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A. Information Category

- ☐ Abstract
- ☐ Journal Article
- ☐ Summary
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- ☒ Report
- ☐ Other ______

B. Document Number DOE/RL-2004-69, Draft A

C. Title
Proposed Plan for the BC Cribs and Trenches Area Waste Sites

D. Internet Address

E. Required Information

1. Is document potentially Classified? (●) No ( ) Yes (MANDATORY)

Loring G. Dusek [signature]
Manager Required (Print and Sign)

If Yes ______ ( ) No ( ) Yes Classified
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2. References in the Information are Applied Technology (●) No ( ) Yes

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5. Release Level? (●) Public ( ) Limited

F. Complete for a Journal Article

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L. G. Dusek [signature]
(Print and Sign)

Approval by Direct Report to FH President (Speech/Articles Only) ______
(Print and Sign)

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Manager Required (Print and Sign)

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Pg. 2 of 2

ADMINISTRATIVE DOCUMENT PROCESSING AND APPROVAL

DOCUMENT TITLE:	OWNING ORGANIZATION/FACILITY:
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Document Number: DOE/RL-2004-69	Revision/Change Number: A

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☐ Plan ☒ Report ☐ Study ☐ Description Document ☐ Other

DOCUMENT ACTION ☐ New ☐ Revision ☐ Cancellation

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Does document contain controlled-use information? ☐ Yes ☒ No

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DOCUMENT REVISION SUMMARY

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Report summarizes risks associated with waste sites and recommends remedial actions.

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DOE/RL-2004-69
DRAFT A

Proposed Plan for the BC Cribs and Trenches Area Waste Sites

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

United States
Department of Energy
P.O. Box 550
Richland, Washington 99352

DOE/RL-2004-69
DRAFT A

Proposed Plan for the BC Cribs and Trenches Area Waste Sites

Date Published
May 2005

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

United States
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P.O. Box 550
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Release Approval

5/24/2005
Date

United States Department of Energy

United States Environmental Protection Agency

Washington State Department of Ecology

DOE/RL-2004-69 DRAFT A

PROPOSED PLAN FOR THE

BC CRIBS AND TRENCHES AREA WASTE SITES

HANFORD SITE

RICHLAND, WASHINGTON

MAY 2005

INTRODUCTION

Environmental cleanup (remedial action) is needed at the BC Cribs and Trenches Area waste sites where more than 117,000 m^3 (31 million gal) of radioactive liquid waste were discharged to the soil. The cleanup is necessary to reduce the risks to human health and the environment from the contaminated soil and debris. Sampled waste sites show that near-surface contamination could be lethal to intruders and deep contamination eventually could contaminate groundwater.

The *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA), also known as Superfund, requires remedial action for these 20 trenches, 6 cribs, 1 tank, and 1 pipeline. This Proposed Plan (Plan) describes five cleanup alternatives and identifies the preferred remedies.

For 22 of the waste sites, the preferred remedial alternative is to physically isolate the contaminants in place, so that exposure pathways to humans, groundwater, and biota are blocked with a protective barrier. The specific remedial actions are as follows.

- The preferred alternative for all but four of the trenches and all of the cribs is to leave the waste in place and provide a protective surface barrier (such as an evapotranspiration barrier) over the contaminated waste site. "Capping" the site will greatly reduce water from infiltrating into the waste and driving contaminants to the groundwater. The cap or barrier also would deter or prevent intrusion by animals and humans at the surface from coming into contact with the contaminated material below. This alternative is protective of the groundwater, protective of the remediation workers, easily implementable, and cost effective. Human health and environmental protection from near-surface contamination are provided by the barrier and the presence of personnel to periodically maintain it.

HOW YOU CAN PARTICIPATE

- **Read** this Proposed Plan and review related documents in the ____. Copies of the Proposed Plan are in the Hanford Information Repositories. Only the Administrative Records will have the supporting documents. The plan can be viewed electronically or obtained by calling the EPA at 1-800-321-2008.
- **Call** DOE or EPA project managers for more information or to request a meeting.
- **Comment** on this Plan by sending comments to XXXXX.

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 are 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 obtain comments. Responses to comments will be presented in a responsiveness summary that will be issued as part of the Record of Decision.

Proposed Plan
The plan that presents the preferred alternatives for remedial action of waste sites to the public. 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 Superfund.

Tri-Parties
U.S. Department of Energy (DOE), U.S. Environmental Protection Agency (EPA), and Washington State Department of Ecology (Ecology).

Inside this Plan

The preferred alternative for the underground siphon tank, the pipeline, and four trenches that received lesser quantities of waste is excavation, including associated contaminated soil. The structures and contaminated soil would be disposed of at the Environmental Restoration Disposal Facility (ERDF). This alternative is protective based on the expected levels of minor contamination for these waste sites.

- Additional evaluation of treatment technologies that focus on groundwater protection is recommended. This evaluation would begin with an independent panel of experts from national laboratories and academia to assess the review performed during the focused feasibility study process and its selection of soil drying, to augment capping, for further evaluation. Panel recommendations will guide future activities, including whether a treatability test is warranted, and, if so, test objectives and initial test design. Successful treatability test results would lead to incorporation of the technology into the remedy.

In presenting the alternatives and preferred remedies, this Plan references or highlights key information that can be found in greater detail in DOE/RL-2004-66, *Focused Feasibility Study for the BC Cribs and Trenches Area Waste Sites*, and other documents within the Administrative Record file. These documents can 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 Plan, which serves as the public notice required by CERCLA, is issued by the U.S. Department of Energy (DOE) and the U.S. Environmental Protection Agency (EPA). These two agencies are proposing the preferred alternatives for these waste sites under the authority of CERCLA and in accordance with the *Hanford Federal Facility Agreement and Consent Order*, also known as the Tri-Party Agreement (Ecology et al. 1989). The DOE also is issuing this Plan as part of its responsibility under the *National Environmental Policy Act of 1969* (NEPA).

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

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

Overview of the Proposed Plan

This Plan proposes remedial actions for 28 different waste sites consisting of 6 cribs, 20 trenches, an underground siphon tank, and an underground pipeline that are in the BC Cribs and Trenches Area.

For these waste sites, this Plan presents "source control" cleanup actions. These actions reduce risks by mitigating the source of the contamination. To identify preferred remedies, the DOE and EPA evaluated the following range of alternatives:

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

BC Cribs and Trenches Area
A series of 200-TW-1 Operable Unit waste sites located south of the 200 East Area; includes 6 cribs, 20 trenches, a siphon tank, and a portion of pipeline from the cribs to Route 4 South (see Figure 2).

Comprehensive descriptions of the waste sites and all of the alternatives considered in this Plan are provided in the focused feasibility study (DOE/RL-2004-66).

Given the varying nature and extent of the contamination at the different waste sites, no single alternative could be applied to all sites. Alternatives 3 and 4 were identified as preferred alternatives to remediate these waste sites. Also, the Plan recommends the establishment of a process to investigate treatment technologies to provide additional groundwater protection.

The combined present-value cost for implementing the preferred alternatives is estimated to be ~$51 million. This is 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. Individual present-value costs for each of the waste sites are provided in Appendix A.

SITE BACKGROUND

Hanford Site

The Hanford Site (Figure 1) is a 1,517 km^2 (586-mi^2) Federal facility located along the Columbia River in southeastern Washington State. 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

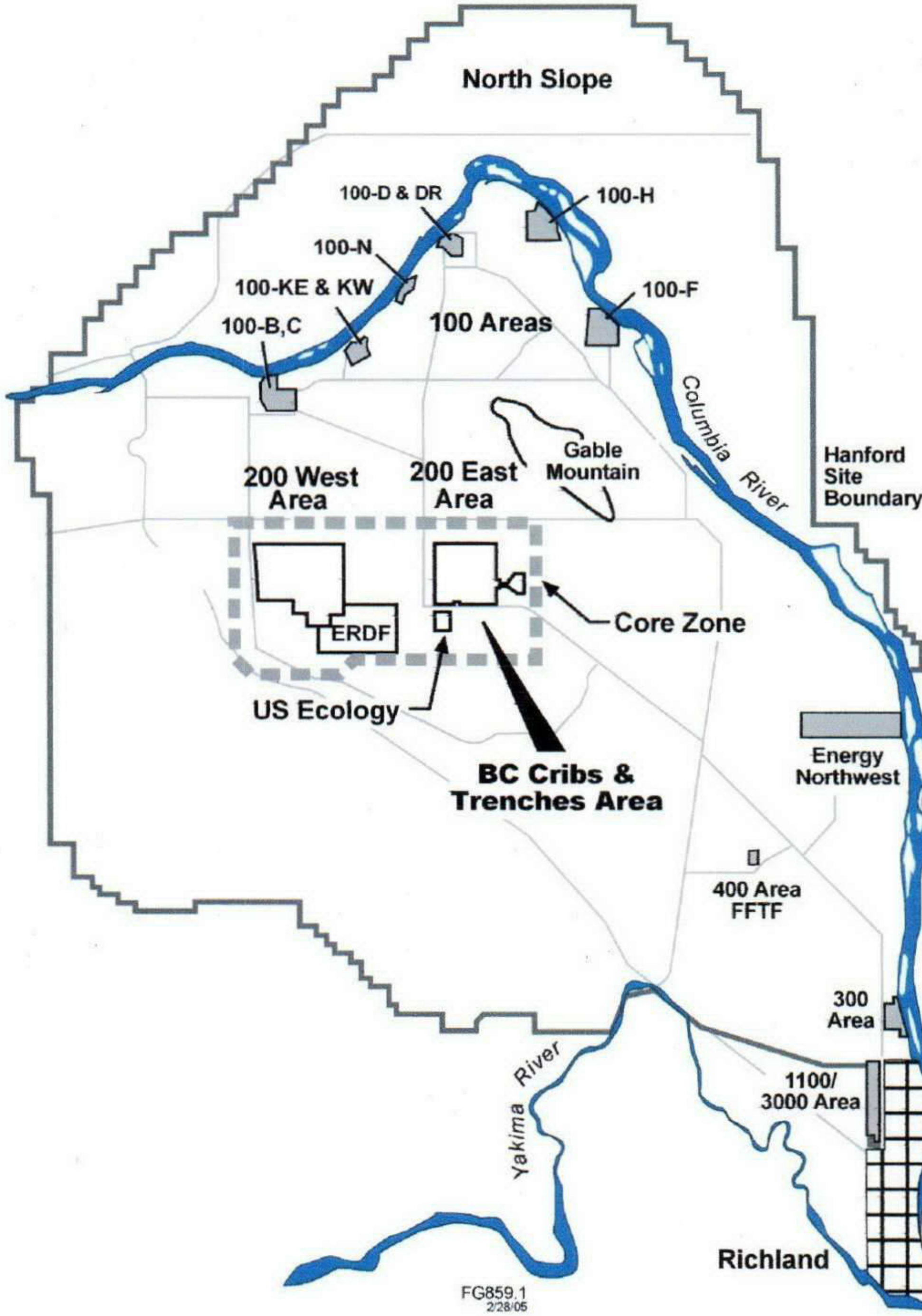
The 200 Areas are located in the central portion of the Hanford Site and are divided into three main areas: 200 East Area, 200 West Area, and 200 North Area. The 200 North Area formerly was used for interim storage and staging of irradiated fuel. Operations in the 200 East and 200 West Areas were related to chemical separation, plutonium and uranium recovery, processing of fission products, and waste partitioning. Major chemical processes routed high-activity waste streams to systems of large underground tanks called "tank farms." The liquid wastes were evaporated (concentrated) and often neutralized before being routed to the tanks. The storage tanks were used to allow settling of the heavier constituents from the liquid effluents, forming sludge. Some liquid wastes in the tanks ultimately were discharged to the soil column using cribs, drains, trenches, and injection/reverse wells. Other wastes and drainages also were sent to cribs and trenches using this underground network. Low-activity liquid wastes were discharged to trenches, cribs, drains, and ponds, many of which were unlined.

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.

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

FIGURE 1. LOCATION OF THE BC CRIBS AND TRENCHES AREA WASTE SITES ON THE HANFORD SITE.



The BC Cribs and Trenches Area waste sites include 6 cribs and 16 trenches. They received scavenged waste from the uranium recovery process and the ferrocyanide processes at the 221/224-U Plant, which recovered uranium from the metal waste streams originating from the B Plant and T Plant. This waste is described as "scavenged" because most of the highly radioactive cesium-137 was chemically removed. The scavenged waste discharges contributed the largest liquid fraction of contaminants to the ground in the 200 Areas. Four additional trenches, formerly in the 200-LW-1 Operable Unit, are located in this area. Three of these four trenches received waste from the 300 Area laboratory facilities and the 340 Waste Neutralization Facility; the fourth trench received waste from the Plutonium Recycle Test Reactor. Discharges to these liquid waste disposal sites were limited to avoid exceeding the estimated capacity of the soil to retain the liquid above the water table. Two other waste sites are included in this area: a siphon tank that held liquid waste before its discharge to the cribs and the pipeline that delivered liquid waste to the siphon tank. Figure 2 shows the distribution or layout of these waste sites within the BC Cribs and Trenches Area; Figure 3 illustrates general features of the cribs, trenches, and siphon tank.

Although the cribs and trenches are similar in that both are liquid-waste disposal sites, they have distinct differences. The cribs are relatively small (12.2 m [~40 ft]) square at the bottom] and were designed to disperse the liquid waste evenly throughout the crib. They received waste in large quantities (~42,000 L [~11,000 gal]) at a time) from the siphon tank that functioned as a large "toilet" that, when full, automatically flushed its contents through a 36 cm (14-in.) diameter pipe to the crib. In contrast, the trenches typically were 153 m (500 ft) long, narrow open excavations that were fed liquid waste through a network of aboveground 5.1 cm (2-in.) diameter pipes placed at infrequent intervals along the length of the trench. Thus, the trenches received uneven contamination distribution along their length.

SCOPE AND ROLE OF ACTION

This Plan recommends remedial actions for contaminated soil, structures (e.g., concrete and tanks), and debris associated with liquid-waste disposal sites in the BC Cribs and Trenches Area. The proposed remedial actions reduce potential threats to human health and the environment from waste site contaminants. Other than the requirement to reduce the source of contamination, the scope of this Plan does not include potential remediation of groundwater beneath these waste sites. Groundwater remediation will be the focus of a separate plan expected to be issued in the next 3 to 10 yr. In addition, this Plan does not address the adjacent BC Controlled Area (a large area south of the BC Cribs and Trenches that has scattered soil contamination resulting from biological intrusion into the waste sites nearly 50 yr ago) and the nearby nonradioactive, dangerous waste landfill.

FIGURE 2. DISTRIBUTION OR LAYOUT OF THE BC CRIBS AND TRENCHES AREA WASTE SITES.

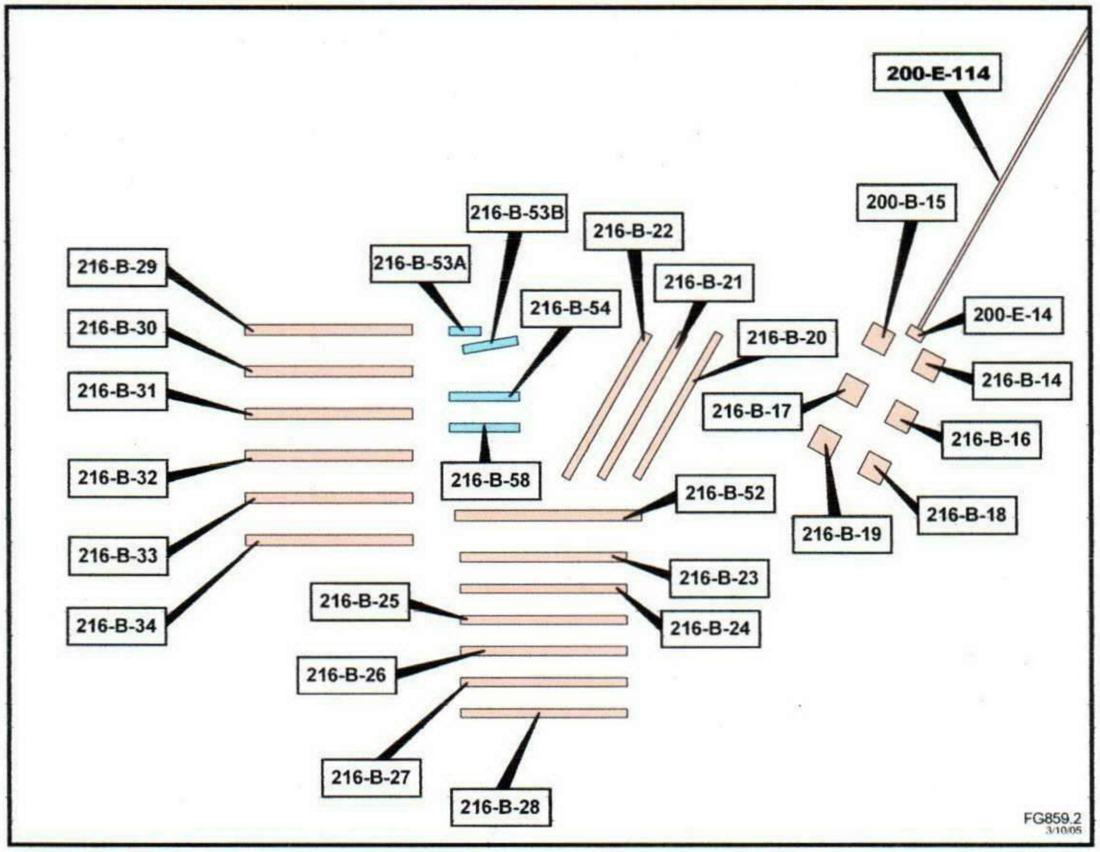
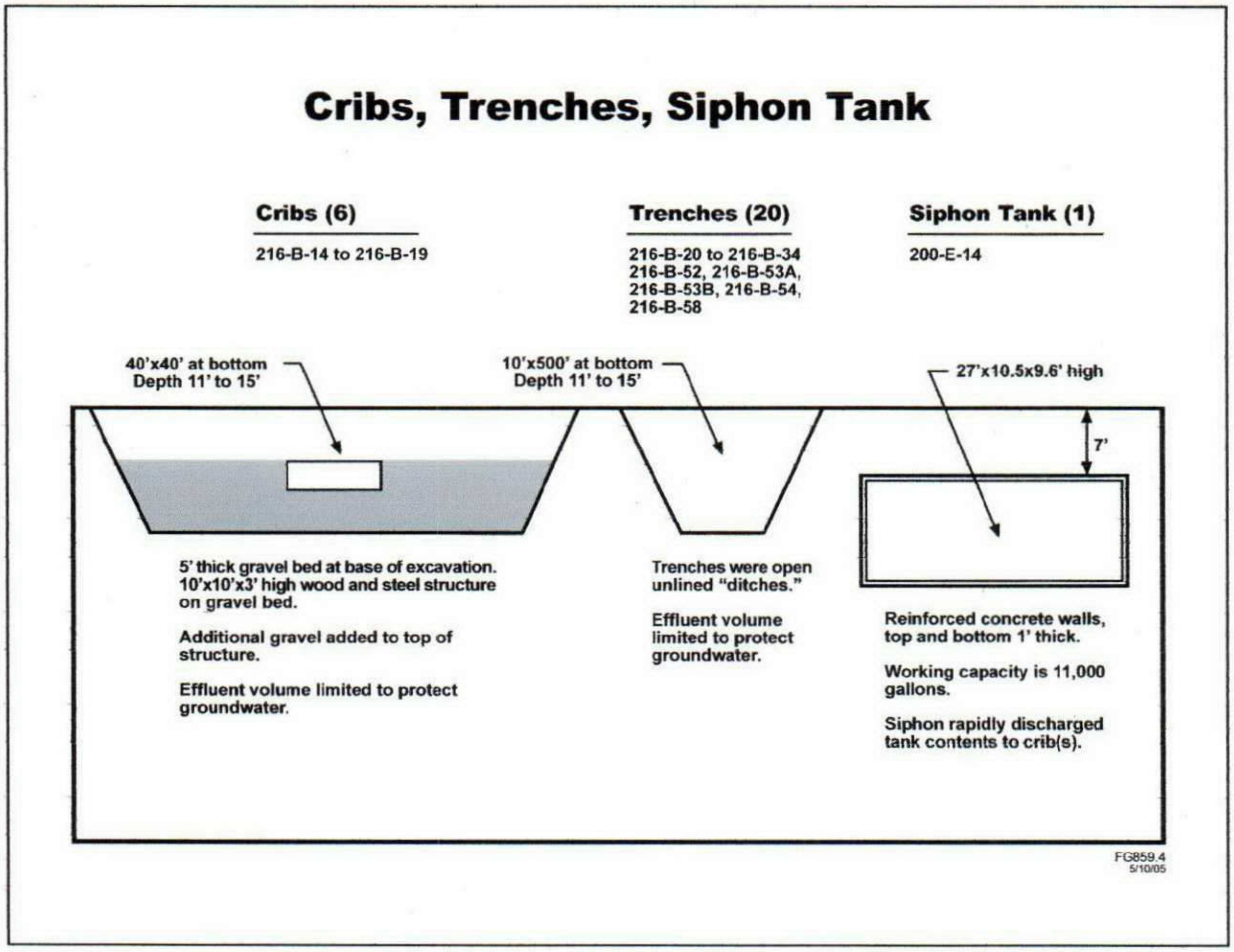


FIGURE 3. FEATURES OF BC CRIBS AND TRENCHES AREA WASTE SITES.



Characterization
Identification of the characteristics of a site, through review of existing site information and/or sampling 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.

Characterization Reports
Waste sites within the 200 Areas have been characterized through a series of three investigations:
(1) A scoping-level investigation (such as the B Plant Source Aggregate Area Management Study Report [DOE/RL-92-05])
(2) A remedial investigation (such as the Remedial Investigation Report for the 200-TW-1 and 200-TW-2 Operable Units (Includes the 200-PW-5 Operable Unit) [DOE/RL-2002-42])
(3) The application of the analogous sites approach in the focused feasibility study (DOE/RL-2004-66).
All of the representative sites have been sampled; several other waste sites have been sampled; and the remaining sites have been characterized through process knowledge and the analogous site approach.

RI
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.

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.

Identifying strategies and determining the requirements, limits, and goals for cleanup, are key elements of the proposed action. These key elements are discussed in the following sections. A major component of the overall strategy includes cleanup of those waste sites that represent some of the most highly contaminated waste sites at the Hanford Site. The focus is on those sites that pose a high risk to human health, the environment, and the groundwater.

SITE CHARACTERIZATION

The waste sites discussed in this Plan were characterized using a streamlined approach where information was collected on selected "worst case" and "typical" sites that could bound or represent other sites. As detailed in DOE/RL-98-28, *200 Areas Remedial Investigation/Feasibility Study Implementation Plan – Environmental Restoration Program* (Implementation Plan), this approach streamlines the risk investigation procss by developing conceptual site models. Sampling data from the representative sites, along with characterization data obtained from other waste sites, are used to generate and continually refine these models. The conceptual site models form the basis for estimating risks and evaluating remedial alternatives for other waste sites. Additional sampling data for these waste sites, however, may be collected concurrently with or after the Record of Decision (ROD) to confirm that the recommended remedial action is appropriate and to obtain data to perform detailed design of the remedial action. Specific sampling requirements will be defined by a data quality objectives process and development of a sampling and analysis plan.

Waste Site Sampling and Conceptual Site Models

The conceptual site models used to characterize the waste sites evaluated in this Plan were developed from waste site sampling data considered to be bounding or typical. The model also considered the waste site construction type and size, estimated contaminant inventory, effluent volume received, and geology to describe the expected contaminant distribution. Sampled sites are the 216-B-26 Trench and the 216-B-58 Trench, which are located in the BC Cribs and Trenches Area, and the 216-B-46 Crib, which received the same type of waste as the cribs in this area and has similar geologic characteristics but is located elsewhere in the northern portion of the 200 East Area. The 216-B-46 Crib had been characterized previously and is considered representative of the cribs in the BC Cribs and Trenches Area.

Table 1 identifies the sampled sites, the sites represented by those sites, and the rationale for applying the sampled waste sites' conceptual models to the other sites.

TABLE 1. CHARACTERIZED WASTE SITES AND CONCEPTUAL MODELS, ANALOGOUS SITES, AND RATIONALE FOR APPLICATION.

<table>
<tr><th>Sampled Waste Site Conceptual Model</th><th>Analogous Sites</th><th>Rationale</th></tr>
<tr><td>216-B-26 Trench
♦ High concentrations of contaminants with low mobility at bottom of waste site
♦ Mobile contaminants located much deeper but held up at 30.5-39.6 m (100-130 ft) deep level
♦ Mobile contaminants exhibit considerable lateral spreading at depth</td><td>216-B-20 through 216-B-25, 216-B-27 through 216-B-34 Trenches; 216-B-52 Trench</td><td>♦ The waste sites all received scavenged waste from the uranium recovery process in U Plant.
♦ Because the sites are co-located with the 216-B-26 Trench and received similar waste volume and contaminant load, the contaminant distributions are expected to be similar.
♦ Construction is similar to the 216-B-26 Trench.</td></tr>
<tr><td rowspan="2">216-B-58 Trench
♦ Moderate concentrations of contaminants with low mobility at bottom of waste site
♦ Essentially no deep contamination</td><td>216-B-53A Trench</td><td>♦ Received liquid waste associated with the Plutonium Recycle Test Reactor process tube failure.
♦ The contaminant distributions for these sites are expected to be similar because of similar construction, waste volumes, and geology.
♦ Co-located with the 216-B-58 Trench.</td></tr>
<tr><td>216-B-53B and 216-B-54 Trenches</td><td>♦ The waste sites received the same waste as the 216-B-58 Trench (i.e., 300 Area laboratory waste).
♦ The contaminant distributions for these sites are expected to be similar because of similar construction, waste volumes, and geology.
♦ Co-located with the 216-B-58 Trench.</td></tr>
<tr><td>216-B-46 Crib
♦ High concentrations of contaminants with low mobility at bottom of waste site
♦ Mobile contaminants located deeper, reaching groundwater</td><td>216-B-14 through 216-B-19 Cribs</td><td>♦ These waste sites all received scavenged waste from the uranium recovery process in U Plant.
♦ Construction is similar to the 216-B-46 Crib.
♦ Mobile contaminants should not be as deep as the 216-B-46 Crib, because these cribs received less effluent.</td></tr>
<tr><td rowspan="2">Standalone sites</td><td>200-E-14 Siphon Tank</td><td>♦ The waste site received the same waste as received at the 216-B-26 Trench and 216-B-46 Crib (i.e., scavenged waste from the uranium recovery process).
♦ The contaminant distribution is expected to be much higher in the soil column than for the 216-B-26 Trench and 216-B-46 Crib, because they were designed to discharge liquid waste to the soil, while the siphon tank was designed to hold and transfer waste.
♦ No history of leaks from the tank.</td></tr>
<tr><td>200-E-114 Pipeline</td><td>♦ The pipeline received the same waste as the 216-B-26 Trench and 216-B-46 Crib. The pipeline was used to transfer scavenged waste to the BC Cribs and Trenches.
♦ The contaminant distribution is expected to be much higher in the soil column than the 216-B-26 Trench and 216-B-46 Crib, because they were designed to discharge wastes to the soil while the pipeline was designed to transfer wastes.
♦ No evidence of pipeline leaks within the BC Cribs and Trenches Area.</td></tr>
</table>

Geophysical Logging
Traversing the length of a hole with special detectors to assess the concentration of gamma-emitting contaminants and moisture.

- **216-B-26 Trench Characterization**
  - To locate the region of the trench with the highest contamination, six shallow [12.2 m (40-ft-deep)] holes spaced evenly along the length of the trench were installed. Data were collected (i.e., logged) on residual gamma radiation. Some portions of the trench appeared to be heavily contaminated; other portions were only slightly contaminated. One of the shallow boreholes showed no contamination, suggesting it intersected a berm that divided the trench. Two others exhibited cesium-137 concentrations in excess of 1 million pCi/g; another two exhibited maximum cesium-137 concentrations ranging from 20,000 to 60,000 pCi/g; and one indicated ~400,000 pCi/g cesium-137.
  - A single borehole located at the place of highest contamination (based on the gamma radiation logging of the evenly spaced shallow holes) was drilled to groundwater, and periodic soil samples were collected. The borehole also was logged to assess residual gamma-emitting radionuclides and moisture concentrations.
  - High concentrations of cesium-137 and strontium-90 are present near the surface (i.e., ~3.7 to 4.6 m [12 to 15 ft] deep). Their spatial distribution may be uneven, based on the shallow borehole characterization described above. These contaminants are relatively immobile and confined to near-surface soil.
  - Elevated concentrations of technetium-99 and nitrate were found in fine-grained soil layers at 30.5 to 39.6 m (100 to 130 ft) deep. Essentially no contamination was observed below 46 m (150 ft).
  - Additional characterization based on measuring soil conductivity (a non-intrusive technology that reveals electrical properties that can be related to past waste discharges) rather than soil sampling revealed that the technetium-99 and nitrate contamination has spread laterally beneath the 216-B-26 Trench and adjacent waste sites to where a continuous "plume" of contamination exists beneath the groups of trenches and beneath the cribs.
  - A groundwater sample showed no contamination.
- **216-B-58 Trench Characterization**
  - To locate the region of the trench with the highest contamination, eight shallow [10.7 m (35-ft)-deep] holes spaced evenly along the length of the trench were installed. Data were collected on residual gamma radiation. The data indicate that some portions of the trench received more waste than others.
  - One borehole located at the place of highest contamination was drilled to a depth of [30.5 m (100 ft)]. Another borehole located at the west end of the trench was drilled to the same depth. Periodic soil samples were collected. These boreholes also were logged to assess residual gamma-emitting radionuclides and moisture concentrations.
  - Cesium-137 and strontium-90 concentrations were low compared to the 216-B-26 Trench. These contaminants were confined to a depth corresponding to near the bottom of the trench.

- **216-B-46 Crib Characterization**
  - Three shallow (9.1 to 10.7 m [30- to 35-ft] deep) holes spaced ~6.1 m (20 ft) apart in a triangular array were installed through the crib.
  - Soil samples were collected from each borehole. Each borehole also was logged to assess residual gamma-emitting radionuclide and moisture concentrations.
  - A deep borehole was drilled through the nearby 216-B-49 Crib, which received approximately the same volume and level of contamination as the 216-B-46 Crib. This borehole was used to evaluate the groundwater risks associated with the 216-B-46 Crib. Soil samples were collected. The borehole also was geophysically logged to assess residual gamma-emitting radionuclide and moisture concentrations.
  - Cesium-137 and strontium-90 are the predominant contaminants in the shallow zone associated with the bottom of the crib.
  - Technetium-99 and nitrate are present in elevated concentrations from 15.2 m (50 ft) to near the groundwater.

SUMMARY OF SITE RISKS

The Tri-Parties believe that action is necessary to protect human health and the environment from actual or threatened releases of hazardous substances into the environment from the BC Cribs and Trenches Area waste sites. Assessing the site risks includes evaluating how the contamination may affect human health and the environment in the context of anticipated future land use.

Risk Assessment
Site risks are based on anticipated land use following remediation. A "No Action" scenario is considered to establish a baseline.

Land Use

Site risks were evaluated based on a reasonably anticipated future land use for the Central Plateau of the Hanford Site, which includes the 200 Areas. Within the Central Plateau is an industrial/exclusive zone, which is located in the middle of the Central Plateau. The Central Plateau industrial/exclusive zone contains the former processing facilities, tank farms, and the majority of the waste disposal sites. A buffer zone around this zone has been proposed to facilitate implementation of institutional controls within it. Although the original definition of the Central Plateau industrial/exclusive zone did not include the BC Cribs and Trenches Area waste sites, adjustment of the boundary now places them within this zone near its southern edge. These evaluations were based on criteria presented in and are consistent with the Hanford Advisory Board (HAB) Advice #132 (http://www.hanford.gov/boards/hab/advice/habadv-132.pdf), and the Tri-Parties' response to that advice.

The HAB acknowledges that some waste within acceptable levels will remain in the Central Plateau industrial/exclusive zone when cleanup is complete. The goal identified within the HAB advice is that the Core Zone be as small as possible.

The DOE is expected to continue industrial/exclusive activities for at least 50 yr, in accordance with DOE/EIS-0222-F, *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement*, and the Record of Decision (64 FR 61615, "Record of Decision: Hanford Comprehensive Land-Use Plan Environmental Impact Statement [HCP EIS]").

Land Use
The area in the middle of the Central Plateau has been designated the Core Zone, which contains current and future waste management activities.

Based on these discussions with the HAB, the alternative risk evaluations used the following anticipated land-use assumptions:

- Industrial-exclusive use for the next 50 yr inside the Central Plateau industrial/exclusive zone
- Industrial land use (non-DOE worker) after the next 50 yr inside the Central Plateau industrial/exclusive zone
- Native American uses consistent with treaty rights
- No groundwater consumption for at least the next 150 yr.

In addition, risks were calculated considering the possibility of intruders beginning 150 yr from now (2155) to evaluate impacts from the potential loss of institutional control.

Human Health Risk
Primary risk to human health is direct contact with near-surface (<15 ft) contamination. Eventual groundwater contamination also is evaluated.

Human Health Risk

The primary risk to human health would be through direct contact with the waste, particularly cesium-137 and strontium-90. Because high concentrations of cesium-137 and strontium-90 are at relatively shallow depths in the cribs and trenches, i.e., less than 4.6 m (15 ft), the potential for direct contact exists following the period of institutional controls. This direct contact could result from modest excavation activities such as pipeline installation or construction of a building basement. The high concentrations of cesium-137 observed during characterization of the 216-B-26 Trench exhibited dose rates that could be lethal (~4.5 rad/h) if exposure time were sufficient (a few hundred years).

The deep mobile contaminants (technetium-99 and nitrate) are predicted to eventually reach groundwater at levels exceeding the drinking water standard, potentially rendering the groundwater unfit for human consumption.

Baseline Risks
With no action, the cribs and majority of the trenches present unacceptable human health (direct contact), groundwater, and ecological risks. Inadvertent intrusion also could result in unacceptable risk.

Baseline risk (without remedial action) assessment was performed using the industrial scenario to establish the need for remedial action. The inadvertent intruder scenario was considered to evaluate potential post-remediation risk.

The baseline risk assessment for the 216-B-26 Trench indicated the significant shallow-zone contaminants (primarily cesium-137 and strontium-90) in the 3.7 to 4.6 m (12 to 15 ft) range would require nearly 450 yr to decay to levels corresponding to acceptable risk to industrial workers. The maximum dose to industrial workers is calculated to be 310,000 mrem/yr, which greatly exceeds the 15 mrem/yr criterion. Predicted migration of technetium-99 and nitrate may exceed the groundwater drinking water standards for those contaminants. With respect to potential intruders past the 150-yr period of active institutional controls, humans are not protected until radioactive decay proceeds for nearly 450 yr. The 216-B-46 Crib, which is representative of the BC Cribs and Trenches Area cribs, indicated similar risks.

The baseline risk assessment for the 216-B-58 Trench indicated lesser shallow-zone contaminant concentration and essentially no deep mobile contaminants. Even so, human health risk standards related to direct exposure were exceeded. Groundwater protection standards are not predicted to be exceeded. Risk to inadvertent intruders is essentially acceptable 250 yr from now with no action.

Uncertainties with the exact nature of future industrial and inadvertent intruder exposures may lead to under- or over-estimation of human health risk. Another source of uncertainty is the limited sample data. Because the investigation and sampling focused on the most highly radioactive wastes, the risk assessment is more likely to overestimate the potential human risk.

Ecological Risk

The same shallow contaminants representing a human health risk also are a threat to the environment. Depending on future changes to the topography, these contaminants, which are ~3 to 4.6 m (10 to 15 ft) deep, could be intercepted by burrowing animals and/or deep-rooted plants.

A phased baseline ecological evaluation is underway in the 200 Area that will supplement other characterization data for waste sites in the Central Plateau. This evaluation is based on the ecological data quality objectives summary report for the Central Plateau on the Hanford Site, as documented in WMP-20570, *Central Plateau Terrestrial Ecological Risk Assessment Data Quality Objectives Summary Report*. The evaluation, which will be completed in FY 2007, will supplement current characterization of the health and/or condition of the ecosystem across habitats.

Remedial Action Objectives

The remedial action objectives (RAO) for the waste sites were developed with consideration of reasonably anticipated future land use, conceptual site models, applicable or relevant and appropriate requirements (ARAR), and worker safety. The following RAOs were identified.

- **RAO 1.** Prevent unacceptable risk to human health and ecological receptors from exposure to contaminated soils and/or debris as defined by ARARs or risk-based criteria. Prevent or reduce occupational health risks to workers performing remedial actions.
- **RAO 2.** Prevent migration of contaminants through the soil column to groundwater so that no further degradation of the groundwater occurs because of leaching from soils.
- **RAO 3.** Minimize the general disruption of cultural resources and wildlife habitat and prevent adverse impacts to cultural resources and threatened or endangered species during remediation.

Preliminary Remediation Goals

Preliminary remediation goals (PRG) are numerical expressions of the RAOs. They will be finalized in the ROD. As described in the focused feasibility study (DOE/RL-2004-66), 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 focused feasibility study screening process compared the observed constituent concentrations at the waste sites to the following concentrations:

- Naturally occurring background concentrations
- 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, Table 749-3.

Table 2 summarizes the PRGs for the contaminants of potential concern (COPC) evaluated and the contaminants of concern (COC) retained as part of this Plan. After public comment, the PRGs will be issued in the ROD for these waste sites as remediation goals or cleanup levels.

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

PRG
Preliminary remediation goals. PRGs are numeric expressions of the remedial action objectives. These are initial cleanup levels developed during the CERCLA decision-making process. PRGs may be refined in the ROD to become final cleanup levels (i.e., the remediation goals). A complete discussion of the PRGs is presented in the focused feasibility study (DOE/RL-2004-66).

COC
Contaminants of concern. A list of radioactive and/or chemical constituents that are a risk to human health or the environment. The COC list is developed from the list of contaminants present in the waste stream and typically is the list of chemicals and radionuclides for which the environmental samples are analyzed and that the remedial decisions are designed to protect against.

WAC
Washington Administrative Code.
WAC 173-340-745, "Soil Cleanup Standards for Industrial Properties."
WAC 173-340-747, "Deriving Soil Concentrations for Ground Water Protection."
WAC 173-340-900, "Tables."

TABLE 2. SUMMARY OF SOIL PRELIMINARY REMEDIATION GOALS.

Constituent	Overall PRG[a] (mg/kg or pCi/g)[a]	Maximum level detected (mg/kg or pCi/g)[a]
Contaminants of Concern		
Nitrate (as nitrogen)[b]	40	4,090[d]
Selenium[c]	0.78	13[f]
Uranium[b]	3.21	56.9[d]
Cesium-137[c]	20	524,000[d]
Cobalt-60[c]	4.90	1,700[f, h]
Plutonium-239/240[c]	425	195[d]
Radium-226[c]	7.03	2.69[g]
Strontium-90[e]	20	974,000[d]
Technetium-99[b]	0.9	92[d]

a. Listed values represent the most restrictive soil PRG derived from evaluation of direct contact, groundwater protection, and terrestrial wildlife protection according to DOE/RL-2004-66, *Focused Feasibility Study for the BC Cribs and Trenches Area Waste Sites*. Units of mg/kg apply to chemicals; pCi/g applies to radionuclides as identified by the chemical name followed by the isotope number, e.g., cesium-137.
b. PRG based on groundwater protection.
c. PRG based on human protection from direct contact.
d. Maximum value from 216-B-26 Trench sampling.
e. PRG based on terrestrial wildlife protection.
f. Maximum value from 216-B-58 Trench sampling.
g. Maximum value from 216-B-46 Crib sampling.
h. Cobalt-60 will decay to the PRG in 44 yr.

PRG = preliminary remediation goal.

Human Health Risk
Human health risk is evaluated in the focused 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. This evaluation is in accordance with regulations and provides a conservative estimate of the subsurface zone that may be encountered by industrial users.

Representative sites 216-B-26 Trench and 216-B-58 Trench have radiological contamination in the 0 to 4.6 m (0 to 15-ft) zone that exceeds the 15 mrem/yr target dose.

The 216-B-26 Trench exceeded ecological screening levels for radionuclides.

Numeric soil PRGs were developed independently for the protection of human health, the protection of ecological receptors, and the protection of groundwater. These PRGs were compared to each other to identify the most restrictive value and to select a PRG that is protective of all pathways.

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). The HAB advice was prepared subsequent to a series of public workshops sponsored by the Tri-Parties. 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 a minimum of 150 yr. The following findings resulted from the risk evaluations.

- Radionuclide contaminants (the most prevalent are cesium-137 and strontium-90) associated with two of the sampled waste sites exceed the criteria for the target dose of 15 mrem/yr to an industrial user after 150 yr of institutional control if the waste site cover is removed. Near-surface high concentrations of cesium-137 and strontium-90 were observed in the 216-B-26 Trench.
- Nonradionuclide contaminants in and around the representative waste sites are less than the industrial-use criteria as defined in WAC 173-340-745(5).

- Groundwater protection values (as identified in WAC 173-340-747) are exceeded for radionuclides and nonradionuclides for the sampled sites that received scavenged waste.
- Ecological evaluations indicate that radiological constituents (cesium-137 and strontium-90) exceed the ecological screening values for terrestrial wildlife populations at the sampled waste sites in the BC Cribs and Trenches Area; none of the nonradiological constituents present in the 0 to 4.6 m (0 to 15-ft) zone that is accessible to ecological receptors exceeded the ecological screening values.
- Post-remediation, inadvertent-intruder evaluations indicate that constituents still are significantly above levels representing acceptable risk based on an assumed inadvertent access anticipated ~150 yr from today at all of the representative waste sites. Most of this risk has attenuated after 450 yr through radioactive decay of cesium-137 and strontium-90.

SUMMARY OF REMEDIAL ALTERNATIVES

As discussed 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*, remedial technologies were identified and evaluated on the basis of 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 were used to identify technologies that would be carried forward to develop remedial alternatives to address the RAOs. This process focused on treatment and removal activities because the Regulatory Agencies (Washington State Department of Ecology [Ecology] and EPA) have a statutory preference for these alternatives rather than containment remedies. For the BC Cribs and Trenches Area waste sites, five remedial alternatives were identified for detailed and comparative analyses.

These five alternatives also were evaluated for their applicability to the 200-E-14 Siphon Tank and 200-E-114 Pipeline. The volumes of sludge and/or liquid estimated to remain in this tank are uncertain. However, up to 3.8 m^3 (1,010 gal) of sludge and 41.9 m^3 (11,060 gal) of liquid may exist.

The following alternatives were evaluated in the focused feasibility study.

- **Alternative 1: No Action.** When this alternative is selected, no further action is taken at the site, other than periodic review to ensure continued protection. No legal restrictions, access controls, or active remedial measures are applied to the site. "No action" implies "walking away from the site" and allowing the wastes to remain in their current configuration, affected only by natural processes.
- **Alternative 2: Maintain Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation.** When this alternative is selected, existing soil covers (e.g., 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 (such as badgers) and humans. Selective herbicides may be applied to prevent establishment of deep-rooted plants. In addition, institutional controls (such as deed restrictions, land-use zoning, and excavation permits) are put in place to further prevent human access to the site.

Groundwater Protection Risk Evaluation

Groundwater protection is evaluated for contaminants in the soil from the ground surface to the water table. This evaluation uses mathematical 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 Assessment

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.

The 216-B-46 Crib and the 216-B-26 Trench exceeded groundwater protection standards.

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 150 yr of institutional controls, the intruder unknowingly could 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. All of the sampled wastes sites had intruder dose rates above 15 mrem/yr at 150 yr.

No Action

A No Action alternative is required by CERCLA to be evaluated, even if it obviously is inadequate. This alternative provides a basis for comparing other viable alternatives. This alternative implies "walking away from the site."

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 for direct exposure and groundwater protection. Excavated material is treated (as necessary) and sent to an onsite or offsite engineered facility for disposal. Treatment of wastes from the BC Cribs and Trenches Area waste sites, except to downblend high dose-rate soil, should not be required.

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. Information that is gathered during the remedial action phase is used to make real-time decisions to guide the remedial action. 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
The Environmental Restoration Disposal Facility is the Hanford Site's disposal facility for most waste and contaminated environmental media generated under a CERCLA response action. The ERDF currently receives wastes from ongoing remedial and removal actions in the Hanford Site 100, 200, and 300 Areas.

Capping
A contaminant method where a barrier is placed over residual waste. Barriers typically prevent precipitation from infiltrating into the waste. The barrier also may restrict human and biological intrusion.

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 contaminant concentrations above PRGs are excavated. The 216-B-20 through 216-B-34 and 216-B-52 Trenches would be excavated to a depth of ~46 m (~150 ft); the cribs would be excavated to a depth of ~67 m (~220 ft); and the 216-B-53A, 216-B-53B, 216-B-54, and 216-B-58 Trenches would be excavated to a depth of ~7.6 m (~25 ft). Because near-surface contamination levels at the majority of the waste sites pose a significant dose threat to workers, specialized equipment and activities are required to protect the workers, the environment in the area, and the public that could be exposed near roads or facilities. In addition, some less-contaminated material is needed to blend with the more contaminated material to allow safe excavation, loading, transporting, and disposal of the material and to meet health and safety and waste acceptance criteria at the disposal facility. Excavated material that is above the PRGs will be disposed of at the ERDF in accordance with that facility's established waste acceptance criteria. This disposal facility is near the waste sites and currently is being used for remediation wastes on the Hanford Site. 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 an evapotranspiration barrier) is built over the contaminated waste site, thus "capping" the site to reduce the quantity of water infiltrating into the waste and to deter or prevent intrusion by human or ecological receptors into the waste. Cap intrusion-deterrence features would vary with the severity of the risk to a potential intruder. For those waste sites, where the majority of the risk will diminish within a few hundred years, an evapotranspiration barrier with intruder-deterrent features, is recommended for individual cribs and trenches. Between the waste sites and around the periphery of waste site groupings, a simple evapotranspiration barrier without intrusion-deterrent features is recommended. Details of the barrier design, particularly the intrusion-deterrent feature, would be determined later. Institutional controls (such as deed restrictions, land-use zoning, and excavation permits) are required to further minimize the potential for exposure to contamination and to ensure the integrity of the cap. Extension of the institutional control period beyond the nominal 150-yr period is considered because of the need to maintain the cap. Performance monitoring is included as a part of this alternative to ensure that the cap is performing as expected. 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, near-surface soil associated with high concentrations of cesium-137 is removed, reducing the intruder risk associated with the highly contaminated zone at the bottom of the waste site. This alternative removes contaminants to a lesser depth than Alternative 3 (4.6 to 6.1 m [15 to 20 ft]). Risk to remediation workers is similar to that associated

with Alternative 3. Once the near-surface contamination has been removed and the excavation backfilled, a simple evapotranspiration barrier would be constructed to provide protection to the groundwater from contaminants that remain deeper in the soil column. This barrier would not require intrusion-deterrent features, because the high concentrations of near-surface contaminants would be excavated. This alternative would reduce the risks to potential intruders and provide protection of the groundwater. Performance monitoring is included as a part of this alternative to ensure that the cap performs as expected, and groundwater monitoring is included to watch for movement of more mobile contaminants. As with Alternative 4, extension of institutional controls beyond 150 yr is considered because of the need to maintain the cap.

CERCLA EVALUATION CRITERIA AND PROCESS

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

- *Overall protection of human health and the environment* is the primary objective of the remedial action and addresses whether a remedial action provides adequate overall protection of human health and the environment. This criterion must be met for a remedial alternative to be eligible for consideration.
- *Compliance with ARARs* addresses whether a remedial action will meet all of the applicable or relevant and appropriate requirements and other Federal and State environmental statutes, or provide grounds for invoking a waiver of the requirements. This criterion must be met for a remedial alternative to be eligible for consideration.
- *Long-term effectiveness and permanence* refers to the magnitude of residual risk and the ability of a remedial action to maintain long-term, reliable protection of human health and the environment after remedial goals have been met.
- *Reduction of toxicity, mobility, or volume through treatment* refers to an evaluation of the anticipated performance of the treatment technologies that may be employed in a remedy. Reduction of toxicity, mobility, and/or volume contributes toward overall protectiveness.
- *Short-term effectiveness* refers to evaluation of the speed with which the remedy achieves protection. It also refers to any potential adverse effects on human health and the environment during the construction and implementation phases of a remedial action.
- *Implementability* refers to the technical and administrative feasibility of a remedial action, including the availability of materials and services needed to implement the selected solution.
- *Cost* refers to an evaluation of the capital, operation and maintenance, and monitoring costs for each alternative.
- *State acceptance* indicates whether the State concurs with, opposes, or has no comment on the preferred alternative based on a review of the focused feasibility study and the Proposed Plan.
- *Community acceptance* assesses the public response to the Proposed Plan, following a review of the public comments received during the public comment period and open community meetings. The remedial action is selected only after consideration of this criterion.

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.*

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 do not comply with ARARs (or justify a waiver) do not meet statutory requirements and are eliminated from further consideration in the focused 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**. Ecology concurs with the proposed alternatives outlined in this Plan. The ability of a preferred remedy to meet the criterion of community acceptance, however, can be evaluated only after the public review and comment period for this Plan. State and community acceptance criteria are not discussed separately in the following paragraphs or in the alternatives presented. The preferred alternative could change in response to public comments or new information.

SUMMARY OF ALTERNATIVE EVALUATIONS AND PREFERRED ALTERNATIVES

The remedial alternatives developed in the focused feasibility study are evaluated for each sampled site and similar waste sites.

Sampled Site 216-B-26 Trench and Similar Waste Sites

The 216-B-26 Trench is the representative site for the following waste sites:

- 216-B-20 through 216-B-34 Trenches
- 216-B-52 Trench
- 200-E-114 Pipeline (NOTE: Although not similar to the 216-B-26 Trench in terms of construction and soil contamination history, the pipeline is reviewed with this grouping, because it is a linear feature like the trenches.)

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

The 216-B-26 Trench is located in the BC Cribs and Trenches Area in the 216-B-52/216-B-23 to 216-B-28 grouping of trenches (see Figure 2). Characterization work was performed at the 216-B-26 Trench in 2003 and 2004; the information from this characterization, including risk assessment, is included in the focused feasibility study. The 216-B-26 Trench exceeds human health, ecological, groundwater protection, and intruder PRGs.

The 200-E-114 Pipeline extends from near the north side of the 200 East Area to the 200-E-14 Siphon Tank. Only the portion of the pipeline south of Route 4 South to the siphon tank is addressed in this Plan. Because the shallow excavation associated with Alternative 5 likely would remove all contamination and because there is no evidence that leaks exist in the portion of interest, Alternative 5 is not applicable for the pipeline.

Alternative Evaluations

The following provides an alternative evaluation discussion specific to each CERCLA criterion. A summary of this information is provided in Table 3.

Overall Protection of Human Health and the Environment. The 216-B-26 Trench and its analogous trenches obtain the most overall protection of human health and the environment through the implementation of Alternative 4 (Capping) for the following reasons.

- Construction of a barrier would provide greater than 4.6 m (15 ft) of cover over the relatively short-lived (<30-yr half-life) contamination.
- Precipitation infiltration is reduced by a barrier, which provides substantial groundwater protection.
- Intruder risk is reduced by the intruder-deterrent features of the barrier, and extension of institutional controls.
- Remediation worker risk is minimal.

Alternatives 3 and 5 limit human health and environmental impacts by removing contaminants and disposing of them in the ERDF. Alternative 5 provides for protection of remaining contaminants after excavation of near-surface contamination by use of an engineered barrier. Alternatives 3 and 5 result in significant risk to workers because of the high concentrations of contaminants.

For the pipeline, the most overall protection of human health and the environment is provided by Alternative 3, because the contamination is completely removed and disposed of to the ERDF. Worker risk is low because of the low contamination levels anticipated. Alternative 4 would be protective if the barrier provided sufficient overall thickness [4.6 m (15 ft)] between the surface and the contamination.

Alternatives 1 and 2 are not protective, because constituents remain above the PRGs.

Compliance with ARARs. Alternatives 1 and 2 do not comply with ARARs, because all the waste sites currently exceed the RAOs. Alternative 3 meets ARARs through the removal of the contaminated material to meet PRGs. For the trenches, Alternatives 4 and 5 may not meet groundwater protection ARARs, because deep mobile contaminants would continue to migrate toward groundwater but at a reduced rate. Mathematical modeling of technetium-99 and nitrate transport from their present location toward groundwater predicts that drinking water standards will be exceeded, even with a robust barrier, at the point where the contamination leaches into the groundwater. However, if groundwater quality is evaluated at a point 100 m (328 ft) "downstream" in the groundwater, the drinking water standards are not exceeded.

Long-Term Effectiveness and Permanence. Alternatives 1 and 2 do not provide long-term effectiveness or permanence, because contaminants are not remediated and will remain past the year 2155 when industrial land use is the basis for evaluation.

Alternative 3 is the most reliable and permanent remedy for the trenches and pipeline, because contaminants above the PRGs will be removed, based on the conceptual site model. Alternative 4 provides reliability by reducing exposure using an engineered barrier. The barrier will limit access to humans, plants, and animals allowing the residual risk of contaminants to decrease to acceptable levels through natural radioactive decay (nearly 450 yr). Groundwater monitoring will be required to ensure no further degradation to the groundwater. Alternative 5 provides somewhat greater long-term effectiveness and permanence by removing the near-surface contaminants, but like Alternative 4, relies on an engineered barrier to protect groundwater from the deep mobile contaminants.

Human Health
Alternative 4, Capping, provides the most overall protection of human health and the environment for the 216-B-20 through 216-B-34 Trenches and the 216-B-52 Trench.

Alternative 3, Removal, Treatment, and Disposal, provides the most overall protection of human health and the environment for the 200-E-114 Pipeline.

Compliance with ARARs
Capping, by itself, may not meet groundwater protection requirements, because the residual moisture associated with the waste will continue to "drain" toward groundwater despite future limits on infiltration.

Long-Term Effectiveness and Permanence
Contaminant removal associated with Alternative 3, Removal, Treatment, and Disposal, and Alternative 5, Partial Removal, Treatment, and Disposal with Capping, provides long-term effectiveness and permanence.

TABLE 3. COMPARISON OF ALTERNATIVES FOR 216-B-26 TRENCH AND SIMILAR SITES.

	ALTERNATIVES				
	❶	❷	❸	❹	❺
Sampled Site 216-B-26 Trench and Analogous Sites 216-B-20 through 216-B-34 and 216-B-52 Trenches				✅	
Threshold Criteria					
Overall Protection	☐	☐	☑	☑	☑
Compliance with Laws	☐	☐	☑	☑[a]	☑[a]
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◈	◈
Short-term effectiveness	◇	◇	◇	◆	◇
Reduction in TMV[b]	◇	◇	◈	◈	◈
Implementability	◆	◆	◇	◆	◈
Cost (in thousands)					
Capital costs	$0	$60	$886,593	$14,549	$32,376
Operating and maintenance costs	$0	$21,971	$0	$103,500	$103,923
Present worth	$0	$4,334	$886,593	$36,195	$54,267
"No discount" scenario	$0	$22,031	$886,593	$118,049	$136,299
Analogous Site 200-E-114 Pipeline			✅		
Threshold Criteria					
Overall Protection	☐	☐	☑	☑	NA
Compliance with Laws	☐	☐	☑	☑	NA
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◈	NA
Short-term effectiveness	◇	◇	◆	◈	NA
Reduction in TMV[b]	◇	◇	◈	◈	NA
Implementability	◆	◆	◈	◈	NA
Cost (in thousands)					
Capital costs	$0	$20	$557	$1,422	NA
Operating and maintenance costs	$0	$4,420	$0	$5,453	NA
Present worth	$0	$930	$557	$2,875	NA
"No discount" scenario	$0	$4,440	$557	$6,875	NA

NOTE: Alternatives:

1. No Action.
2. Maintain Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation.
3. Removal, Treatment, and Disposal.
4. Capping.
5. Partial Removal, Treatment, and Disposal with Capping.

Preferred alternatives are shaded.

a. May not be fully compliant with groundwater protection requirements.

b. Toxicity, mobility, or volume through treatment.

NA = not applicable.

TMV = toxicity, mobility, or volume.

✅ Indicates the preferred alternative

☑ Yes, meets criterion

☐ No, does not meet criterion

◆ High: satisfies criterion

◈ Moderate: partially meets criterion

◇ Low: least satisfies criterion

Short-Term Effectiveness. Alternatives 1 and 2 would be more effective for worker protection in the short term, because these alternatives do not involve any remedial actions that remove or contain contaminants. However, because contaminants are located less than 4.6 m (15 ft) deep, short-term risks to human health and the environment would be expected at these sites. These alternatives do not achieve overall protection. Alternative 4 would be more effective in the short term than Alternatives 3 and 5 because of its lower risk to remediation workers. Alternative 3 involves excavating contaminated soil and debris, which would create a potential for short-term worker impacts during excavation of the trenches and transportation of the materials. Risks to workers from potential exposure to contaminated soil and dust would be greater with Alternatives 3 and 5 than with Alternative 4. The short-term impacts to vegetation and wildlife (e.g., borrow areas) are minimal under Alternatives 1 and 2 and minimal to moderate for Alternative 4. The short-term impacts are moderate to high for Alternatives 3 and 5 because of the amount of borrow material needed and the large areas that would be disturbed to reach the required excavation depths.

Pipeline excavation represented by Alternative 3 would not present more than minimal risk to remediation workers because of its shallow depth and low contamination. Alternative 1 is not protective, because residual contamination is left in place. Alternative 2 may be protective, depending on the contaminant levels within the pipeline and leaks that may have occurred. Extensive sampling would be necessary to confirm the extent of contamination. Alternative 4 would provide somewhat less short-term effectiveness than Alternative 3, because residual contamination would remain beneath the engineered barrier.

The times to complete the various remedial alternatives (excluding Alternatives 1 and 2) for the trenches are: Alternative 3 - 17.0 yr, Alternative 4 - 2.4 yr, and Alternative 5 - 2.6 yr. For the pipeline, Alternative 3 would require 1.4 mo and Alternative 4 would require 2.9 mo.

Reduction of Toxicity, Mobility, or Volume Through Treatment. Treatment associated with excavation is included as an element of Alternatives 3 and 5 but is not anticipated except when soil is being added to downblend highly contaminated soil. The majority of the excavated soil is expected to meet the disposal facility waste acceptance criteria. All the alternatives incorporate natural attenuation (i.e., radiological decay), which ultimately reduces 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 (ERDF), thereby reducing the infiltration of water that drives 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 and can be easily continued. The waste sites are in a surveillance and monitoring program, 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.

Worker Risk

Greater worker risk accompanies Alternative 3, Removal, Treatment, and Disposal, and Alternative 5, Partial Removal, Treatment, and Disposal with Capping, because highly contaminated soil is excavated.

Treatment

None of the alternatives explicitly include treatment. However, further investigation of technologies capable of addressing the deep mobile contaminants is warranted

Implementability

For the trenches, Alternative 3, Removal, Treatment, and Disposal, would take decades to complete and require expansion of the ERDF.

Implementability
Alternative 3, Removal, Treatment, and Disposal, is readily implemented for the 216-B-58 Trench and its analogous sites because of the relatively shallow depth of excavation required.

Cost
Alternative 3, which requires complete excavation, would be prohibitively expensive. Alternative 5, which involves limited excavation and subsequent capping, would be less expensive.

RCRA
Resource Conservation and Recovery Act of 1976.

Preferred Alternatives
Alternative 4, Capping, is the preferred alternative for Analogous Sites 216-B-20 through 216-B-34 Trenches and the 216-B-52 Trench.

Alternative 3, Removal, Treatment, and Disposal, is the preferred alternative for the 200-E-114 Pipeline.

Alternative 3 is difficult to implement for the trenches because of the depth (46 m [150 ft]) of excavation required. Alternative 3 would require significant downblending of removed soil that is highly contaminated with less contaminated soil to meet health and safety requirements and waste acceptance criteria. This downblending requires a large volume of material to backfill and generates 5 to 10 times as much waste as a normal excavation. Approximately 3.6 million m^3 (4.7 million yd^3) of waste would be generated through excavation to meet the PRGs. Excavation is not practicable or cost effective at these depths, especially with the anticipated contamination levels. The excavation component of Alternative 5 (i.e., limited to near the bottom of the waste site structure) is less difficult than for Alternative 3 but is still considered hazardous to implement. Alternative 4 is easily implemented. A barrier was implemented at the Hanford Site, and other types of barriers were regulatory approved and implemented at other western arid sites. They are easy to construct and maintain.

For the pipeline, Alternatives 1 and 2 are readily implementable. Alternative 3 also is readily implementable because of the shallow depth of the pipeline. Alternative 4 is less implementable because of the length of the pipeline.

Cost. Capital costs and operating and maintenance costs are provided in Table 3. The listed present worth is based on a discount rate of 3.1 percent. A "no discount" scenario (i.e., one that simply sums the annual costs without consideration of the present value of money) also is provided for comparison. The costs in Table 3 that are associated with Alternative 3 for the 216-B-26 Trench include full excavation of the contaminated material to meet PRGs. The costs in Table 3 that are associated with Alternative 4 are for Modified RCRA Subtitle C Barriers over individual trenches, with the area between the trenches and around the periphery covered by a simple evapotranspiration barrier without intrusion-deterrent features. The Alternative 5 cost includes excavation of contaminated soil to a depth of 4.6 m (15 ft) to remove high concentrations of cesium-137, followed by construction of a simple evapotranspiration barrier to protect remaining contaminants in the deeper vadose zone. The barrier for Alternative 5 does not include intruder-deterrence features. Because the prevalence of near-surface high concentrations of cesium-137 is unknown, half the contaminated soil to a depth of 4.6 m (15 ft) is assumed to require downblending to satisfy waste acceptance criteria. The present worth cost for Alternative 5 is ~1.5 times that for Alternative 4.

The cost of Alternative 3 is many times the cost of any of the other alternatives.

PREFERRED ALTERNATIVES

- The preferred alternative for the 216-B-26 Trench and similar trenches is Alternative 4, Capping. This alternative is protective of the groundwater and the workers, easily implementable, and cost effective. Human health and environmental protection from near-surface contamination is provided by the cap and the associated presence of personnel to periodically maintain it.
- The preferred alternative for the 200-E-114 Pipeline is Alternative 3, Removal, Treatment, and Disposal, because this alternative provides protectiveness for the minor contamination assumed for this waste site.

- An expanded technology review and evaluation process was recommended with the goal to define treatment options for the deep technetium-99 and nitrate contamination. Eventual groundwater contamination from both technetium-99 and nitrate is predicted, even with a perfect cap that could prevent any water from infiltrating into the waste. A review of technologies having the potential to immobilize deep contamination was performed. Because the technetium-99 and nitrate contamination is more than 30.5 m (100 ft) deep, which makes excavation difficult and very expensive, the focus was on in situ technologies. The primary focus was on technetium-99, although nitrate also is predicted to exceed drinking water standards. Several technologies were considered. Some involved mechanical fixation techniques, such as grouting or vitrification, which would prevent or slow future contaminant migration. These technologies were rejected, because they require closely spaced, deep boreholes to treat the waste/contaminant. Changing the chemistry of the technetium-99 to a less mobile form was considered, because it is known that the current chemical form is very soluble in the soil pore water and does not readily sorb in the soil matrix, but other forms are essentially insoluble. These technologies were rejected, because they depend on maintaining non-equilibrium conditions in the soil to prevent the technetium-99 from reverting to its mobile form. The technology with the most promise is soil desiccation, which would remove much of the water associated with the contamination, which is the driving force for contaminant transport toward groundwater.
- The next step in this recommended technology review and evaluation process is to evaluate the report from a panel of experts that met April 26-28, 2005. Their task was to assess the review performed during the focused feasibility study process and evaluate the selection of soil desiccation as the preferred technology. The panel report is anticipated at the end of June 2005. Recommendations of the panel will guide future activities, including whether a treatability test is warranted, and, if so, the objectives and initial test design. Successful treatability test results would lead to incorporation of the technology into the remedy.

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

Sampled Site 216-B-46 Crib and Similar Sites

The 216-B-46 Crib is the representative site for the following waste sites:

- 216-B-14 through 216-B-19 Cribs (216-B-14 Series Cribs)
- 200-E-14 Siphon Tank. (NOTE: Although not similar to the 216-B-46 Crib, the siphon tank is reviewed with this grouping.)

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

Treatability Evaluation
Evaluation of treatability options focusing on immobilizing deep mobile contamination is recommended to determine potential for supplementing cap performance and to provide additional groundwater protection.

216-B-46 Contaminants
Representative site 216-B-46 Crib. COCs include antimony, cadmium, cyanide, nitrate, uranium, cobalt-60, technetium-99, and radium-226. Contamination extends from 5.5 to ~67 m (18 to ~220 ft) deep.

BC Crib Contaminants
The 216-B-14 through 216-B19-Cribs, while analogous to the 216-B-46 Crib, are shallower. High concentrations of cesium-137 and strontium-90 are expected less than 4.6 m (15 ft) deep.

200-E-14 Siphon Tank
The contents of the 200-E-14 Siphon Tank are unknown, but it is expected to contain at least a small quantity of sludge.

Although the 216-B-46 Crib is not located in the BC Cribs and Trenches Area, it is representative of the cribs in this area. Most important is that it received the same type and quantity of waste as each of the BC Cribs and it is the same type of liquid disposal facility (i.e., a crib). In addition, the general soil conditions in the vicinity of the 216-B-46 Crib are similar to the BC Cribs and Trenches Area soil conditions.

Based on current conditions, the 216-B-46 Crib exceeds the groundwater protection PRGs for nitrate, uranium, cobalt-60, technetium-99, and radium-226. The initial/first level of the contamination is ~5.5 m (~18 ft) below ground surface; therefore, the 0 to 4.6 m (0 to 15-ft) zone is not a human health or ecological risk. The contaminants at the base of the crib (at 5.5 m [18 ft] below ground surface) do exceed PRGs associated with a potential intruder in the year 2155.

The 216-B-46 Crib is near the BY Tank Farm and was investigated as part of the 200-BP-1 Operable Unit. The results of that investigation are reported in DOE/RL-92-70, *Phase I Remedial Investigation Report for 200-BP-1 Operable Unit*, and are summarized in the focused feasibility study for the BC Cribs and Trenches Area waste sites (DOE/RL-2004-66). A risk assessment was conducted for this site and reported in the focused feasibility study. Although similar to the 216-B-46 Crib, some contaminants associated with the 216-B-14 Series Cribs are shallower than 4.6 m (15 ft). Therefore, the human health and ecological risk PRGs are exceeded at these cribs. All these cribs have contamination in the vadose zone that exceeds groundwater protection PRGs. In addition, all these cribs have concentrations such that in 2155 a potential intruder would receive a higher dose than the EPA 15 mrem/yr standard.

Specific characterization of the 216-B-14 Series Cribs, in the form of high-resolution resistivity (described earlier), has revealed the presence of anomalous high soil conductivity in a continuous "plume" beneath the cribs. Soil sampling at the nearby 216-B-26 Trench associates the deep soil conductivity with nitrate and technetium-99 contamination and associated moisture. Examination of soil removed during drilling of the borehole at the 216-B-26 Trench indicates that this zone of high soil conductivity correlates well with a few distinct layers of fine-grained soil that retain moisture and promote lateral contamination spread.

The contaminant distributions for the 216-B-14 Series Cribs are expected to be very similar to those of the 216-B-46 Crib. All of these sites pose a threat to groundwater, and all present a significant risk to an intruder who inadvertently would be exposed to the contaminated soils less than 4.6 m (15 ft) deep. All of these sites pose human health and ecological risks from direct exposure, because significant contamination is above 4.6 m (15 ft) below ground surface.

The contaminants for the 200-E-14 Siphon Tank are expected to be the same as those for the 216-B-46 Crib; however, the contaminant distribution is expected to be much shallower for the 200-E-14 Siphon Tank when compared to the 216-B-46 Crib. The tank was designed to hold effluents, not to discharge them to the ground. Existing information does not indicate any leaks associated with the tank.

ALTERNATIVE EVALUATIONS

The following provides an alternative evaluation discussion specific to each CERCLA criterion. A summary of this information is provided in Table 4.

Overall Protection of Human Health and the Environment. The 216-B-14 Series Cribs obtain the most overall protection of human health and the environment through the implementation of Alternative 4 for the following reasons.

- Construction of the barrier would provide greater than 4.6 m (15 ft) of cover over the contamination.
- A barrier reduces water infiltration, which provides substantial groundwater protection.
- Intruder risk is reduced by the intruder-deterrent features of the barrier and use of institutional controls.
- Remediation worker risk is minimal.

Alternative 5 is a close second. It removes the near-surface contamination but increases risk to the worker.

Alternatives 3 and 5 limit human health, environmental, and groundwater impacts by removing contaminants and disposing of them in the ERDF. However, Alternatives 3 and 5 increase worker risk associated with exposure to contaminants. Alternative 3 has additional worker risk and implementability issues because of the deep excavation required (up to 67 m [220 ft] deep). Also, large volumes of waste require disposal. Meeting PRGs under Alternative 3 would require removal of soil to a depth of 67 m (220 ft). This type of excavation is difficult and requires workers be exposed to high contaminant concentrations, as well as to risks associated with deep excavation. It is expensive, and creates considerable waste requiring disposal. Alternative 5 would require removal of the most highly contaminated soil beneath the waste sites, to a depth of ~6.2 m (20 ft).

For the 200-E-14 Siphon Tank, the greatest overall protection of human health and the environment is achieved through implementation of Alternative 3. The tank and its contents are completely removed and disposed of to the ERDF. Alternative 4 is not considered protective of human health and the environment. The top of the tank is only 2.1 m (7 ft) deep, making it and the sludge remaining within it accessible and an unacceptable hazard to potential intruders. Alternative 5 would be protective because the tank contents would be removed.

Alternative 1 is not protective of any of the waste sites, because constituents remain above the PRGs. All alternatives must provide protection to current workers based on existing engineering and administrative controls.

Human Health Assessment

Alternative 4, Capping, provides the most overall protection of human health and the environment for the 216-B-14 Series Cribs.

Alternative 3, Removal, Treatment, and Disposal, provides the most overall protection of human health and the environment for the 200-E-14 Siphon Tank.

TABLE 4. COMPARISON OF ALTERNATIVES FOR 216-B-14 SERIES CRIBS AND SIMILAR SITES.

	ALTERNATIVES				
	❶	❷	❸	❹	❺
Analogous Sites 216-B-14 through 216-B-19 Cribs				☑	
Threshold Criteria					
Overall Protection	☐	☐	☑	☑	☑
Compliance with Laws	☐	☐	☑	☑[a]	☑[a]
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◈	◈
Short-term effectiveness	◇	◇	◇	◆	◇
Reduction in TMV[b]	◇	◇	◈	◈	◈
Implementability	◆	◆	◇	◆	◈
Cost (in thousands)					
Capital costs	$0	$20	$159,074	$2,408	$10,856
Operating and maintenance costs	$0	$7,424	$0	$18,119	$18,202
Present worth	$0	$1,470	$159,074	$6,136	$14,600
"No discount" scenario	$0	$7,444	$159,074	$20,527	$29,058
200-E-14 Siphon Tank			☑		
Threshold Criteria					
Overall Protection	☐	☐	☑	☐	☑
Compliance with Laws	☐	☐	☑	☐	☑
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◇	◈
Short-term effectiveness	◇	◇	◆	◇	◆
Reduction in TMV[b]	◇	◇	◈	◈	◈
Implementability	◆	◆	◈	◆	◈
Cost (in thousands)					
Capital costs	$0	$20	$6,076	$561	$5,124
Operating and maintenance costs	$0	$4,420	$0	$2,522	$2,522
Present worth	$0	$950	$6,076	$1,087	$5,650
"No discount" scenario	$0	$4,440	$6,076	$3,083	$7,645

NOTE: Alternatives:

1. No Action.
2. Maintain Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation.
3. Removal, Treatment, and Disposal.
4. Capping.
5. Partial Removal, Treatment, and Disposal with Capping.
6. Treatability Test with Capping.

Preferred alternatives are shaded.

a. May not be fully compliant with groundwater protection requirements.

b. Toxicity, mobility, or volume through treatment.

NA = not applicable.

TMV = toxicity, mobility, or volume.

☑ (large) Indicates the preferred alternative

☑ Yes, meets criterion

☐ No, does not meet criterion

◆ High: satisfies criterion

◈ Moderate: partially meets criterion

◇ Low: minimally satisfies criterion

Compliance with ARARs. Alternatives 1 and 2 do not comply with ARARs, because the waste sites currently exceed the RAOs. Alternative 3 meets the ARARs through the removal of all contaminated material above PRGs. For the cribs, Alternatives 4 and 5 may not meet groundwater protection ARARs, because the cap would allow deep mobile contaminants to migrate toward groundwater only at a slower rate. Mathematical modeling of technetium-99 and nitrate movement from their present location toward groundwater predicts that drinking water standards may be exceeded, even with a robust barrier, depending on the methodology of evaluating potential groundwater impact.

Long-Term Effectiveness and Permanence. Alternatives 1 and 2 do not provide long-term effectiveness or permanence, because contaminants are not remediated and will remain past the year 2155 when the loss of institutional controls is assumed. Alternative 3 provides the most long-term effectiveness and permanence, because contaminants above PRGs are removed from the site and sent to a disposal facility. For the cribs, Alternatives 4 and 5 provide long-term effectiveness and reliability by reducing exposure using an engineered barrier until the residual risk of contaminants decreases to acceptable levels through natural radioactive decay. Alternatives 4 and 5 reduce water infiltration, which reduces mobility of the contaminants to the groundwater. Monitoring and maintenance of the cap increase the effectiveness of Alternatives 4 and 5. The proposed engineered barrier is designed to provide long-term isolation of the waste sites, allowing the residual risks associated with near-surface contamination to decrease by natural radioactive decay. Groundwater monitoring will be required to ensure no further degradation of the groundwater (e.g., technetium-99 and uranium contamination).

Long-Term Effectiveness and Permanence
Alternative 3, Removal, Treatment, and Disposal, provides the most long-term effectiveness and permanence, because contaminants are removed and disposed of at a suitable facility.

For the siphon tank, Alternative 4 is not effective. Access to the tank interior and its contents (sludge) would be possible, because the combination of current clean soil cover over the tank and barrier thickness would be less than 4.6 m (15 ft). Alternative 5 would provide long-term effectiveness and permanence by removing the tank and its contents.

Short-Term Effectiveness. For the cribs and siphon tank, Alternative 1 would be effective for workers in the short term, because this alternative does not involve any remedial actions. Similarly, Alternative 2 does not remove or contain contaminants. However, because contamination is found in the 0 to 4.6 m (0 to 15-ft) range, human and ecological receptors are not protected. Historical evidence indicates that the ecological receptors played a role in spreading contaminants from waste sites in the BC Cribs and Trenches Area. For the cribs, Alternative 4 would be more effective in the short term than Alternatives 3 and 5 because of its lower risk to remediation workers. Alternatives 3 and 5 involve excavating contaminated soil and debris. This activity would result in potential significant short-term worker impacts during excavation, loading, transportation, and disposal of the materials because of the high concentrations expected from most of these waste sites. Risks to workers from potential exposure to contaminated soil and dust would be similar for Alternatives 3 and 5 in that both subject the workers to the highly contaminated areas at the bottom of the waste sites. Alternative 3 presents the greatest short-term risk to workers. Both the contamination and the excavation activities would be at a depth of 67 m (220 ft) for the cribs. The excavation depth for the siphon tank should not extend beyond the bottom of the tank (~5.2 m [17 ft]).

Short-Term Effectiveness
Alternative 3, Removal, Treatment, and Disposal, and Alternative 5, Partial Removal, Treatment, and Disposal with Capping, have less short-term effectiveness because excavation of high concentrations of contaminants would present high potential worker risk.

For the siphon tank, Alternative 4 would not provide short-term effectiveness, because RAOs would not be met. Alternatives 3 and 5 provide short-term effectiveness by removing the contaminants with minor worker risk.

Short-term impacts to vegetation and wildlife are considered minimal for Alternative 2, because the waste sites would not be disturbed and the existing soil cover provides protection. Short-term impacts to vegetation and wildlife would be minimal to moderate for Alternative 4, because the waste site and the borrow sites, used to obtain capping materials, would be disturbed. The short-term impacts to vegetation and wildlife could be potentially high for Alternatives 3 and 5 because of the large volumes of borrow material needed to backfill the excavations. Also, the lengthy timeframes needed to implement these alternatives would be disruptive to the environment. The short-term impacts to vegetation and wildlife could be minimal to moderate for Alternative 1, depending on the depth of the initial/first level of contamination.

The times to complete the remedial alternatives (excluding Alternatives 1 and 2) for the cribs are: Alternative 3 – 3.7 yr, Alternative 4 – 5.0 mo, and Alternative 5 – 10.1 mo. For the siphon tank, Alternative 4 would require ~1.5 mo, and Alternatives 3 and 5 each would require ~1.5 mo plus the time to remove the sludge.

Reduction of Toxicity, Mobility, or Volume through Treatment. Treatment is included as an element of Alternatives 3 and 5, but is not anticipated except when soil is being added to downblend highly contaminated soil. The majority of the excavated soil is expected to meet the disposal facility waste acceptance criteria. All the alternatives incorporate natural attenuation (i.e., radiological decay), which ultimately reduces toxicity and volume. Alternatives 3 and 5 provide an additional reduction, because these alternatives place the contaminants in a more managed environment, thereby reducing water infiltration that drives contaminants toward groundwater.

Treatment of the siphon tank sludge may be necessary to meet waste acceptance criteria for the engineered waste disposal facility.

Implementability. Alternative 1 would be easily implemented, because no action is performed. Alternative 2 currently is in use for all of the waste sites and can be easily continued. The waste sites are in a surveillance and monitoring program and posted with signs. 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 can be easily implemented. Alternative 4 is considered easy to implement. Capping is a well-known and commonly used remedy for waste sites around the world. A barrier was implemented at the Hanford Site, and other types of barriers were approved and implemented at other western arid sites. These barriers are easy to construct and maintain. For the cribs, Alternative 3 is considered difficult to implement because of the high degree of contamination and the depths of excavation that would be required. The high contamination levels in the soil found at the bottom of some waste sites would result in dose levels as high as 21 person-rem[1] to workers and require special techniques and protections to reduce these levels to an acceptable range. For the cribs, Alternative 3 would require

[1]Based on removal and disposal of contamination at the 216-B-26 Trench and extrapolated to the 216-B-14 Series Cribs.

significant downblending of the highly contaminated removed soil with soil that is less contaminated to meet health and safety requirements and waste acceptance criteria. This downblending would require a large volume of backfill material and for the highly contaminated region generates 5 to 10 times as much waste. Approximately 530,000 m^3 (700,000 yd^3) of waste would be generated by excavating to meet the PRGs. Excavation is not considered practicable or cost effective at these depths, especially given the high contamination levels. The excavation component of Alternative 5 is similar to Alternative 3. However, this alternative only removes the near-surface contamination located at the bottom of the waste site structure (to ~6.1 m [20 ft]), making it more implementable.

For the siphon tank, Alternative 3 is implementable. The bottom of the tank is 5.2 m (17 ft) deep. Because tank sludge removal has been demonstrated successfully elsewhere, its removal does not represent any particular uncertainty.

Cost. Capital costs and operating and maintenance costs are provided in Table 4. The listed present worth is based on a discount rate of 3.1 percent. A "no discount" scenario (i.e., one that simply sums the annual costs without consideration of the present value of money) also is provided for comparison. The costs in Table 4 associated with Alternative 3 for the cribs include full excavation of the contaminated material. For the siphon tank, cost includes sludge removal. The costs associated with Alternative 4 are for Modified RCRA Subtitle C Barriers over individual cribs with the area between the cribs and around the periphery covered by a simple evapotranspiration barrier without intrusion-deterrent features. The costs associated with Alternative 5 include excavation of contaminated soils to a depth of 6.1 m (20 ft), followed by construction of a simple evapotranspiration barrier that does not include intruder-deterrence features. The cost of Alternative 5 for the siphon tank includes sludge removal, followed by filling the tank with grout and then constructing a simple evapotranspiration barrier. The present worth cost for Alternative 5 is more than twice that for Alternative 4.

The cost of Alternative 3 is more than an order of magnitude greater than Alternative 5 and more than 25 times the cost of Alternative 4.

PREFERRED ALTERNATIVES

- The preferred alternative for the 216-B-14 Series Cribs is Alternative 4. This alternative is the most protective of workers, human health, the environment and groundwater. Until the radioactive decay of cesium-137 and strontium-90 occurs, the barrier and the presence of people to maintain it provide human health and environmental protection from near-surface contamination.

Preferred Alternatives

The preferred alternative for the 216-B-14 Series Cribs is Alternative 4, Capping.

The preferred alternative for the 200-E-14 Siphon Tank is Alternative 3, Removal, Treatment, and Disposal.

Human Health Protection
Alternative 3, Removal, Treatment, and Disposal, provides the most overall protection of human health and the environment for the 216-B-58 Trench and its analogous sites

216-B-58 and 216-B-53A Contaminants
The 216-B-58 Trench and its analogous sites received small quantities of 300 Area laboratory waste.

The 216-B-53A Trench received waste from a test reactor process tube failure.

- The preferred alternative for the 200-E-14 Siphon Tank is Alternative 3. Sludge removal is the most protective for workers, human health, the environment, and groundwater. Also, because the tank is located within the footprint of the anticipated cap for the cribs, the excavated site would be capped after the sludge and tank are removed.
- As described for the 216-B-26 Trench and similar sites, evaluation of additional treatment is recommended. A panel of experts met April 26-28, 2005, to assess the review performed during the focused feasibility study process and its selection of soil desiccation as a technology worthy of further investigation. Panel recommendations will guide future activities, including whether a treatability test is warranted, and, if so, test objectives and initial test design. Successful treatability test results would/could lead to incorporation of the technology into the remedy.

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-B-58 Trench and Similar Waste Sites

The 216-B-58 Trench is the representative site for the following waste sites, all of which are located in the BC Cribs and Trenches Area:

- 216-B-53A Trench
- 216-B-53B Trench
- 216-B-54 Trench.

The conceptual site model for these sites is presented in Table 1, with additional information specific to each waste site provided in Appendix B, Table B-1. Based on current conditions, the 216-B-58 Trench exceeds the human health PRGs for cesium-137 in the near-surface soils and the ecological PRGs for cesium-137 and strontium-90. The waste site will reach acceptable levels for cesium-137 in 287 years. Characterization work was performed at the 216-B-58 Trench in 2003; the information from that characterization, including risk assessment for human health, ecological, and groundwater protection, is included in the focused feasibility study (DOE/RL-2004-66).

ALTERNATIVE EVALUATIONS

The following provides an alternative evaluation discussion specific to each CERCLA criterion. A summary of this information is provided in Table 5. Because of the relatively shallow depth of contaminants found by the 216-B-58 Trench characterization and expected to exist in the analogous sites, Alternative 5 is not applicable.

TABLE 5. COMPARISON OF ALTERNATIVES FOR 216-B-58 TRENCH AND SIMILAR SITES.

	ALTERNATIVES				
	1	2	3	4	5
216-B-58 Trench and Similar Sites 216-B-53A Trench, 216-B-53B Trench, and 216-B-54 Trench			☑		
Threshold Criteria					
Overall Protection	□	□	☑	☑	NA
Compliance with Laws	□	□	☑	☑	NA
Balancing Criteria					
Long-term effectiveness	◇	◇	◆	◈	NA
Short-term effectiveness	◇	◇	◈	◆	NA
Reduction in TMV*	◇	◇	◈	◈	NA
Implementability	◆	◆	◈	◈	NA
Cost (in thousands)					
Capital costs	$0	$40	$3,115	$2,080	NA
Operating and maintenance costs	$0	$13,682	$0	$15,830	NA
Present worth	$0	$2,675	$3,115	$5,204	NA
"No discount" scenario	$0	$13,722	$3,115	$17,910	NA

NOTE: Alternatives:

1. No Action.
2. Maintain Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation.
3. Removal, Treatment, and Disposal.
4. Capping.
5. Partial Removal, Treatment, and Disposal with Capping.

Preferred alternatives are shaded.

*Toxicity, mobility, or volume through treatment

NA = not applicable.
TMV = toxicity, mobility, or volume.

☑ Indicates the preferred alternative
☑ Yes, meets criterion
□ No, does not meet criterion
◆ High: satisfies criterion
◈ Moderate: partially meets criterion
◇ Low: minimally satisfies criterion

Human Health Protection
Alternative 3, Removal, Treatment, and Disposal, provides the most overall protection of human health and the environment for the 216-B-58 Trench and its analogous sites

Overall Protection of Human Health and the Environment. The 216-B-58 Trench obtains the most overall protection of human health and the environment through the implementation of Alternative 3. Contaminants above PRGs are removed, protecting humans, ecology, and the groundwater. Worker risks are low because of lower contamination levels. The approximate worker dose associated with the excavation alternative is 0.4 person-rem.

Alternative 4 is protective because the cap (barrier) eliminates exposure, reduces water infiltration into the waste, and protects against intruders.

Alternative 5 is not applicable at the 216-B-58 Crib or its analogous sites, because the contamination is relatively shallow and complete excavation can be done without undue risk.

Alternatives 1 and 2 are not protective of any of the waste sites. Constituents remain above the PRGs, even past 150 yr.

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

Long-Term Effectiveness and Permanence
Alternative 3, Removal, Treatment, and Disposal, provides the most long-term effectiveness and permanence by removal of the contaminants.

Long-Term Effectiveness and Permanence. Alternatives 1 and 2 do not provide long-term effectiveness or permanence, because contaminants are not remediated and will remain through 2155 when institutional controls are assumed to no longer exist. Alternative 3 provides the most long-term effectiveness and permanence, because contaminants above PRGs are removed from the site and disposed of at the ERDF. Alternative 4 provides long-term effectiveness and reliability by reducing exposure using an engineered barrier. Alternative 4 reduces water infiltration, which in turn reduces mobility of the contaminants to the groundwater. Monitoring and maintenance of the cap increase the effectiveness of Alternative 4. The proposed engineered barrier is designed to provide long-term isolation of the waste sites, during which time the residual risks will decrease by natural radioactive decay. Groundwater monitoring will be required to ensure that no further degradation occurs.

Worker Risk
Worker risk associated with Alternative 3, Removal, Treatment, and Disposal, is minimal for the 216-B-58 Trench and its analogous sites.

Short-Term Effectiveness. Alternative 1 would be effective for workers in the short term, because this alternative does not involve any remedial actions. However, for sites where contamination is found in the 0 to 4.6 m (0 to 15-ft) depth range, human and ecological receptors may not be protected. Historical evidence shows that the ecological receptors have played a role in spreading contaminants from waste sites in the BC Cribs and Trenches Area. Alternatives 2 and 4 would be more effective in the short term than Alternative 3 because of their lower risk to remediation workers. Alternative 3 involves excavating contaminated soil and debris, resulting in short-term worker impacts during excavation, loading, transportation, and disposal of the materials. These risks are expected to be low, because the contaminant concentrations associated with these waste sites are anticipated to be low. Radiological dose to workers from excavation of contaminated soil at the 216-B-58 Trench and analogous sites is estimated at 0.41 person-rem. The 216-B-53A Trench, which contains plutonium, can be excavated safely, because that contaminant is expected to be confined to a thin layer of soil and controls will be in place to protect workers.

Short-term impacts to vegetation and wildlife are considered minimal for Alternative 2, because the waste sites would not be disturbed and the existing soil cover provides protection. Short-term impacts to vegetation and wildlife would be minimal to moderate for Alternative 4, because the waste site and the borrow sites, used to obtain the capping materials, would be disturbed. The short-term impacts to vegetation and wildlife are considered moderate for Alternative 3 because of the amount of borrow material needed to backfill the excavations and the timeframes required to implement these alternatives. The short-term impacts to vegetation and wildlife could be minimal to moderate for Alternative 1, depending on the depth to the initial/first level of the contamination.

The times to implement the various alternatives, excluding Alternatives 1 and 2, are: Alternative 3 - 6.7 mo and Alternative 4 - 4.7 mo.

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. Reduction in toxicity, mobility, or volume of the contaminants will not be realized except by natural attenuation. All the alternatives incorporate natural attenuation in the form of radiological decay, which ultimately results in reduced toxicity and volume. Alternative 3 provides an additional reduction, because it places the contaminants in a more managed environment, thereby reducing water infiltration that drives the contaminants toward groundwater.

Implementability. Alternative 1 would be easy to implement, because no action is performed. Alternative 2 currently is used for all of the waste sites. The waste sites are in a surveillance and monitoring program, posted with signs and/or fenced. Also, access to the waste sites is controlled through Hanford Site access requirements, an excavation permit program, and a radiation work permit program. The addition of monitoring wells or boreholes can be easily implemented. Alternative 4 is considered readily implementable. Capping is a well-known and commonly used remedy for waste sites around the world. A barrier was implemented at the Hanford Site, and other types of barriers were approved and implemented at other western arid sites. These barriers are easy to construct and maintain. Alternative 3 is readily implementable because of the relatively shallow depths (i.e., 7.6 m [25 ft] at the 216-B-58 Trench) of excavation that would be required. The contamination levels in the soil found at the bottom of the waste site would result in dose levels of up to 0.4 person-rem to workers. Alternative 3 may require modest downblending of removed soil with less-contaminated soil in isolated sections to meet health and safety requirements and waste acceptance criteria.

Implementability

Alternative 3, Removal, Treatment, and Disposal, is readily implemented for the 216-B-58 Trench and its analogous sites because of the relatively shallow depth of excavation required.

Cost. Capital costs and operating and maintenance costs are provided in Table 5. The listed present worth is based on a discount rate of 3.1 percent. A "no discount" scenario (i.e., one that simply sums the annual costs without consideration of the present value of money) is provided for comparison. The costs in Table 5 that are associated with Alternative 3 include full excavation of the contaminated material to meet PRGs. Alternative 3 clearly is the most cost-effective of the alternatives that will meet human health requirements and comply with regulatory requirements.

Preferred Alternative
The preferred alternative for the 216-B-58, 216-B-53A, 216-B-53B, and 216-B-54 Trenches is Alternative 3, Removal, Treatment, and Disposal.

Alternative 3 is readily implemented for the 216-B-58 Trench and its analogous sites because of the relatively shallow depth of excavation required.

NEPA Values
The NEPA process is intended to assist Federal agencies make decisions that are based on understanding environmental consequences, and take actions that protect, restore, and enhance the environment

PREFERRED ALTERNATIVES

- The preferred alternative for the 216-B-58, 216-B-53A, 216-B-53B, and 216-B-54 Trenches is Alternative 3. This alternative is most protective of workers, human health, the environment, and groundwater.

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.

NEPA VALUES

The *Secretarial Policy on the National Environmental Policy Act* (DOE 1994) and DOE O 451.1A, *National Environmental Policy Act Compliance Program*, encourage that CERCLA documents incorporate NEPA values (e.g., 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 with the following activities:

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

The NEPA-related resources and values that have been considered for these waste sites support the CERCLA decision-making process. CERCLA's evaluation criteria involve detailed consideration of environmental resources with an emphasis on meeting the substantive standards of other environmental laws and requirements. NEPA is a procedural statute reflecting many of the same values that are incorporated into the CERCLA process and are discussed in the following text. The No Action and Monitored Natural Attenuation alternatives do not impact NEPA values and are not included in the discussion.

Offsite Impacts. None of the proposed remedial alternatives would be expected to create any long-term transportation impacts. The short-term impact resulting from importing borrow material from the other side of state Highway 240 has the potential to adversely impact local transportation, but engineered features are expected to be incorporated in the intersection design, such as on/off lanes. If adverse impacts to transportation were to be detected, remedial activities would be modified or halted until the impact is mitigated.

Potential air quality impacts are associated with all of the alternatives. These impacts have not been quantified but in the near-term would be expected to be minor. For Alternatives 3, 4, and 5, impacts would be mitigated through appropriate engineering controls to be identified during final design and in the remedial action work plan.

All of the alternatives would increase noise levels, but the impacts would be relatively short-term, except for Alternative 3, which would require many years to implement. However, Alternative 3 activities would be entirely onsite and distant from the public. Alternatives 4 and 5 would use the borrow site near State Highway 240 and contribute to noise experienced by the public during the barrier construction period. The barriers would be low profile, with a maximum height of less than 2.1 m (7 ft), and cover more than 20 hectares (50 acres). The barriers would be vegetated to enhance evapotranspiration. Thus, visual and aesthetic effects are considered to be minimal.

Ecological Impacts. Alternatives 4 and 5, requiring borrow material from largely undisturbed habitat, would result in loss of habitat from that area.

Alternative 3 also would require borrow material to backfill the excavation, but the source of this material is expected to be from an onsite area that already has undergone substantial disturbance.

Alternative 3 would require the most borrow material (to fill the hole following excavation of the contamination) and, therefore, would have the greatest potential impact on borrow sites. Alternatives 4 and 5, which require engineered barriers, would have similar but lesser impact. Alternative 3 also presents the greatest potential for adverse impact at the ERDF, which is located in an area of high-quality shrub-steppe habitat, because of the need to expand that facility.

Socioeconomic Impacts. The BC Cribs and Trenches Area waste sites are not a factor in the socioeconomics of the region. The number of workers involved in remedial actions associated with any of the remedial alternatives would be small; therefore, impacts would be negligible.

Offsite impacts to any of the local communities would be minimal for all of the alternatives, so environmental justice issues (i.e., high and disproportionate adverse health and socioeconomic impacts on minority or low-income populations) would not be a concern.

Cumulative Effects. The proposed remedial action alternatives could have impacts when considered together with impacts from past and foreseeable future actions at and near the Hanford Site. Authorized current and future activities in the Central Plateau that might be ongoing during remedial action include soil and groundwater remediation; operation and closure of underground waste tanks; construction and operation of tank waste vitrification facilities; storage of spent nuclear fuel; and surveillance, maintenance, and decontamination and decommissioning of reprocessing facilities and excess ancillary facilities. Other activities on the Hanford Site include operation of the Energy Northwest commercial reactor. Activities near the Hanford Site include a privately owned radioactive and mixed waste treatment facility, a commercial fuel manufacturer, and a titanium reprocessing plant.

Some potential exists for impacts to natural resources at onsite borrow sites, although impacts can be minimized by appropriate planning. A DOE NEPA environmental assessment (DOE/EIS-0286F, *Final Hanford Site Solid (Radioactive and Hazardous) Waste Program Environmental Impact Statement, Richland, Washington*) that evaluated impacts to borrow sites from Hanford Site projects, including remediation, did not identify significant impacts associated with continued use of onsite borrow pits.

Alternative 3 would provide the potential to shrink the footprint of the Core Zone by removing all risk-based contaminants. Alternatives 4 and 5 would maintain the Core Zone boundary around the waste sites. However, these waste sites would be a small fraction of the Central Plateau waste sites within the Core Zone.

COMMUNITY PARTICIPATION

Public Involvement

This Proposed Plan is being issued by the Tri-Parties for public comment. Tribal nations, stakeholders, and the general public are encouraged to comment on this document during the public comment period that runs from XX to XX. Preferred alternatives will be selected only after the public comment period has ended and comments received are reviewed and considered. Responses to comments will be presented in a Responsiveness Summary that will be part of the Record of Decision.

Public Meetings

At this time, no public meeting is scheduled. To request a meeting, please contact Dennis Faulk at (509) 376-8631 by XXX.

Submitting Comments

The Tri-Parties will accept written comments on this Plan at any time during the 30-day public comment period that runs from XX to XX. Please send written comments to Dennis Faulk at the EPA via:

- Mail: U.S. Environmental Protection Agency, 712 Swift Boulevard, Suite 5, Richland, Washington 99352
- Fax: (509) 376-2396
- Email: faulk.dennis@epa.gov

For more information, please consult the Administrative Record in the location specified below.

Administrative Record

The Administrative Record can be reviewed at the following location:
Lockheed Martin Information Technology
Administrative Record
2440 Stevens Center Place, Room 1101
Richland, Washington 99352
ATTN: Debbi Isom
(509) 376-2530

This information can be accessed electronically at
http://www2.hanford.gov/arpir

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Public Comment Period:
June XX - July XX, 2005

Public Meetings:
As requested

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