑		N/A
Threshold Criteria					
Overall protection	☐	☐	☑	☑	
Compliance with ARARs	☐	☐	☑	☑	
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◈	
Short-term effectiveness	◈	◈	◈	◆	
Reduction in TMV	◇	◇	◆	◈	
Implementability	◈	◈	◆	◈	
Cost (in thousands)					
Capital costs	$0	$15	$2,536	$10,452	
Non-discounted costs	$0	$4,135	$0	$36,783	
Total present worth	$0	$862	$2,536	$15,888	
Analogous Site 200-W-102 Process Sewer			☑		N/A
Threshold Criteria					
Overall protection	☐	☐	☑	☑	
Compliance with ARARs	☐	☐	☑	☑	
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◈	
Short-term effectiveness	◈	◈	◈	◆	
Reduction in TMV	◇	◇	◆	◈	
Implementability	◈	◈	◆	◈	
Cost (in thousands)					
Capital costs	$0	$4	$981	$2,932	
Non-discounted costs	$0	$3,531	$0	$10,377	
Total present worth	$0	$738	$981	$4,475	

[a]Maintain existing soil cover, monitored natural attenuation, and institutional controls.
[b]Removal, treatment, and disposal.
[c]Toxicity, mobility, or volume through treatment.
[d]Partial removal, treatment, and disposal with capping – not applicable for 216-U-14 Ditch or its analogous waste sites.
[e]The choice of the preferred alternative is based on information at the writing of this feasibility study. The preferred alternative may be revised based on future characterization efforts at the analogous sites.

☑ = Indicates the preferred alternative (e).
☑ = Yes, meets criterion.
☐ = No, does not meet criterion.
◆ = High: best satisfies evaluation guidelines.
◈ = Moderate: partially satisfies evaluation guidelines.
◇ = Low: least satisfies evaluation guidelines.

ARAR = applicable or relevant and appropriate requirement.
IC = institutional controls.
MESC = maintain existing soil cover.
MNA = monitored natural attenuation.
N/A = not applicable.
RTD = removal, treatment, and disposal.
TMV = toxicity, mobility, or volume through treatment.

monitoring would be required to show no further degradation based on the elevated concentrations of contaminants that could impact groundwater.

Short-Term Effectiveness - Alternative 1 would be effective for worker protection in the short term because this alternative does not involve any remedial actions. Alternatives 2 and 4 would be slightly more effective in the short term than Alternative 3, predominantly based on lower risk to remediation workers. Alternative 3 would involve excavating contaminated soil and debris, which would create potential contaminant exposures to short-term workers during excavation and transportation of the materials. Under Alternative 3, workers would be exposed to a cumulative dose of approximately 0.02 rem during the excavation of the 216-U-14 Ditch. The capping alternative results in a lower dose associated only with removal of aboveground structures, such as pipes. Risks to workers from potential exposure to contaminated soil and fugitive dust would be greater with Alternative 3 than with Alternative 4. Short-term impacts to vegetation and wildlife are minimal for Alternatives 1 and 2, minimal to moderate for Alternative 4 because of impacts to borrow areas, and moderate to high for Alternative 3 because of impacts to borrow areas and the larger areas that would be disturbed to reach the required excavation depths.

Reduction of Toxicity, Mobility, or Volume Through Treatment - Treatment is included as an element of Alternative 3, but is not anticipated because constituents are expected to meet the disposal facility waste acceptance criteria. As such, reduction in toxicity, mobility, or volume of the contaminants will not be realized except through natural attenuation. All of the alternatives incorporate natural attenuation in the form of radioactive decay, which ultimately results in reduced toxicity and volume. Alternative 3 provides an additional perceived risk reduction because this alternative includes a physical action that places the contaminants in a more managed environment, thereby reducing the forces (e.g., infiltration) that drive the contaminants toward groundwater.

Implementability - Alternative 1 would be easily implemented because no action is performed. Alternative 2 currently is in use for all of the waste sites. The waste sites are in a surveillance and monitoring program and are posted with signs and/or are fenced. Access to the waste sites also is controlled through Hanford Site access requirements, an excavation permit program, and a radiation work area permit program. The addition of monitoring wells or boreholes is easily implementable. Alternative 3 is considered more difficult to implement because excavation would be required. The contamination levels in the soil at some waste sites would result in cumulative dose levels of 0.02 rem to workers. This is not a very high cumulative dose, so it may be possible to implement Alternative 3 with few or no special radiation protection techniques, other than routine monitoring and controls. Approximately 49,000 m^3 (64,000 yd^3) of waste would be generated to meet the PRGs through excavation and disposal of the 216-U-14 Ditch and its analogous sites. This volume represents less than 1 percent of the current capacity of the ERDF. Alternative 4 is considered easily implementable. Capping is a well-known and commonly used remedy for waste sites around the world. A barrier has been implemented at the Hanford Site and other types of barriers have been approved and implemented at other western arid sites. These barriers are easy to construct and maintain.

Cost – Capital costs and operating and maintenance costs are provided in Table 4. The listed present worth is based on a discount rate of 3.2 percent. The costs in Table 4 associated with Alternative 3 include excavation of the contaminated material to a depth of 4.6 m (15 ft). The costs associated with Alternative 4 are for a protective engineered barrier.

PREFERRED ALTERNATIVES

- The preferred alternative for the 216-U-14 Ditch and its analogous sites is Alternative 3, Removal, Treatment, and Disposal. This alternative is protective of human health, the environment, groundwater, and workers. It is implementable and cost-effective.

The Tri-Parties believe that the preferred alternative is protective of human health and the environment, complies with ARARs, uses permanent solutions, protects workers, and is cost-effective.

Alternative 4, Capping, is the preferred alternative for representative site 216-Z-11 Ditch and its analogous sites except as noted below. The contaminants of concern include americium-241, cesium-137, plutonium-238/239/240, radium-226, strontium-90, Aroclor-1254 (polychlorinated biphenyl), and nitrite.

Alternative 3, Removal, Treatment, and Disposal, is the preferred alternative for analogous waste site 207-Z Retention Basin which could be effectively addressed through excavation, treatment as needed, and disposal by this alternative.

Representative Site 216-Z-11 Ditch and its Analogous Waste Sites

The 216-Z-11 Ditch is the representative site for the following waste sites:

- 216-Z-1D Ditch
- 216-Z-19 Ditch
- 216-Z-20 Ditch
- 207-Z Retention Basin
- UPR-200-W-110.

The conceptual site model for these sites is presented in Table 1, with further information specific to each waste site provided in Appendix B.

Based on data obtained during past investigations at the 216-Z-11 Ditch, contamination was found in soil in a zone ranging from 1.2 m (4 ft) below ground surface to a depth of 12 m (40 ft) (see Figure 6). PRGs for the industrial and intruder scenarios only are exceeded in the top 4.6 m (15 ft) of soil. Contaminant concentrations in this zone do not pose a threat of impacting the underlying groundwater. Because a clean soil cover exists at the site, these contaminants do not currently pose a risk to Hanford Site workers; however, these concentrations would pose unacceptable risks if humans (e.g., construction workers) were to dig into the contaminated soil zone. If no clean cover were present at the site, it is estimated that contaminants would take more than 1,000 years to naturally decay to levels that would be safe for humans. Although contaminant concentrations exceed screening levels that are protective of terrestrial wildlife, site-specific factors such as the size of the site and extent of clean soil cover suggest minimal ecological risks under current conditions.

ALTERNATIVE EVALUATIONS

The following provides an alternative evaluation discussion specific to each CERCLA criterion. A summary is provided in Table 5. Alternative 5, Partial Removal, Treatment, and Disposal with Capping, does not apply to this representative site and associated analogous sites because protection from deeper contamination is not required and therefore only near-surface contamination needs to be excavated. In addition, Alternative 5 is identical to Alternative 3.

Overall Protection of Human Health and the Environment – Alternative 4, Capping, is chosen as the preferred alternative for the 216-Z-11 Ditch and all but one of

Table 5. Preferred Alternative for the Representative Site 216-Z-11 Ditch and its Analogous Waste Sites.[f] (2 Pages)

Comparison of Alternatives - Representative Site 216-Z-11 Ditch and Associated Analogous Sites						
	Alternatives					
Criteria for Representative and Analogous Waste Sites	① No Action	② MESC, MNA, IC[a]	③ RTD[b]	④ Capping	⑤ RTD/ Capping[d]	⑥ ISV[e]
Representative Sites 216-Z-11 Ditch and Group Consisting of 216-Z-1D Ditch, 216-Z-19 Ditch, 216-Z-20 Crib, and UPR-200-W-110				☑	N/A	
Threshold Criteria						
Overall protection	☐	☐	☑	☑		☑
Compliance with ARARs	☐	☐	☑	☑		☑
Balancing Criteria						
Long-term effectiveness	◇	◇	◆	◈		◈
Short-term effectiveness	◈	◈	◇	◆		◈
Reduction in TMV[c]	◇	◇	◈	◇		◆
Implementability	◈	◈	◇	◆		◈
Cost (in thousands)						
Capital costs	$0	$16	$77,501	$35,302		$92,440
Non-discounted costs	$0	$7,470	$0	$68,690		$97,697
Total present worth	$0	$1,593	$77,501[g]	$42,237		$93,567
Analogous Site 207-Z Retention Basin			☑		N/A	N/A
Threshold Criteria						
Overall protection	☐	☐	☑	☑		
Compliance with ARARs	☐	☐	☑	☑		
Balancing Criteria						
Long-term effectiveness	◇	◇	◆	◈		
Short-term effectiveness	◈	◈	◈	◆		
Reduction in TMV	◇	◇	◆	◈		
Implementability	◈	◈	◆	◈		
Cost (in thousands)						
Capital costs	$0	$36	$296	$78,441		
Non-discounted costs	$0	$3,531	$0	$10,944		
Total present worth	$0	$741	$296	$3,761		

Table 5. Preferred Alternative for the Representative Site 216-Z-11 Ditch and its Analogous Waste Sites.[f] (2 Pages)

Comparison of Alternatives - Representative Site 216-Z-11 Ditch and Associated Analogous Sites						
Criteria for Representative and Analogous Waste Sites	Alternatives					
	① No Action	② MESC, MNA, IC[a]	③ RTD[b]	④ Capping	⑤ RTD/ Capping[d]	⑥ ISV[e]

[a]Maintain existing soil cover, monitored natural attenuation, and institutional controls.
[b]Removal, treatment, and disposal.
[c]Toxicity, mobility, or volume through treatment.
[d]Partial removal, treatment, and disposal with capping – not applicable for 216-Z-11 Ditch or its analogous sites.
[e]In situ vitrification.
[f]The choice of the preferred alternative is based on information at the writing of this feasibility study. The preferred alternative may be revised based on future characterization efforts at the analogous sites.
[g]This cost does not reflect the programmatic disposal cost at the Waste Isolation Pilot Plant. If the programmatic disposal cost were included, the total cost for this alternative would be $142,247,000.

☑ = Indicates the preferred alternative (f).
☑ = Yes, meets criterion.
☐ = No, does not meet criterion.
◆ = High: best satisfies evaluation guidelines.
◈ = Moderate: partially satisfies evaluation guidelines.
◇ = Low: least satisfies evaluation guidelines.

ARAR = applicable or relevant and appropriate requirement.
IC = institutional controls.
ISV = in situ vitrification.
MESC = maintain existing soil cover.
MNA = monitored natural attenuation.
N/A = not applicable.
RTD = removal, treatment, and disposal.
TMV = toxicity, mobility, or volume through treatment.

its analogous sites (the 207-Z Retention Basin). These waste sites obtain protection of human health and the environment through implementing Alternative 4 for the following reasons.

- The exposure pathway is removed through the placement of a barrier/cap.
- Although modeling predicts that contaminants do not present a threat to groundwater, placement of a cap would further reduce infiltration, which supports the protection of groundwater.
- Intrusion is reduced by the design of the barrier, which would include an intrusion protection layer.
- Institutional controls provide limitations on use around the barrier.

Alternative 3, Removal, Treatment, and Disposal, also would be protective of human health, the environment, and groundwater by removing contaminants and disposing of them in an engineered facility.

The 207-Z Retention Basin waste site consists of a concrete-lined basin. No indication of leakage has been observed. These factors suggest the presence of shallow contamination that could be effectively addressed through removal, treatment (as appropriate), and disposal at the onsite engineered facility.

Alternative 6, In Situ Vitrification, applicable for the Z-Ditches only, is considered protective of human health and the environment because it immobilizes the contaminants, preventing further migration. A cap similar to the cap used in Alternative 5 will be required to augment protectiveness until PRGs are achieved through natural attenuation.

Alternatives 1 and 2 are not protective because constituents are anticipated to remain at concentrations greater than the PRGs in excess of 500 years.

Compliance with ARARs – Alternatives 1 and 2 do not comply with ARARs because the waste sites currently exceed the RAOs. Alternatives 3, 4, and 6 meet ARARs for all waste sites. Alternative 3 meets ARARs through the removal of the contaminated material. Alternative 4 meets the ARARs by placement of an engineered barrier that eliminates the exposure pathway to humans and ecological receptors. Groundwater protection standards are not exceeded at the Z-Ditches; consequently, the cap would not be designed to address groundwater concerns. Alternative 6 complies with ARARs by breaking exposure pathways through a combination of a highly stable waste form and placement of an engineered barrier.

Long-Term Effectiveness and Permanence – Alternatives 1 and 2 do not provide long-term effectiveness or permanence because contaminants are not remediated and could remain for more than 500 years. It is assumed that the enforcement of institutional controls could not be ensured past this time frame.

Alternative 3 is a permanent solution, because it removes all contamination from the site and places the contamination in an engineered facility.

Alternative 4 provides long-term effectiveness by reducing exposure using an engineered barrier and incorporating intrusion barriers to limit access by the receptors. However, it is anticipated that contaminants may take up to 1,000 years to decrease to acceptable levels through natural radioactive decay.

Alternative 6 is anticipated to be effective and permanent in the long term because in situ vitrification activities under Alternative 6 would immobilize contaminants to meet direct exposure human health RAOs; however, this technology has not been widely demonstrated at large sites. To be effective in the long-term, a cap is required because of the estimated surface dose after implementation of the alternative. A cap also will be required to eliminate the inadvertent intruder scenario.

Short-Term Effectiveness - Alternative 1 would be effective for worker protection in the short term because this alternative does not involve any remedial actions. Alternatives 2, 4, and 6 would be more effective in the short term than Alternative 3, predominantly because of their lower risk to remediation workers. Alternative 3 would involve excavating contaminated soil and debris. Because of high transuranic concentrations found in the 216-Z-11 Ditch and analogous Z-Ditches, high short-term risks to workers would exist during excavation and transportation of the materials. Under Alternative 3, workers would be exposed to a cumulative dose of approximately 5.8 rem during the excavation of the 216-Z-11 Ditch. Alternatives 4 and 6 result in a lower dose associated only with removal of aboveground structures, such as pipes. Risks to workers from potential exposure to contaminated soil and fugitive dust would be greater with Alternative 3 than with Alternatives 4 and 6. Short-term impacts to vegetation and wildlife are minimal for Alternatives 1 and 2, minimal to moderate for Alternatives 4 and 6, and moderate to high for Alternative 3 because of impacts to borrow areas and the larger areas that would be disturbed to reach the required excavation depths.

Reduction of Toxicity, Mobility, or Volume Through Treatment - Treatment is included as an element of Alternative 3 but is not anticipated because the constituents are expected to meet the disposal facility waste acceptance criteria. As such, reduction in toxicity, mobility, or volume of the contaminants will not be realized. All the alternatives incorporate natural attenuation in the form of radioactive decay, which ultimately results in reduced toxicity and volume. Alternative 3 provides an additional perceived reduction because this alternative includes a physical action that places the contaminants in a more managed environment. Alternative 6, In Situ Vitrification, reduces mobility by immobilizing contaminants and binds them into a glass matrix having minimal leaching. However, given the long half lives of technetium and uranium, performance of the onsite disposal facility cannot be determined during the decay cycle of these contaminants.

Implementability - Alternative 1 would be easily implemented because no action is performed. Alternative 2 currently is in use for all of the waste sites. The waste sites are in a surveillance and monitoring program and are posted with signs and/or are fenced. Access to the waste sites also is controlled through Hanford Site access requirements, an excavation permit program, and a radiation work area permit program. The addition of monitoring wells or boreholes is easily implementable. Alternative 3 is considered more difficult to implement because excavation is required. The high contamination levels in the soil at some waste sites would result in cumulative dose levels as high as 5.8 rem to workers and would require special techniques and protections to reduce these levels to an acceptable range. It is estimated that 28,000 m^3 (36,000 yd^3) of soil would be disposed at ERDF and at WIPP for the 216-Z-11 Ditch and its analogous sites. This volume represents less than 1 percent of the current capacity of the ERDF. Alternative 4 is implementable. Capping is a well-known and commonly used remedy for waste sites around the world. A barrier has been implemented at the Hanford Site and other types of barriers have been approved and implemented at other western arid sites. These barriers are easy to construct and maintain. The implementability of Alternative 6 is in question because in situ vitrification is an innovative technology; its implementability has not been widely demonstrated.

Cost – Capital costs and operating and maintenance costs are provided in Table 5. The listed present worth is based on a discount rate of 3.2 percent. The costs in Table 5 associated with Alternative 3 include excavation of the contaminated material to a depth of 4.6 m (15 ft). The costs associated with Alternative 4 are for an engineered barrier that provides intrusion protection for potential inadvertent intruders.

PREFERRED ALTERNATIVES

- The preferred alternative for the 216-Z-11 Ditch, 216-Z-1D Ditch, 216-Z-19 Ditch, 216-Z-20 Ditch, and UPR-200-W-110 is Alternative 4, Capping. This alternative is protective of human health, the environment, groundwater, and workers. It is implementable and cost-effective.
- The preferred alternative for the 207-Z Retention Basin is Alternative 3, Removal, Treatment, and Disposal. This alternative is protective of human health, the environment, groundwater, and workers. It is implementable and cost-effective.

The Tri-Parties believe that the preferred alternatives are protective of human health and the environment, comply with ARARs, use permanent solutions, protect workers, and are cost-effective.

Representative Site 216-A-25 Pond and its Analogous Waste Site

The 216-A-25 Pond is the representative site for the 207-A North Retention Basin. The conceptual site model for this site is presented in Table 1, with further information provided in Appendix B.

Alternative 3, Removal, Treatment, and Disposal, is the preferred alternative for analogous waste site 207-A North Retention Basin.

Based on data obtained during past investigations at the 216-A-25 Pond, contamination was found in soil ranging from 0.9 m (3 ft) below ground surface to a depth of 11.3 m (37 ft) (see Figure 7). Evaluations contained in DOE/RL-2000-35, *200-CW-1 Operable Unit Remedial Investigation Report,* indicate that contaminant concentrations do not pose a threat to groundwater. The 207-North Retention Basin is a Hypalon®-lined concrete basin 16.8 by 3.0 m (55 by 10 ft). Given the impervious liner (Hypalon) and no documented leakage, impact to the groundwater is negligible.

ALTERNATIVE EVALUATIONS

The following provides an alternative evaluation discussion specific to each CERCLA criterion. A summary is provided in Table 6. Alternative 5, Partial Removal, Treatment, and Disposal with Capping, does not apply to this representative site and its associated analogous site because protection from deeper contamination is not required; therefore, only near-surface contamination needs to be excavated. In addition, Alternative 5 is identical to Alternative 3. Alternative 6, In Situ Vitrification, does not apply to this representative site and associated analogous waste site.

The preferred alternative for the 216-A-25 Pond has been documented in DOE/RL-2002-69, *Feasibility Study for the 200-CW-1 and 200-CW-3 Operable Units and the 200 North Area Waste Sites.* This representative site is only used here to address one analogous site, 207-A North Retention Basin, located in the 200-SC-1 OU.

Overall Protection of Human Health and the Environment – Alternative 2, Maintain Existing Soil Cover, Monitored Natural Attenuation, and Institutional Controls, is chosen as the preferred alternative for the 207-A North Retention Basin (the

Table 6. Preferred Alternative for the Representative Site 216-A-25 Pond Analogous Waste Site.[e]

Comparison of Alternatives – Representative Site 216-A-25 Pond Analogous Site					
Criteria for Representative and Analogous Waste Sites	Alternatives				
	① No Action	② MESC, MNA, IC[a]	③ RTD[b]	④ Capping	⑤ RTD/ Capping[d]
Analogous Site 207-A North Retention Basin			**☑**		N/A
Threshold Criteria					
Overall protection	☐	☑	☑	☑	
Compliance with ARARs	☐	☑	☑	☑	
Balancing Criteria					
Long-term effectiveness	◇	◈	◆	◈	
Short-term effectiveness	◈	◆	◈	◈	
Reduction in TMV[c]	◇	◇	◆	◈	
Implementability	◈	◆	◈	◈	
Cost (in thousands)					
Capital costs	$0	$0.1	$247	$60	
Non-discounted costs	$0	$3,552	$0	$1,930	
Total present worth	$0	$748	$247	$702	

[a]Maintain existing soil cover, monitored natural attenuation, and institutional controls.
[b]Removal, treatment, and disposal.
[c]Toxicity, mobility, or volume through treatment.
[d]Partial removal, treatment, and disposal with capping – not applicable for 216-A-25 Pond representative site or analogous site.
[e]The choice of the preferred alternative is based on information at the writing of this feasibility study. The preferred alternative may be revised based on future characterization efforts at the analogous sites.

☑ = Indicates the preferred alternative (e).
☑ = Yes, meets criterion.
☐ = No, does not meet criterion.
◆ = High: best satisfies evaluation guidelines.
◈ = Moderate: partially satisfies evaluation guidelines.
◇ = Low: least satisfies evaluation guidelines.

ARAR = applicable or relevant and appropriate requirement.
IC = institutional controls.
MESC = maintain existing soil cover.
MNA = monitored natural attenuation.
N/A = not applicable.
RTD = removal, treatment, and disposal.
TMV = toxicity, mobility, or volume through treatment.

one site analogous to the 216-A-25 Pond). This analogous site consists of a Hypalon-lined concrete basin. No leakage from the basin has been observed. Alternative 2 is protective because contamination is expected to be minimal and institutional controls would prevent exposure while contaminants decay to PRG levels.

Alternative 3, Removal, Treatment, and Disposal, also would be protective of human health and the environment because excavation would remove all contaminant concentrations that are greater than the PRGs, thereby protecting humans, ecology, and the groundwater. As a result of these actions, all RAOs would be achieved.

Alternative 4 also would be protective by placement of an engineered barrier, which eliminates exposure, reduces infiltration, and provides for intrusion protection.

Alternative 1 would not be protective because constituents presently exceed RAOs.

Compliance with ARARs - Alternative 1 does not comply with ARARs because constituents presently exceed the RAOs. Alternative 2 complies with ARARs at the 207-A North Retention Basin, where groundwater protection PRGs are not expected to be exceeded and direct exposure and environmental PRGs are expected to be attained within the 150 years. ARARs are met for Alternative 3 because all contaminants are removed. Alternative 4 meets the ARARs by placement of an engineered barrier that eliminates the exposure pathway to humans and ecological receptors. Groundwater protection standards are not expected to be exceeded at the 207-A North Retention Basin; consequently, the cap would not be built to address groundwater concerns.

Long-Term Effectiveness and Permanence - At the 207-A North Retention Basin, Alternative 1 does not provide long-term effectiveness or permanence because contaminants are not remediated. It is expected that Alternative 2 would be protective at the 207-A North Retention Basin because contamination is minimal and institutional controls would prevent exposure while contaminants decay to PRG levels (if they are not there already).

Alternative 3 is a permanent solution, because it removes all contamination from the site and places the contamination in an engineered facility.

Alternative 4 provides long-term effectiveness by reducing exposure using an engineered barrier to limit access by the receptors during the time necessary for the residual risk of contaminants to decrease to acceptable levels through natural radioactive decay. Groundwater protection standards are not expected to be exceeded at the 207-A North Retention Basin; consequently, the cap would not be built to address groundwater concerns.

Reduction of Toxicity, Mobility, or Volume Through Treatment - Treatment is included as an element of Alternative 3, but is not anticipated because constituents are expected to meet the disposal facility waste acceptance criteria. As such, reduction in toxicity, mobility, or volume of the contaminants will not be realized except through natural attenuation. All of the alternatives incorporate natural attenuation in the form of radioactive decay, which ultimately results in reduced toxicity and volume. Alternative 3 provides an additional perceived risk reduction because this alternative includes a physical action that places the contaminants in a more managed environment.

Short-Term Effectiveness - Alternative 1 would be effective for worker protection in the short term because this alternative does not involve any remedial actions. Alternatives 2 and 4 would be more effective in the short term than Alternative 3, predominantly because of their lower risk to remediation workers. Alternative 3 would involve excavating contaminated soil and debris, which would create potential contaminant exposures to short-term workers during excavation and transportation of the materials. Under Alternative 3, the contamination levels in the soil at the 216-A-25 Pond representative site would result in cumulative dose levels as high as 3.8 rem to workers and would require special techniques and protections to keep these levels in an acceptable range. The capping alternative results in a lower dose associated only with removal of aboveground structures, such as pipes. Risks to workers from potential exposure to contaminated soil and fugitive dust would be greater with Alternative 3 than with Alternative 4. Short-term impacts to vegetation and wildlife are minimal for Alternatives 1 and 2, minimal to moderate for Alternative 4 because of impacts to borrow areas, and moderate to high for Alternative 3 because of impacts to borrow areas and the larger areas that would be disturbed to reach the required excavation depths.

Implementability - Alternative 1 would be easily implemented because no action is performed. Alternative 2 currently is in use for all of the waste sites. The waste sites are in a surveillance and monitoring program and are posted with signs and/or fenced. Access to the waste sites also is controlled through Hanford Site access requirements, an excavation permit program, and a radiation work area permit program. The addition of monitoring wells or boreholes is easily implementable. Alternative 3 is considered more difficult to implement because excavation is required. Approximately 660 m^3 (860 yd^3) of waste would be generated to meet the PRGs through excavation and disposal of analogous site 207-A North Retention Pond. This volume represents less than 0.1 percent of the current capacity of the ERDF. Alternative 4 is considered easily implementable. Capping is a well-known and commonly used remedy for waste sites around the world. A barrier has been implemented at the Hanford Site and other types of barriers have been approved and implemented at other western arid sites. These barriers are easy to construct and maintain.

Cost - Capital costs and operating and maintenance costs are provided in Table 6. The listed present worth is based on a discount rate of 3.2 percent. The costs in Table 6 associated with Alternative 3 include excavation of the contaminated material to a depth of 4.6 m (15 ft). The costs associated with Alternative 4 are for an engineered barrier that provides protection for potential industrial users.

PREFERRED ALTERNATIVES

- The preferred alternative for the 207-A North Retention Basin is Alternative 3, Removal, Treatment, and Disposal. This alternative provides protectiveness for the minor contamination assumed for this waste site.

The Tri-Parties believe that the preferred alternatives are protective of human health and the environment, comply with ARARs, use permanent solutions, protect workers, and are cost-effective.

Representative Site 216-T-26 Crib and its Analogous Waste Sites

The 216-T-26 Crib is the representative site for the 216-T-36 Crib and the 200-W-79 Pipeline. The conceptual site model for these sites is presented in Table 1, with further information specific to each waste site provided in Appendix B.

Based on data obtained during past investigations, modeling predicts that cyanide, nitrate, nitrite, uranium, and technetium-99 may reach the groundwater at concentrations that exceed Federal standards. The top of the contamination is found about 5.5 m (18 ft) below ground surface and extends to a depth of 61 m (200 ft) (see Figure 8). Because the contamination is more than 4.6 m (15 ft) below the surface, it is not a risk to the industrial user or to ecological receptors. However, the contamination does present a risk to the inadvertent intruder down to a depth of 9.1 m (30 ft). This contamination will remain above intruder PRGs for 190 years.

Alternative 4, Capping, is the preferred alternative for 216-T-36 Crib. The contaminants of concern include cyanide, nitrate, nitrite, americium-241, cesium-137, plutonium-239, strontium-90 uranium, and technetium-99.

Alternative 3, Removal, Treatment, and Disposal, is the preferred alternative for the 200-W-9 Pipeline. The pipeline conveyed the liquid waste to the 216-T-36 Crib and did not dispose of the liquid waste. Therefore, deep contaminants are not expected.

ALTERNATIVE EVALUATIONS

The following provides an alternative evaluation discussion specific to each CERCLA criterion. A summary is provided in Table 7. Alternative 6, In Situ Vitrification, does not apply to this representative site and its associated analogous waste sites.

The preferred alternative (Alternative 4, Capping) for the 216-T-26 Crib has been documented in DOE/RL-2003-64, *Feasibility Study for the 200-TW-1 Scavenged Waste Group, the 200-TW-2 Tank Waste Group, and the 200-PW-5 Fission-Product-Rich Waste Group Operable Units.* This representative site is used to address two analogous sites (the 216-T-36 Crib and the 200-W-79 Pipeline) found in the OUs addressed in this Proposed Plan.

Overall Protection of Human Health and the Environment – Alternative 4, Capping, is chosen as the preferred alternative for the 216-T-36 Crib. This waste site achieves overall protection of human health and the environment through the implementation of Alternative 4 because infiltration is reduced, which supports the protection of groundwater, and inadvertent intrusion is prevented by the design of the barrier, which would include intrusion protection layers.

Alternative 3 is the preferred alternative for the 200-W-79 Pipeline. Deep contamination is not expected given the materials of construction and the function of the pipeline. Alternative 3 would be protective of human health and the environment because excavation would remove COCs that are greater than the PRGs, thereby protecting humans, ecology, and the groundwater. Alternative 5 provides for protection of human health and the environment by removing near-surface contamination (in this case to a depth of 9.1 m [30 ft]) and by use of an engineered barrier to protect groundwater.

Alternatives 1 and 2 are not protective because constituents are anticipated to remain at concentrations greater than the PRGs past the 500 years of institutional control.

Compliance with ARARs – Alternatives 1 and 2 do not comply with ARARs because the waste sites currently exceed the RAOs. ARARs are met for Alternatives 3, 4, and 5. Alternative 3 meets the ARARs through the removal of contaminated material. Alternative 5 meets the ARARs by removing the portion of the subsurface soil associated with higher contaminant concentrations and placing a soil barrier over remaining residual contamination. Alternative 4 meets the ARARs through placement of an engineered barrier, which eliminates the exposure pathway and limits infiltration to protect groundwater.

Long-Term Effectiveness and Permanence – Alternatives 1 and 2 do not provide long-term effectiveness or permanence because contaminants are not remediated and

Table 7. Preferred Alternative for the Representative Site 216-T-26 Crib Analogous Waste Sites.[e]

Comparison of Alternatives - Representative Site 216-T-26 Crib Analogous Sites					
	Alternatives				
Criteria for Representative and Analogous Waste Sites	① No Action	② MESC, MNA, IC[a]	③ RTD[b]	④ Capping	⑤ RTD/ Capping[d]
Analogous Site 216-T-36 Crib				**☑**	
Threshold Criteria					
Overall protection	☐	☐	☑	☑	☑
Compliance with ARARs	☐	☐	☑	☑	☑
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◇	◈
Short-term effectiveness	◈	◈	◇	◆	◈
Reduction in TMV[c]	◇	◇	◆	◇	◈
Implementability	◈	◈	◇	◆	◈
Cost (in thousands)					
Capital costs	$0	$28	$37,736	$1,522	$1,568
Non-discounted costs	$0	$3,483	$0	$8,739	$10,765
Total present worth	$0	$727	$37,736	$3,004	$3,455
Analogous Site 200-W-79 Pipeline			**☑**		N/A
Threshold Criteria					
Overall protection	☐	☐	☑	☑	
Compliance with ARARs	☐	☐	☑	☑	
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◇	
Short-term effectiveness	◈	◈	◇	◆	
Reduction in TMV	◇	◇	◆	◇	
Implementability	◈	◈	◇	◆	
Cost (in thousands)					
Capital costs	$0	$4	$238	$211	
Non-discounted costs	$0	$3,483	$0	$1,872	
Total present worth	$0	$729	$238	$685	

[a]Maintain existing soil cover, monitored natural attenuation, and institutional controls.
[b]Removal, treatment, and disposal.
[c]Toxicity, mobility, or volume through treatment.
[d]Partial removal, treatment, and disposal with capping.
[e]The choice of the preferred alternative is based on information at the writing of this feasibility study. The preferred alternative may be revised based on future characterization efforts at the analogous sites.

☑ = Indicates the preferred alternative (e).
☑ = Yes, meets criterion.
☐ = No, does not meet criterion.
◆ = High: best satisfies evaluation guidelines.
◈ = Moderate: partially satisfies evaluation guidelines.
◇ = Low: least satisfies evaluation guidelines.

ARAR = applicable or relevant and appropriate requirement.
IC = institutional controls.
MESC = maintain existing soil cover.
MNA = monitored natural attenuation.
RTD = removal, treatment, and disposal.
TMV = toxicity, mobility, or volume through treatment.

could remain for more than 500 years. It is assumed that the enforcement of institutional controls could not be ensured past this time frame.

At the waste sites analogous to the 216-T-26 Crib, Alternative 3 would be effective and permanent, because it removes all contaminants from the site. Alternative 5 provides long-term protection by removing near-surface contamination and providing a cap to protect groundwater.

Alternative 4 provides long-term effectiveness and permanence by reducing exposure using an engineered barrier and incorporating intrusion barriers to limit access by the receptors during the time necessary for the residual risk of contaminants to decrease to acceptable levels through natural radioactive decay (190 years). Groundwater monitoring would be required to show no further degradation based on the elevated concentrations of contaminants that could impact groundwater.

Short-Term Effectiveness - Alternative 1 would be effective for worker protection in the short term because this alternative does not involve any remedial actions. Alternatives 2 and 4 would be more effective in the short term than Alternatives 3 and 5, predominantly because of their lower risk to remediation workers. Alternatives 3 and 5 would involve excavating contaminated soil and debris, which would create potential contaminant exposures to short-term workers during excavation and transportation of the materials. Under Alternatives 3 and 5, workers would be exposed to a cumulative dose of approximately 0.6 rem during the excavation of the 216-T-26 Crib. The capping alternative results in a lower dose associated only with removal of aboveground structures, such as pipes. Risks to workers from potential exposure to contaminated soil and fugitive dust would be greater with Alternatives 3 and 5 than with Alternative 4. Short-term impacts to vegetation and wildlife are minimal for Alternatives 1 and 2, minimal to moderate for Alternative 4 because of impacts to borrow areas, and moderate to high for Alternatives 3 and 5 because of impacts to borrow areas and the large areas that would be excavated.

Reduction of Toxicity, Mobility, or Volume Through Treatment - Treatment is included as an element of Alternatives 3 and 5, but is not anticipated because constituents are expected to meet the disposal facility waste acceptance criteria. As such, reduction in toxicity, mobility, or volume of the contaminants will not be realized except through natural attenuation. All of the alternatives incorporate natural attenuation in the form of radioactive decay, which ultimately results in reduced toxicity and volume. Alternatives 3 and 5 provide an additional perceived risk reduction because these alternatives include a physical action that places the contaminants in a more managed environment, thereby reducing the forces (e.g., infiltration) that drive the contaminants toward groundwater.

Implementability - Alternative 1 would be easily implemented because no action is performed. Alternative 2 currently is in use for all of the waste sites. The waste sites are in a surveillance and monitoring program and are posted with signs and/or are fenced. Access to the waste sites also is controlled through Hanford Site access requirements, an excavation permit program, and a radiation work area permit program. The addition of monitoring wells or boreholes is easily implementable. Alternative 3 is considered more difficult to implement because excavation would be required to a depth of 9.1 m (30 ft) to remove the threat to an inadvertent intruder. The contamination levels in the soil at some waste sites would result in cumulative dose levels as high as 0.54 rem to workers and would require special techniques and protections to maintain these doses at an acceptable level. Approximately 10,200 m^3 (13,300 yd^3) of waste would be generated to meet the PRGs through excavation and disposal of waste sites analogous to the 216-T-26 Crib. This volume represents less than 0.3 percent of the current capacity of the ERDF. Alternative 5 will require the excavation of 1,300 m^3 (1,700 yd^3) of contaminated soil, much less than Alternative 3.

Alternative 4 is considered easily implementable. Capping is a well-known and commonly used remedy for waste sites around the world. A barrier has been implemented at the Hanford Site and other types of barriers have been approved and implemented at other western arid sites. These barriers are easy to construct and maintain.

Cost – Capital costs and operating and maintenance costs are provided in Table 7. The listed present worth is based on a discount rate of 3.2 percent. The costs in Table 7 associated with Alternative 3 include excavation of the contaminated material up to a depth of 61 m (200 ft). The costs associated with Alternative 4 are for an engineered barrier that provides intrusion protection for potential inadvertent intruders. The costs associated with Alternative 5 include excavation of contaminated soils to a depth of 9.1 m (30 ft), followed by a soil barrier.

PREFERRED ALTERNATIVES

- The preferred alternative for the 216-T-36 Crib is Alternative 4, Capping. This alternative is protective of human health, the environment, groundwater, and workers. It is implementable and cost-effective.
- The preferred alternative for the 200-W-79 Pipeline is Alternative 3, Removal, Treatment, and Disposal. This alternative is protective of human health, the environment, groundwater, and workers. It is implementable and cost-effective.

The Tri-Parties believe that the preferred alternatives are protective of human health and the environment, comply with ARARs, use permanent solutions, protect workers, and are cost-effective.

PLUG-IN APPROACH OF 200-CW-5, 200-CW-2, 200-CW-4, AND 200-SC-1 OPERABLE UNIT WASTE SITES

The plug-in approach is a process that helps make remedial action decisions for additional waste sites using existing CERCLA evaluations. In the future, the plug-in approach is proposed for any similar waste sites that already have been defined within the 200-CW-5, 200-CW-2, 200-CW-4, and 200-SC-1 OUs and for newly discovered waste sites that have a conceptual site model similar to that of those for the representative waste sites already addressed in this Proposed Plan. The plug-in approach will be used on the analogous sites considered in the feasibility study after additional data are collected in the confirmatory and design sampling phases.

The plug-in approach supports the goal of remediating waste sites within the OUs in conjunction with the analogous site approach. The traditional CERCLA approach for remedy selection would require the development of multiple proposed plans and RODs that, for similar sites, would be nearly identical to the feasibility studies, proposed plans, and RODs already developed and proven to be successful. The plug-in approach allows remedial actions to begin quickly at a waste site without the need for redundant remedy selection processes.

The plug-in approach requires three main elements to establish its use as a cost-effective tool for remediation.

- First, multiple sites must be identified that share common physical and contaminant characteristics. These characteristics are referred to as the conceptual site model.
- Second, a remedial alternative, or standard remedy, must be established that has been shown to be protective and cost-effective for sites that share the common conceptual site model.
- Lastly, sites sharing a common conceptual site model must be shown to require remedial action because of contaminant concentrations that pose risk to human health and the environment.

To use the plug-in approach for a waste site not evaluated in the feasibility study, a site must fit the defined conceptual model and must be shown to require remedial action. The site then can be "plugged in" to the standard remedy. The following information describes how the plug-in approach is proposed to be used for remedy selection.

Establishing the Conceptual Site Model

Five conceptual site models have been defined based on the site characteristics contained in the feasibility study. These characteristics are as follows:

- Type of contaminant inventory
- Concentrations of contaminants in environmental media
- Types of contaminated environmental media (soil) or material (e.g., concrete, metal, wood)
- Extent of contamination within the environment (that is, the depth of discharge, the expected contaminant distributions, and the potential for hydrologic and contaminant impacts to groundwater).

Based on the representative sites evaluated in the feasibility study, the following five conceptual site models were developed:

- Waste sites where no hazardous material was disposed of or where contaminants disposed of currently meet the RAOs.
- Waste sites where limited contamination exists at the waste sites, an existing soil cover is in place and is of sufficient thickness to provide protection, contaminants are expected to meet the RAOs during the institutional control period (such as within 150 years), and groundwater PRGs are not exceeded. Contaminated environmental media include soil, solid waste, debris, and materials associated with the waste sites, such as timbers and pipes.
- Waste sites where contaminants exceed the RAOs and contamination is shallow and low-volume and can be cost-effectively remediated through removal, treatment, and disposal. Typically, these contaminants exceed the human health and ecological PRGs; however, groundwater PRGs are not exceeded at depths that make excavation impracticable. Contaminated environmental media include soil, solid waste, debris, and materials associated with the waste sites, such as timbers and pipes.
- Waste sites where contaminants exceed the PRGs, where contaminants are at concentrations that pose a significant worker risk, and where the contaminants having potential to adversely impact groundwater are at significant depth.

Contaminated environmental media include soil, solid waste, debris, and materials associated with the waste sites, such as timbers and pipes.

- Waste sites where contaminants exceed the PRGs, where contaminants are at concentrations that would not pose a significant worker risk, and where the contaminants having potential to adversely impact groundwater are at significant depth. Contaminated environmental media include soil, solid waste, debris, and materials associated with the waste sites, such as timbers and pipes.

Establishing the Standard Remedy

The standard remedies, based on the 200-CW-5, 200-CW-2, 200-CW-4, and 200-SC-1 OU waste sites, have been defined on the basis of the conceptual models presented by the representative waste sites, as well as on the alternative evaluations conducted for all waste sites. As such, six standard remedies are identified for potential plug-in sites. These remedies, along with their required characteristics, are as follows.

- **Alternative 1: No Action** has been defined as a standard remedy for waste sites whose conceptual site model indicates that no hazardous materials were disposed of at the waste site or that contaminants disposed of currently meet the RAOs.
- **Alternative 2: Maintain Existing Soil Cover, Monitored Natural Attenuation, and Institutional Controls** has been defined as the standard remedy for waste sites whose conceptual site model indicates that limited contamination exists at the waste sites, an existing soil cover is in place and of sufficient thickness to provide protection, contaminants are expected to meet the RAOs during the institutional control period (such as within 150 years), and groundwater PRGs are not exceeded. Contaminated environmental media are similar to the media exhibited by the waste sites included in this Proposed Plan. The media include soil, solid waste, debris, and materials associated with the waste sites, such as timbers and pipes.
- **Alternative 3: Removal, Treatment, and Disposal** has been defined as the standard remedy for waste sites whose conceptual site model indicates that contaminants exceed the RAOs and that contamination is shallow and low volume and can be cost-effectively remediated through the removal, treatment, and disposal of contaminated media. Typically, as shown in the 200-CW-5, 200-CW-2, 200-CW-4, and 200-SC-1 OU waste sites, these contaminants exceed the human health and ecological PRGs; however, groundwater PRGs are not exceeded at depths that make excavation impracticable. Contaminated environmental media are similar to the media exhibited by the waste sites included herein. The media include soil, solid waste, debris, and materials associated with the waste sites, such as timbers and pipes.
- **Alternative 4: Capping** has been defined as the standard remedy for waste sites whose conceptual site model indicates that contaminants exceed the RAOs and that the contaminants at greater depths have a potential to adversely impact groundwater. Contaminant concentrations and contaminated environmental media are similar to the media exhibited by the waste sites included in this Proposed Plan. These media include soil, solid waste, debris, and materials associated with the waste sites, such as timbers and pipes. Contaminant concentrations would indicate the potential to adversely impact groundwater and would pose significant worker protection and intruder risk. Contaminants also

may pose a risk to humans and ecological receptors, depending on the depth to the top of the contamination.

- **Alternative 5: Partial Removal, Treatment, and Disposal with Capping** has been defined as the standard remedy for waste sites where contaminants exceed the PRGs, where contaminants in the near surface are at concentrations that would not pose a significant worker risk, but that would result in substantial risk reduction, and where the contaminants having potential to adversely impact groundwater are at significant depth. The contaminants that can be readily excavated would be removed and the remaining contaminants would be capped to provide groundwater protection. Contaminant concentrations and contaminated environmental media generally are less than the media exhibited by the waste sites included in this Proposed Plan; however, the concentrations are high enough to result in real risk reduction in the near surface without exposing workers to unacceptable risks. Contaminated environmental media include soil, solid waste, debris, and materials associated with the waste sites, such as timbers and pipes. Cost analysis would be required to ensure that this alternative is cost-effective when compared to either Alternative 3 or Alternative 4.
- **Alternative 6: In Situ Vitrification** has been defined as a potential remedy where significant concentrations of transuranic radionuclides are present, the waste is relatively shallow, and contaminant concentrations may pose significant worker and intruder risk. Contaminants also may pose a direct contact risk to humans and ecological receptors, depending on the depth to the top of the contamination. Cost analysis would be required to ensure vitrification is cost-effective when compared to other alternatives. Costs of vitrification should include an analysis as to whether a cap is required. A cap may be required if contamination below the vitrified zone exceeds groundwater protection PRGs or if an inadvertent intruder risk exists.

Establishing the Need for Remedial Action

Waste sites that share a common conceptual site model will plug-in to the standard remedy if they are determined to require remedial action because of a risk to human health and the environment (based on the defined RAOs and associated PRGs, as defined previously). Some of the waste sites in the 200-CW-5, 200-CW-2, 200-CW-4, and 200-SC-1 OUs likely will require confirmatory sampling to validate the conceptual site model and the identified preferred remedy. The preferred remedy will be implemented following confirmation of the conceptual site model. Should the confirmatory sampling indicate variations in the defined conceptual site model, this plug-in approach will be used to define the appropriate remedy.

Public Involvement in the Plug-in Approach

To ensure that the public is involved in the application of the plug-in approach, the Tri-Parties will publish explanations of significant differences at the following points in the plug-in process:

- When newly discovered waste sites are proven through analysis to be above remediation goals and can plug-in to the standard remedy
- When confirmatory sampling identified for the waste sites discussed herein indicates variations in the defined conceptual site model such that the preferred remedy is no longer protective.

lic Comment Period:
March XX - April XX, 2005

Public Meetings:
As requested

Information Repositories
This Proposed Plan is available for viewing at the following public information repositories:

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Consolidated Information Center
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Public Reading Room
Room 101L
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Richland, Washington 99352
509/372-7443
ATTN: Terri Traub

COMMUNITY PARTICIPATION

Public Involvement

Citizens are encouraged to get involved in decision making for the Hanford Site and specifically the 200-CW-5, 200-CW-2, 200-CW-4, and 200-SC-1 OU waste sites by reviewing this Proposed Plan and related documents, attending a public meeting or briefing, and providing feedback to the Tri-Parties.

Public Meetings

Members of the public may request a meeting to provide oral comments or to receive an explanation of the remedial alternatives presented in the Proposed Plan by contacting John Price at the Washington State Department of Ecology. To provide adequate notice for all Hanford stakeholders, public meeting requests should be received by TBD.

Submitting Comments

The Tri-Parties will accept written comments on the Proposed Plan at any time during the 30-day public comment period. Please send written comments to John Price at the Washington State Department of Ecology via the following:

- mail: 3100 Port of Benton Blvd., Richland, WA 99352
- fax: (509) 736-3030
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Administrative Record

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Figure 1. Location of the Hanford Site and the 200-CW-5, 200-CW-2, 200-CW-4, and 200-SC-1 Operable Unit Waste Sites.

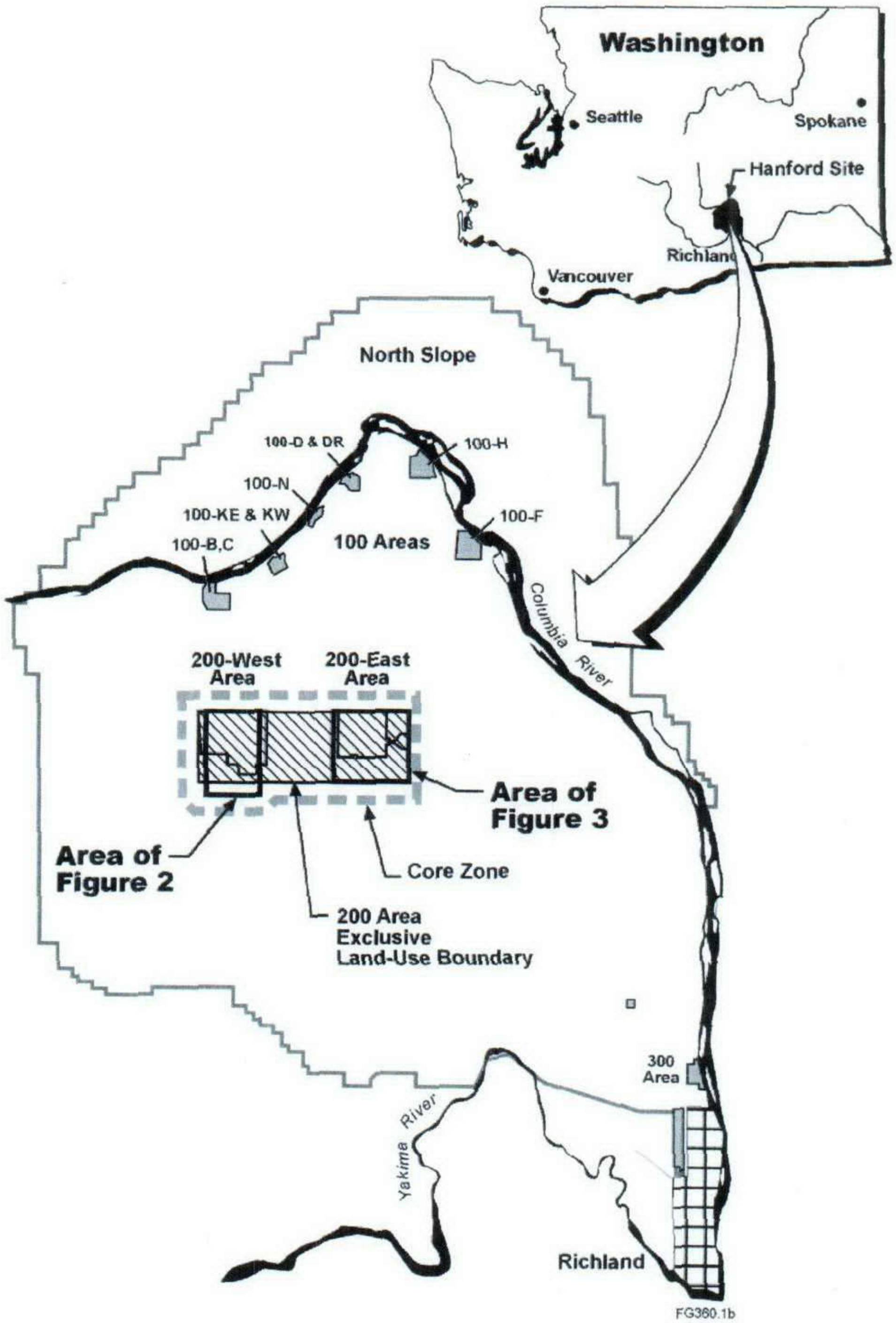


Figure 2. Location of the 200-CW-5, 200-CW-2, 200-CW-4, and 200-SC-1 Operable Unit Waste Sites in the 200 West Area.

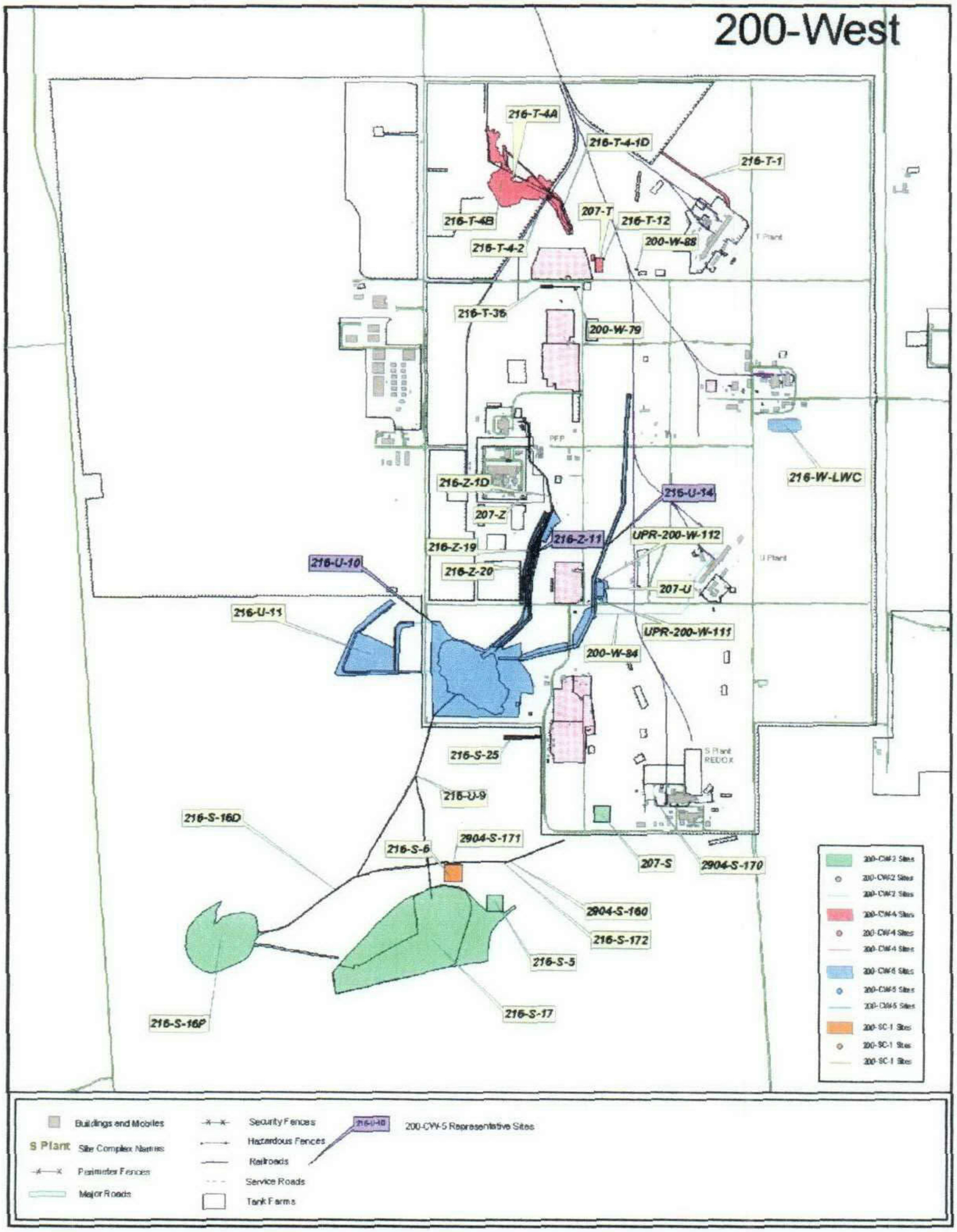


Figure 3. Location of the 200-SC-1 Operable Unit Waste Sites in the 200 East Area.

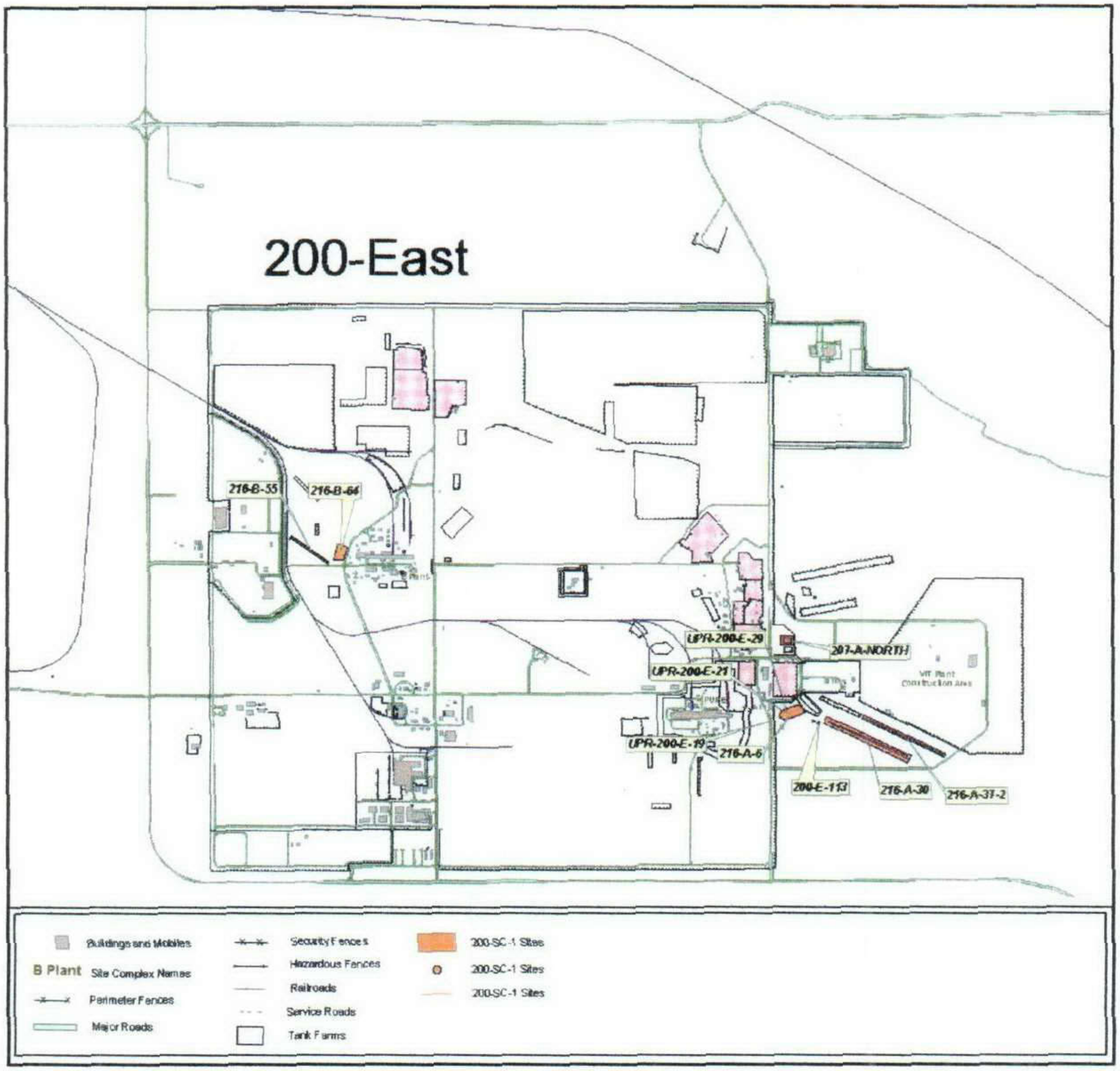


Figure 4. 216-U-10 Pond Contaminants of Concern.

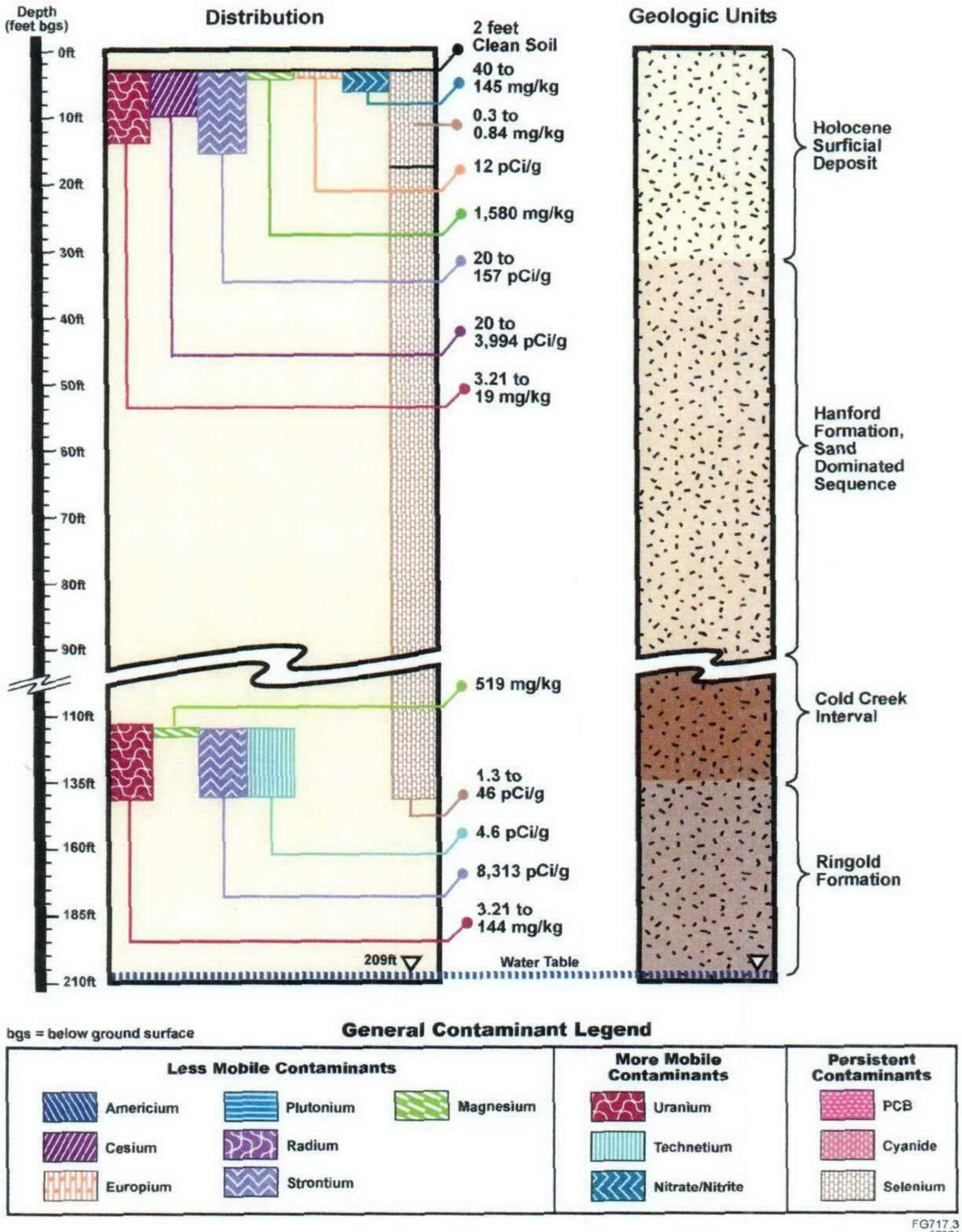


Figure 5. 216-U-14 Ditch Contaminants of Concern.

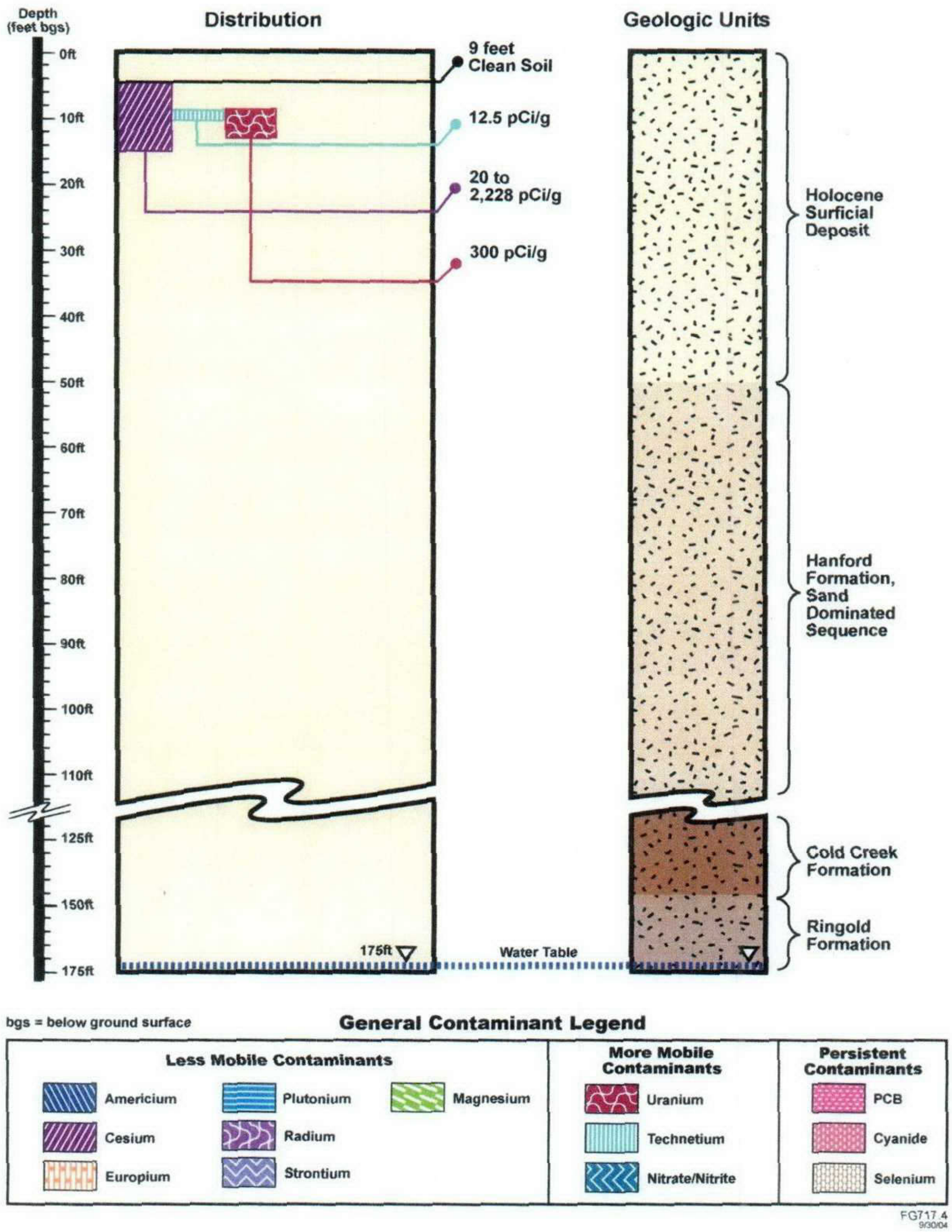


Figure 6. Z Ditches Contaminants of Concern.

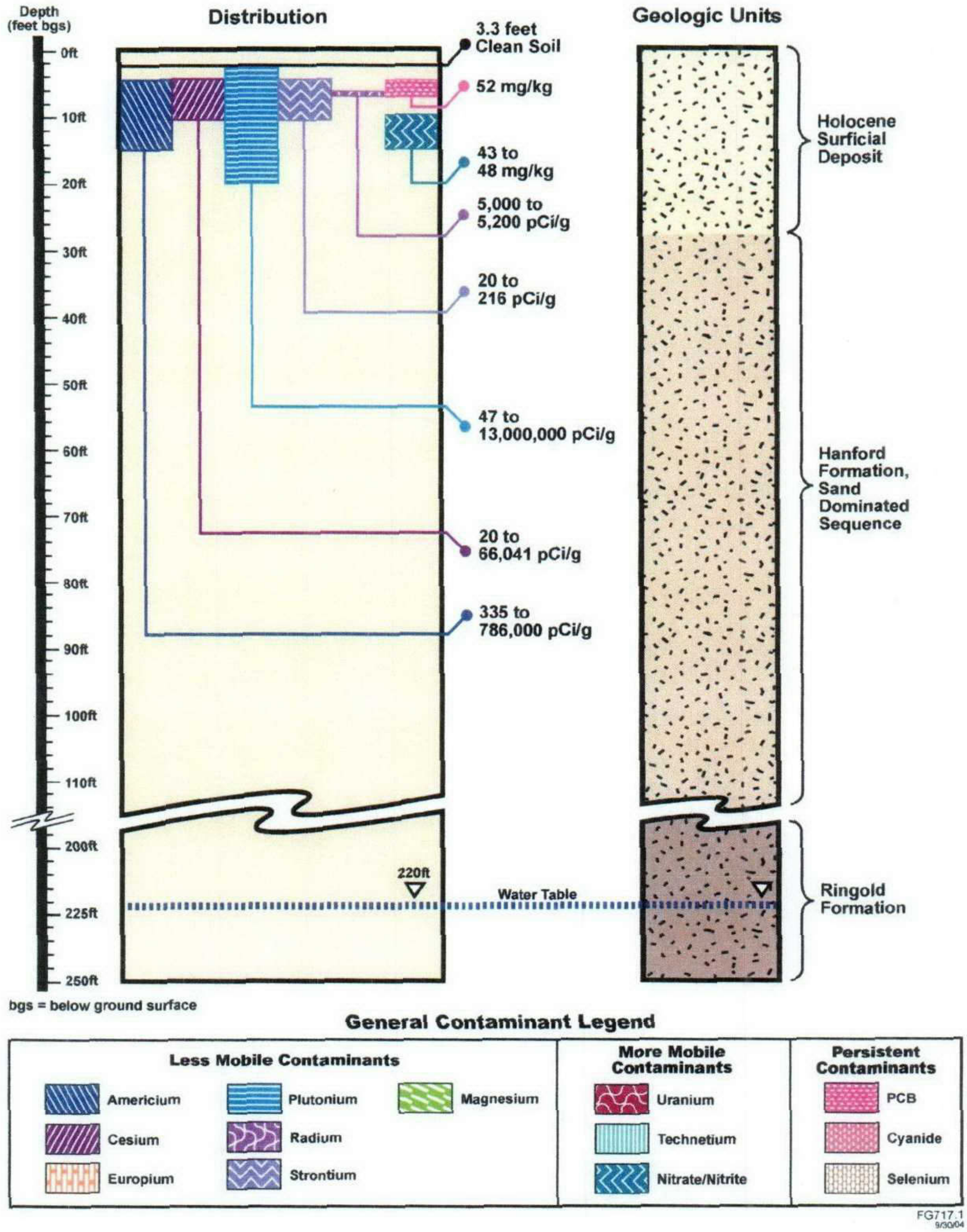


Figure 7. 216-A-25 Gable Mountain Pond Contaminants of Concern.

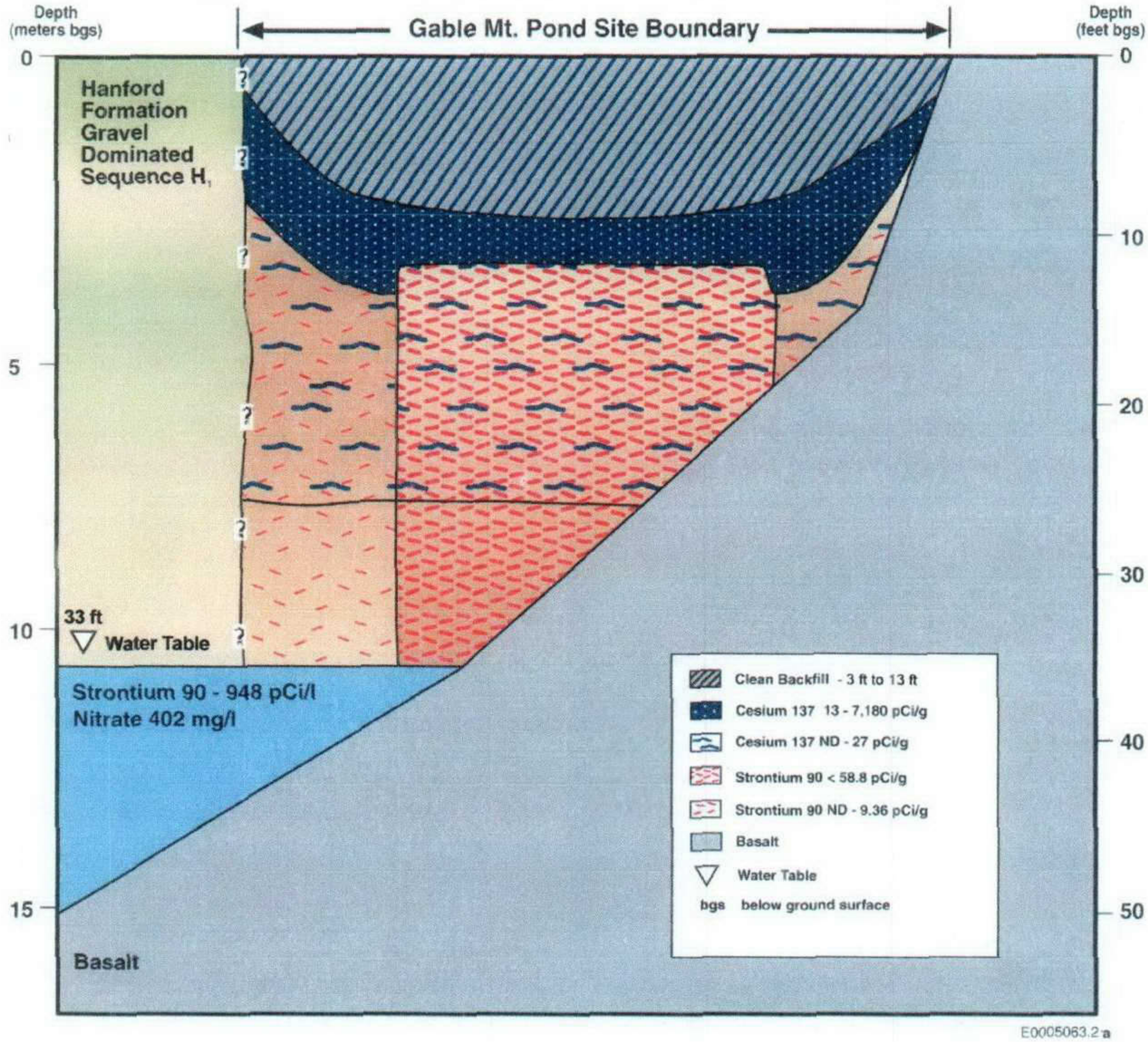
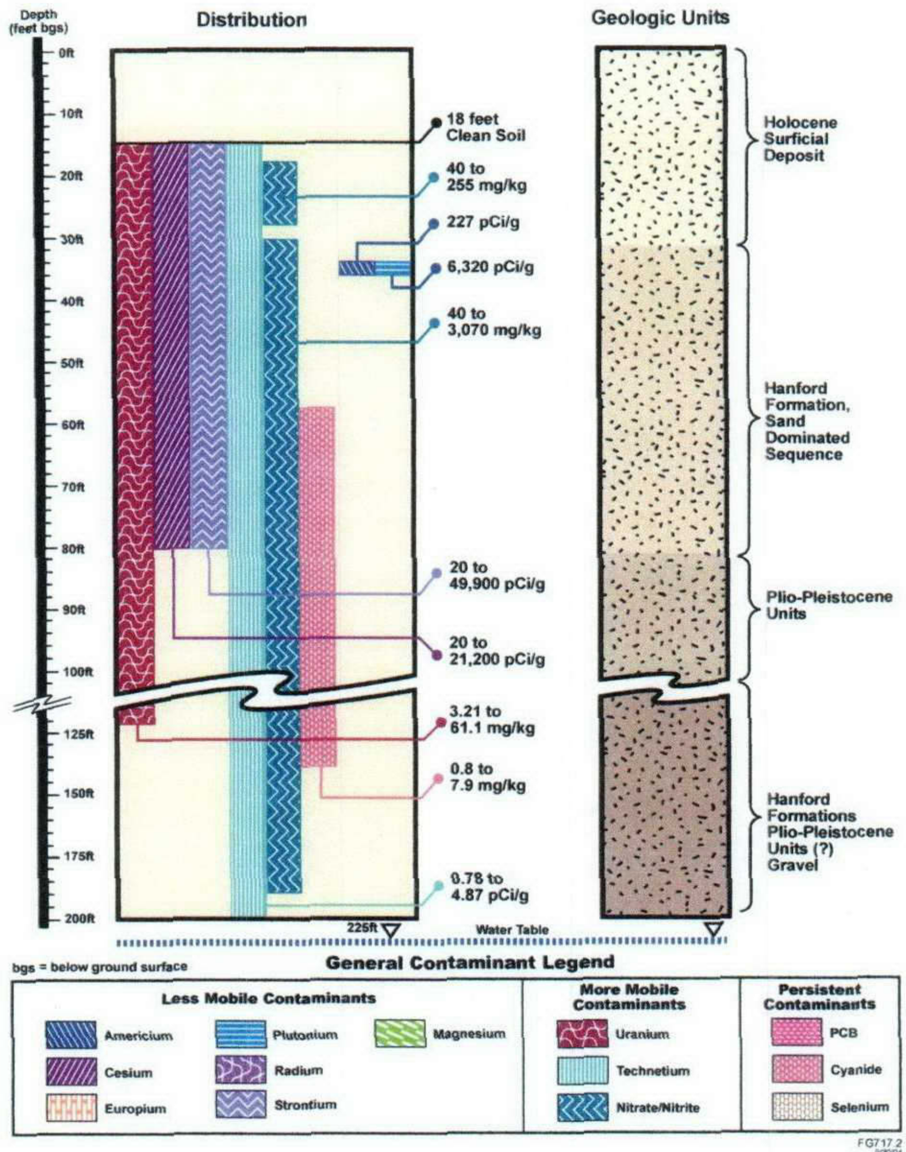


Figure 8. 216-T-26 Crib Contaminants of Concern.



APPENDIX A

COST ESTIMATE DETAILS

Table A-1. Net Present Worth Cost Estimates in Thousands. (2 Pages)

Waste Site/Group	ALT 1: No Action	ALT 2: Maintain Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation	ALT 3: Removal, Treatment, and Disposal	ALT 4: Capping	ALT 5: Partial Removal, Treatment, and Disposal with Capping	ALT 6: In Situ Vitrification
Representative Site						
216-U-10 Pond	--	$13,765	$1,811,601	$46,064	$130,523	--
Analogous Sites						
216-S-16P Pond	--	$14,158	$1,869,572	$47,629	$137,569	--
Group Consisting of 216-S-17 Pond and UPR-200-W-124	--	$12,146	$1,338,773	$32,389	$93,637	--
216-T-4A Pond	--	$11,532	$1,581,528	$38,091	$110,287	--
216-T-4B Pond	--	$1,391	$219,204	$2,330	$7,075	--
216-U-9 Ditch	--	$915	$554,350	$777	$4,085	--
216-U-11 Ditch	--	$1,043	$699,278	$1,329	$6,173	--
216-S-5 Crib	--	$1,096	$182,972	$1,605	$4,738	--
216-S-6 Crib	--	$1,096	$182,972	$1,605	$4,738	--
Group Consisting of 216-A-6 Crib, UPR-200-E-19, UPR-200-E-21, and UPR-200-E-29	--	$821	$117754	$729	$1,241	--
216-A-30 Crib	--	$815	$277,175	$677	$2,234	--
216-S-25 Crib	--	$4,752	$592,393	$11,684	$34,096	--
216-A-37-2 Crib	--	$815	$277,175	$677	$2,234	--
216-B-55 Crib	--	$771	$186,595	$682	$1,325	--
216-S-172 Control Structure	--	$746	$238	$702	--	--
2904-S-160 Control Structure	--	$746	$238	$702	--	--
2904-S-170 Control Structure	--	$730	$238	$686	--	--
2904-S-171 Control Structure	--	$746	$238	$702	--	--
207-S Retention Basin	--	$877	$2,510	$702	--	--
216-B-64 Retention Basin	--	$769	$1,044	$682	--	--
200-E-113 Process Sewer	--	$726	$467	$677	--	--
Representative Site						
216-U-14 Ditch	--	$918	$3,702	$17,497	--	--
Analogous Sites						
216-S-16D Ditch	--	$789	$1,363	$5,260	--	--
216-T-1 Ditch	--	$738	$977	$4,230	--	--
Group Consisting of 216-T-4-1D Ditch and 216-T-4-2 Ditch	--	$882	$3,243	$16,012	--	--
216-W-LWC Crib	--	$1,510	$2,588	$61,333	--	--
Group Consisting of 207-U Retention Basin, UPR-200-W-111, and UPR-200-W-112	--	$1,072	$4,362	$28,035	--	--
207-T Retention Basin	--	$952	$4,180	$23,276	--	--
216-T-12 Trench	--	$725	$238	$681	--	--
200-W-84 Process Sewer	--	$742	$238	$3,049	--	--
200-W-88 Process Sewer	--	$862	$2,536	$15,888	--	--
200-W-102 Process Sewer	--	$738	$981	$4,475	--	--

Table A-1. Net Present Worth Cost Estimates in Thousands. (2 Pages)

Waste Site/Group	ALT 1: No Action	ALT 2: Maintain Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation	ALT 3: Removal, Treatment, and Disposal	ALT 4: Capping	ALT 5: Partial Removal, Treatment, and Disposal with Capping	ALT 6: In Situ Vitrification
Representative Site						
Group Consisting of 216-Z-11 Ditch, 216-Z-1D Ditch, 216-Z-19 Ditch, 216-Z-20 Crib, and UPR-200-W-110	--	$1,593	$77,501[(1)]	$42,237	--	$93,567
Analogous Sites						
207-Z Retention Basin	--	$741	$296	$3,761	--	--
Representative Site						
216-A-25 Pond	--	(2)	(2)	(2)	--	--
Analogous Sites						
207-A North Retention Basin	--	$748	$247	$702	--	--
Representative Site						
216-T-26 Crib	--	(2)	(2)	(2)	(2)	--
Analogous Sites						
216-T-36 Crib	--	$727	$37,726	$3,004	$3,455	--
200-W-79 Pipeline	--	$729	$238	$685	--	--

1 - This cost does not reflect the programmatic disposal cost at the Waste Isolation Pilot Plant. If the programmatic disposal cost were included, the total cost for this alternative would be $142,247,000.

2 - Cost not included because they were reported in DOE/RL-2002-69, *Feasibility Study for the 200-CW-1 and 200-CW-3 Operable Units and the 200 North Area Waste Sites*, Draft A and DOE/RL-2003-64, *Feasibility Study for the 200-TW-1 Scavenged Waste Group, the 200-TW-2 Tank Waste Group, and the 200-PW-5 Fission-Product Rich Waste Group Operable Units*, Draft A Re-issue..

APPENDIX B

REPRESENTATIVE AND ANALOGOUS WASTE SITE SUMMARY

Table B-1. Representative Sites and Associated Analogous Waste Sites. (26 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site and Discharge History	Rationale
Representative Site			
216-U-10 Pond	The 216-U-10 Pond is an unlined topographic depression. It was 12 ha (30 a) with varying depth and was in operation from 1944 to 1985, when it was backfilled and surface stabilized.	The pond received from the following: 284-W Powerhouse, 231-Z Laboratory, 234-5Z Building, 2723-W Building, 2724-W Building, 221-U Building, 224-U Building, 241-U-110 Condenser Tank, and 242-S Evaporator Facilities via the 216-U-14 Ditch.	Characterization is described in DOE/RL-2003-11. <u>Contaminant Distribution</u> Contaminants were detected beneath the 216-U-10 Pond to a maximum depth of about 42.6 m (140 ft). Maximum contaminant concentrations generally are present near the surface in the upper 2.0 m (6.5 ft) of the soil column. The depth to the bottom of the pond was about 2.0 m (6.5 ft) when it was actively receiving effluent. Soils above 2.0 m (6.5 ft) are characterized by material used to fill in the pond during decommissioning efforts, sediment from the bottom of the pond, or both. Cesium-137, Sr-90, Se-79, plutonium, and uranium are the predominant radionuclides detected from the surface to the bottom of the pond with concentrations generally decreasing with depth beneath the pond bottom. With few exceptions, radionuclides either were not detected or were detected at concentrations of less than about 2.0 pCi/g at depths greater than 2.0 m (6.5 ft). Maximum values of Tc-99 (4.6 pCi/g), Sr-90 (28 pCi/g), U-235 (2.4 pCi/g), and U-234 (56 pCi/g) sporadically are present at depths greater than 2.0 m (6.5 ft) bgs. In boreholes adjacent to the pond, Cs-137 and U-235 were detected above screening levels with Cs-137 (4.3 pCi/g) at approximately 0.8 m (2.5 ft) bgs and U-235 (5 pCi/g), detected 73 m (240 ft) bgs (reference: DOE/RL-2003-11). Maximum uranium: 56 pCi/g. Maximum Cs-137: 440 pCi/g. Maximum Sr-90: 28 pCi/g. Within the pond, Cs-137 was detected at 440 pCi/g decayed to 366 pCi/g (in 2002) 0 to 3 m (0 to 10 ft) bgs. Soil samples indicate that the average concentration of Cs-137 is 337 pCi/g. Comparison of the two data sets indicates good correlation between the logging and laboratory data. From a groundwater contamination perspective, the effluent volume discharged to the 216-U-10 Pond was greater than the soil column pore volume, suggesting the volume released was sufficient to reach the aquifer during waste site operations. PNNL-13788 indicates that mobile contaminants (nitrate, carbon tetrachloride, and uranium) exceed groundwater protection standards near the pond. Nitrate and uranium may be associated with waste disposal practices at the pond as well as at other waste sites in the 200 West Area. The results of 216-U-10 Pond modeling indicate that Se-79, Tc-99, cyanide, fluoride, and the uranium species reach the groundwater at significant concentrations.

Table B-1. Representative Sites and Associated Analogous Waste Sites. (26 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site and Discharge History	Rationale
Analogous waste sites to be evaluated by the 216-U-10 Pond model			
216-S-16P Pond	The 216-S-16P Pond consists of four lobes separated by dikes and a leach trench. Lobe #4 never was used. In 1975, the pond was backfilled and surface stabilized using soil from the dikes. The pond was 125,000 m^2 (1,350,000 ft^2) and 0.9 m (3 ft) deep.	The pond received process cooling water and steam from the 202-S Building (only Lobe #1 received 202-S waste). In 1973, the 216-U-9 Ditch was connected to the 216-S-16 Ditch to divert overflow from the 216-U-10 Pond to the 216-S-16 Pond. The pond was opened in 1957 and operated until 1975.	The 216-S-16P Pond is analogous to the 216-U-10 Pond as indicated by process history, contaminant inventory, and effluent volume received, and is analogous because of the following. 1. Construction and configuration are similar (unlined ponds). 2. Waste was received from the same type of source (202-S Building), although the volume received was less. 3. The inventory for this site is very similar to and bounded by the 216-U-10 Pond. 4. The geology of both sites is similar. 5. The extent of contamination spread is bounded by the 216-U-10 Pond. The highest concentration for Cs-137 was 391 pCi/g and the Am-241 concentration was 19.7 pCi/g at 1.1 m (3.5 ft bgs) (1976). 6. The effluent volume discharged to this crib is 18 times the soil column capacity, bounded by the 216-U-10 Pond, and suggests a potential for groundwater impact.
216-S-17 Pond	The 216-S-17 Pond was formed by earthen dikes, approximately 1 m (3.3 ft) high on the north and west side of the site. Overall site dimensions are 292 by 292 m (958 by 958 ft), or 6.9 to 8.5 ha (17 to 21 a) and 3.1 m (10 ft) deep. The pond was in operation from 1951 to 1954.	The pond received process effluent from the 202-S Building and overflow from the 216-U-10 Pond via the 216-U-9 Ditch.	The 216-S-17 Pond is analogous to the 216-U-10 Pond as indicated by process history, contaminant inventory, and effluent volume received, and is analogous because of the following. 1. Construction and configuration are similar (unlined ponds). 2. Waste was received from the same source (e.g., 202-S Building) and overflow from the 216-U-10 Pond, although the volume received was significantly less. 3. The contaminant inventory for this site is appropriate given its source (overflow from the 216-U-10 Pond). 4. The geology of both sites is similar. 5. The extent of contamination spread is bounded by the 216-U-10 Pond. 6. The effluent volume discharged to this crib is bounded by the 216-U-10 Pond and is four times the soil column capacity, suggesting a potential for groundwater impact.
216-T-4A Pond	The 216-T-4A Pond is a natural surface depression, 6.5 ha (16 a) in area, and 3.1 m (10 ft) deep. In 1972, the bottom of the original pond was scraped to a depth of 15 to 23 cm (6 to 9 in.) and the scrapings were placed in the 218-W-2A Burial Ground (Trench #27). The scraped area was covered with clean soil in 1973. The pond was "L" shaped. Land from the site is now the 218-W-2A Burial Grounds.	The pond received 221-T Building and 224-T Building process cooling water, 221-T Building steam condensate, 242-T Evaporator condenser cooling water and steam condensate, 2706-T Building decontamination waste, and 242-T Condenser cooling water. The pond was in operation from 1944 to 1972. According to WIDS, the contaminant inventory for the 216-T-4A and 216-T-4B Ponds are reported together.	The 216-T-4A Pond is analogous to the 216-U-10 Pond as indicated by construction, process history, contaminant inventory, effluent volume received, and vertical extent of contamination, and is analogous because of the following. 1. Construction and configuration are similar (unlined ponds). 2. Waste was received from a similar source (e.g., process condensate from 221-T, 224-T, and 242-T Buildings), although the volume received was less. 3. The contaminant inventory for this site is bounded by the 216-U-10 Pond and is similar, as compared to the volume received and source. 4. The geology of both sites is similar. 5. The extent of contamination spread is bounded by the 216-U-10 Pond. 6. The effluent volume discharged to this crib is more than 3,000 times the soil column capacity and suggests a high potential for groundwater impact.

Table B-1. Representative Sites and Associated Analogous Waste Sites. (26 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site and Discharge History	Rationale
216-T-4B Pond	The 216-T-4B Pond replaced the 216-T-4A Pond. It was a natural depression that received runoff from the 216-T-4-2 Ditch. Normally, the volume of water in the new 216-T-4-2 Ditch was not enough to fill the pond because it usually was absorbed in the first quarter of the ditch, leaving the pond area dry. The pond is 0.5 m (1.5 ft) deep and 0.6 ha (1.5 a). A 397 m (1,300-ft) long, 6.1 m (12-ft) tall dike was built along the pond to keep the pond out of the 216-W-24 Burial Ground.	The pond received 242-T Evaporator steam condensate and condenser cooling water, and nonradioactive wastewater from 221-T Building air conditioning filter units and floor drains from 1972 to 1977. According to WIDS, the contaminant inventory for the 216-T-4A and 216-T-4B Ponds are reported together.	The 216-T-4B Pond replaced the 216-T-4A Pond, is analogous to the 216-U-10 Pond as indicated by construction, process history, contaminant inventory, effluent volume received, and vertical extent of contamination, and is analogous because of the following. 1. Construction and configuration are similar (unlined ponds). 2. Waste was received from a similar source (e.g., process condensate from 221-T and 242-T Buildings), although the volume received was less. 3. The contaminant inventory for this site is bounded by the 216-U-10 Pond. 4. The geology of both sites is similar. 5. The extent of contamination spread is bounded by the 216-U-10 Pond. 6. The potential for groundwater impact is bounded by the 216-U-10 Pond.
216-U-9 Ditch	The 216-U-9 Ditch is an unlined ditch that was backfilled in 1954. A portion of the ditch was reopened in 1973 and used until 1975. It is 1,067 by 1.8 m (3,500 by 6 ft) and 1.5 m (5 ft) deep.	The ditch received overflow from the 216-U-10 Pond and connects the 216-U-10 Pond with the 216-S-17 Pond.	The 216-U-9 Ditch is analogous to the 216-U-10 Pond as indicated by source of the waste received and is analogous because of the following. 1. Construction is similar (unlined) but waste configuration is dissimilar (216-U-9 is a ditch whereas 216-U-10 is a pond). 2. The waste site received overflow from the 216-U-10 Pond. 3. The contaminant inventory for this site is bounded by the 216-U-10 Pond. 4. The geology of both sites is similar. 5. The extent of contamination spread is bounded by the 216-U-10 Pond. 6. The effluent volume discharged to this ditch and contaminant distribution are unknown; however, characterization test holes dug to 2.7 m (9 ft) and trenches dug to 1.2 m (4 ft) across the ditch revealed that no contamination was present; therefore, potential for groundwater impact is low.
216-U-11 Ditch	The 216-U-11 Ditch is an unlined ditch that was backfilled and surface stabilized in 1985 in conjunction with the 216-U-10 Pond. It is 1,375 by 1.2 m (4,510 ft by 4 ft) and 0.9 m (3 ft) deep. A flood plain in the southern portion of the ditch sometimes filled with contaminated water when significant amounts of water overflowed from the 216-U-10 Pond (reference: WIDS).	The ditch received waste overflow from the 216-U-10 Pond. The ditch operated from 1944 to 1957. The older portion was retired in 1955 with the remainder retired in 1957.	The 216-U-11 Ditch is analogous to the 216-U-10 Pond as indicated by source of waste received and is analogous because of the following. 1. Construction is similar (unlined) but waste configuration is dissimilar (216-U-11 is a ditch whereas 216-U-10 is a pond). 2. The 216-U-11 Ditch received overflow from the 216-U-10 Pond. 3. The contaminant inventory for this site is bounded by the 216-U-10 Pond. 4. The geology of both sites is similar. 5. The extent of contamination spread is bounded by the 216-U-10 Pond. 6. Groundwater impact is bounded by the 216-U-10 Pond. From a groundwater perspective, remedial investigations at other OU waste sites suggest that infiltration beneath ditches used to channel wastewater typically is very limited (DOE/RL-99-07).

Table B-1. Representative Sites and Associated Analogous Waste Sites. (26 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site and Discharge History	Rationale
216-S-5 Crib	The 216-S-5 Crib is a gravel-filled (approximately 12.2 m^3 [16 yards]) crib with two lengths of perforated, corrugated metal pipe that form a cross. A hole was cut along the top edge of the crib to discharge overflow to a nearby trench. Overflow was 5% of the total flow. When the REDOX Plant A-2 dissolver and H-4 coils failed, the dose rates at the overflow area reached 17 rad/h. The crib has been surface stabilized. The crib was in operation from 1954 to 1957 and is 64 by 64 m (210 by 210 ft) and 3.1 m (10 ft) deep.	The crib received REDOX Plant effluent with a low potential for contamination and process vessel cooling water and steam condensate water from the 202-S Building. The 216-S-5 Crib replaced the 216-S-17 Crib to handle lower activity waste (the 216-S-6 Crib was designed to handle higher activity waste to replace the 216-S-17 Crib).	The 216-S-5 Crib is analogous to the 216-U-10 Pond as indicated by process history, contaminant inventory, and effluent volume received, and is analogous because of the following. 1. Construction and waste site configuration of the 216-S-5 Crib (gravel-filled crib with PVC distribution lines) and 216-U-10 Pond (unlined ditch) are dissimilar in construction but similar in that they both are unlined. 2. Waste was received from the same source (e.g., process effluent from the 202-S Building and overflow from the 216-U-10 Pond), although the volume received was significantly less. 3. The contaminant inventory for this site is bounded by the 216-U-10 Pond. 4. The geology of both sites is similar. 5. The extent of contamination spread is bounded by the 216-U-10 Pond. 6. The effluent volume discharged to this crib is more than 50 times the soil column capacity along with more than 270 kg of uranium, suggesting a high potential for groundwater impact; however, borehole 299-W26-06 (A5445) indicated no Cs-137 contamination to 63.7 m (209 ft).
216-S-6 Crib	The 216-S-6 Crib is a square pit filled with gravel with perforated pipe running down the center, and six pipes branching off perpendicular to the main pipe. The northwest end of the crib is heavily populated with growing tumbleweeds, but no contamination was found. The crib was in operation from 1954 to 1977 and is 64 by 64 m (210 by 210 ft) and 4.6 m (15 ft) deep.	The crib received process cooling water and steam condensate from the 202-S Building waste and REDOX Plant effluent with a high potential for contamination. High potential activity waste was sent to the 216-S-6 Crib; the lower activity waste to the 216-S-5 Crib. The 216-S-6 Crib was designed to handle higher activity waste to replace the 216-S-17 Crib.	The 216-S-6 Crib is analogous to the 216-U-10 Pond as indicated by process history, contaminant inventory, and effluent volume received, and is analogous because of the following. 1. Construction and waste site configuration of the 216-S-5 Crib (gravel-filled crib with PVC distribution lines) and 216-U-10 Pond (unlined ditch) are dissimilar in construction but similar in that they both are unlined. 2. Waste was received from the same source (e.g., process effluent from the 202-S Building and overflow from the 216-U-10 Pond), although the volume received was significantly less. 3. The contaminant inventory for this site is bounded by the 216-U-10 Pond. 4. The geology of both sites is similar. 5. The extent of contamination spread is bounded by the 216-U-10 Pond. 6. The effluent volume discharged to this crib is more than 100 times the soil column capacity along with more than 270 kg of uranium, suggesting a high potential for groundwater impact.

Table B-1. Representative Sites and Associated Analogous Waste Sites. (26 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site and Discharge History	Rationale
216-A-6 Crib	The 216-A-6 Crib was constructed with a vitrified clay pipe placed horizontally over the length of the unit. Five lengths of perforated pipe are perpendicular to the first pipe. The pipes are covered with approximately 2580 m^3 (3,370 yards) of gravel. Periodically, the crib exceeded flow capacity and contaminated the ground surface (UPR-200-E-21, UPR-200-E-29). A trench was dug connecting the crib with the 216-A-29 Ditch to collect the overflow water. UPR-200-E-19 occurred when *low-level fission product seeped* into the ground around the edges of the concrete pad at the 216-A-6 Proportional Sampler Pit. The release was caused by moisture dripping from the vent pipe bonnet. The crib is 31 by 31 m (100 by 100 ft) and 6.4 m (21 ft) deep, and was in operation from 1955 to 1970.	The crib received steam condensate, equipment disposal tunnel floor drainage, water-filled door drainage, and slug storage basin overflow waste from the 202-A Building. The 216-A-6 Crib was used in conjunction with the 216-A-30 Crib.	The 216-A-6 Crib is analogous to the 216-U-10 Pond as indicated by similar process history and contaminant inventory (although the 216-U-10 Pond is located in the southwest portion of the 200 West Area and the 216-A-6 Crib is located in the southeast portion of the 200 East Area) and is analogous because of the following. 1. Construction and waste site configuration of the 216-S-5 Crib (gravel-filled crib with PVC distribution lines) and 216-U-10 Pond (unlined ditch) are dissimilar in construction but similar in that they both are unlined. 2. Waste was received from a similar source (e.g., floor drain and steam condensate), although the volume received was significantly less due to site configuration differences. 3. The contaminant inventory for this site is bounded by the 216-U-10 Pond. 4. The geology of both sites is similar. 5. The extent of contamination spread is bounded by the 216-U-10 Pond. 6. The effluent volume discharged to this crib is more than 140 times the soil column capacity along with more than 160 kg of uranium, suggesting a high potential for groundwater impact.

Table B-1. Representative Sites and Associated Analogous Waste Sites. (26 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site and Discharge History	Rationale
216-A-30 Crib	The 216-A-30 Crib is a gravel-filled (approximately 9170 m^3 [12,300 yards]]) crib that has been isolated and backfilled. There are two distribution pipes, 38 cm (15 in. diameter). One pipe extends half the length of the crib (214 m [700 ft]) and one extends the full length of the crib (427 m [1,400 ft]). During the winter of 1971 and early 1972, an alkaline deposit formed over the surface of the 216-A-30 Crib. Exploration into the crib revealed a salt deposit that condensed from vapors emitted through the soil. The ground then was covered with layers of sand and plastic. The crib is 427 by 3.1 m (1,400 by 10 ft) and 3.7 m (12 ft) deep, and was in operation from 1955 to 1970.	The crib received steam condensate, equipment disposal tunnel floor and water-filled door drainage, and the slug storage basin overflow waste from the 202-A Building and PUREX Facility steam condensate. The 216-A-30 Crib was used in conjunction with the 216-A-6 Crib.	The 216-A-30 Crib is analogous to the 216-U-10 Pond as indicated by similar process history and contaminant inventory (although the 216-U-10 pond is located in the southwest portion of the 200 West Area and the 216-A-30 Crib is located in the southeast portion of the 200 East Area), and is analogous because of the following. 1. Construction and waste site configuration of the 216-S-5 Crib (gravel-filled crib with PVC distribution lines) and 216-U-10 Pond (unlined ditch) are dissimilar in construction but similar in that they both are unlined. 2. Waste was received from a similar source (e.g., floor drain and steam condensate), although the volume received was significantly less due to site configuration differences. 3. The contaminant inventory for this site is bounded by the 216-U-10 Pond. 4. The geology of both sites is similar. 5. The extent of contamination spread is bounded by the 216-U-10 Pond. 6. The effluent volume discharged to this crib is more than 200 times the soil column capacity along with more than 290 kg of uranium, suggesting a high potential for groundwater impact.
216-S-25 Crib	The 216-S-25 Crib is a gravel-filled site (31,300 m [41,000 yards]) with a below-grade distribution pipe. Growing tumbleweeds were contaminated at levels from 12,000 to 36,000 d/min. Soil was contaminated from 1,000 to 4,000 d/min. The crib is 175 by 3.01 m (575 by 10 ft) and 3.1 m (10 ft) deep, and was in operation from 1973 to 1992.	The crib received 242-S Evaporator process steam condensate and 216-U-1 Crib and 216-U-2 Crib groundwater pump-and-treat effluent. In 1976, a scintillation detector was inserted into one of the wells associated with the 216-S-25 Crib (TW-299-W-23-9, -11, and -12) with no measurable dose rate.	The 216-S-25 Crib is analogous to the 216-U-10 Pond based on the type of waste liquid received and the low specific activity received (contaminated groundwater from a pump-and-treat effort), and is analogous because of the following. 1. Construction and waste site configuration of the 216-S-5 Crib (gravel-filled crib with PVC distribution lines) and 216-U-10 Pond (unlined ditch) are dissimilar in construction but similar in that they both are unlined. 2. Waste was received from groundwater, although the volume received was significantly less than the 216-U-10 Pond due to site configuration differences. 3. The contaminant inventory for this site is bounded by the 216-U-10 Pond. 4. The geology of both sites is similar. 5. The extent of contamination spread is bounded by the 216-U-10 Pond. 6. The effluent volume discharged to this crib is 24 times the soil column capacity along with more than 160 kg of uranium, suggesting a potential for groundwater impact.

Table B-1. Representative Sites and Associated Analogous Waste Sites. (26 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site and Discharge History	Rationale
216-A-37-2 Crib	The 216-A-37-2 Crib was built as a replacement for the 216-A-30 Crib. There are two associated steel drainpipes. One is perforated and runs the length of the unit. The other is not perforated and runs from west to east only to the center of the unit, 1.5 m (5 ft) above the bottom. The crib is 427 by 3.1 m (1,400 by 10 ft) and 3.4 m (11 ft) deep, and was in operation from 1983 to 1995.	The crib received PUREX Facility steam condensate waste in parallel operations with the 216-A-30 Crib. Monitoring Wells 299-ES-21-21 through -24 extend to 90 m (295 ft) and support the 216-A-37-2 Crib.	The 216-A-37-2 Crib is analogous to the 216-U-10 Pond as indicated by similar process history and contaminant inventory (although the 216-U-10 Pond is located in the southwest portion of the 200 West Area and the 216-A-37-2 Crib is located in the southeast portion of the 200 East Area), and is analogous because of the following. 1. Construction and waste site configuration of the 216-S-5 Crib (gravel-filled crib with PVC distribution lines) and 216-U-10 Pond (unlined ditch) are dissimilar in construction but similar in that they both are unlined. 2. Waste was received from a similar source (e.g., floor drain and steam condensate), although the volume received was significantly less due to site configuration differences. 3. The contaminant inventory for this site is bounded by the 216-U-10 Pond and appropriate given its source (overflow from the 216-U-10 Pond). 4. The geology of both sites is similar. 5. The extent of contamination spread is bounded by the 216-U-10 Pond. 6. The effluent volume discharged to this crib is more than 30 times the soil column capacity, suggesting a potential for groundwater impact.
216-B-55 Crib	The 216-B-55 Crib is filled with gravel (approximately 1376 m^2 [1,800 ft^3]) and contains a perforated pipe that runs the length of the unit. The site had two gauge wells of 20 cm (8-in.) steel pipe with a galvanized sheet metal cap. The crib is 229 by 3.1 m (750 by 10 ft) and 3.4 m (11 ft) deep, and was in operation from 1967 to 1991.	The crib received steam condensate from the 221-B Building.	The 216-B-55 Crib is analogous to the 216-U-10 Pond based on similarities in source of waste received (steam condensate) and is analogous because of the following. 1. Construction and waste site configuration of the 216-S-5 Crib (gravel-filled crib with PVC distribution lines) and 216-U-10 Pond (unlined ditch) are dissimilar in construction but similar in that they both are unlined. 2. Waste was received from a similar source. 3. The contaminant inventory for this site is bounded by the 216-U-10 Pond and similar, given the volumes of waste received (216-U-10 Pond received more than 100 times the waste volume). 4. The geology of both sites is similar. 5. The extent of contamination spread is bounded by the 216-U-10 Pond. 6. The effluent volume discharged to this crib is approximately 68 times the soil column capacity, suggesting a potential for groundwater impact; however, well 299-E28-12, which monitors the 216-B-55 Crib, indicates a breakthrough to groundwater has not occurred.

Table B-1. Representative Sites and Associated Analogous Waste Sites. (26 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site and Discharge History	Rationale
216-S-172 Control Structure	The 216-S-172 Control Structure is an underground concrete structure with interior sluice gates. It is 4.1 by 2.2 by 2.1 m deep (13 by 7 by 7 ft) with 25.4 cm (10 in.) thick walls.	The structure received process cooling waste and steam condensate from the 202-S Building and sent it to the 216-S-16D Ditch. The structure has been covered with soil and posted with URM/Cave-in Potential signs. It operated from 1956 to 1976.	The 216-S-172 Control Structure is analogous to the 216-U-10 Pond as indicated by process history and is analogous because of the following. 1. Construction of the 216-S-172 Control Structure is dissimilar to the 216-U-10 Pond (concrete structure vs. unlined pond). 2. Waste was received from the same source (e.g., 202-S Building) as the 216-S-16 Ditch and 216-S-17 Pond. 3. The contaminant inventory for this site is bounded by the 216-U-10 Pond and is reflective of the 216-S-16 Ditch and 216-S-17 Pond. 4. The geology of both sites is similar. 5. The extent of contamination spread is bounded by the 216-U-10 Pond. 6. Groundwater impact is bounded by the 216-U-10 Pond. The construction of the structure (concrete control box) and no indication of leakage indicate that impact is minimal.
2904-S-160 Control Structure	The 2904-S-160 Control Structure is a below-grade "pentagon" structure with reinforced concrete walls, floor, and roof with 60 cm (2 ft) diameter vitrified clay inlet and outlet piping. It is a 3 m (10-ft) pentagon, 2.74 m (9 ft) deep with 30.5 cm (1 ft) thick walls.	It received process cooling and steam condensate from the 202-S Building to the 216-S-17 Pond, 216-S-6 Crib, and 216-S-16 Pond. It operated from 1954 to 1976.	The 216-S-160 Control Structure is analogous to the 216-U-10 Pond as indicated by process history and is analogous because of the following. 1. Construction of the 216-S-172 Control Structure is dissimilar to the 216-U-10 Pond (concrete structure vs. unlined pond). 2. Waste was received from the same source (e.g., 202-S Building) as the 216-S-17 Pond, 216-S-6 Crib, and 216-S-16 Pond. 3. The contaminant inventory for this site is bounded by the 216-U-10 Pond and is reflective of the 216-S-17 Pond, 216-S-6 Crib, and 216-S-16 Pond. 4. The geology of both sites is similar. 5. The extent of contamination spread is bounded by the 216-U-10 Pond. 6. The effluent volume discharged is bounded by the 216-U-10 Pond and suggests a negligible potential for groundwater impact. There are low levels of contamination inside the structure (300 c/min loose surface contamination) and in the surrounding soil (500 c/min).

Table B-1. Representative Sites and Associated Analogous Waste Sites. (26 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site and Discharge History	Rationale
2904-S-170 Control Structure	The 2904-S-170 Control Structure is a below-grade structure with reinforced concrete walls, floor, and roof with 76 cm (2.5 ft) diameter vitrified clay inlet and outlet piping. The 2904-SA Sample Building is located over the south end of the weir structure. It is 4.9 by 1.5 m (16 by 5 ft) with 25.4 cm (10 in.) thick walls.	The 2904-S-170 Control Structure directed waste from the 202-S REDOX Facility to the 2904-SA Sample Building from 1954 to 1976.	The 216-S-170 Control Structure is analogous to the 216-U-10 Pond as indicated by process history and is analogous because of the following. 1. Construction of the 216-S-172 Control Structure is dissimilar to the 216-U-10 Pond (concrete structure vs. unlined pond). 2. Waste was received from the same source (e.g., 202-S Facility) as the 216-S-17 Pond, 216-S-6 Crib, and 216-S-16 Pond. 3. The contaminant inventory for this site is bounded by the 216-U-10 Pond and is reflective of the 216-S-17 Pond, 216-S-6 Crib, and 216-S-16 Pond. 4. The geology of both sites is similar. 5. The extent of contamination spread is bounded by the 216-U-10 Pond. 6. Groundwater impact is bounded by the 216-U-10 Pond. The construction of the structure (concrete control box) and no indication of leakage indicate that impact is minimal.
2904-S-171 Control Structure	The 2904-S-171 Control Structure is a below-grade rectangular structure with reinforced concrete walls, floor, and roof with 46 cm (1.5 ft) diameter vitrified clay inlet and outlet piping and hand-operated gate valve. The site has been backfilled with clean material. It is 4 by 2.6 m (13 by 9 ft) and 3.05 m (10 ft) deep with 25.4 cm (10 in.) thick walls.	The 2904-S-171 Control Structure was used to measure and regulate the flow of process waste that was being routed to the 216-S-6 Crib and was in service from 1954 to 1976.	The 2904-S-171 Control Structure is analogous to the 216-U-10 Pond as indicated by process history. The site is analogous to the 216-U-10 Pond because of the following. 1. Construction of the 216-S-172 Control Structure is dissimilar to the 216-U-10 Pond (concrete structure vs. unlined pond). 2. Waste was received from the same source (e.g., 202-S Facility) as the 216-S-6 Crib. 3. The contaminant inventory for this site is bounded by the 216-U-10 Pond and is reflective of the 216-S-6 Crib. 4. The geology of both sites is similar. 5. The extent of contamination spread is expected to be similar. 6. Groundwater impact is bounded by the 216-U-10 Pond. The construction of the structure (concrete control box) and no indication of leakage indicate that impact is minimal.

Table B-1. Representative Sites and Associated Analogous Waste Sites. (26 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site and Discharge History	Rationale
207-S Retention Basin	The 207-S Retention Basin is a concrete structure, backfilled with soil, with an overflow tank located in the center of the north end and an outlet weir structure adjacent to the south wall. The retention basin is 40 by 40 m (130 by 130 ft) and 2.1 m (6.75 ft) deep with 25.4 cm (10 in.) thick walls.	The site received process cooling water and steam from the 202-S Building, en route to the 216-S-17 Pond and 216-S-16 Pond. It was in operation from 1951 to 1954.	The 207-S Retention Basin is analogous to the 216-U-10 Pond as indicated by process history and is analogous because of the following. 1. Construction of the 217-S Retention basin is dissimilar to the 216-U-10 Pond (concrete structure vs. unlined pond). 2. The 207-S Retention Basin was an intermediate stop for waste transferred from the 202-S Building to the 216-S-17 Pond and/or 216-S-16 Pond, which are analogous to the 216-U-10 Pond. Waste was received from the same source (e.g., 202-S Building) as the 216-S-16P and -17 Ponds. 3. The contaminant inventory for this site is bounded by the 216-U-10 Pond and is reflective of the 216-S-16P and -17 Ponds. 4. The geology of both sites is similar. 5. The extent of contamination spread is bounded by the 216-U-10 Pond, although there is no documented evidence that the basin has leaked, indicating minimal contamination spread. 6. Groundwater samples taken on July 31, 1964 (W-22-13 and W-22-14) indicate the presence of Sr-90 groundwater contamination; however, there is no evidence that the groundwater contamination resulted from the 207-S Retention basin.
216-B-64 Retention Basin	The 216-B-64 Retention Basin is an emergency diversion basin for steam condensate that exceeded crib release limits. The crib is 51 by 13 m (167 by 42 ft) and 4.6 m (15 ft) deep, and was operational from 1974 to 1997.	The unit has not been used except for an initial test. The source of effluent was planned to be diverted steam condensate from the 221-B Building. A radiological speck of contamination, present in the basin, migrated from the adjacent surface contamination (270-E-1 Neutralization Tank riser, named UPR-200-E-64 [alias UN-216-E-36]).	The basin was intended to receive 221-B Building waste that exceeded release limits. A facility test was conducted, but the basin never was used. The 216-B-64 Retention Basin is analogous to the 216-U-10 Pond based on the projected source of waste and is analogous because of the following. 1. Construction and waste site configuration of the 216-B-64 Retention Basin (concrete basin) are dissimilar to the 216-U-10 Pond (unlined pond). 2. Waste was planned to be received from a similar waste stream as compared to the 216-U-10 Pond. 3. The contaminant inventory for this site consists of loose surface contamination spread from UPR-200-E-64, which is different from the 216-U-10 Pond. 4. The geology of both sites is similar. 5. Documentation indicates no liquid leakage, because contaminated liquid never was introduced. 6. There is no impact to groundwater because only surface contamination is present (no contaminated liquid was introduced to the basin).

Table B-1. Representative Sites and Associated Analogous Waste Sites. (26 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site and Discharge History	Rationale
200-E-113 Process Sewer	The 200-E-113 Process Sewer is an underground, 0.406 m (16 in.) diameter steel pipeline that extends from the PUREX Plant to a distribution box located on the west side of the 216-A-6 Crib and continues eastward to the 216-A-30 Crib. The 216-A-42C Valve Box is located on the pipeline, inside a domed cover and was installed to select either the 216-A-30 Crib or the 216-A-6 Crib for discharge. The pipeline is 538 m (1,765 ft) long and is buried 2.4 m (8 ft) deep.	The process sewer transported steam condensate waste from the PUREX Facility to the 216-A-30 Crib or 216-A-6 Crib. Waste received is associated with the steel pipeline and adjacent contaminated soil from pipe leaks. This process sewer was in operation from 1961 to 1970. In 1995, the distribution box was filled with concrete, backfilled, and stabilized.	The 200-E-113 Process Sewer is analogous to the 216-U-10 Pond as indicated by similar process history and contaminant inventory (although the 216-U-10 Pond is located in the southwest portion of the 200 West Area and the 216-A-6 Crib is located in the southeast portion of the 200 East Area), and is analogous because of the following. 1. Construction and waste site configuration are dissimilar to the 216-U-10 Pond (unlined pond vs. steel pipeline). 2. Waste was transferred from a similar source via the 200-E-113 Process Sewer and contained a similar waste stream as compared to the 216-U-10 Pond. 3. The contaminant inventory for this site is included in the 216-A-6 and 216-A-30 Cribs inventory. 4. The geology of both sites is similar. 5. Documentation does not indicate that a pipeline leakage has occurred. 6. The effluent transferred via this process sewer is bounded by the 216-U-10 Pond, although, because the pipeline has not leaked, groundwater impact from the pipeline is not evident.
UPR-200-E-19	UPR-200-E-19 was caused when low-level fission product seeped into the ground around the edges of the concrete pad at the 216-A-6 Proportional Sampler Pit. The release was caused by moisture dripping from the vent pipe bonnet. The UPR occurred in 1959.	The source of the UPR was 216-A-6 Crib effluents due to a leaking valve bonnet at the proportional sampler pit.	UPR-200-E-19 is analogous to the 216-U-10 Pond because of its association with the 216-A-6 Crib and because of its location, and is analogous because of the following. 1. The UPR is similar to the 216-U-10 Pond because liquid spilled onto an unlined area. 2. Waste was received from the 216-A-6 Crib. 3. The contaminant inventory for this site is included in the inventory for the 216-A-6 Crib and is bounded by the 216-U-10 Pond. 4. The geology of both sites is similar. 5. Contamination from the UPR is adjacent to the 216-A-6 Crib; therefore, the extent of contamination spread is bounded by the 216-U-10 Pond. 6. The effluent volume discharged (and groundwater impact) is included with the 216-A-6 Crib; therefore, it is bounded by the 216-U-10 Pond.
UPR-200-E-21	UPR-200-E-21 was caused when 216-A-6 Crib overflowed and contaminated the adjacent area to 500 mrad/h. The UPR occurred in 1959.	The source of the UPR was 216-A-6 Crib effluents. In 1981, 15.2 to 30.5 cm (6 to 12 in.) of soil were removed and disposed in the 216-A-4 Burial Grounds. The excavated area was covered with 46 to 61 cm (18 to 24 in.) of clean soil.	UPR-200-E-21 is analogous to the 216-U-10 Pond because of its association with the 216-A-6 Crib and because of its location, and is analogous because of the following. 1. The UPR is similar to the 216-U-10 Pond because liquid spilled onto an unlined area. 2. Waste was received from the 216-A-6 Crib. 3. The contaminant inventory for this site is included in the inventory for the 216-A-6 Crib and is bounded by the 216-U-10 Pond. 4. The geology of both sites is similar. 5. Contamination from the UPR is adjacent to the 216-A-6 Crib; therefore, the extent of contamination spread is bounded by the 216-U-10 Pond. 6. The effluent volume discharged (and groundwater impact) is included with the 216-A-6 Crib; therefore, it is bounded by the 216-U-10 Pond.

Table B-1. Representative Sites and Associated Analogous Waste Sites. (26 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site and Discharge History	Rationale
UPR-200-E-29	UPR-200-E-29 was caused when the 216-A-6 Crib overflowed and contaminated the adjacent area to 30 rad/h at 1.2 m (4 ft). The UPR occurred in 1961.	The source of the UPR was 216-A-6 Crib effluents. After the UPR, the site was covered with 15 cm (6 in.) of sand and topped with plastic sheeting. In 1972, the site was covered with an additional 46 cm (18 in.) of sand and 10 cm (4 in.) of gravel. The crib was surface stabilized on 1993.	UPR-200-E-29 is analogous to the 216-U-10 Pond because of its association with the 216-A-6 Crib and because of its location, and is analogous because of the following. 1. The UPR is similar to the 216-U-10 Pond because liquid spilled onto an unlined area. 2. Waste was received from the 216-A-6 Crib. 3. The contaminant inventory for this site is included in the inventory for the 216-A-6 Crib and is bounded by the 216-U-10 Pond. 4. The geology of both sites is similar. 5. Contamination from the UPR is adjacent to the 216-A-6 Crib; therefore, the extent of contamination spread is bounded by the 216-U-10 Pond. 6. The effluent volume discharged (and groundwater impact) is included with the 216-A-6 Crib; therefore, it is bounded by the 216-U-10 Pond.
UPR-200-W-124	UPR-200-W-124 occurred when a dike broke at the "REDOX Swamp" located southeast of the 200 West Area. The pond located southeast of the 200 West Area is 216-S-19; however, the dike break could have occurred at the 216-S-17 Pond. The UPR was 9 m (30 ft) wide and 305 m (1,000 ft) long. The location suggests this UPR is part of the 216-S-17 Pond's footprint and would be remediated with 216-S-17.	The source of this UPR was cooling water from 202-S Processing Facility tanks. This UPR occurred in 1959.	UPR-200-W-124 is analogous to the 216-U-10 Pond as indicated by process history and is analogous because of the following. 1. Construction and configuration are similar (216-U-10 is an unlined pond and UPR-W-114 is an unlined trench). 2. Waste was received from the same source (e.g., 202-S Building). 3. The contaminant inventory for this site is bounded by the 216-U-10 Pond. 4. The geology of both sites is similar. 5. The extent of contamination spread is bounded by the 216-U-10 Pond. 6. The effluent volume discharged is bounded by the 216-U-10 Pond and suggests a minimal potential for groundwater impact. UPR 200-W-124 is located within the footprint of the 216-S-17 Pond.

Table B-1. Representative Sites and Associated Analogous Waste Sites. (26 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site and Discharge History	Rationale
Representative Site			
216-U-14 Ditch	The 216-U-14 Ditch is an unlined ditch, backfilled, and surface stabilized in sections with the last section completed in 1997. It is 1731 by 1.2 m (5,680 by 4 ft) (bottom width) and 3.1 m (10 ft) deep.	The ditch received waste from the following: 284-W Powerhouse; 2723-W Original Laundry Facility; 2724-W New Laundry Facility; 221-U, 224-U, 271-U, and 242-S Steam Evaporators; and 241-U-110 Condenser Tank.	Characterization is described DOE/RL-2003-11. <u>Contaminant Distribution</u> Contamination associated with the 216-U-14 Ditch was detected from 2.7 to 5.8 m (9 to 19 ft) bgs. The major zone of contamination is from 2.7 to 3 m (9 to 10 ft) bgs, corresponding to the ditch bottom with maximum concentrations of Cs-137 (2228 pCi/g), plutonium (10 pCi/g), Am-241 (1.6 pCi/g), Co-60 (0.62 pCi/g), Tc-99 (12 pCi/g), Sb-125 (0.10 pCi/g), and uranium (350 pCi/g). From 3.0 to 5.8 m (10 to 19 ft), concentrations decrease with depth. Available data indicate maximum concentrations at 5.8 m (19 ft) are 8.3 pCi/g for Cs-137, 0.39 pCi/g for plutonium isotopes (0.39), 1.6 pCi/g for Am-241, and 7 pCi/g for uranium. Strontium-90 also was detected (between 0.81 pCi/g and 5.2 pCi/g) beneath the ditch. Maximum concentrations for Sr-90 typically were detected from 3.6 to 4.5 m (12 to 15 ft) bgs. Distribution of contaminants in the ditch also varies along its length. Maximum uranium: 350 pCi/g. Maximum plutonium: 10 pCi/g. Maximum Am-241: 1.6 pCi/g. Maximum Cs-137: 440 pCi/g. Maximum Sr-90: 28 pCi/g. Contaminants with large distribution coefficients (e.g., Cs-137 and plutonium) were detected in higher concentrations near the head end of the ditch. Contaminants with moderate to low contaminant distribution coefficients (e.g., Sr-90, uranium) were detected in higher concentrations at the lower end of the ditch. Antimony was the only metal detected above screening levels (detected at 3.4 to 5.8 m (11 to 19 ft) bgs with concentrations from 6.1 and 7.0 mg/kg. Very little radiological contamination was detected adjacent to the 216-U-14 Ditch. According to Section 3.2.4.3 of DOE/RL-2003-11, the effluent volume discharged to the 216-U-14 Ditch is greater than the soil column pore volume, suggesting that the volume of effluent released was sufficient to reach the aquifer during waste site operation. Impact to groundwater also was confirmed in WHC-EP-0698 by comparing discharge data, changes in water table elevation, and groundwater chemistry over time. PNNL-13788 indicates that mobile contaminants (carbon tetrachloride and uranium) exceed groundwater protection standards near the ditch. Uranium from the 216-U-14 Ditch is known to be a source of groundwater contamination. The results of the 216-U-14 Ditch modeling indicate Tc-99, sulfide, and uranium reach the groundwater in appreciable concentrations.

Table B-1. Representative Sites and Associated Analogous Waste Sites. (26 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site and Discharge History	Rationale
Analogous waste sites to be evaluated by the 216-U-14 Ditch model			
216-S-16D Ditch	The 216-S-16D Ditch connected the 202-S Building to the 216-S-16 Pond. The ditch is 518 by 1.2 m (1,700 by 4 ft) and 0.9 m (3 ft) deep.	The ditch connected the 202-S Building to the 216-S-16 Pond. In 1973, a portion of the 216-U-9 Ditch was connected to the 216-S-16 Ditch to divert overflow from the 216-U-10 Pond to the 216-U-16 Pond. It is backfilled and surface stabilized. It operated from 1957 to 1975. Contaminant inventory is included in the 216-S-16 Pond inventory.	The 216-S-16D Ditch is analogous to the 216-U-14 Ditch as indicated by process history and is analogous because of the following. 1. The ditches are similar in construction and configuration (unlined ditches). 2. The ditch connected the 202-S Building to the 216-S-16 Pond, which is functionally similar to the 216-U-14 Ditch, and the waste was received from a similar source (e.g., 242-S Facility). 3. The contaminant inventory for this site is bounded by the 216-U-14 Ditch and is reflective of the 216-S-16 Pond. 4. The geology of both sites is similar. 5. The extent of contamination spread is bounded by the 216-U-14 Ditch. 6. The effluent volume discharged as compared to the soil pore volume suggests a potential for groundwater impact. From a groundwater perspective, remedial investigations at other OU waste sites suggest infiltration beneath ditches used to channel wastewater typically is very limited (DOE/RL-99-07).
216-T-1 Ditch	The 216-T-1 Ditch is an earthen ditch with 2.5:1 slope and a 5 cm (2 in.) diameter vitrified clay feeder pipe. The ditch is 556 m (1,825 ft) long, 0.9 m (3 ft) wide, and 3.1 m (10 ft) deep. It was surface stabilized in 1995 when the 221-T Building inlet waste stream was rerouted to TEDF.	The ditch received miscellaneous waste from pilot experiments, decontamination waste, other waste from the 221-T Building, 271-T blowdown vessel cooling water, 221-T Building condensate from steam-heated radiators, and sodium hydroxide wash water (nonradioactive). It was in operation from 1944 to 1995.	The 216-T-1 Ditch is analogous to the 216-U-14 Ditch as indicated by construction and process history. The site is analogous to the 216-U-14 Ditch because of the following. 1. Construction and site configuration of the 216-T-1 Ditch are similar (unlined ditch). 2. The ditch connected the 221-T and 271-T Buildings to the 216-T-4A Pond and later the 216-T-4B Pond, similar to the 216-U-14 Ditch connection to the 216-U-10 Pond. Waste was received from a similar source (e.g., 221-T Building). 3. The contaminant inventory for this site is bounded by the 216-U-14 Ditch. 4. The geology of both sites is similar. 5. The extent of contamination spread is bounded by the 216-U-14 Ditch. 6. The effluent volume discharged as compared to the soil pore volume suggests a potential for groundwater impact. From a groundwater perspective, remedial investigations at other OU waste sites suggest that infiltration beneath ditches used to channel wastewater typically is very limited (DOE/RL-99-07).

Table B-1. Representative Sites and Associated Analogous Waste Sites. (26 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site and Discharge History	Rationale
216-T-4-1D Ditch	The 216-T-4-1D Ditch was replaced by the 216-T-4-2 Ditch. The area was backfilled and surface stabilized in 1995, along with the 216-T-4-2 Ditch. This ditch was 259 by 2.4 m (850 by 8 ft) and 1.2 m (4 ft) deep.	The ditch received process cooling water from the 221-T and 224-T Buildings via the 207-T Retention Basin and steam condensate from the 221-T Building and 242-T Evaporator and decontamination waste from the 2706-T Building. The 216-T-4-1D Ditch was used from 1944 to 1972, but was inactive from mid-1957 to mid-1964.	The 216-T-4-1D Ditch is analogous to the 216-U-14 Ditch as indicated by construction and process history and is analogous because of the following. 1. Construction and site configuration of the 216-T-1 Ditch are similar (unlined ditch). 2. The ditch connected the 221-T, 224-T, and 242-T Buildings to the 216-T-4A Pond and later the 216-T-4B Pond, similar to the 216-U-14 Ditch connection to the 216-U-10 Pond. Waste was received from similar sources. 3. The contaminant inventory for this site is bounded by the 216-U-14 Ditch. 4. The geology of both sites is similar. 5. The extent of contamination spread is bounded by the 216-U-14 Ditch. 6. Groundwater impact is bounded by the 216-U-14 Ditch. From a groundwater perspective, remedial investigations at other OU waste sites suggest that infiltration beneath ditches used to channel wastewater typically is very limited (DOE/RL-99-07).
216-T-4-2 Ditch	The first 15 m (5 ft) of the 216-T-4-2 Ditch, from the head of the unit, was part of the original 216-T-4-1 Ditch. A portion was parallel to the old 216-T-4-1 Ditch, leading to the 216-T-4B Pond. Most of the effluent was absorbed in the first quarter of the ditch. The end of the ditch and the 216-T-4B Pond were often dry. The ditch is backfilled and stabilized. The ditch is 533.8 m (1750 ft) long, 2.4 m (8 ft) wide, and 1.2 m (4 ft) deep.	The ditch received 242-T Evaporator steam condensate and condenser cooling water, and nonradioactive wastewater from 221-T Building air conditioning filter units and floor drains. The ditch was in operation from 1972 to 1995, when it was surface stabilized and backfilled.	The 216-T-4-2 Ditch is analogous to the 216-U-14 Ditch as indicated by construction and process history and is analogous because of the following. 1. Construction and site configuration of the 216-T-1 Ditch are similar (unlined ditch). 2. The ditch connected the 221-T and 242-T Buildings to the 216-4B Pond, similar to the 216-U-14 Ditch connection to the 216-U-10 Pond; however, most of the effluent was absorbed in the first quarter of the ditch. Therefore, the end of the ditch and the 216-T-4B Pond often were dry. 3. The contaminant inventory for this site is bounded by the 216-U-14 Ditch. 4. The geology of both sites is similar. 5. The extent of contamination spread is bounded by the 216-U-14 Ditch. 6. Groundwater impact is bounded by the 216-U-14 Ditch. From a groundwater perspective, remedial investigations at other OU waste sites suggest that infiltration beneath ditches used to channel wastewater typically is very limited (DOE/RL-99-07).
216-W-LWC Crib	The 216-W-LWC Crib consists of two independent crib structures (i.e., drain fields) including a central distribution pipe and drain lines with rock fill beneath and 4243 m^3 (5,546 yards) of gravel fill to grade. The 216-W-LWC crib operated from 1981 to 1994. Each side of the crib is 47 m (150 ft) by 40.5 m (133 ft) and 5.8 m (19 ft) deep with 31.5 cm (1 ft) thick walls. There is 81.1 m (266 ft) of separation between the cribs.	It received waste from the 2723-W and 2724-W Laundry and Mask Cleaning Facilities.	The 216-W-LWC Crib is analogous to the 216-U-14 Ditch as indicated by the source of waste received and is analogous because of the following. 1. Construction and waste site configuration of the 216-W-LWC Crib (gravel-filled crib with PVC distribution lines) and 216-U-14 Ditch (unlined ditch) are dissimilar in construction but similar in that they both are unlined. 2. The site received waste from the 2723-W and 2724-W Laundry and Mask Cleaning Facilities and was a replacement for laundry waste sent to the 216-U-14 Ditch. 3. The contaminant inventory for this site is bounded by the 216-U-14 Ditch. 4. The geology of both sites is similar. 5. The extent of contamination spread is bounded by the 216-U-14 Ditch. 6. There is a potential for groundwater impact because the waste discharged to the crib exceeded soil pore volume by a factor of 203.

Table B-1. Representative Sites and Associated Analogous Waste Sites. (26 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site and Discharge History	Rationale
207-U Retention Basin	The 207-U Retention Basin is a plastic-lined concrete basin divided into halves. It was in operation as a retention basin from 1952 to 1994. It is 75 by 37 m (246 by 123 ft) and 2 m (6.5 ft) deep.	The 207-U Retention Basin received waste from the 221-U and 224-U Buildings where it was held for sampling and discharged to the 216-U-10 Pond via the 216-U-14 Ditch. The 207-U Retention Basin has been modified (by plugging the outlet line), converting the function of the basin into an evaporation pond to support receipt of 224-U Building grounds and storm water runoff.	The 207-U Retention Basin is analogous to the 216-U-14 Ditch as indicated by process history and is analogous because of the following. 1. Construction and waste site configuration of the 207-T Retention Basin (concrete basin) are dissimilar to the 216-U-14 Ditch (unlined ditch). 2. The 207-U Retention Basin was an intermediate transfer point for waste from the 221-U and 224-U Buildings to the 216-U-14 Ditch and the 216-U-10 Pond. 3. The contaminant inventory for this site is expected to be reflective of the 216-U-14 Ditch and the 216-U-10 Pond. 4. The geology of the sites is similar. 5. Evidence of contamination spread is not evident, except for sludge removed from the retention basin and disposed in holes located around the perimeter of the basin and covered with clean dirt (documented as UPR-200-W-111 and UPR-200-W-112). 6. Groundwater impact is bounded by the 216-U-14 Ditch. Leakage has not been documented outside the basin. A contamination survey conducted in the basin in 1977 indicated that no smearable contamination was found.
207-T Retention Basin	The 207-T Retention Basin is a concrete structure, divided into two sections, 75 by 37 m (246 by 123 ft). It had a 3,800,000 L (1,000,000-gal) capacity. Periodically, the sludge that accumulated on the bottom of the basin was cleaned out and placed in holes located around the perimeter of the basin and covered with clean dirt. One of these holes was documented as the 216-T-12 Trench.	The retention basin received T Plant process cooling and ventilation steam condensate, process cooling water from equipment jackets in the 221-T Building, and 224-T Evaporator cooling water and flow from the 221-TA Building via the 216-T-4-2 Ditch. The retention basin was in operation from 1944 to 1995. In 1996, 7.6 to 15.2 cm (3 to 6 in.) of contaminated soil, scraped from adjacent areas, were deposited in the basin, followed by 20.3 to 61 cm (8 to 24 in.) of clean soil.	The 207-T Retention Basin is analogous to the 216-U-14 Ditch as indicated by process history and is analogous because of the following. 1. Construction and waste site configuration of the 207-T Retention Basin (concrete basin) are dissimilar to the 216-U-14 Ditch (unlined pond). 2. The 207-T Retention Basin was an intermediate transfer point for waste from the 221-T and 242-T Buildings to the 216-T-4A and 216-T-4B Ponds; however, not all of the waste from the 221-T and 242-T Buildings was routed to the 207-T Retention Basin (one branch of the 200-W-88 Process Sewer bypassed the 207-T Retention Basin). 3. The contaminant inventory is bounded by the 216-U-14 Ditch. 4. The geology of the sites is similar. 5. Evidence of contamination spread is not evident, except for sludge removed from the retention basin and disposed in holes located around the perimeter of the basin and covered with clean dirt (one such hole was documented as the 216-T-12 Trench). 6. Groundwater impact is bounded by the 216-U-14 Ditch. Leakage has not been documented outside the basin.

Table B-1. Representative Sites and Associated Analogous Waste Sites. (26 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site and Discharge History	Rationale
216-T-12 Trench	The 216-T-12 Trench is a sludge pit used to bury contaminated material from the 207-T Retention Basin. It was only used once. At the time of burial, 15 mrad/h was the maximum detected on the sludge (1954). It has been backfilled and stabilized. It is 4.6 m by 3.1 m (15 ft by 10 ft) and 2.4 m (8.0 ft) deep.	It received contaminated sludge from the 207-T Retention Basin in 1954.	The 216-T-12 Trench is analogous to the 216-U-14 Ditch as indicated by process history and is analogous because of the following. 1. Construction and waste site configuration of the 216-U-14 Ditch (buried concrete culverts) and 216-T-12 Trench (unlined trench) are dissimilar in construction but similar in that they both are unlined. 2. The 216-T-12 Trench received waste from the 207-T Retention Basin, similar to the 216-U-14 Ditch; the waste deposited in the 216-T-12 Trench was sludge removed from the 207-T Retention Basin. 3. The contaminant inventory for this site is more reflective of the 216-T-4A Pond than the 216-T-26 Crib. 4. The geology of both sites is similar. 5. The extent of contamination spread likely will be the same for the 216-T-12 Trench, as compared to the 216-U-14 Ditch, based on the form of material disposed (sludge vs. liquid). The sludge volume discharged and waste form suggest minimal potential for groundwater impact.
200-W-84 Process Sewer	The 200-W-84 Process Sewer is underground, vitrified clay pipeline that is 46 cm (18 in) diameter by 800 m (2,625 ft) long and 0.6 m (2 ft) deep. It terminated at a timber headwall where the flow entered the 216-U-14 Ditch. The process sewer was active from 1952 to 1984.	The process sewer transported 221-U Plant process sewer waste to the 216-U-14 Ditch.	The 200-W-84 Process Sewer is analogous to the 216-U-14 Ditch as indicated by source of waste received and point of discharge, and is analogous because of the following. 1. Construction and waste site configuration of the 200-W-84 Process Sewer (vitrified clay pipe) are dissimilar to the 216-U-14 Ditch (unlined ditch). 2. The 200-W-84 Process Sewer received waste from the same source (221-U Plant) and discharged waste to the 216-U-14 Ditch. 3. The contaminant inventory for this site is bounded by the 216-U-14 Ditch. 4. The geology of both sites is similar. 5. The extent of contamination spread is bounded by the 216-U-14 Ditch. 6. Groundwater impact is bounded by the 216-U-14 Ditch.

Table B-1. Representative Sites and Associated Analogous Waste Sites. (26 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site and Discharge History	Rationale
200-W-88 Process Sewer	The 200-W-88 Process Sewer consists of two vitrified clay process sewer pipelines. The southern line extends from the south end of T Plant to the 207-T Retention basin. The northern process sewer line extends from the south end of T Plant and bypasses the retention basin, connecting to the 207-T Discharge Pipe. The total dimensions are 1321 m (4,330 ft) long and 0.6 m (2 ft) wide. The burial depth is 2 m (6.5 ft).	The process sewer received cooling water, air conditioning condensate, and floor drain waste from the 221-T Building, 224-T Building, and 242-T from 1944 to 1995 and was isolated in 1996. The pipelines are associated with the 221-T Building and 207-T Retention Basin.	The 200-W-88 Process Sewer is analogous to the 216-U-14 Ditch as indicated by process history and is analogous because of the following. 1. Construction and waste site configuration of the 200-W-88 Process Sewer (vitrified clay pipe) are dissimilar to the 216-U-14 Ditch (unlined ditch). 2. The ditch connected the 221-T and 242-T Buildings to the 216-4B Pond, similar to the 216-U-14 Ditch connection to the 216-U-10 Pond; however, one of two branches of the 200-W-88 Process Sewer contains the 207-T Retention Basin. 3. The contaminant inventory impact is bounded by the 216-U-14 Ditch. 4. The geology of both sites is similar. 5. The extent of contamination spread is bounded by the 216-U-14 Ditch. 6. Groundwater impact is bounded by the 216-U-14 Ditch. From a groundwater perspective, remedial investigations at other OU waste sites suggest that infiltration beneath ditches used to channel wastewater typically is very limited (DOE/RL-99-07).
200-W-102 Process Sewer	The 200-W-102 Process Sewer is an underground pipeline used to transfer laundry and mask-cleaning effluent to the 216-U-14 Ditch. It was in operation from 1944 to 1981. Portions of the pipeline are associated with the 2724-U Building foundation. The process sewer is 885 m (2,900 ft) long and 0.6 m (2 ft) in diameter.	The process sewer transported waste from the 2723-W and 2724-W Laundry and Mask Cleaning Facilities to the 216-U-14 Ditch. A portion of the pipeline remained open until 1984 to transfer mask-cleaning effluent to the 216-LWC Crib. In 1981 alone, 26,250 m^3 of wastewater per month were transported in this process sewer.	The 200-W-102 Process Sewer is analogous to the 216-U-14 Ditch as indicated by source of waste received and point of discharge, and is analogous because of the following. 1. Construction and waste site configuration of the 200-W-102 Process Sewer (vitrified clay pipe) are dissimilar to the 216-U-14 Ditch (unlined ditch). 2. The 200-W-102 Process Sewer transferred waste to the 216-U-14 Ditch. 3. The contaminant inventory is bounded by the 216-U-14 Ditch and likely will be lower due to the source of contamination (2723-W and 2724-W Laundry and Mask Cleaning Facilities). 4. The geology of both sites is similar. 5. The extent of contamination spread is bounded by the 216-U-14 Ditch. 6. The effluent volume discharged to this crib and contaminant distribution is bounded by the 216-U-14 Ditch. From a groundwater perspective, remedial investigations at other OU waste sites suggest that infiltration beneath ditches used to channel wastewater typically is very limited (DOE/RL-99-07).

Table B-1. Representative Sites and Associated Analogous Waste Sites. (26 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site and Discharge History	Rationale
UPR-200-W-111	UPR-200-W-111 is a UPR area consisting of a narrow trench adjacent to the 207-U Retention Basin. It was used once, sometime in the 1960s, to bury approximately 21 m^3 (27 yd^3) of sludge scraped from the bottom of the south side of 207-U Retention Basin. The sludge is covered with 1.2 m (4 ft) of clean soil, surface stabilized in 1997. The dimensions are 12.2 by 4.6 m (40 by 15 ft) and 3.1 m (10 ft) deep.	This UPR area received sludge removed from the 207-U Retention Basin. A radiological survey conducted in 1953 indicated readings as high as 25 rad/h at 20 cm (8 in.) above the waste sludge.	UPR-200-W-111 is analogous to the 216-U-14 Ditch as indicated by process history and is analogous because of the following. 1. Construction is similar (unlined) but configuration is different (sludge disposal trench vs. liquid transfer ditch). 2. UPR-200-W-111 received waste from the 221-U Building, similar to the 216-U-14 Ditch; however, the waste deposited in UPR-200-W-111 was sludge deposited in the 207-U Retention Basin. 3. The contaminant inventory is bounded by the 216-U-14 Ditch. 4. The geology of both sites is similar. 5. The extent of contamination spread is bounded by the 216-U-14 Ditch but will be significantly less for UPR-200-W-111 based on the amount (21 m^3 [27 yd^3]) and form of material disposed (sludge vs. liquid). 6. Groundwater impact is bounded by the 216-U-14 Ditch; however, because of the low volume of material disposed and waste form (sludge vs. liquid), groundwater impact will be minimal.
UPR-200-W-112	UPR-200-W-112 is a UPR area consisting of a narrow trench within 3.1 m (10 ft) to the 207-U North Retention Basin concrete wall. It was used once, sometime in the 1960s. It was dug to bury approximately 21 m^3 (27 yd^3) of sludge scraped from the bottom of the south side of 207-U Retention Basin. The sludge is covered with 1.2 m (4 ft) of clean soil, surface stabilized in 1997. The dimensions are 12.2 by 4.6 m (40 by 15 ft) and 3.1 m (10 ft) deep.	This UPR area received sludge removed from the 207-U Retention Basin.	UPR-200-W-112 is analogous to the 216-U-14 Ditch as indicated by process history and is analogous because of the following. 1. Construction is similar (unlined) but configuration is different (sludge disposal trench vs. liquid transfer ditch). 2. UPR-200-W-112 received waste from the 221-U Building, similar to the 216-U-14 Ditch; however, the waste deposited in UPR-200-W-112 was sludge deposited in the 207-U Retention Basin. 3. The contaminant inventory is bounded by the 216-U-14 Ditch. 4. The geology of both sites is similar. 5. The extent of contamination spread is bounded by the 216-U-14 Ditch but will be significantly less for UPR-200-W-112 based on the amount (21 m^3 [27 yd^3]) and form of material disposed (sludge vs. liquid). 6. Groundwater impact is bounded by the 216-U-14 Ditch; however, due to the low volume of material disposed and waste form (sludge vs. liquid), groundwater impact will be minimal.

Table B-1. Representative Sites and Associated Analogous Waste Sites. (26 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site and Discharge History	Rationale
Representative Site			
216-Z-11 Ditch	The 216-Z-11 Ditch is an unlined ditch, active from 1959 to 1971, backfilled, and surface stabilized in 1971. This ditch is 797 by 1.2 m (2,615 by 4 ft) and 0.6 m (2 ft) deep.	The ditch received waste from the PFP 231-Z, 234-5Z, and 291-Z process sewers to the 216-U-10 Pond.	Characterization is described in DOE/RL-2003-11. <u>Contaminant Distribution</u> Contamination was detected beneath the 216-Z-11 Ditch to 12 m (40 ft) bgs. Maximum concentrations are present from 2.3 to 5.3 m (7.5 to 17.5 ft). Americium-241 and plutonium were the predominant contaminants detected at the ditch bottom, approximately 2.3 to 2.6 m (7.5 to 8.5 ft) bgs with concentrations of 468 pCi/g and 2,780 pCi/g, respectively. Maximum concentrations of Am-241 (919 pCi/g) and plutonium (4,840 pCi/g) were detected about 1.2 m (4 ft) beneath the bottom of the ditch at a depth of 3.7 m (12 ft) bgs. This zone of contamination may represent the bottom of the 216-Z-1D Ditch. The 216-Z-1D, 216-Z-11, and 216-Z-19 Ditches were known to converge in this area to use the culvert passing beneath 16th Street. Americium-241 and Pu-239/240 concentrations decrease with depth to less than 1 pCi/g at depths more than 5.3 m (17.5 ft) bgs. Other radiological contaminants detected in the upper zone of contamination (2.3 to 5.3 m [7.5 to 17.5 ft] bgs) were Ra-226, Sr-90, and Th-230, with maximum concentrations of 58.4 pCi/g, 1.07 pCi/g, 2.73 pCi/g, and 8.43 pCi/g, respectively. At more than 5.3 m (17.5 ft) bgs, the contaminant concentrations were less than 1 pCi/g. Maximum plutonium concentration: 4,840 pCi/g. Maximum Am-241 concentration: 919 pCi/g. Maximum nitrate concentration: 43 mg/kg. Nitrite was detected 3 to 5.3 m (10 to 17.5 ft) bgs with the maximum concentration of 43 mg/kg at a depth of 3 m (10 ft), decreasing with depth to 5.3 m (17.5 ft). TPH was detected 3.0 to 3.8 m (10 to 12.5 ft) bgs at a concentration of 27 mg/kg. Molybdenum is the only inorganic metal that exceeded screening levels in soil samples from borehole C3808, detected 46 to 47 m (152 to 154.5 ft) bgs at 0.82 mg/kg. Plutonium-239, at a depth of 2.9 m (9.5 ft) bgs, was the primary manufactured contaminant identified during logging, estimated at 21,400 pCi/g. Contamination was not detected more than 3.4 m (11 ft) bgs with the RLS. Effluent volume discharged to the Z-Ditch area is not known; therefore, impact to groundwater from the volume of effluent discharges is not known. Contaminants associated with Z-Ditch effluents were not detected below 12.2 m (40 ft). The Z-Ditches mainly were used to channel wastewater to areas of infiltration rather than to percolate wastewater. From a groundwater perspective, remedial investigations at other OU waste sites suggest that infiltration beneath ditches used to channel wastewater typically is very limited (DOE/RL-99-07). Results of 216-Z-11 Area modeling indicate that contaminants do not reach groundwater. One important factor to consider in the determination that sites are analogous to the 216-Z-11 Ditch is the proximity of the 216-Z-11 and 216-Z-19 Ditches, the 216-Z-20 Ditch Replacement Tile Field, and the lower portion of the 216-Z-1D Ditch. They are close enough for all of these ditches to be covered by the characterization efforts and results obtained for the representative site (216-Z-11 Ditch).

Table B-1. Representative Sites and Associated Analogous Waste Sites. (26 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site and Discharge History	Rationale
Analogous waste sites to be evaluated by the 216-Z-11 Ditch model			
216-Z-1D Ditch	The 216-Z-1D Ditch is an unlined ditch, in operation from 1944 to 1959, backfilled, and surface stabilized in 1959. The ditch is 1,295 by 1.22 m (4,250 by 4 ft) and 0.6 m (2 ft) deep.	The ditch received waste from the PFP 231-Z, 234-5Z, and 291-Z process sewers. The 216-Z-1D Ditch is classified as a TRU disposal site.	The 216-Z-1D Ditch is analogous to the 216-Z-11 Ditch as indicated by construction, location, source of waste received and point of discharge, and is analogous because of the following. 1. Construction and waste site configuration are similar (unlined ditches). 2. The 216-Z-1D Ditch received waste from a similar source (234-5Z Building) and discharged to the 216-Z-11 Ditch. 3. The contaminant inventory is bounded by the 216-Z-11 Ditch. 4. The geology of both sites is similar. 5. The extent of contamination spread is bounded by the 216-Z-11 Ditch. 6. The effluent volume discharged to this crib and contaminant distribution are expected to be similar to the 216-Z-11 Ditch; therefore, the potential for groundwater impact is low. From a groundwater perspective, remedial investigations at other OU waste sites suggest that infiltration beneath ditches used to channel wastewater typically is very limited (DOE/RL-99-07). One important factor to consider in the determination that the 216-Z-1-D Ditch is analogous to the 216-Z-11 Ditch is the proximity of the 216-Z-11 and 216-Z-19 Ditches, the 216-Z-20 Ditch Replacement Tile Field, and the lower portion of the 216-Z-1D Ditch. They are close enough for all of these ditches to be covered by the characterization efforts and results obtained for the representative site (216-Z-11 Ditch).
216-Z-19 Ditch	The 216-D-19 Ditch is an unlined ditch, in operation from 1971 to 1981, backfilled, and surface stabilized in 1981. The ditch is 843 by 1.2 m (2,765 by 4 ft) and 0.6 m (2 ft) deep. There is 0.6 to 0.9 m (2 to 3 ft) of clean cover over the ditch. The ditch terminates at the 216-U-10 Pond.	The ditch received waste from the PFP 231-Z, 234-5Z, and 291-Z process sewers. In 1976, between 30 and 60 kg of plutonium were released to the ditch. The 216-U-19 Ditch was replaced in 1981 by the 216-Z-20 Ditch Replacement Tile Field.	The 216-Z-19 Ditch is analogous to the 216-Z-11 Ditch as indicated by construction, location, and point of discharge, and is analogous because of the following. 1. Construction and waste site configuration are similar (unlined ditches). 2. The 216-Z-19 Ditch received waste from a similar source (234-5Z Building) and discharged to the 216-Z-11 Ditch. 3. The contaminant inventory is bounded by the 216-Z-11 Ditch. 4. The geology of both sites is similar. 5. The extent of contamination spread is bounded by the 216-Z-11 Ditch. 6. Groundwater impact is bounded by the 216-Z-11 Ditch. From a groundwater perspective, remedial investigations at other OU waste sites suggest that infiltration beneath ditches used to channel wastewater typically is very limited (DOE/RL-99-07). One important factor to consider in the determination that the 216-Z-19 Ditch is analogous to the 216-Z-11 Ditch is the proximity of the 216-Z-11 and 216-Z-19 Ditches, the 216-Z-20 Ditch Replacement Tile Field, and the lower portion of the 216-Z-1D Ditch. They are close enough for all of these ditches to be covered by the characterization efforts and results obtained for the representative site (216-Z-11 Ditch).

Table B-1. Representative Sites and Associated Analogous Waste Sites. (26 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site and Discharge History	Rationale
216-Z-20 Ditch	The 216-Z-20 Ditch Replacement Tile Field is an unlined ditch, in operation from 1981 to 1995 that was backfilled and surface stabilized in 1981. It is 463 by 3 m (1519 by 10 ft) with a depth of 2.9 m (9.5 ft). Three perforated PVC pipes run the length of the ditch, backfilled with gravel and soil.	The 216-Z-20 Ditch Replacement Tile Field received cooling water, steam condensate, storm sewer, building drains, HEDL RADTU cooling water, and chemical drain waste from the following buildings: 234-5Z, 231-Z, 291-Z, 232-Z, 236-Z, and 2736-Z.	The 216-Z-20 Ditch Replacement Tile Field is analogous to the 216-Z-11 Ditch as indicated by point of discharge and proximity to the representative site, and is analogous because of the following. 1. Construction and waste configuration are similar, although the 216-Z-20 Ditch includes PVC distribution piping that is backfilled with gravel. 2. The 216-Z-20 Ditch Replacement Tile Field received waste from a similar source (234-5Z Building) and discharged to the 216-Z-11 Ditch. 3. The contaminant inventory for this site is bounded by the 216-Z-11 Ditch. 4. The geology of both sites is similar. 5. The extent of contamination spread is bounded by the 216-Z-11 Ditch. 6. Groundwater impact is bounded by the 216-Z-20 Ditch. From a groundwater perspective, remedial investigations at other OU waste sites suggest that infiltration beneath ditches used to channel wastewater typically is very limited (DOE/RL-99-07). One important factor to consider in the determination that the 216-Z-20 Ditch Replacement Tile Field is analogous to the 216-Z-11 Ditch is the proximity of the 216-Z-11 and 216-Z-19 Ditches, the 216-Z-20 Ditch Replacement Tile Field, and the lower portion of the 216-Z-1D Ditch. They are close enough for all of these ditches to be covered by the characterization efforts and results obtained for the representative site (216-Z-11 Ditch).
207-Z Retention Basin	The 207-Z Retention Basin consists of two concrete basins within one concrete structure. The basins are separated by a 0.3 m (1-ft)-thick concrete wall. Each basin contains a sump with a sump pump. The concrete structure is 15 by 12 m (50 by 40 ft) and 3.1 m (10 ft) deep and was in operation from 1949 to 1959.	The basin received steam condensate and cooling water from the Z Plant Complex (PIF, RECUPLEX, 291-Stack) and released it to the 216-Z-1 and 216-Z-11 Ditches.	The 207-Z Retention Basin is analogous to the 216-Z-11 Ditch as indicated by source of waste received and point of discharge, and is analogous because of the following. 1. Construction and waste site configuration of the 207-Z Retention Basin (concrete basin) are dissimilar to the 216-Z-11 Ditch (unlined ditch). 2. The 207-Z Retention Basin transferred waste to the 216-Z-11 Ditch. 3. The contaminant inventory for this site is bounded by the 216-Z-11 Ditch. 4. The geology of both sites is similar. 5. Extent of contamination is bounded by the 216-Z-11 Ditch; however, a review of associated documentation does not reveal contamination spread outside of the basin. 6. Groundwater impact is bounded by the 216-Z-11 Ditch; however, a review of associated documentation does not reveal contamination spread outside of the basin and potential for groundwater impact is low.

Table B-1. Representative Sites and Associated Analogous Waste Sites. (26 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site and Discharge History	Rationale
UPR 200-W-110	UPR-200-W-110 is a narrow trench east of, and adjacent to, the 216-Z-11 Ditch. It received contaminated backfill material generated during the construction of the 216-Z-19 Ditch. The contaminated backfill was from the 216-Z-1 Ditch. This trench is within the same underground radioactive material zone as the 216-Z-11 Ditch. This one-time release occurred in 1971 and is 130 m (425 ft) long and 4.6 m (15 ft) deep.	UPR-200-W-110 waste originated from the 216-Z-1 Ditch.	UPR-200-W-110 is analogous to the 216-Z-11 Ditch as indicated by source of waste received and proximity to the 216-Z-11 Ditch, and is analogous because of the following. 1. Construction is similar (unlined) but configuration is different (sludge disposal trench vs. liquid transfer ditch). 2. UPR-200-W-110 received contaminated soil, excavated during construction of the 216-Z-19 Ditch, which is analogous to the 216-Z-11 Ditch. 3. The contaminant inventory for this site is bounded by the 216-Z-11 Ditch. 4. The geology of both sites is similar. 5. The extent of contamination spread is bounded by the 216-Z-11 Ditch; however, because of the form of material exposed (contaminated soil), the extent of contamination spread will be lower. 6. Groundwater impact is bounded by the 216-Z-11 Ditch.
Representative Site			
216-A-25 Gable Mountain Pond	The 216-A-25 Gable Mountain Pond was a 29-ha (71-a) pond located in a natural depression north of the 200 Area perimeter fence. The pond operated from 1957 to 1987. The site no longer receives effluent and has an existing soil cover consisting of sand and gravel that ranges from 0.9 to 4 m (3 to 13 ft) thick.	The pond received cooling water and other low-level radioactive effluents from 200 East Area facilities, including the 207-A North Retention Basin.	Characterization is described in DOE/RL-2000-35. <u>Contaminant Distribution</u> Radionuclides detected include Am-241, Cs-137, Co-60, Sr-90, Pu-239/240, Tc-99, and Eu-154. The greatest level of contamination at the 216-A-25 Gable Mountain Pond typically is detected and associated with the pond bottom; however, Sr contamination extends to a depth of 11.3 m (37 ft). Contaminant concentration decreases with depth below the pond bottom, with one exception (Sr-90). Strontium-90 and Cs-137 are the major radiological contaminants at the 216-A-25 Gable Mountain Pond and were the only contaminants detected at depths greater than 4.6 m (15 ft) bgs in significant concentrations. The maximum concentrations of Sr-90 and Cs-137 are 58.8 pCi/g and 7,180 pCi/g, respectively. The maximum activity of Cs-137 was associated with the bottom of the pond. The distribution of Sr-90 does not appear to correlate with a particular stratigraphic horizon and was detected throughout the vadose zone at concentrations ranging from not detected to 58.8 pCi/g. The activities of other radiological contaminants typically were less than 2 pCi/g with few exceptions and commonly were observed at less than 4.6 m (15 ft) bgs. Maximum Cs-137: 58.8 pCi/g. Maximum Sr-90: 7,180 pCi/g. Cesium-137 was the only manmade radionuclide detected in boreholes adjacent to the 216-A-25 Gable Mountain Pond. Activities ranged between 0.25 and 0.4 pCi/g and typically occurred less than 1.1 m (3.5 ft) bgs. However, a single detection occurred in borehole 699-55-50D at a depth of 1.8 m (59.5 ft). Groundwater has been impacted by discharges to the pond, most notably a UPR of 7,500 Ci of Sr-90 in 1964 (UPR-200-E-34). A Sr-90 groundwater plume currently is located on the northeast side of the pond. The plume shows virtually no movement because the water table is very flat. The plume, which had a maximum concentration of 1,210 pCi/L in 2001, is not expected to move beyond its current location. Continued or future impacts to groundwater are not expected at this site, based on the low concentrations of mobile contaminants remaining in the soils and the limited infiltration/driving force to move contaminants from the vadose zone to the groundwater.

Table B-1. Representative Sites and Associated Analogous Waste Sites. (26 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site and Discharge History	Rationale
Analogous waste sites to be evaluated by the 216-A-25 Gable Mountain Pond model			
207-A North Retention Basin	The 207-A North Retention Basin consists of three Hypalon*-lined, concrete basins. Before the liner was installed, the basins had been posted as a Contamination Area, but currently there is no radiological posting. Each basin is 16.8 by 3.0 by 2.1 m (55 by 10 by 7 ft) (total 50.3 m (165 ft) long) and was in operation from 1977 to 1999.	The basins received steam condensate from the 242-A Evaporator, and then it was transferred to the 216-A-25 Crib or the 216-B-3 Pond.	The 207-A North Retention Basin is analogous to the 216-A-25 Gable Mountain Pond as indicated by source of waste received (242-A Evaporator Facility) and point of discharge (207-Z Retention Basin), and is analogous because of the following. 1. Construction and waste site configuration of the 207-A North Retention Basin (concrete basin) are dissimilar to the 216-A-25 Gable Mountain Pond (unlined pond). 2. The 207-A North Retention Basin transferred waste to the 216-A-25 Gable Mountain Pond. 3. The contaminant inventory for this site is bounded by the 216-A-25 Gable Mountain Pond. 4. The geology is significantly different (much thicker layer of basalt below the 216-A-25 Gable Mountain Pond). 5. Extent of contamination spread is bounded by the 216-A-25 Gable Mountain Pond. Review of associated documentation does not indicate that contamination spread outside of the basin. 6. Groundwater impact is bounded by the 216-A-25 Gable Mountain Pond. Because of the Hypalon* liner installed in the 207-A North Retention Basin and no documentation of basin leakage, the potential impact to groundwater is negligible.
Representative Site			
216-T-26 Crib	The 216-T-26 Crib consists of four 1.2 m (4 ft) diameter by 1.2 m (4 ft) length concrete culverts, buried vertically with centers spaced 4.6 m (15 ft) apart in a 9.1 by 9.1 by 4.6 m (30 by 30 by 15 ft) excavation.	Tank Farm/T Plant (bismuth phosphate/lanthanum fluoride): 1955-1956. The crib received first-cycle scavenged supernatant waste from the 221-T Building via an underground pipeline and the 216-TY-201 Flush Tank after cascading through the 241-TY-101, 241-TY-103, and 241-TY-104 tanks. It also received scavenged $BiPO_4$ solvent extraction waste from "in plant" and "in tank farm" scavenging operations.	Investigated in 2001 under DOE/RL-2000-38. Characterization is described in DOE/RL-2002-42 for this representative site. <u>Contaminant Distribution</u> Most of the contamination is in a 16.5-ft zone below the bottom of the crib at 18 ft. The main zone of contamination extends from 18 to 36.5 ft (5.5 to 11 m) bgs. The predominant contaminant is Cs-137. The lower portion of this zone is the approximate top of the Cold Creek unit, where only Tc-99 and H-3 were detected greater than 28.8 m (94.5 ft) bgs. Concentrations were less than 4 pCi/g each in this zone. Maximum Cs-137 concentration occurs from the release site bottom and generally decreases with depth to 11 m (36.5 ft); however, the maximum concentrations of most contaminants occurred in the lower portion of this contaminated zone 34 to 36.5 ft (10.4 to 11 m) bgs. Maximum Cs-137 concentration: 47,900 pCi/g. Maximum Sr-90 Concentration: 49,100 pCi/g. Significant reduction in the levels of contamination is associated with top of the sand-dominated sequence of the Hanford formation and the Cold Creek unit. RLS detected Cs-137 from near the surface to a depth of 128 ft (39 m) bgs. Log data indicate that most of the Cs-137 was detected from 18 to 91 ft (5.5 to 27.7 m) bgs and is distributed deeper in the vadose zone toward the south end of the site. The maximum concentration detected by RLS is estimated to be greater than 3,000 pCi/g.

Table B-1. Representative Sites and Associated Analogous Waste Sites. (26 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site and Discharge History	Rationale
Analogous Waste Site to be evaluated by the 216-T-26 Crib model			
216-T-36 Crib	The 216-T-36 Crib consists of a single distribution pipe in a gravel layer in a rectangular trench. Backfill covers the pipe and gravel. A long, narrow area of posted contamination adjacent to the east side of the crib appears to be located over the buried pipeline that fed the crib. The crib is 49 by 3.1 m (160 by 10 ft) and 4.6 m (15 ft) deep, and was in operation from 1967 to 1970 or 1973.	The crib received steam condensate, decontamination waste, and miscellaneous waste from the 221-T and 221-U Buildings, and 2706-T Building decontamination waste. The 216-T-36 Crib replaced the 216-T-26 Crib.	The 216-T-36 Crib is analogous to the 216-T-26 Crib as indicated by process history and is analogous because of the following. 1. Construction and waste site configuration are similar. 2. The 216-T-36 Crib replaced the 216-T-26 Trench and received waste from the 221-T Building, similar to the 216-T-26 Trench. 3. The contaminant inventory for this site is reflective of the 216-T-26 Crib. 4. The geology of both sites is similar. 5. The extent of contamination spread is bounded by the 216-T-26 Crib but is significantly less because it was in service for a much shorter period and received only 4 percent of the waste. 6. Groundwater impact is bounded by the 216-T-26 Crib. The contaminant inventory and small amount of discharge as compared to the pore volume suggests a low potential to effect groundwater.
200-W-79 Pipeline	The 200-W-79 Pipeline is a 10 cm (4-in.) vitrified clay underground pipeline that fed the 216-T-36 Crib. The pipeline is 225.00 m (738 ft) long and buried 3.1 m (10 ft) deep.	Waste was received from T Plant and U Plant effluent discharges to the 241-T-151 Diversion Box, then the 216-T-36 Crib, and is associated with a 10 cm (4-in.) diameter, vitrified clay pipeline, and adjacent soil.	The 200-W-79 Pipeline is analogous to the 216-T-26 Crib as indicated by process history and is analogous because of the following. 1. Construction and waste site configuration of the 200-W-79 Process Sewer (vitrified clay pipe) are dissimilar to the 216-T- 26 Crib (buried concrete culverts). 2. The 200-W-79 Pipeline transferred waste to the 216-T-36 Crib, which replaced the 216-T-26 Crib and received waste from the 221-T Building, similar to the 216-T-26 Crib. 3. The contaminant inventory for this site is bounded by the 216-T-26 Crib. 4. The geology of both sites is similar. 5. The extent of contamination spread is bounded by the 216-T-26 Crib. 6. Groundwater impact is bounded by the 216-T-26 Crib.

Table B-1. Representative Sites and Associated Analogous Waste Sites. (26 Pages)

Waste Site	Waste Site Configuration, Construction, and Purpose	Site and Discharge History	Rationale

*Hypalon is a registered trademark of Dupont Dow Elastomers Limited Liability Company, Wilmington, Delaware.

DOE/RL-2000-35, *200-CW-1 Operable Unit Remedial Investigation Report.*
DOE/RL-2000-38, *200-TW-1 Scavenged Waste Group Operable Unit and 200-TW-2 Tank Waste Group Operable Unit RI/FS Work Plan.*
DOE/RL-2002-42, *Remedial Investigation Report for the 200-TW-1 and 200-TW-2 Operable Units (Includes the 200-PW-5 Operable Unit).*
DOE/RL-2003-11, *Remedial Investigation for the 200-CW-5 U Pond/Z Ditches Cooling Water Group, the 200-CW-2 S Pond and Ditches Cooling Water Group, the 200-CW-4 T Pond and Ditches Cooling Water Group, and the 200-SC-1 Steam Condensate Group Operable Units.*
DOE/RL-96-81, *Waste Site Grouping for 200 Areas Soil Investigations.*
DOE/RL-99-07, *200-CW-1 Operable Unit RI/FS Work Plan and 216-B-3 RCRA TSD Unit Sampling Plan.*
PNNL-13788, *Hanford Site Groundwater Monitoring for Fiscal Year 2001.*
WHC-EP-0698, *Groundwater Impact Assessment Report for the 216-U-14 Ditch.*

bgs	=	below ground surface.
c/min	=	counts per minute.
d/min	=	disintegrations per minute.
HEDL	=	Hanford Engineering Development Laboratory.
OU	=	operable unit.
PFP	=	Plutonium Finishing Plant.
PIF	=	Plutonium Isolation Facility.
PUREX	=	Plutonium-Uranium Extraction Plant.
PVC	=	polyvinyl chloride.
RADTU	=	Radioactive Acid Digestion Test Unit.
RECUPLEX	=	Recovery of Uranium and Plutonium by Extraction Plant.
REDOX	=	Reduction-Oxidation Plant.
RLS	=	radionuclide logging system.
TBP	=	tributyl phosphate.
TEDF	=	Treated Effluent Disposal Facility.
TPH	=	total petroleum hydrocarbon.
TRU	=	Waste materials contaminated with 100 nCi/g of transuranic materials having half-lives longer than 20 years.
UPR	=	unplanned release.
URM	=	Underground Radioactive Material (area).
WIDS	=	*Waste Information Data System.*