RL-F-1325.6 (02/98)

0053881

United States Government **Department of Energy**

memorandum

Richland Operations Office

DATE: OCT 11 2000

REPLY TO ATTN OF: 00-ERD-172

SUBJECT: 100 AREA BURIAL GROUND RECORD OF DECISION (ROD)

TO: Keith A. Klein
Manager

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Background

The attached ROD is for the 100 Area Burial Grounds. The preferred remedy for these waste sites is Remove/Treat/Dispose, and is consistent with the previous decisions made in the 100 Areas.

Request for Signature

The ROD is an U.S. Environmental Protection Agency (EPA) document and has been sent for the U.S. Department of Energy (DOE) signature. Per new guidance, this document is being sent to DOE Headquarters for concurrence.

The EPA Region 10 and State of Washington Department of Ecology are in the process of signing the signature pages for the attached ROD. Your signature of the attached DOE signature page is required so that remediation of these waste sites can begin. The EPA is currently planning to have this document approved by September 27, 2000.

If you have any questions, please feel free to contact me on (509) 376-6628 or Glenn Goldberg on (509) 376-9552.

Helen E. Bilson

Helen E. Bilson, Assistant Manager
for Environmental Restoration and Waste Management

Attachment

cc w/attach:
Admin Record, H6-08 (100 Area General)

0053745

DECLARATION OF THE RECORD OF DECISION

SITE NAME AND LOCATION

USDOE Hanford 100 Area
100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-2, 100-HR-2, 100-KR-2 Operable Units,
Hanford Site (100 Area Burial Grounds)
Benton County, Washington

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected interim remedial actions for portions of the U.S. Department of Energy (DOE) Hanford 100 Area (100 Area Burial Grounds), Hanford Site, Benton County, Washington, which were chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record for this site and for the specific operable units.

The State of Washington concurs with the selected remedy.

ASSESSMENT OF THE SITES

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

INTEGRATION OF CERCLA AND RCRA REQUIREMENTS

Regulatory oversight for the waste sites covered in this ROD is shared by the U.S. Environmental Protection Agency (EPA) and the Washington State Department of Ecology (Ecology). EPA has lead regulatory oversight for the 100-BC-1, 100-BC-2, 100-KR-2, and 100-FR-2 waste sites; and Ecology has lead regulatory oversight for the 100-DR-1, 100-DR-2, and 100-HR-2 waste sites. The wastes sites where EPA is the lead are designated as CERCLA past-practice sites. Waste sites covered by this interim action where Ecology is the lead regulator are designated as Resource Conservation and Recovery Act of 1976 (RCRA) past-practice sites.

DOE, EPA, and Ecology, herein referred to as the Tri-Parties, recognize the similarities between the RCRA corrective action and CERCLA remedial action processes and their common objective of protecting human health and the environment from potential releases of hazardous substances, wastes, or constituents. As such, the Tri-Parties are electing to combine response actions under RCRA corrective action and CERCLA remedial action.

RCRA corrective action authorities have jurisdiction over waste with chemical constituents (in particular, hazardous waste and hazardous constituents) and "mixed wastes" (mixtures of hazardous waste and radiological contaminants). CERCLA authorities provide jurisdiction over hazardous substances including radiological contaminants. The Tri-Parties agreed in the Hanford Federal Facility Agreement and Consent Order (referred to as the Tri-Party Agreement) that they intend for all remedial and corrective actions conducted under the Tri-Party Agreement to address all aspects of contamination so that no further action will be required under federal and state law. In particular, they agreed that any units managed under RCRA corrective action shall address all CERCLA hazardous substances for the purposes of corrective action. Therefore, actions taken to remediate these operable units will comply with the provisions of both CERCLA and RCRA.

It is the intent of the Tri-Parties to select the same remedy for sites addressed by this ROD requiring RCRA corrective action as for the selected CERCLA interim remedial actions. It is anticipated that the Hanford Facility RCRA Permit will be modified to include the RCRA corrective action sites pursuant to a Class 3 Permit modification, as specified in WAC 173-303-830. At that time, the public will have the opportunity to comment on the permit conditions relevant to these actions in accordance with the Tri-Party Agreement and applicable State and Federal Regulations.

DESCRIPTION OF THE SELECTED REMEDY

Components of the selected remedy for the 45 100 Area Burial Ground sites listed in Table A-1 include:

- Remove contaminated soil, structures and associated debris
- Treat these wastes as required to meet disposal facility requirements
- Disposal of contaminated materials at the Hanford Site Environmental Restoration Disposal Facility (ERDF)
- Backfill of excavated areas with clean material, followed by revegetation.

Burial grounds are defined as areas used for near-surface disposal of solid wastes containing hazardous substances and include the engineered structure, soil that was used as cover as the burial grounds were filled, and the associated waste.

STATUTORY DETERMINATIONS

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

Although this interim action is not intended to fully address the statutory mandate for permanence and treatment to the maximum extent practicable, this interim action does utilize treatment and thus is in furtherance of that statutory mandate.

Cleanup of waste sites in the 100 Area operable units began in 1995. Burial grounds waste site remediation will be integrated into the current remediation schedule, and it is expected to take a minimum of 10 years to complete cleanup of all the source waste sites in the 100 Area NPL site. Therefore, review of the remedy for cleanup of the 100 Area waste sites will be ongoing and will be formally reviewed at least once every 5 years.

The preamble to the NCP states that when noncontiguous facilities are reasonably close to one another and wastes at these sites are compatible for a selected treatment or disposal approach, CERCLA Section 104(d)(4) allows the lead agency to treat these related facilities as one site for response purposes and, therefore, allows the lead agency to manage waste transferred between such noncontiguous facilities without having to obtain a permit. The 100 Area sites addressed by this interim action ROD and ERDF are reasonably close to one another, and the wastes are compatible for the selected disposal approach. Therefore, the sites are considered to be a single site for response purposes.

DATA CERTIFICATION CHECKLIST

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

- Chemicals of concern (COCs) and their respective concentrations (see Section V and Table 2).
- Qualitative risk represented by the COCs (see Section VII). Due to limited data and the fact that this is an interim remedial action, no baseline risk assessment was performed.
- Cleanup levels established for COCs and the basis for the levels (see Sections VII and Table 2).
- Source materials constituting principal threats (see Sections XVI and XVII).
- Current and reasonably anticipated future land and groundwater use assumptions used in the qualitative risk assessment and ROD (see Sections VI and VII).
- Land and groundwater use that will be available at the site as a result of the selected remedy (see Section VI).
- Estimated capital, annual operation and maintenance (O&M), and total present worth costs; discount rate; and the number of years over which the remedy cost estimates are projected (see Section IX and Table 3).
- Key factor(s) that led to selecting the remedy (i.e., describe how the selected remedy provides the best balance of trade-offs with respect to the balancing and modifying criteria) (see Section X).

Signature sheet for the Record of Decision for the USDOE Hanford 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-2, 100-HR-2, 100-KR-2, Operable Unit Interim Remedial Actions between the United States Department of Energy and the United States Environmental Protection Agency, with concurrence by the Washington State Department of Ecology.

Keith Klein
Manager, Richland Operations
United States Department of Energy

Sept. 25, 2000
Date

Signature sheet for the Record of Decision for the USDOE Hanford 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-2, 100-HR-2, 100-KR-2, Operable Unit Interim Remedial Actions between the United States Department of Energy and the United States Environmental Protection Agency, with concurrence by the Washington State Department of Ecology.

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

9-25-00
Date

Signature sheet for the Record of Decision for the USDOE Hanford 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-2, 100-HR-2, 100-KR-2, Operable Unit Interim Remedial Actions between the United States Department of Energy and the United States Environmental Protection Agency, with concurrence by the Washington State Department of Ecology.

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

9/26/00
Date

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DECISION SUMMARY

INTRODUCTION

The U.S. Department of Energy's Hanford Site was listed on the National Priorities List (NPL) in July 1989 under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986. The Hanford Site was divided and listed as four NPL Sites: the 100 Area, the 200 Area, the 300 Area, and the 1100 Area.

The U.S. Department of Energy (DOE) performed a 100 Area wide Phase 1 and 2 Feasibility Study and a 100 Area Burial Ground Focused Feasibility Study for soils, structures, and debris that received chemical and radioactive solid wastes. Waste site specific Qualitative Risk Assessments, comprised of human health risk assessments and ecological risk assessments, also were conducted to evaluate current and potential effects of contaminants in those operable units on human health and the environment.

I SITE NAME, LOCATION, AND DESCRIPTION

The Hanford Site is a 1,450km^2 (560 mi^2) Federal facility located in Benton County in southeastern Washington along the Columbia River. It is situated north and west of the cities of Richland, Kennewick, and Pasco, an area commonly known as the Tri-Cities (Figure 1). Land use in the areas surrounding the Hanford Site includes urban and industrial development, irrigated and dry-land farming, grazing, and designated wildlife refuges. The region includes the incorporated cities of Richland, Pasco, and Kennewick (Tri-Cities) and surrounding communities in Benton, Franklin, and Grant counties. Industries in the Tri-Cities mostly are related to agriculture and electric power generation. Wheat, corn, alfalfa, hay, barley, and grapes are the major crops in Benton, Franklin, and Grant counties.

The 100 Area, which encompasses approximately 68 km^2 (26 mi^2) bordering the south shore of the Columbia River, is the site of the nine retired plutonium production reactors. The waste sites being considered for remediation in this ROD are in the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-2, 100-HR-2, 100-KR-2 operable units. These waste sites received irradiated reactor hardware and other solid wastes associated with reactor operations.

100 Area Land Use. Pre-Hanford uses included Native American usage and agriculture. Existing land use in the 100 Area includes facilities support, waste management, and undeveloped land. Facility support activities include operations such as water treatment and maintenance of the reactor buildings. The contaminated waste site land area resulted from former uncontrolled disposal activities in areas now known as "past-practice waste sites" located throughout the 100 Area. Lastly, there are undeveloped lands located throughout the 100 Area that comprise approximately 90 percent of the land area within the 100 Area. These areas are the least disturbed and contain minimal infrastructure. An 18-mile stretch of the Columbia River is

located within the 100 Area. The shoreline of the Columbia River is a valued ecological area within the Hanford Site that was declared a national monument in June 2000. Portions of the shoreline within the 100 Area are within the 100-year flood plain of the Columbia River. Semi-arid land with a sparse covering of cold desert shrubs and drought-resistant grasses dominates the Hanford landscape. Forty percent of the area's annual average of 6.25 inches of rain occurs between November and January. Wetlands along the Columbia River are contained within the boundaries of the 100 Area NPL Site; however, no wetlands are in the vicinity of the 45 burial grounds covered in this ROD.

The *Hanford Future Site Uses Working Group* (the Working Group) in 1992 recommended that the 100 Area be considered for the following four future use options:

- Native American uses
- Limited recreation, recreation-related commercial use, and wildlife use
- B Reactor as a museum and visitor center
- Wildlife and recreational use

The working group report was submitted to DOE as a formal scoping document for the development of DOE's Hanford Remedial Action Environmental Impact Statement (EIS) and Comprehensive Land Use Plan. Based on public comment, DOE changed the scope of the EIS to focus on land use alternatives only and issued the Hanford Comprehensive Land Use Plan ROD in November 1999 (64 FR 61615). The DOE selected land uses for the 100 Area include recreation, conservation, and preservation.

For the purposes of this interim action, the remedial action objectives are for "unrestricted use," which is not inconsistent with DOE's land use plan.

II SITE HISTORY AND ENFORCEMENT ACTIONS

This section provides a brief overview of the site history, operable unit background, and the primary regulatory considerations for the 100 Area waste sites.

The Hanford Site was established during World War II as part of the "Manhattan Project" to produce plutonium for nuclear weapons. Hanford Site operations began in 1943, and DOE facilities are located throughout the Hanford Site and the City of Richland. Certain portions of the Hanford Site are known to have cultural and historical significance and may be eligible for listing in the National Register of Historic Places.

In 1988, the Hanford Site was scored using EPA's Hazard Ranking System. As a result of the scoring, the Hanford Site was added to the NPL in July 1989 as four sites (the 100 Area, the 200 Area, the 300 Area, and the 1100 Area). Each of these areas was further divided into operable units (a grouping of individual waste units based primarily on geographic area and common waste sources). The 100 Area NPL site consists of the following operable units for contaminated sources such as soils, structures, debris, and burial grounds, 100-BC-1, 100-BC-2,

100-KR-1, 100-KR-2, 100-NR-1, 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, 100-FR-1, 100-FR-2, 100-IU-1, -2, -3, -4, -5, and -6; and for contaminated groundwater, 100-BC-5, 100-KR-4, 100-NR-2, 100-HR-3, and 100-FR-3. Previous RODs address priority waste sites in the 100 Area. The waste sites being considered for remediation in this ROD are in the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-2, 100-HR-2, and 100-KR-2 operable units.

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

Operable Unit Background

100-BC. The B Reactor, constructed in 1943, operated from 1944 through 1968, when it was retired from service. The C Reactor, constructed in 1951, operated from 1952 until 1969, when it also was retired from service. Currently, the only active facilities in the 100-BC-1 operable unit are those that extract and treat water from the Columbia River and transport that water to other 100 Area and 200 Area facilities. The 100-BC-1 and 100-BC-2 operable units, located in BC Area, include contaminant sources, while the 100-BC-5 operable unit includes contamination present in the underlying groundwater. The 100-BC-1 and 100-BC-2 operable units contain a total of 11 burial grounds (see Figure 2).

100-DR. The 100 D/DR Area contains two reactors, the D Reactor associated with the 100-DR-1 operable unit and the DR Reactor associated with the 100-DR-2 operable unit. The D Reactor operated from 1944 to 1967, when it was retired. The DR Reactor operated from 1950 to 1964, when it was retired. Currently, sanitary and fire protection water is provided to the 100-H and 100-F Areas from the 100-D Area. The groundwater operable unit for the D/DR and H Areas is 100-HR-3. The 100-DR-1 and 100-DR-2 operable units contain a total of 19 burial grounds (see Figure 3).

100-H. The H Reactor operated from 1949 to 1965, when it was retired. Currently there are no active facilities, operations, or liquid discharges in the H Area. The 100-HR-1 and 100-HR-2 source operable units, located in the H Area, include contaminant sources while the 100-HR-3 groundwater operable unit include contamination present in the underlying groundwater. The 100-HR-2 operable unit contains five burial grounds (see Figure 4).

100-F. The F Reactor operated from 1945 to 1965, when it was retired. Most of the facilities associated with F Reactor, other than the biological research facilities, were also retired in 1965. Currently there are no active facilities, operations, or liquid discharges in the F Area. The 100-FR-1 and 100-FR-2 operable units contain contaminant sources, while the 100-FR-3 groundwater operable unit includes contamination present in the underlying groundwater. There are eight burial grounds in the 100-FR-2 operable unit (see Figure 5).

Figure 1. Map of the Hanford Site Showing the 100 Areas.

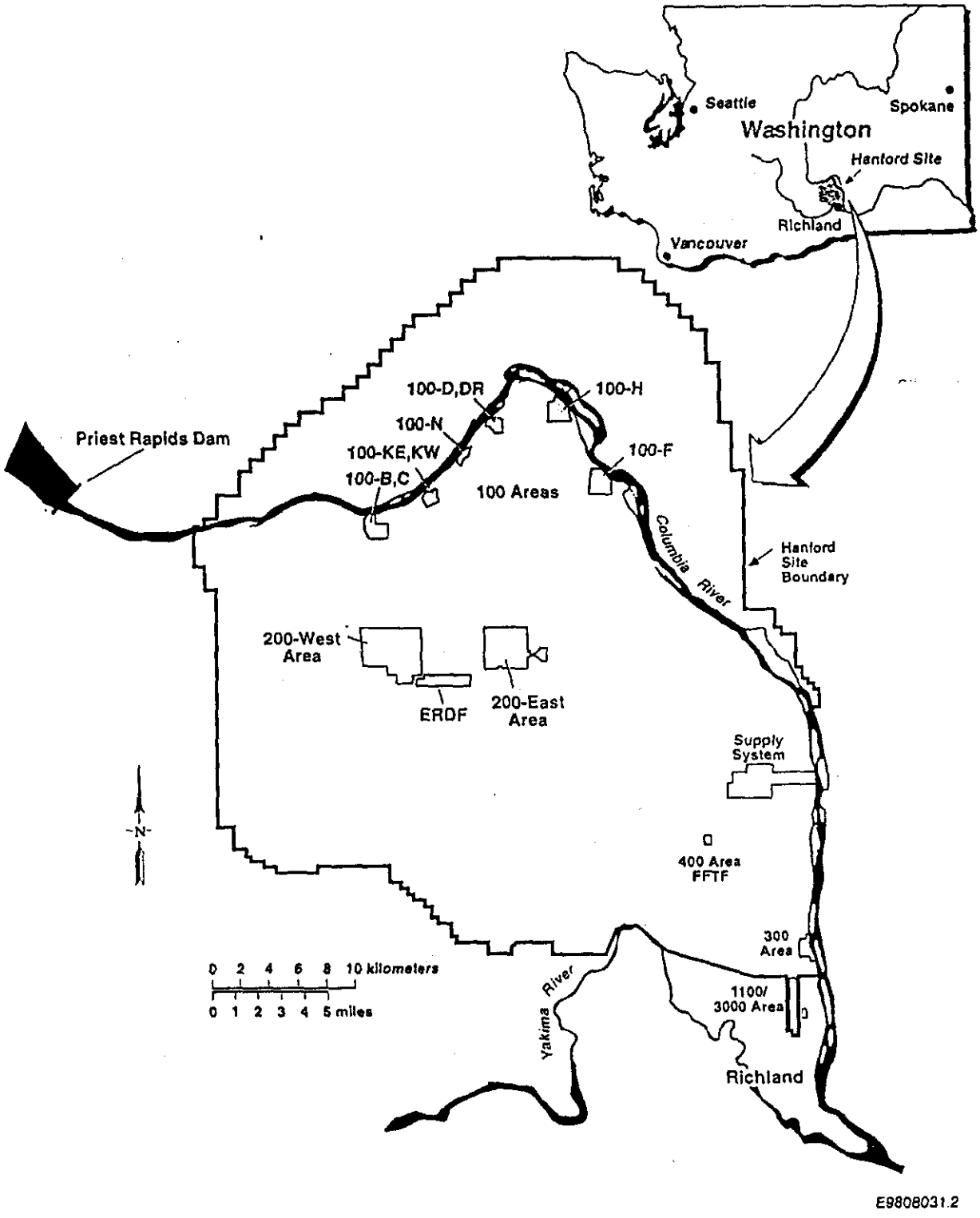


Figure 2. Burial Grounds at the 100-B/C Area.

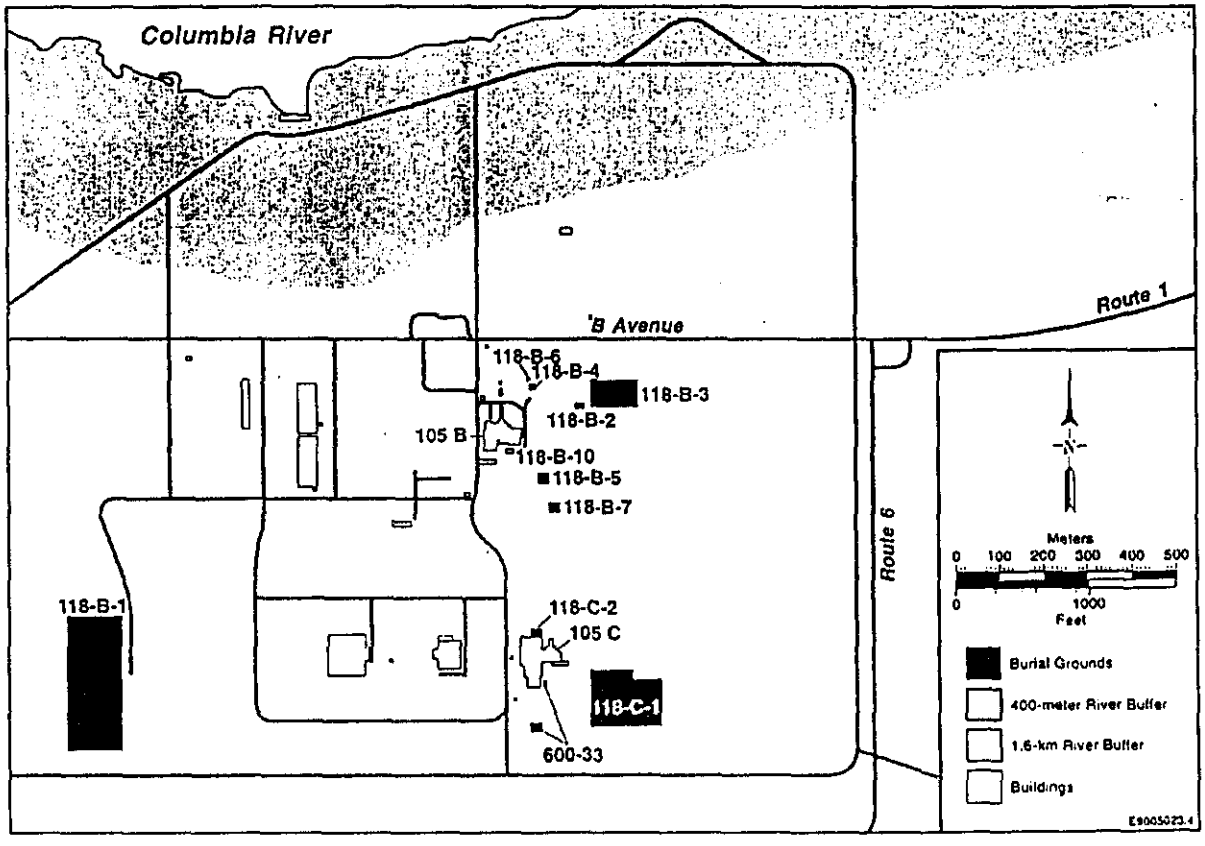


Figure 3. Burial Grounds at the 100-D Area.

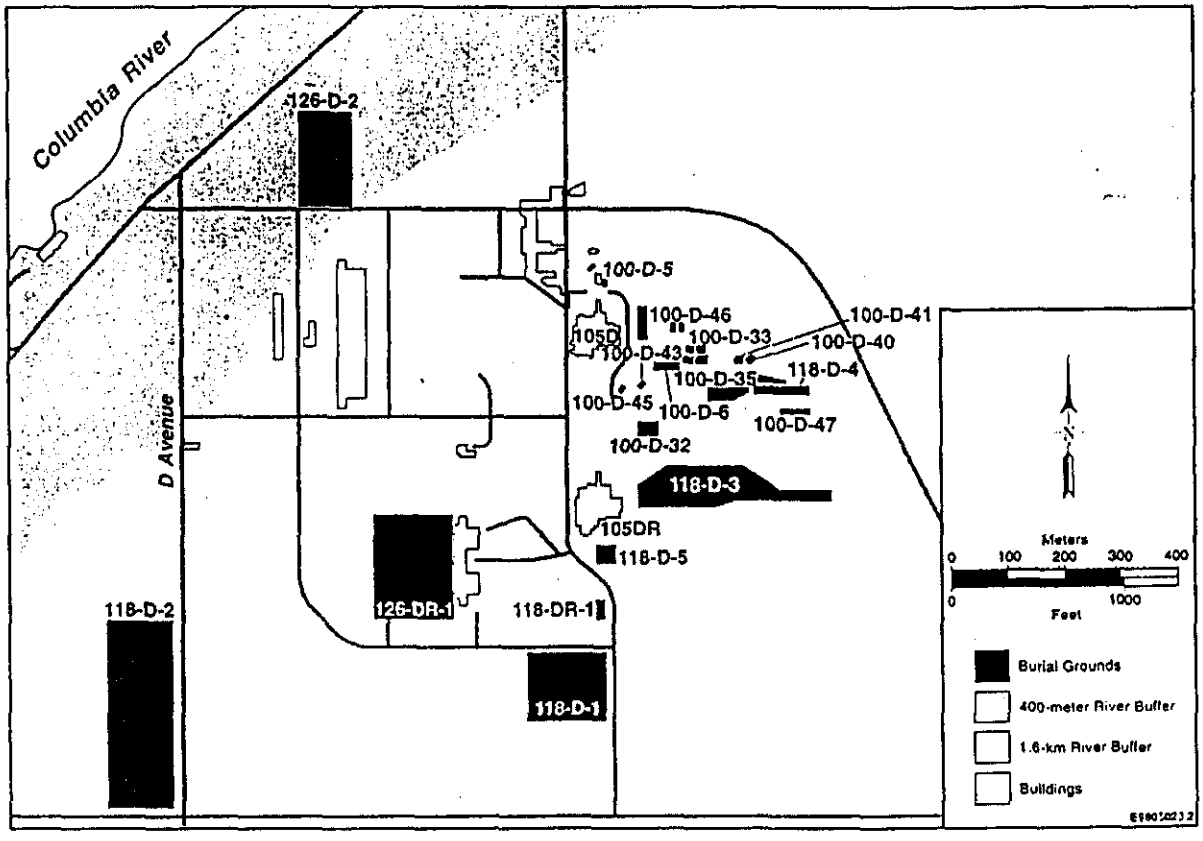


Figure 4. Burial Grounds at the 100-H Area.

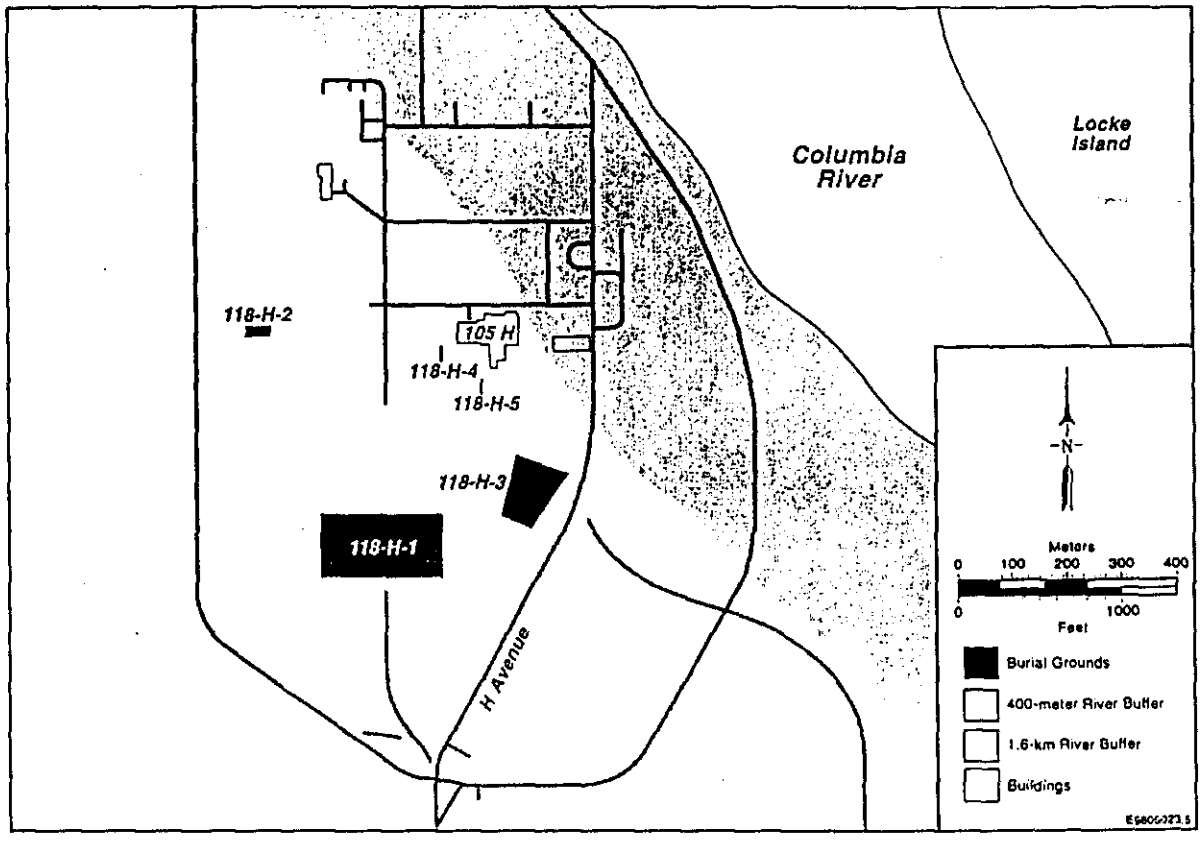


Figure 5. Burial Grounds at the 100-F Area.

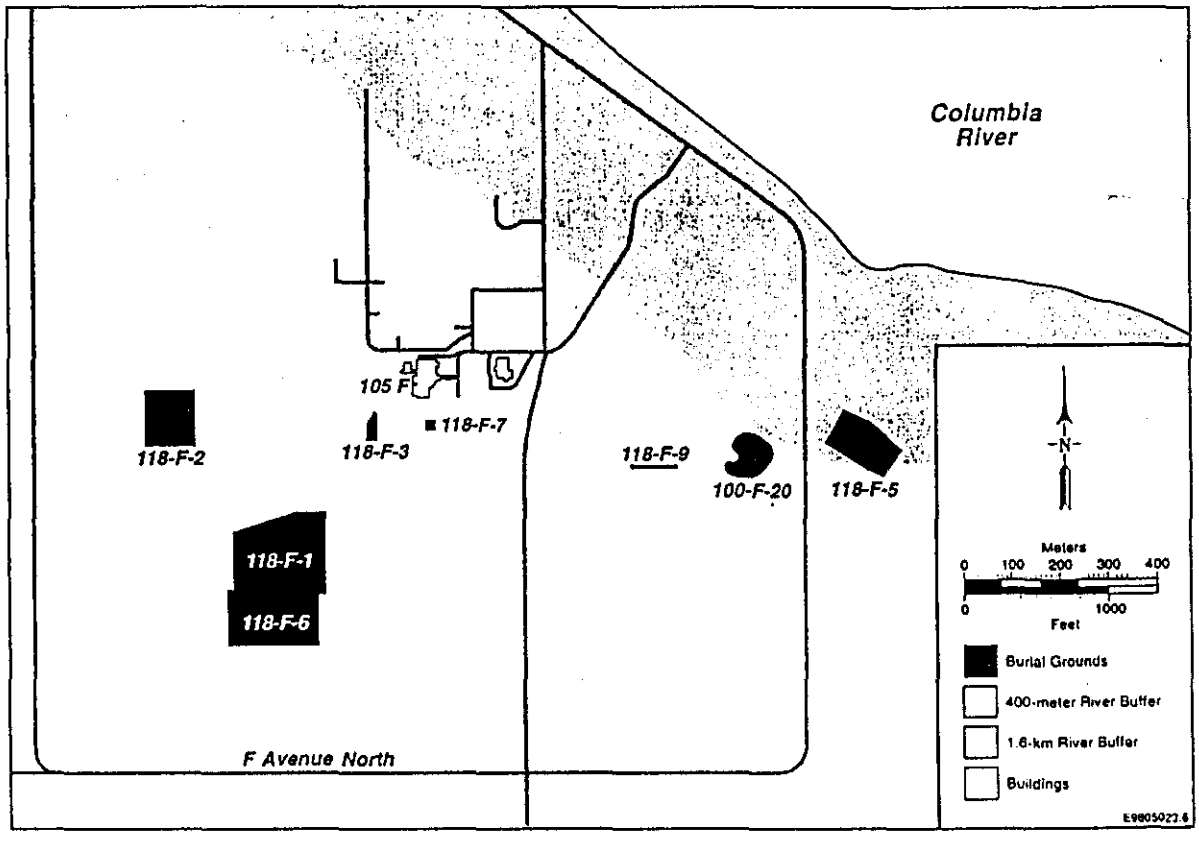
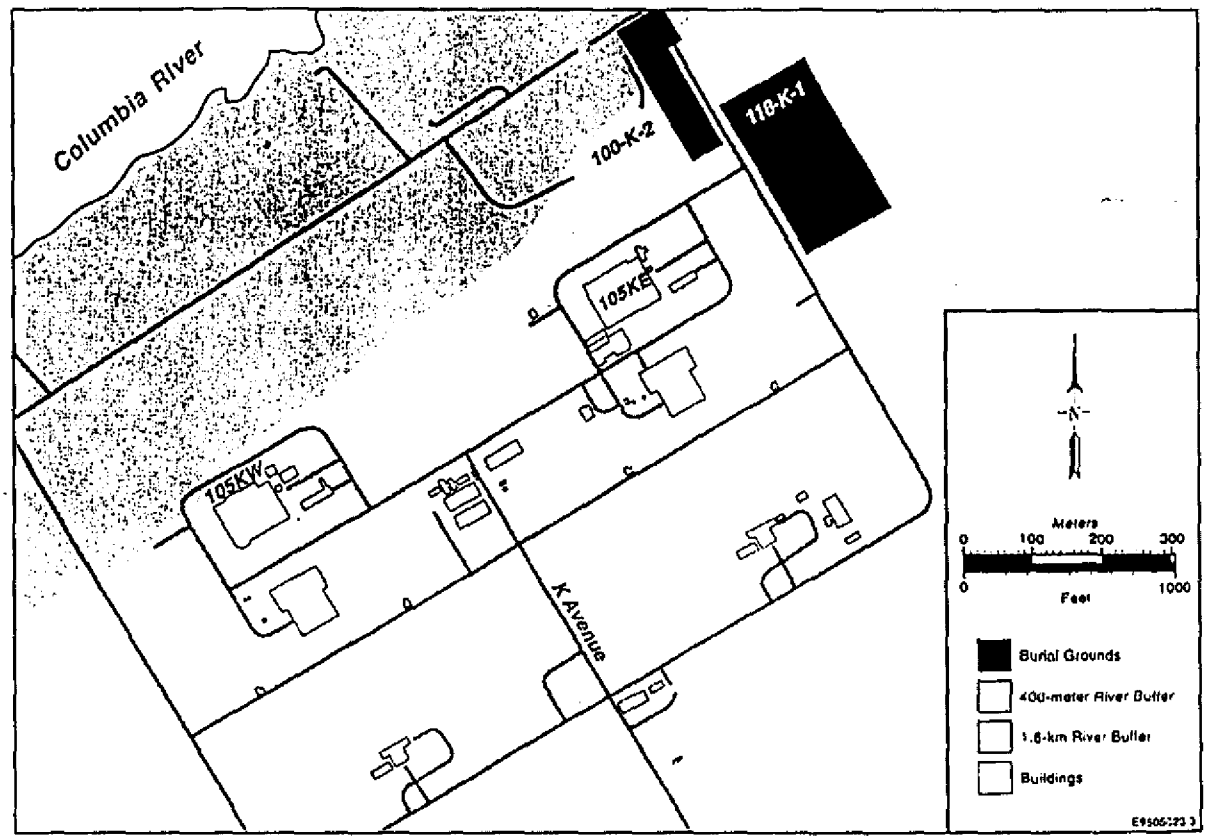


Figure 6. Burial Grounds at the 100-K Area.



100-K. The KW reactor operated from 1955 to 1970 and the KE reactor operated from 1955 to 1971. The 100-KR-1 and 100-KR-2 source operable units, located in the K Area, include contaminant sources, while the 100-KR-4 groundwater operable unit includes contamination in the underlying groundwater. Currently, there are several active facilities within the 100-K Area. They include the 105-KE and 105-KW fuel storage basins, which are used to store spent fuel from the N reactor. There are two burial grounds in the 100-KR-2 operable unit (see Figure 6).

III HIGHLIGHTS OF COMMUNITY PARTICIPATION

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

The *Proposed Plan for Interim Remedial Actions for the 100 Area Burial Grounds* and the *Focused Feasibility Study* were made available to the public in both the Administrative Record and the Information Repositories maintained at the locations listed below on May 22, 2000.

A fact sheet, which explained the proposed action and informed the public that they could request a public meeting, was mailed to approximately 2,000 people. In addition, an article appeared in the bi-monthly newsletter, the *Hanford Update*, detailing the start of public comment. The *Hanford Update* is mailed to over 4,000 people. The Proposed Plans were made available to members of the Hanford Advisory Board. In addition, a public meeting was held on June 15, 2000 in Hood River, Oregon, to discuss the cleanup.

ADMINISTRATIVE RECORD (Contains all project documents)

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

INFORMATION REPOSITORIES (Contain limited documentation)

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

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

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

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

The notice of the availability of these documents was published in the *Tri-City Herald* on May 21, 2000. The public comment period was held from May 22 to June 20, 2000. All submitted written comments can be found in the Administrative Record. Responses to the public comments received during the public comment period are included in the Responsiveness Summary (Appendix B) and were considered during the development of this ROD.

This decision document presents the selected interim remedy for the 100 Area Burial Grounds at the Hanford Site, Richland, Washington, chosen in accordance with CERCLA, as amended by SARA, and to the extent practicable, the NCP. The decision for these sites is based on the Administrative Record.

IV SCOPE AND ROLE OF RESPONSE ACTION WITHIN SITE STRATEGY

This section describes the objectives of the selected interim remedial action, how it fits within the overall site remediation strategy, and discusses the application of the Observational Approach.

This ROD addresses contaminated soils, structures, and debris found at the sites listed in Table A-1, but does not address groundwater that has been contaminated by releases from these sites. The proposed interim remedial actions are to identify and reduce potential future threats to human health and the environment from waste site contaminants. Other waste sites within the 100 Area will require cleanup. These sites have been addressed in previous decision documents and are currently undergoing remediation.

Burial grounds are defined as areas used for near-surface disposal of solid wastes containing hazardous substances and include the engineered structure, soil that was used as cover as the burial grounds were filled, and the associated waste.

Regulatory oversight for the waste sites covered in this ROD is shared by EPA and Ecology. EPA has lead regulatory oversight for the 100-BC-1, 100-BC-2, 100-KR-2, and 100-FR-2 waste sites; and Ecology has lead regulatory oversight for the 100-DR-1, 100-DR-2, and 100-HR-2 waste sites. The wastes sites where EPA is the lead are designated as CERCLA past-practice sites. Waste sites covered by this interim action where Ecology is the lead regulator are designated as RCRA past-practice sites.

The Tri-Parties recognize the similarities between the RCRA corrective action and CERCLA remedial action processes and their common objective of protecting human health and the environment from potential releases of hazardous substances, wastes, or constituents. As such, the Tri-Parties are electing to combine response actions under RCRA corrective action and

CERCLA remedial action. Therefore, all of the RCRA past-practice units included in this ROD are subject to the ROD's remedial action requirements under CERCLA as well as RCRA corrective action requirements.

RCRA corrective action authorities have clear jurisdiction over waste with chemical constituents (in particular, hazardous waste and hazardous constituents) and "mixed wastes" (mixtures of hazardous waste and radiological contaminants). CERCLA authorities provide jurisdiction over hazardous substances including radiological contaminants. The Tri-Parties agreed in the Hanford Federal Facility Agreement and Consent Order (referred to as the Tri-Party Agreement) that they intend for all remedial and corrective actions conducted under the Tri-Party Agreement to address all aspects of contamination so that no further action will be required under federal and state law. In particular, they agreed that any units managed under RCRA corrective action shall address all CERCLA hazardous substances for the purposes of corrective action. Therefore, actions taken to remediate these operable units will comply with the provisions of both CERCLA and RCRA. It is the intent of the Tri-Parties to select the same remedy for sites addressed in this ROD requiring RCRA corrective action as the selected CERCLA interim remedial actions. It is anticipated that the Hanford Facility RCRA Permit will be modified to include the RCRA corrective action sites pursuant to a Class 3 Permit modification, as specified in WAC 173-303-830, At that time, the public will have the opportunity to comment on the permit conditions relevant to these actions in accordance with the Tri-Party Agreement and applicable state and federal regulations.

Consistent with the previous 100 Area soil cleanup decisions, the Tri-Parties have agreed to remediate the 100 Area Burial Grounds, to the extent practicable, such that future use of the land is not precluded by contamination left from past Hanford operations. This would be accomplished by remediating the sites to address potential direct exposure effects, air and groundwater releases, and ecological and cultural impacts. Any remaining risks will be addressed in a final ROD for the 100 Area NPL site.

The 100 Area of the Hanford Site is complex and contains many individual waste sites within the area. Based on the circumstances presented by the 100 Area, the use of the observational approach will enhance the efficiency of the selected interim remedy.

The Observational Approach. This approach relies on information from historical process operations and information from limited field investigations on the nature and extent of contamination, combined with a "characterize and remediate in one step" methodology. Remediation of the sites specified in Table A-1 proceeds until it can be demonstrated through a combination of field screening and confirmational sampling that cleanup goals have been achieved. This information is documented in a cleanup verification package for each waste site and approved by the lead regulatory agency.

V SITE CHARACTERISTICS

This section presents an overview of the physical characteristics of the 100 Area, available historical data that was evaluated, and summaries of the various 100 Area studies.

Site Geology and Hydrology. The Hanford Site is located in the Pasco Basin, a topographic and structural basin situated in the northern portion of the Columbia Plateau. The plateau is divided into three general structural subprovinces: the Blue Mountains, the Palouse, and the Yakima Fold Belt. The Hanford Site is located near the junction of the Yakima Fold Belt and the Palouse subprovinces.

Geology. The 100 Area is located in the northern portion of the Hanford Site, adjacent to the Columbia River. The geologic structure beneath the 100 Area is similar to much of the rest of the Hanford Site, which consists of three distinct levels of soil formations. The deepest level is a thick series of basalt flows that have been warped and folded, resulting in protrusions that crop out as rock ridges in some locations. The top of the basalt in the 100 Area ranges in elevation from 46 m (150 ft) near the 100-H Area to 64 m (210 ft) below sea level near the 100-B/C Area. Layers of silt, gravel, and sand known as the Ringold formation form the middle level. The Ringold Formation shows a marked west-to-east variation in the 100 Area. The main channel of the ancestral Columbia River flowed along Umtanum Ridge and through the 100-B/C and 100-K areas, before turning south to flow along Gable Mountain and/or through the Gable Mountain-Gable Butte gap, leaving relatively thin deposits of sand and gravel in the 100-B/C and 100-K Areas. The uppermost level is known as the Hanford formation and consists of gravel and sands deposited by catastrophic floods during glacial retreat. In the 100 Area, the Hanford formation consists primarily of Pasco Gravels facies, with local occurrences of the sand-dominated or slackwater facies. The predominant soil types in this area are Burbank loamy sand (34 percent), Ephrata sandy loam (23 percent), Ephrata stony loam (23 percent), and Quincy sand (17 percent). Other soil types include Pasco silt loam, Kiona silt loam, and river wash.

Groundwater. Groundwater flows in to the 100 Area from the south, through the gaps between Umtanum Ridge, Gable Butte, and Gable Mountain and discharges to the Columbia River. Groundwater flow is predominantly to the north in the 100 BC Area and northwest in the 100 K Area. Groundwater flow in the 100 D Area is to the northwest and changes to northeastern across the horn towards the 100 H Area. The 100 H Area and 100 F Area groundwater flow is predominantly to the east and southeast. The depth to the water table in the 100 Area ranges from 1 meter near the river to approximately 30 meters near the reactor buildings.

Columbia River. The Columbia River is the second largest river in North America and the dominant surface-water body on the Hanford Site. The existence of the Hanford Site has precluded development of this section of river for irrigation and power. The uses of the Columbia River include the production of hydroelectric power, extensive irrigation in the Mid-Columbia Basin, and as a transportation corridor for barges. Several communities located on the Columbia River rely on the river as their source of drinking water. Water from the Columbia River along the Hanford Reach is also used as a source of drinking water by several onsite facilities and for industrial uses. In addition, the Columbia River is used extensively for recreation, including fishing, hunting, boating, sailboarding, waterskiing, diving, and swimming.

Historical Data. An integral part of the 100 Area investigations was the acquisition, evaluation, and utilization of records pertaining to the construction, operation, and decontamination/ decommissioning of the reactors and related facilities. This information is categorized as historical information and includes operations records and reports, engineering drawings, photographs, interviews with former or retired operations personnel, and data from sampling and analysis of facilities and the local environment.

A primary reference for radiological characterization of the 100 Area operable unit sources is a sampling study of the 100 Area performed during 1975-76 by Dorian and Richards. In the 100 Area source operable unit areas, Dorian and Richards collected samples from retention basins, effluent pipelines and surrounding soil, liquid waste disposal trenches, retention basin sludge disposal trenches, miscellaneous trenches, cribs, french drains, and dummy decontamination drains. Samples of soil were collected from the surface and subsurface to a maximum of 11.6m (38ft) below grade in the 100-B/C area, and 7.6 m (25ft) below grade in the 100-D/DR and 100-H Areas. Samples were also collected from retention basin sludge and concrete and from effluent line scale and sludge. The samples were analyzed for radionuclides. Inventories of radionuclides for the facilities and sites were calculated. Results from Dorian and Richards were a major resource used in the development of the 100-Area conceptual models. In addition, in 1995 several test pits were dug in the 118-B-1 burial grounds to augment the data obtained by Dorian and Richards.

Background Study. The evaluation of levels of naturally occurring constituents in Hanford area soils and groundwater was undertaken in order to better understand baseline conditions against which to evaluate potential cleanup levels and actions. A report on inorganic constituents in soils was released in May 1994 by DOE. Preliminary results of the evaluation of radionuclides in soils was released in July 1995 by DOE. For the purposes of the interim actions discussed in this ROD, background considerations for radionuclides is being considered in terms of mrem/year dose, and then by specific analyte(s) as appropriate. For the 100 Area, the average background dose associated with radionuclides in soils is approximately 60 mrem/year, and the 95 percent upper confidence limit (UCL) dose is approximately 78 mrem/year.

Ecological Analysis. Ecological surveys and sampling have been conducted in the 100 Areas and in and along the Columbia River adjacent to the 100 Areas. Sampling included plants with either a past history of documented contaminant uptake or an important position in the food web, such as river algae, reed canary grass, tree leaves, and asparagus. In addition, samples were collected of caddisfly larvae (next step in the food chain from algae), burrow soil excavated by mammals and ants at waste sites, and pellets cast by raptors and coyote scat to determine possible contamination of the upper end of the food chain. Bird, mammal, and plant surveys were conducted. Current contamination data have been compiled from other sources, along with ecological pathways and lists of all wildlife and plants identified at the site, including threatened and endangered species. Species of special concern at the 100 Areas include the federally-protected bald eagle, generally found from November through March. Established bald eagle roosting and nesting sites are found near the 100-D, 100-H, and 100-F Areas, but none of the burial grounds are within the buffer zones established to protect the eagles. No federally-listed plant species are found at the Hanford Site, but state species of concern that could be found on disturbed sites (such as the burial grounds) include Piper's daisy. The Columbia River is home to several federally-protected endangered species, including steelhead and chinook salmon. The

DOE will conduct an ecological review prior to any ground-disturbing projects (e.g., waste removal/disposal or surface barrier construction).

Cultural Resources Review. In compliance with Section 106 of the National Historic Preservation Act, the Hanford Cultural Resources Laboratory conducted an archaeological survey during fiscal year 1991 of the 100 Area reactor compounds on the Hanford Site. This survey was conducted as part of a comprehensive cultural resources review of the 100 Area operable units in support of CERCLA characterization activities. The work included a literature and records review and pedestrian survey of the project area, following procedures presented in the Hanford Cultural Resources Management Plan.

Conceptual Site Model

Direct land burial in excavated trenches, termed "burial grounds," was used to dispose of solid low-level radioactive materials associated with reactor operations (e.g., equipment and structural debris). Each reactor area includes burial grounds containing irradiated reactor hardware and other solid waste materials incidental to facility operations, mixed with soil. Each reactor area also has specialty burial grounds where wastes from reactor alterations or other specific activities (e.g., biological research and facility construction) were disposed. These burial grounds range in depth from 2.1 m (7 ft) to 8.8 m (29 ft).

The primary exposure pathway for humans is direct contact/exposure to solid waste material and contaminated soil.

The primary exposure routes for ecological receptors at the 100 Area Burial Grounds waste sites include direct exposure to contaminated soil, plant uptake of contaminants from the soil through physical/biological processes, and consumption of contaminated plants and animals by various animal species. Plant exposure is a function of the species, root depth, physical nature of the contamination, and concentration/distribution of contaminants in the soil. Due to the nature of burial ground wastes, migration of contaminants to the groundwater and the Columbia River is unlikely. Therefore, contaminant exposures to aquatic organisms from burial ground wastes are expected to be minimal.

Nature and Extent of Contamination

All the 100 Area single pass reactor operations were virtually identical, leading to similar releases of contaminants to similar type waste sites. Limited field investigations in various 100 Area operable units verified that the contamination of waste sites was very similar in all 100 Area operable units. Process knowledge and available data were used to identify contaminants of potential concern (COPCs).

The predominant contaminants of potential concern are radionuclides contained in hard wastes (greater than 99 percent metallic), with the exception of burial grounds in the 100-F Area that contain radiologically-contaminated soft wastes from biological studies. The major radiological constituents in the burial grounds are tritium, carbon-14, cobalt-60, nickel-63, strontium-90, silver-108m, cesium-137, europium-152, and europium-154. No transuranic or high-level wastes are identified in historical documents or were identified in characterization studies at the 118-B-1

Burial Ground. Hard metallic wastes may include lead, boron, cadmium, cobalt, and nickel-containing equipment. No bulk organic liquids were identified from historical information and are not expected in the 100 Area Burial Grounds. Asbestos is assumed to exist in association with buried equipment or structural material. Appendix A lists current site knowledge, including potential contaminants, for each of the 45 burial grounds.

VI LAND USE

Currently the land use in the 100 Areas is for industrial purposes and includes maintenance shops, water supply systems, and environmental cleanup.

A key component of the remedy selection process is the determination of potential future land use at the site. These long range land use assumptions are not predictors of long-term land use (beyond 20 to 30 years) and should not be used as predictors of land use beyond reasonable lengths of time, nor for land use changes resulting from longer term events. The Hanford Future Site Users Working Group (the Working Group) was convened in April of 1992 to develop recommendations concerning the potential use of lands after cleanup. The Working Group issued their report in December 1992 and proposed that the cleanup options at the 100 Area be based on eventual *unrestricted* land use.

Factors that were considered in conjunction with the Working Group proposals include: (1) that contaminated sites which would exist indefinitely (beyond any reasonable time for assured institutional control) would be cleaned up for unrestricted use where practicable, and (2) that institutional controls (such as land and groundwater restrictions) be implemented for sites associated with low risks where it can be shown that the contaminant would degrade or attenuate within a reasonable period of time or, for sites where contaminants would remain in place above unrestricted use cleanup goals, where it can be shown that meeting the more stringent cleanup goal is not practicable. For the 100 Area, a reasonable period of time was identified by the Working Group as "as soon as possible (by 2018)". This time frame coincides with the Tri-Party Agreement date for completion of cleanup actions in the 100 Area.

The *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement* (HCP EIS) (DOE/EIS-0222F), which became final after the ROD was signed by DOE in November 1999 (64 FR 61615), designates area use for the land encompassing the burial grounds as the preservation and conservation of natural and cultural resources. Actions selected in this ROD are not inconsistent with the land-use designation of preservation and conservation.

Currently the groundwater use in the 100 Areas is restricted and not used for human consumption. Areas of the aquifer are undergoing remedial actions that have been specified in separate decision documents. The Columbia River is a rich ecological resource that is the home to a variety of fish, waterfowl, and mammals. In addition, the river is used for recreation, fishing, and as a drinking water source.

As a result of implementing the remedy at the waste sites listed in this ROD, it is anticipated that in the future the surface soils to a depth of at least 15 feet will be available for unrestricted use. Although outside the scope of this ROD, it is the goal of the Tri-Parties to return the groundwater in the 100 Areas to a condition so that in the future it would be available as a drinking water source.

VII SUMMARY OF SITE RISKS

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

Potential risks to human health and ecological receptors have been evaluated in qualitative risk assessments of the contents of the majority of the 100 Area Burial Ground sites. Concentrations (activities) of radionuclides were determined using the information developed in *Estimates of Solid Waste Buried in 100 Area Burial Grounds*, which used process knowledge to calculate the curies of radioactive material believed to be contained in 27 of the 45 100 Area Burial Ground sites.

Human Health Risk

Contamination detected or known to exist at waste sites poses the potential for increased human health risk to future site users. The level of potential health risk posed by contaminants differs depending upon the future site use. Two future site use scenarios were evaluated in the qualitative risk assessments, a recreational use and a residential use. In either case, future users could be exposed to contaminants in soil through ingestion of soil, inhalation of wind-blown dust, or external exposure to radiation. The residential use scenario would additionally include drinking well water and ingestion of milk and fish raised on site. Exposure duration for recreational land use is set at 7 days/year for 30 years. The residential scenario exposure duration is set at 292 days/year for 30 years.

Based on the qualitative risk assessments, the contaminants in the 100 Area Burial Grounds providing the highest contribution to potential increased human health risks include the radionuclides carbon-14, cesium-137, cobalt-60, strontium-90, tritium [H-3], and europium-152. Environmental media and waste material contaminated by these constituents include soil, metallic waste, concrete, asbestos, and miscellaneous debris.

Table 1 provides a comparison of representative maximum contaminant levels for the 118-B-1 waste site with the cleanup levels in soil for contaminants of concern for residential use. The cleanup levels in this table generally represent a 3×10^{-4} risk level for individual radionuclides. A comparison of this data to the cleanup levels indicates that the risks to future site users would be expected to be above the risk range of 1×10^{-4} to 1×10^{-6}. Calculation of the site risk from this data shows that these contamination levels present a total risk of 1.9×10^{-2} from radionuclide contamination for residential land use. This risk level shows that remedial action is necessary at this site. Appendix C of the 100 Area Burial Grounds Focused Feasibility Study contains qualitative risk assessment results for 27 of the 45 burial grounds and shows that remedial

Table 1. Residential Risk Due to Radionuclide Concentrations at 118-B-1 Burial Ground and Remediation Goals in Soil

Radionuclide Contaminants	118-B-1 Radionuclide Concentrations[1]	Residential Risk[2]	Soil Cleanup Levels
Carbon-14	0.8 pCi/gm	2.2×10^{-4}	5.2 pCi/gm
Cesium-137	0.8 pCi/gm	2.8×10^{-5}	6.2 pCi/gm
Cobalt-60*	264 pCi/gm	1.3×10^{-2}	1.4 pCi/gm
Europium-152	4.5 pCi/gm	1.8×10^{-4}	3.3 pCi/gm
Europium-154	2.3 pCi/gm	8.2×10^{-5}	3.0 pCi/gm
Nickel-63	818 pCi/gm	1.2×10^{-4}	4,026 pCi/gm
Silver-108m*	29.1 pCi/gm	3.1×10^{-3}	2.4 pCi/gm
Strontium-90	0.8 pCi/gm	2.5×10^{-5}	4.5 pCi/gm
Tritium (H-3)*	7,070 pCi/gm	2.6×10^{-3}	510 pCi/gm
Total		1.9×10^{-2}	

[1]Concentrations (activities) of radionuclides were determined using the information developed in *Estimates of Solid Waste Buried in 100 Area Burial Grounds*, WHC-EP-0620)

[2]From Table C1-3 of Appendix C of the *100 Area Burial Ground Focused Feasibility Study*

*COCs that represent risk drivers in a residential exposure scenario.

this site. Appendix C of the 100 Area Burial Grounds Focused Feasibility Study contains qualitative risk assessment results for 27 of the 45 burial grounds and shows that remedial actions are necessary at these sites. Eighteen burial grounds did not have sufficient information to calculate a qualitative risk. Risk information for metals and organics was not calculated due to the limited data available.

Ecological Risk. Ecological risks from the 100 Area sites were estimated by evaluating potential impacts to the Great Basin pocket mouse. Where remedial investigation results were not available, ecological risks were evaluated by comparing 100 Area sites to analogous sites with similar characteristics. Risks to the mouse were estimated assuming the food pathway was the primary route of exposure to both radionuclides and inorganic/organic contaminants. An Environmental Hazard Quotient (EHQ) equal to or greater than 1.0 was considered to indicate that individual mice were at risk.

Nearly all of the radiological risk (EHQ > 1.0) to the mouse at the 100 Area sites was attributable to cobalt-60, although tritium also exceeded an EHQ of 1.0 at some sites. Comparison to analogous sites indicates that the risk estimates to the Great Basin pocket mouse due to exposure to heavy metals and various organic contaminants at selected sites would also exceed an EHQ of 1.0.

Chemicals and Media of Concern. Risks from contaminated soil and debris were identified at levels that exceed the EPA risk threshold and may pose a potential threat to human health. The NCP requires that the overall incremental cancer risk (ICR) at a site not exceed the range of 10^{-6} to 10^{-4}. For systemic toxicants or noncarcinogenic contaminants, acceptable exposure levels are represented by a hazard index of less than 1.

VIII REMEDIAL ACTION OBJECTIVES

Remedial Action Objectives (RAOs) provide a general description of what the cleanup will accomplish. RAOs have been identified for the contaminated near-surface and subsurface soils, structures, and debris at the 100 Area operable units waste site for this interim action, The RAOs and the principal requirements for achievement of them are discussed in the following paragraphs.

The interim remedial action selected by this document has the following specific remedial action objectives:

1. Protect human and ecological receptors from exposure to contaminants in soils, structures, and debris by direct exposure, inhalation, or ingestion of radionuclides, inorganics or organics.

Protection will be achieved by reducing concentrations of contaminants in the upper 4.6 meters (15 ft) of soil exposure scenario. The levels of reduction will be such that for radionuclides the EPA CERCLA risk range of 10^{-4} to 10^{-6} increased cancer risk will be achieved. To address this objective, the total dose for radionuclides shall not exceed 15 mrem/yr above Hanford site background for 1,000 years following remediation also, State of Washington MTCA method B limits for inorganics and organics (see Table 2).

Table 2. Cleanup Values for 100 Area Burial Grounds. (2 Pages)

Contaminant	Protection from Direct Exposure	Protection of Groundwater/Columbia River		Selected Cleanup Level [a]
	Remedial Action Goals	Contaminant-Specific Concentration in Soil Protective of Groundwater	Contaminant-Specific Concentration in Soil Protective of the Columbia River	
Radionuclides (piC/g)				
Carbon-14	5.16	2.0[b]	2.0[b]	2.0
Cesium-137	6.2	NA[c]	NA[c]	6.2
Cobalt-60	1.4	NA[c]	NA[c]	1.4
Europium-152	3.3	NA[c]	NA[c]	3.3
Europium-154	3.0	NA[c]	NA[c]	3.0
Europium-155	125	NA[c]	NA[c]	125
Nickel-63	4,026	NA[c]	NA[c]	4.026
Plutonium-238	37.4	NA[c]	NA[c]	37.4
Plutonium-239/240	33.9	NA[c]	NA[c]	33.9
Silver-108m	2.4	NA[c]	NA[c]	2.4
Strontium-90	4.5	NA[c]	NA[c]	4.5
Technetium-99	15[b]	15[b]	15[b]	15
Thorium-232	1.3	NA[c]	NA[c]	1.3
Tritium (H-3)	510	35.5	106.7	35.5
Uranium-233/234	1.1[d]	1.1[d]	1.1[d]	1.1
Uranium-235	1.0[b]	1.0[b]	1.0[b]	1.0
Uranium-238	1.1[d]	1.1[d]	1.1[d]	1.1
Non-Radionuclides (mg/kg)				
Antimony	32	6.0[b]	6.0[b]	6.0
Arsenic	20[d]	20[d]	20[d]	20
Cadmium	80	NA[c]	NA[c]	80
Chromium (III)	80,000	NA[c]	NA[c]	80,000
Chromium (VI)	400	8.0	2.0	2.0
Lead	353	NA[c]	NA[c]	353
Manganese	11,200	NA[c]	NA[c]	11,200
Mercury	24	NA[c]	NA[c]	24
Silver	400[e]	NA[c]	NA[c]	400
Zinc	24,000	NA[c]	NA[c]	24,000
Polychlorinated biphenyls [f]	0.5	NA[c]	NA[c]	0.5

Table 2. Cleanup Values for 100 Area Burial Grounds. (2 Pages)

Contaminant	Protection from Direct Exposure	Protection of Groundwater/Columbia River		Selected Cleanup Level [a]
	Remedial Action Goals	Contaminant-Specific Concentration in Soil *Protective of Groundwater*	Contaminant-Specific Concentration in Soil *Protective of the Columbia River*	
Benzo(a)anthracene	0.33 [b]	NA [c]	NA [c]	0.33
Benzo(a)pyrene	0.33 [b]	NA [c]	NA [c]	0.33
Benzo(b) fluoranthrene	0.33 [b]	NA [c]	NA [c]	0.33
Benzo(k) fluoranthrene	0.33 [b]	NA [c]	NA [c]	0.33
Chlordane	0.769	NA [c]	NA [c]	0.769
Chrysene	0.33 [b]	NA [c]	NA [c]	0.33
Pentachlorophenol	8.33	NA [c]	NA [c]	8.33
Pesticides [g]	Compound specific: 0.1 - 1.0	NA [c]	NA [c]	Compound specific: 0.1 - 1.0
Phthalates [g]	Compound specific: 32-320	NA [c]	NA [c]	Compound specific: 32-320
Bis(2-ethylhexyl) Phthalate	71.4	NA [c]	NA [c]	71.4
Sulfate	NA [h]	25,000	25,000	25,000
Total petroleum hydrocarbons [g]	Compound specific: 100-200	NA [c]	NA [c]	Compound specific: 100-200
Semivolatile organic analytes [g]	Compound specific: 0.01-1.0	NA [c]	NA [c]	Compound specific: 0.01-1.0
Volatile organic analytes [g]	Compound specific: 0.5-20	Compound specific: 0.1-0.5	NA [c]	Compound specific: 0.1-0.5

Note: The values are based on a 10,000 m^2 generic site. Values may change slightly based on site-specific information (e.g., actual size of waste site, nature and extent of contamination and presence of multiple contaminants). The actual values will be documented in a closeout verification package for the individual waste sites.

[a] The lowest value among the "Protection from Direct Exposure," "Protective of Groundwater," and "Protective of the Columbia River" values is the selected cleanup value.

[b] The remedial action goal is below the practical quantitation limit. The value presented is the practical quantitation limit.

[c] The RESidual RADioactivity (RESRAD) model predicts the contaminant will not reach groundwater within a 1,000-year time frame based on the generic site model. Site-specific remedial action goals will be calculated for site closeout verification using site-specific information. The process for determining final standards is detailed in *Remedial Design Report/Remedial Action Work Plan for the 100 Area*.

[d] The remedial action goal is based on statewide background level.

[e] MTCA Method B soil cleanup level.

[f] Compliance is based on the sum of all aroclors detected.

[g] The range of concentrations presented represent several compounds in this contaminant class.

[h] No published standard.

NA = not applicable

Maximum values for radionuclides are based on individual constituent concentrations that would meet the risk objectives by resulting in an annual effective dose equivalent of 15 mrem/yr under a rural-residential scenario. Values will be lower for multiple constituents to achieve the same risk objectives.

2. Control the sources of groundwater contamination to minimize the impacts to groundwater resources, protect the Columbia River from further adverse impacts, and reduce the degree of groundwater cleanup that may be required under future actions.

Protection will be such that contaminants remaining in the soil after remediation do not result in an adverse impact to groundwater underneath the site that could exceed Maximum Contaminant Levels (MCLs) under the Safe Drinking Water Act (SDWA).

Protection of the Columbia River from adverse impacts such that contaminants remaining in the soil after remediation do not result in an impact to groundwater and, therefore, the Columbia River that could exceed the Ambient Water Quality Criteria (AWQC) under the Clean Water Act for protection of fish. Since there are no AWQC for radionuclides, MCLs will be used . The protection of receptors (aquatic species, with emphasis on salmon) in surface waters will be achieved by reducing or eliminating further contaminant loadings to groundwater such that receptors at the groundwater discharge in the Columbia River are not subject to additional adverse risks. Each of the reactor areas has an extensive well network and monitoring plans that have been approved by the lead regulatory agency for each reactor Area. Data from the networks is reviewed periodically to assure adequate information is collected. Any changes to the monitoring plans will require approval of the lead regulatory agency.

3. Provide conditions suitable for future land use of the 100 Areas.

This objective will be achieved by meeting the first two objectives as defined above.

Residual Risks Post-Achievement of RAOs. Residual risks after meeting RAOs are based on a residential land use scenario for soils. Potential site risks from contaminated soils, structures, and debris with respect to metals and organics will be approximately 1×10^{-6}. Site risks from contaminated soils, structures, and debris with respect to radionuclides are reduced from greater than 2×10^{-2} to approximately 3×10^{-4}.

Remediation Time Frame. Completion of these actions shall be consistent with the overall goal of completion of 100 Area remedial actions by the year 2018.

IX DESCRIPTION OF ALTERNATIVES

The 100 Area Burial Grounds focused feasibility study identified three alternatives for interim remedial action:

- No Action alternative - Evaluated as a comparative baseline for the other alternatives
- Remove/Treat/Dispose alternative - Protects human health and the environment by removing the sources of contamination and placing them in an engineered facility located on the 200 Area Plateau.
- Containment alternative - Protects human health and the environment by eliminating exposure pathways for potential receptors (i.e., humans and biota) through construction of engineered surface barriers.

Each alternative is summarized below. Each burial ground was individually evaluated in the focused feasibility study.

No Action Alternative

The National Contingency Plan (NCP) (40 CFR 300) requires that a No Action alternative be evaluated as a baseline for comparison with other remedial alternatives. The No Action alternative represents a situation where no legal restrictions, access controls, or active remedial measures are applied to the site. No action implies "walking away from the burial ground" and allowing the wastes to remain in their current configuration, affected only by natural processes. Selecting the No Action alternative would require that a burial ground pose no unacceptable threat to human health or the environment.

Remove/Treat/Dispose Alternative

The removal aspect of the Remove/Treat/Dispose alternative involves several components:

- Applying the observational approach, which allows waste characterization, designation, and treatment to occur as excavation proceeds
- Removing and stockpiling the clean overburden
- Removing (excavating) contaminated burial ground wastes and soils (i.e., to native soils at the bottom and sides of the burial ground trenches) using standard soil excavation equipment (e.g., backhoes and front-end loaders) until cleanup levels are achieved
- Applying water sprays and/or crusting agents to control dust and dispersion of soft wastes (e.g., paper)
- Performing air monitoring in accordance with current Washington State Department of Health air quality requirements
- Performing soil sampling and analysis for site-specific contaminants of concern to document achievement of remediation goals
- Transporting clean soil from approved borrow pits to backfill remediated areas
- Grading remediated areas to match local area contours
- Revegetating remediated areas to control soil erosion and reflect the natural 100 Area environment
- Implementing institutional controls, as defined in the site-wide plan.

Wastes resulting from implementation of the Remove/Treat/Dispose alternative would be disposed at the ERDF on the Hanford Site. Most wastes and soils excavated from the burial grounds are expected to meet the criteria established for ERDF waste acceptance. If the ERDF

waste acceptance criteria cannot be achieved, waste treatment will be required. Specific treatment technologies will be applied to the contaminated media as appropriate to meet ERDF waste acceptance criteria. For example, waste volume may be minimized by void-space reduction, or macroencapsulation may be used to treat dangerous wastes (e.g., lead) that are subject to land disposal restrictions (LDRs). The process to allow disposal at the ERDF is as follows:

- Initially segregating materials, based on visual inspections and field screening, to accommodate different treatment and disposal options
- Isolating or mechanically separating suspect or "unknown" materials (radioactive and nonradioactive) from other burial ground debris
- Conducting waste sampling and analysis
- Evaluating uncontaminated waste for reuse or recycle
- Consolidating compatible wastes for subsequent treatment or disposal
- Packaging and shipping waste to an appropriate facility (assumed to be the ERDF for planning purposes).

If the Remove/Treat/Dispose alternative was applied to all 45 burial ground sites, approximately 1.8 million loose cubic meters (LCM) (2.4 million loose cubic yards [LCY]) of contaminated soil and debris would be removed, treated if necessary, and disposed. Disposing this entire waste volume, without waste segregation or volume reduction, would require slightly more than two ERDF cells (each cell holds approximately 728,000 LCM [952,188 LCY]) to accommodate the 100 Area Burial Grounds' waste. The Remove/Treat/Dispose alternative would require approximately 2 million m^3 (2.6 million LCM [3.4 million LCY]) of borrow material for fill at the burial grounds and capping at the ERDF.

Unrestricted use of the excavated area, both surface and subsurface to at least 4.6 m (15 ft), could occur following removal, treatment, and disposal. However, until such time as remedial actions are completed, DOE will maintain active institutional controls to prevent access to the waste sites.

Estimated Costs. Capital costs, annual operation and maintenance costs, total projected life cycle costs, and total present-value costs for the Remove/Treat/Dispose alternative are presented in Table 3.

Containment Alternative

The surface barriers and other controls proposed in the Containment alternative would be designed to prevent unintentional human and biotic intrusion into burial ground wastes, minimize potential human and biotic exposures, and control potential contaminant migration by preventing water infiltration into the waste materials. The Containment alternative would include restrictions on disturbance, excavation of the surface barrier, and would require

maintenance; however, all other land uses, including surface uses that do not compromise the integrity of the barrier, could occur. These restrictions would still allow for a variety of land-use scenarios, including restricted residential use (residential use in the near vicinity of the contained burial grounds), as well as recreation/conservation/preservation land use selected in the DOE land use ROD (64 FR 61615).

The following sections discuss the surface barrier, institutional controls, and EPA guidance considerations inherent in the Containment alternative for the 100 Area Burial Grounds. The description of this alternative concludes with the estimated time to construct and implement the remedy and estimated costs.

Surface Barrier. The **modified RCRA Subtitle C-compliant surface barrier** included in this alternative is a 3.5-m (11.9 ft)-thick, eight-layer cover system designed to provide protection against water (e.g., precipitation) infiltration and biotic intrusion for 500 years. The barriers would be constructed of variable thickness, with graded-fill bases that establish a stable, planar surface over the burial grounds. Once constructed, the barrier surface and side slopes would be vegetated to control soil erosion, promote moisture evapotranspiration, and reflect the natural 100 Area setting.

During remedial design, surveying (e.g., using ground-penetrating radar) would be conducted to verify the burial ground boundaries and to verify that the existing rock/soil cover at each burial ground satisfies the minimum requirements for the surface barrier (e.g., subsidence concerns).

It is expected that most barrier materials would be excavated with standard soil excavation equipment and transported to the burial grounds from Hanford Site borrow areas. If barriers were constructed on all 45 burial ground sites, approximately 1.3 million LCM (1.7 million LCY) of borrow materials would be required. Water spraying would generally be used to control dust from materials associated with barrier construction. Operation and maintenance activities would include regular inspections, cover vegetation management (e.g., weed control), regular environmental monitoring (e.g., groundwater and neutron moisture monitoring system), and barrier maintenance.

Institutional Controls. The Containment alternative would include physical and legal institutional controls. Access control, surveillance, and land-use restrictions (i.e., development limitations) would be implemented in conjunction with the surface barrier.

Public notices and community relation efforts would supplement site surveillance efforts. Burial ground land-use controls would be established by DOE, prohibiting any activities (e.g., residential development) that could compromise the integrity of the containment barrier. The DOE, or subsequent land managers, would enforce land-use restrictions as long as risks remain above acceptable levels.

Monitoring. A neutron probe moisture monitoring system is assumed for each surface barrier to monitor barrier soil moisture and ensure that water is not infiltrating through the barrier into the burial ground waste. This system would incorporate a horizontal tube in the lowest layer of the barrier so moisture levels within the barrier could be measured with a neutron probe from numerous locations at regular (e.g., seasonal or annual) intervals.

Upgradient and downgradient groundwater monitoring wells would be required for each burial ground to ensure that waste isolation is achieved and contaminant migration is not occurring. The existing network of groundwater monitoring wells in the 100 Areas, plus the shallow groundwater monitoring system along the Columbia River shoreline, would be utilized to the extent possible for this groundwater monitoring effort. Burial ground monitoring would be incorporated into the ongoing Hanford Site environmental monitoring program.

Estimated Costs. Capital costs, annual operation and maintenance costs, total projected life cycle costs, and total present-value costs for the Containment alternative are presented in Table 3.

Table 3. Summary of Costs for 100 Area Burial Ground Remedial Alternatives.

Alternative	Capital Cost	Operation and Maintenance[a]	Total Present-Value Cost[b]	Total Project Life Cycle Cost[c]
No Action (Baseline)	0	0	0	0
Remove/Treat/ Dispose	$356,347,000	$237,724,000	$399,361,000	$594,071,000
Containment[d]	$345,824,000	$1,551,185,000	$156,928,000	$1,897,009,000

Note: All costs estimated with an accuracy of -30% to +50%.

[a] Total O&M is the total undiscounted cost of annual operations and maintenance expenditures.

[b] Present-value costs based on a 2.9% real discount rate (OMB Circular A-94, Appendix C) and a 1,000-year period of analysis (e.g., project duration). Note: This duration was used to bound the estimate. Actual duration will exceed 1,000 years.

[c] Total costs are 1999 dollars.

[d] The number of years used in calculating total costs was based on 1,000 years of operation and maintenance and a one-time capital cost barrier replacement at 500 years.

X SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The following evaluation of remedial alternatives summarizes each alternative in relation to each of the nine CERCLA criteria.

The first two criteria, overall protection and compliance with ARARs, are defined under CERCLA as "threshold criteria." Threshold criteria must be met by an alternative to be eligible

for selection. The next five criteria are defined as "primary balancing criteria." These criteria are used to weigh major trade-offs among alternatives. The last two criteria, state and community acceptance, are defined as "modifying criteria." These criteria may be considered to the extent that information is available during the focused feasibility study but cannot be fully considered until after public comment is received on the Proposed Plan. In the final comparison of alternatives to select a remedy, modifying criteria are of equal importance to the balancing criteria.

Overall Protection. The Remove/Treat/Dispose alternative would protect human health and the environment by removing contaminants from the burial ground sites. The Containment alternative would protect human health and the environment by eliminating or reducing exposure pathways. The Containment and Remove/Treat/Dispose alternatives would meet this threshold criterion.

The No Action alternative would fail to meet this threshold criterion and, therefore, is not discussed further in this evaluation.

Compliance with Applicable or Relevant and Appropriate Requirements. The Remove/Treat/ Dispose and Containment alternatives would comply with ARARs. No waivers from ARARs are necessary to implement either of these alternatives.

Long-Term Effectiveness and Permanence. The Remove/Treat/Dispose alternative provides a higher degree of long-term effectiveness and permanence than the Containment alternative. Long-term use restrictions, monitoring, and barrier maintenance would be required under the Containment alternative and at the ERDF under Remove/Treat/Dispose. However, the greater degree of containment at the ERDF (e.g., trench bottom liner) and consolidation of many sites into one inclusive site, as well as the greater distance to the Columbia River, would result in this alternative being more effective in the long term than the Containment alternative.

Reduction of Toxicity, Mobility, or Volume Through Treatment. To the extent that wastes may be treated to achieve LDRs and ERDF waste acceptance criteria (the focused feasibility study estimates that only 5 percent of the wastes in the burial grounds may require such treatment), the Remove/Treat/Dispose alternative may provide a slightly greater reduction of mobility and possibly volume through treatment than the Containment alternative.

Short-Term Effectiveness. The Containment alternative would be more effective in the short term than the Remove/Treat/Dispose alternative, predominantly because of lower risk to workers. The Remove/Treat/Dispose alternative would generate a large volume of contaminated soils and debris which could present risks to workers from potential exposure to contaminated soils and fugitive dust or from potential accidents. Multiple handling of waste necessary for segregation and treatment at some burial grounds would further increase worker risk. Smaller burial grounds that typically contain more homogeneous waste streams would cause less of a short-term impact to workers whereas at larger burial grounds, more waste would be segregated and treated, and this would require more precautions.

Implementability. The Remove/Treat/Dispose alternative would be more complicated to implement than the Containment alternative because of the difficulties and safety requirements

associated with the excavation, transportation, treatment, and disposal of contaminated equipment, soft wastes, and soils and because of inherent unknowns in the burial grounds. However, both alternatives are implementable with existing technologies.

Costs. For comparison purposes, the net present value (in 1999 dollars) was calculated for each of the alternatives. Net present value comparisons comprise the standard criteria for comparison as specified in CERCLA's National Contingency Plan (55 Federal Register 866, March 8, 1990). Present value estimates allow for a cost comparison of different remedial alternatives where costs are incurred in different time periods, on the basis of a single cost figure for each alternative. This single figure, or present value, is the amount needed to be set aside at the start of the remedial action to ensure that funds will be available in the future as they are needed. The total non-discounted cost is a summation of the capital and operation and maintenance costs for the duration of the project.

Individual cost estimates for each waste site and remedial alternative are presented in Table 3. Costs presented are estimates with an expected accuracy of +50% to -30%. It is estimated that applying the Remove/Treat/Dispose alternative to all of the burial grounds would cost approximately $399 million, and implementing the Containment alternative would cost approximately $157 million. For information purposes and to reflect potential long-term costs, the non-discounted costs of the alternatives (i.e., costs that have not been discounted to reflect cost in 1999 dollars) are $594 million for Remove/Treat/Dispose and $1.9 billion for Containment.

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

Community Acceptance. In general, comments received on the Proposed Plan were supportive of the Remove/Treat/Dispose alternative. Several comments were received regarding what impact the designation of the Hanford Reach as a National Monument might have on cleanup of these and other 100 Area waste sites. No modification to the remedy was necessary as a result of public comment.

XI SELECTED REMEDY

The components of the selected remedy achieve the best balance of the nine evaluation criteria. In particular, this remedy provides better long-term protection than capping by removing wastes from along the river and has lower life-cycle costs than capping. Implementation of this remedy will allow for unrestricted surface use of the 100 Areas and reduce long-term monitoring costs. This remedy meets the values expressed by the community to restore the river corridor to productive uses.

The selected remedy for 100 Area Burial Grounds waste sites will include the following activities.

- Per the Tri-Party Agreement, DOE is required to submit the Remedial Design Report, Remedial Action Work Plan, and Sampling and Analysis as primary documents. These

documents and associated documents concerning the planning and implementation of remedial design and remedial action shall be submitted to EPA and Ecology for approval prior to the initiation of remediation. The current 100 Area Remedial Design Report and Remedial Action Work Plan may be revised as an alternative to submitting new documents.

- Necessary removal and stockpiling of any uncontaminated overburden. To the extent practicable, this material will be used for backfilling of excavated areas.

- Excavation and transportation of contaminated soils, structures, and debris to the ERDF for disposal. Excavation activities will follow standard construction practices for excavation and transportation of hazardous materials, and will follow ALARA practices for remediation workers. Dust suppression during excavation, transportation, and disposal will be required, as necessary.

- Treatment, as necessary to meet ERDF waste acceptance criteria will be performed in the 100 Area or at ERDF prior to disposal. Treatment envisioned for these waste materials is macroencapsulation. Materials that are transported to ERDF for disposal must meet the disposal acceptance criteria, including treatment provisions, for that facility.

- The extent of remediation of the waste sites will take into account certain site-specific factors. The waste sites are represented by the following two general categories and the primary factors for consideration are discussed for each.

  - For shallow sites where the entire engineered structure, soil, or debris contamination is present within the top 15 feet, excavation may cease when contaminant levels are demonstrated to be at or below MTCA method B for inorganics and organics for residential exposure and for radionuclides the EPA CERCLA risk range of 10^{-4} to 10^{-6} increased cancer risk is achieved. In order to meet the 10^{-4} to 10^{-6} risk range, the total dose for radionuclides shall not exceed 15 mrem/year above Hanford site background for 1000 years following remediation, and residual contamination levels shall be at or below MCLs for protection of groundwater or AWQC for protection of the Columbia River.

  - For sites where the engineered structure and/or contaminated soil and debris extends below 15 feet, the engineered structure, at a minimum, will be remediated to achieve RAOs such that contaminant levels are demonstrated to be at or below MTCA method B levels for metals and organics for residential exposure, and for radionuclides, the EPA CERCLA risk range of 10^{-4} to 10^{-6} increased cancer risk is achieved. In order to meet the 10^{-4} to 10^{-6} risk range, the total dose for radionuclides shall not exceed 15 mrem/year above Hanford site background for 1000 years following remediation, and residual contamination levels shall provide protection of groundwater and the Columbia River. Any residual contamination that is present below the engineered structure and is greater than 15 feet in depth shall be subject to several factors in determining the extent of remediation, including reduction of risk by decay of short-lived (half-life of less than 30.2

years) radionuclides, protection of human health and the environment, remediation costs, sizing of the Environmental Restoration Disposal Facility, worker safety, presence of ecological and cultural resources, availability and projected effectiveness of institutional controls, and long-term monitoring costs. The extent of remediation also will have to ensure that contaminant levels are at or below MCLs for protection of groundwater or AWQC for protection of the Columbia River. For nonradioactive contaminants, MTCA specifies that concentrations of residual contaminants are protective of groundwater at levels equal to or less than the 100 times the groundwater cleanup levels established in accordance with WAC 173-340-720, unless it can be demonstrated that a higher soil concentration is protective of groundwater at the site. If residual concentrations exceed cleanup levels calculated using the 100 times rule, site specific modeling will be performed to provide refinement on contaminants found to simulate actual conditions at the waste site. For radionuclides, groundwater and river protection will be demonstrated through a technical evaluation using the computer model Residual Radioactivity (RESRAD). The application of the criteria for the balancing factors will be made by EPA and Ecology on a site by site basis. A public comment period of no less than 30 days will be required prior to making any determination to invoke balancing factors.

- Once a site has been demonstrated to have achieved cleanup levels and RAOs, it will be backfilled with clean materials and revegetated in accordance with approved plans. Revegetation plans will be developed as part of remedial design activities with input from affected stakeholders such as Natural Resource Trustees and Native American Tribes. Revegetation efforts will attempt to establish a viable habitat at the remediated areas and will emphasize the use of native seed stock.

- Institutional controls selected as part of this remedy are designed consistent with the interim action nature of this ROD. Additional measures may be necessary to ensure long-term viability of institutional controls if the final remedial action selected for the 100 Area NPL site does not allow for unrestricted land use. Any additional controls will be specified as part of the final remedy. The following institutional controls are required as part of this interim action:

  - DOE will continue to use a badging program to control access to the associated sites for the duration of the interim action. Visitors entering any of the sites associated with this Interim Action ROD are required to be escorted at all times.

  - Well drilling is prohibited, except for monitoring or remediation wells authorized in EPA and Ecology-approved or Ecology-approved documents. Groundwater use is prohibited, except for monitoring and treatment, as approved by EPA or Ecology.

  - No intrusive work is allowed on or near the waste sites covered in this ROD without prior approval of EPA or Ecology.

- DOE shall maintain signs which warn river users of potential hazards along the shoreline from 100 Area waste sites.

- DOE shall post and maintain in good condition "No Trespassing" signs along the 100 Area shoreline.

- DOE shall maintain signs along access roads that warn site visitors and workers of potential hazards from 100 Area waste sites.

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

- Because this is an interim action and wastes will continue to be present in the 100 Area until such time as a final ROD is issued and final remediation objectives are achieved, a 5-year review will be required.

Sitewide Institutional Controls Requirements

- DOE shall submit a sitewide institutional controls plan that includes the applicable institutional controls for the 100 Area operable units. This sitewide plan will be submitted to EPA and Ecology for approval as a primary document under the Tri-Party Agreement by July 2001. This plan shall be updated by DOE periodically at the request of EPA or Ecology. At a minimum, the plan shall contain the following:

  - Include a comprehensive facility-wide list of all areas or locations covered by any and all decision documents at Hanford that have or should have institutional controls for protection of human health or the environment. The information on this list will include, at a minimum, the location of the area, the objectives of the restriction or control, the time frame that the restrictions apply, the tools and procedures DOE will use to implement the restrictions or controls and to evaluate the effectiveness of these restrictions or controls;
  - Cover, and legally bind where appropriate, all entities and persons, including, but not limited to, employees, contractors, lessees, agents, licensees, and visitors. In areas where DOE is aware of routine trespassing, trespassers must also be covered;
  - Cover all activities, and reasonably anticipated future activities, including, but not limited to, any future soil disturbance, routine and non-routine utility work, well placement and drilling, recreational activities, national monument-related uses, groundwater withdrawals, paving, construction, renovation work on structures, tribal use, or other activities;
  - Include a tracking mechanism that identifies all land areas under restriction or control;
  - Include a process to promptly notify both EPA and Ecology prior to any anticipated change in land use designation, restriction, land users or activity for any institutional controls required by a decision document.

- DOE will notify EPA and Ecology immediately upon discovery of any activity that is inconsistent with the operable unit-specific institutional controls objectives for the site, or of any change in the land use or land use designation of a site. DOE will work together with EPA and Ecology to determine a plan of action to rectify the situation, except in the case where DOE believes the activity creates an emergency situation, DOE can respond to the emergency immediately upon notification to EPA and Ecology and need not wait for EPA or Ecology input to determine a plan of action. DOE will also identify deficiencies with the institutional controls process, evaluate how to correct the process to avoid future problems, and implement these changes after consulting with EPA and Ecology.

- DOE will identify a point of contact for implementing, maintaining, and monitoring institutional controls for the 100 Area, as well as the Hanford Site.

- DOE will comply with Tri-Party Agreement requirements to request and obtain funding to institute and maintain institutional controls as a compliance requirement under the Tri-Party Agreement.

- DOE will notify EPA and Ecology at least 6 months prior to any transfer, sale, or lease of any property subject to institutional controls required by a CERCLA decision document so that EPA and Ecology can be involved in discussions to ensure that appropriate provisions are included in the conveyance documents to maintain effective institutional controls. If it is not possible for DOE to notify EPA and Ecology at least 6 months prior to any transfer, sale, or lease, then DOE will notify EPA and Ecology as soon as possible, but no later than 60 days prior to the transfer, sale, or lease of any property subject to institutional controls.

- DOE will not delete or terminate any institutional controls unless EPA and Ecology have concurred in the deletion or termination.

- DOE will evaluate the implementation and effectiveness of institutional controls for the Hanford Site and the 100 Area operable units on an annual basis. The annual institutional controls monitoring report shall be written by DOE and submitted to EPA and Ecology as a primary document under the Tri-Party Agreement. The report shall be consistent with the requirements established in the sitewide institutional controls plan. Justification will be provided for any information that is not included as required by the sitewide plan. The annual monitoring report will be due on September 30 of each year and will summarize the results of the evaluation for the preceding calendar year. In addition, after the comprehensive sitewide approach is well established and DOE has demonstrated its effectiveness, the frequency of future monitoring reports may be modified subject to approval by EPA and Ecology. The institutional controls monitoring report, at a minimum, must contain:

  - a description of how DOE is meeting the sitewide institutional controls requirements;

- a description of how DOE is meeting the operable unit-specific objectives, including results of visual field inspections of all areas subject to operable unit-specific restrictions;
- an evaluation of whether or not all operable unit-specific and sitewide institutional controls requirements are being met;
- a description of any deficiencies and what efforts or measures have been or will be taken to correct problems.

- EPA and Ecology review of the institutional controls monitoring report will follow existing procedures for agency review of primary documents.

XII STATUTORY DETERMINATIONS

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

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

The qualitative risk assessment for a residential scenario associated with radionuclides at waste sites under this interim action estimated risks greater than 2×10^{-2}. The qualitative risk assessment for a recreational scenario associated with radionuclides at waste sites under this action also estimated risks greater than 1×10^{-3}. Remediation of sites will principally occur to remove radioactive contaminated soils, structures, and debris. The incremental residual risks after implementation of this remedy are estimated at 3×10^{-4} (residential scenario) for exposure to radionuclides. Inorganics and organics will be remediated to levels at or below MTCA method B levels during the course of implementation of the interim remedial actions. The residual risk from organics and inorganics is expected to be 1×10^{-6} or lower. This will be verified and/or documented in individual waste site cleanup verification packages. Contaminants will be remediated to levels that provide protection of groundwater and the Columbia River.

Compliance with ARARs. The selected remedy will comply with the federal and state ARARs identified below. No waiver of any ARAR is being sought. The ARARs identified for the 100 Area Burial Ground waste sites are the following:

- Safe Drinking Water Act (SDWA), 40 USC Section 300, Maximum Contaminant Levels (MCLs) for public drinking water supplies are relevant and appropriate for protecting groundwater.

- Model Toxics Control Act Cleanup Regulations (MTCA), Chapter 173-340 WAC, risk-based cleanup levels are applicable for establishing cleanup levels for soil.

- Clean Water Act, 33 USC Section 1251, for Protection of Aquatic Life are applicable for protecting the Columbia River.

- Water Quality Standards for Waters of the State of Washington, Chapter 173-201-035 WAC are applicable for protecting the Columbia River.

- National Primary and Secondary Ambient Air Quality Standards, 40 CFR Part 50, are applicable due to potential airborne emissions of particulates or lead during excavation, treatment, transportation or disposal of hazardous materials.

- National Emission Standards for Hazardous Air Pollutants, 40 CFR part 61, are applicable for radionuclide emissions from facilities owned and operated by DOE. Radionuclides are presented in the contaminated soils, structures and debris that will be excavated, treated, transported and disposed under this interim action.

- State of Washington Dangerous Waste Regulations, Chapter 173-303 WAC are applicable for the identification, treatment, storage, and land disposal of hazardous and dangerous wastes.

- RCRA Subtitle C (40 CFR Parts 261, 264, 268) are applicable for the identification, treatment, storage, and land disposal of hazardous wastes.

- U.S. Department of Transportation Requirements for the Transportation of Hazardous Materials (49 CFR Parts 100 to 179) will be applicable for any wastes that are transported offsite.

- Hazardous Materials Transportation Act (49 USC 1801-1813), is applicable for transportation of potentially hazardous materials, including samples and wastes.

- Minimum Standards for Construction and Maintenance of Wells (Chapter 173-160 and 162 WAC) Applicable regulations for the location, design, construction, and abandonment of water supply and resource protection wells.

- Toxic Substances Control Act (15 U.S.C. 2601, implemented via 40 CFR 761. Applicable to the management and disposal of remediation waste containing regulated concentrations of polychlorinated biphenyls (PCBs), including specific requirements for PCB remediation waste.

- State of Washington, Department of Health WAC 246, 247 is applicable to the release of airborne radionuclides.

- National Archeological and Historical Preservation Act (16 USC Section 469); 36 CFR Part 65, is applicable in order to recover and preserve artifacts in areas where an action may cause irreparable harm, loss, or destruction of significant artifacts.

- Native American Graves Protection and Repatriation Act (25 USC 3001) is applicable to any sites should Native American remains be found.

- National Historic Preservation Act (16 USC 470, *et. seq.)*; 36 CFR Part 800, is applicable in order to preserve historic properties controlled by a federal agency.

- Endangered Species Act of 1973 (16 USC 1531, *et. seq.*); 50 CFR Part 200; 50 CFR 402, is applicable in order to conserve critical habitat upon which endangered or threatened species depend. Consultation with the Department of the Interior is required.

Other Criteria, Advisories, or Guidance to be Considered for this Remedial Action (TBCs)

- Environmental Restoration Disposal Facility Waste Acceptance Criteria (Rev 3) that delineates primary requirements including regulatory requirements, specific isotopic constituents and contamination levels, the dangerous/hazardous constituents and concentrations, and the physical/chemical waste characteristics that are acceptable for disposal of wastes at ERDF.

- 59 FR 66414. Radiation Protection Guidance for Exposure to the General Public. EPA protection guidance recommending (non-medical) radiation doses to the public from all sources and pathways to not exceed 100 mrem/year above background. It also recommends that lower dose limits be applied to individual sources and pathways. One such individual source is residual environmental radiation contamination after the cleanup of a site. Lower doses limits and individual pathways are referred to as secondary limits.

- The Future For Hanford: Uses and Cleanup, The Final Report of the Hanford Future Site Uses Working Group, December 1992.

- Record of Decision: Hanford Comprehensive Land Use Plan Environmental Impact Statement (Federal Register/Vol. 64, No. 218, November 12, 1999).

Cost Effectiveness. The selected remedy provides overall effectiveness proportional to its cost. In addition, the use of the Observational approach will ensure that a protective remedy is implemented, while saving both time and money required to evaluate, select, and implement remedies on a site-by-site basis, as well as through combining aspects of characterization with remediation.

Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Possible. The selected remedy utilizes permanent solutions and alternative treatment technologies practicable for this site.

Preference for Treatment as a Principal Element. Treatment is not a significant component of the selected remedy due to the nature of the source material (i.e., it is not highly toxic or highly mobile). However, treatment technologies will be employed if excavated source material does not meet the waste acceptance criteria at ERDF. Therefore, the selected remedy meets the statutory preference for treatment as a principal element and is consistent with EPA's policy on principal threat wastes.

5-Year Review Requirements. Because this is an interim action and wastes will continue to be present in the 100 Area until such time as a final ROD is issued and final remediation objectives are achieved, a 5-year review will be required.

Onsite Determination. CERCLA Section 104(d)(4) states where two or more non-contiguous facilities are reasonably related on the basis of geography, or on the basis of the threat or potential threat to the public health or welfare or the environment, the President may, at his discretion, treat these facilities as one for the purposes of this section.

The preamble to the NCP states that when noncontiguous facilities are reasonably close to one another and wastes at these sites are compatible for a selected treatment or disposal approach, CERCLA Section 104(d)(4) allows the lead agency to treat these related facilities as one site for response purposes and, therefore, allows the lead agency to manage waste transferred between such noncontiguous facilities without having to obtain a permit. The 100 Area sites addressed by this interim action ROD and ERDF are reasonably close to one another, and the wastes are compatible for the selected disposal approach.. Therefore, the sites are considered to be a single site for response purposes.

XIII DOCUMENTATION OF SIGNIFICANT CHANGES

The Tri-Parties reviewed all written and verbal comments submitted during the public comment period. Upon review of these comments, it was determined that no significant changes to the selected remedy, as originally identified in the Proposed Plan, were necessary.

APPENDIX A

100 AREA BURIAL GROUNDS DESCRIPTIONS

Table A-1. Area Burial Ground Descriptions. (6 Pages)

Site Name	Current Site Knowledge	Media/ Material	Potential Contaminants
118-B-1 105-B Burial Ground	Primary burial ground for general wastes from the operation of 100-B Reactor. Received approximately 10,000 m^3 (13,079 yd^3) of solid wastes, including aluminum tubes, aluminum thimbles, stainless-steel gun barrels, thermocouples, and miscellaneous irradiated reactor hardware, plus wastes from operation of the P-10 Tritium Separation Project and project waste from replacing boiler tubes in eight steam generators in the Hanford Generating Plant in the 100-N Area. Operated from 1944 to 1973. Site contains 21 trenches in an area approximately 305 m x 98 m x 6 m (1,000 ft x 321 ft x 20 ft) deep. Located 915 m (3,000 ft) west of the 105-C Reactor. The principal radionuclide is long-lived Ni-63. References: WHC-SD-EN-TI-220, DOE/RL-94-61, WHC-EP-0620.	Solid waste mixed with soil	H-3, C-14, Co-60, Ni-63, Sr-90, Ag-108m, Cs-137, Eu-152, Eu-154, cadmium, lead, mercury
118-B-2 Minor Construction Burial Ground No. 1	Received approximately 100 m^3 (130 yd^3) of dry wastes from repair of the 107-B Retention Basin and conversion of the 115-B Gas Recirculation Building to serve both the B and C Reactors. Operated from 1952 to 1956. Site is described as a pit 18.3 m x 9.1 m x 77 m (60 ft x 30 ft x 13.8 ft) deep located 137 m (450 ft) east of the 105-B Reactor. The principal radionuclide is short-lived Co-60. References: WHC-SD-EN-TI-220, DOE/RL-94-61, WHC-EP-0620.	Solid waste mixed with soil	Co-60, Sr-90, Cs-137, Eu-152, Eu-154, chromium, lead, mercury
118-B-3 Minor Construction Burial Ground No. 2	Received solid wastes generated during modifications to the effluent lines and other 100-B Reactor alterations. Burial ground contains many trenches in an area 106.7 m x 84 m x 6.1 m (350 ft x 275 ft x 20 ft) deep located 198 m (650 ft) east of the 100-B Reactor building. Operated from 1956 to 1960. Site received approximately 5,000 m^3 (640 yd^3)of waste, which was primarily cold-rolled steel pipe. The principal radionuclide is short-lived Co-60. References: WHC-SD-EN-TI-220, WHC-EP-0620.	Solid waste mixed with soil	Co-60, Ni-63, Sr-90, Cs-137, Eu-152, Eu-154, U-238, Pu-238, Pu-239/240, chromium, lead, mercury
118-B-4 105-B Spacer Burial Ground	Disposal site for irradiated B Reactor aluminum fuel spacers. Site is 15.3 m x 9.2 m x 4.6 m (50 ft x 30 ft x 15 ft) deep and contains six vertical metal culverts, 1.8-m (6-ft) diameter and 4.6-m (15-ft) deep. Operated from 1956 to 1958. Located 91.5 m (300 ft) northeast of the 100-B Reactor building. Currently the site is covered with about 1 m (2 to 4 ft) of cobble. The principal radionuclide is short-lived Co-60. References: WHC-SD-EN-TI-220, WHC-EP-0620.	Solid waste in metal culverts	Co-60
118-B-5 Ball 3X Burial Ground	Received irradiated equipment and metallic wastes removed from 100-B Reactor during the Ball 3X Project in 1953. Site contains approximately 40 m^3 (52 yd^3) of highly irradiated metallic wastes in a pit 15 m x 15 m x 6.1 m (50 ft x 50 ft x 20 ft) deep covered with 1 m (3 ft) of cobble. The principal radionuclide is short-lived Co-60. References: WHC-SD-EN-TI-220, WHC-EP-0620.	Solid waste mixed with soil	Co-60, Ni-63
118-B-6 108-B Solid Waste Burial Ground	Site contains two vertical concrete pipes 5.5 m (18 ft) long and 1.8 m (6 ft) in diameter used for the disposal of wastes from "metal line" of the P-10 Tritium Separation Project. One of the pipes was filled with waste and capped, and then the other was partially filled with waste material and capped. Finally, both pipes were capped with a concrete pad measuring 4.6 m (15 ft) long and 3 m (10 ft) wide. Site operated from 1950 to 1953. Waste disposed at the site was estimated at 21.2 metric tons (23.4 tons). The principal radionuclide was short-lived tritium. References: WHC-SD-EN-TI-220, WHC-EP-0620.	Solid waste in concrete pipes	H-3, lead, mercury, palladium
118-B-7 Solid Waste Burial Site	Received decontamination materials and assorted equipment from the 111-B Decontamination Facility and workshop from 1951 to 1968. Unlined inactive solid waste burial ground about 2.4 m x 2.4 m x 2.4 m (8 ft x 8 ft x 8 ft) deep. The principal radionuclide was short-lived Co-60. References: WHC-SD-EN-TI-220, DOE-RL 1992, WHC-EP-0620.	Solid waste mixed with soil	Co-60, Ni-63
118-B-10 Ball 3X Storage Tank	Location of a metal tank used to store highly radioactive boron-steel and carbon-steel balls. Tank is believed to be empty. During the demolition of the 115-B/C Gas Recirculation Building, the ventilation tunnel to the B Reactor building was not demolished because this waste site is located on top of the tunnel. Site is 14.6 m x 5.5 m x 6.1 m (48 ft x 18 ft x 20 ft) deep. Operation dates unknown. Reference: WHC-SD-EN-TI-220.	Buried storage tank may contain solid waste	Co-60, Ni-63

Table A-1. Area Burial Ground Descriptions. (6 Pages)

Site Name	Current Site Knowledge	Media/ Material	Potential Contaminants
118-C-1 105-C Solid Waste Burial Ground	Primary burial ground for general wastes from the operation of the 100-C Reactor. Received process tubes, aluminum fuel spacers, control rods, reactor hardware, and soft wastes from the 100-C Reactor building from 1953 to 1969. Estimated to contain 86 metric tons (94.8 tons) of boron, 1.1 metric tons (1.2 tons) of graphite, 0.51 metric tons (0.56 tons) of lead, 21.6 metric tons (23.8 tons) of lead/cadmium, and 96 metric tons (105.9 tons) of other materials. Solid waste was buried in trenches and pits in a trapezoidal area 156 m x 122 m x 6.1 m (510 ft x 400 ft x 20 ft) deep. The principal radionuclide was long-lived Ni-63. References: WHC-SD-EN-TI-220, WHC-EP-0620.	Solid waste mixed with soil	H-3, C-14, Co-60, Ni-63, Sr-90, Ag-108m, Cs-137, Eu-152, Eu-154, cadmium, lead, mercury
118-C-2 105-C Ball Storage Tank	Used in 1969 for disposal of 9,000 kg (19,800 lb) of highly activated boron steel and carbon steel balls in their storage tank. Storage tank was buried under several feet of clean fill and has a shielding mound about 0.6 m (2 ft) above ground level. Site dimensions are 2.1 m x 2.1 m (7 ft x 7 ft) deep. References: WHC-SD-EN-TI-220, WHC-EP-0620, DOE/RL-94-65.	Solid waste in a buried storage tank	Co-60, Ni-63
600-33 105-C Reactor Test Loop Burial Site	Site contains a single trench that received an irradiated stainless-steel double tube (test loop) about 6.1 m (20 ft) long, 12.2 m (40 ft) of contaminated carbon steel shielding pipe, and about 305 m (1,000 ft) of cable used to remove the test loop from C Reactor in 1963. Trench was approximately 6.1 m x 6.1 m x 3 m (20 ft x 20 ft x 10 ft) deep. Reference: WHC-SD-EN-TI-220.	Solid waste mixed with soil	Co-60, Ni-63
100-D-5 Undocumented waste site near 103-D	Received contaminated soil and pipe from the tie-in of 100-D and 100-DR effluent lines during 1950. Trench was approximately 3 m x 3 m x 4.6 m (10 ft x 10 ft x 15 ft) deep, located north of the 105-D Reactor building and east of the 103-D Building. Operated in 1950. Material was covered with at least 0.6 m (2 ft) of soil and a concrete cap. Reference: WHC-SD-EN-TI-181.	Solid waste mixed with soil	Co-60, Ni-63, Sr-90, Cs-137, Eu-152, Eu-154, U-238, Pu-238, Pu-239/240, chromium, lead, mercury
100-D-6 (118-D-4D) Buried VSR Thimble Site 4D	Received contaminated VSR thimbles, guides, and miscellaneous waste removed from 105-D Reactor during the Ball 3X project in 1953. Irregularly shaped pit with side lengths of 43 m x 46 m x 17 m x 18.6 m (140 ft x 153 ft x 56 ft x 61 ft) x 7.6 m (25 ft) deep. Solid waste was covered with 1.5 m (5 ft) of clean soil. Isotopic analysis found Mn-54 and Co-60 in aluminum process tubes that are similar to VSR thimbles but the short half-life of Mn-54 (0.85 yr) makes it unlikely to be present. Reference: WHC-SD-EN-TI-181.	Solid waste mixed with soil	Co-60, Ni-63
100-D-32 Minor Construction Burial Ground No. 6	Received contaminated materials and equipment from 100-D/DR Reactor effluent system modifications. The burial pit was 15.2 m x 15.2 m x 7.6 m (50 ft x 50 ft x 25 ft) deep, including a 1.5 m (5 ft) cover depth. Operated in 1956. Reference: WHC-SD-EN-TI-181.	Solid waste mixed with soil	Co-60, Ni-63, Sr-90, Cs-137, Eu-152, Eu-154, U-238, Pu-238, Pu-239/240, chromium, lead, mercury
100-D-33 Minor Construction Burial Ground No. 4	Used for the disposal of low-level construction wastes from modifications to the reactors. The site was 30.5 m x 15.2 m x 7.6 m (100 ft x 50 ft x 25 ft) including a cover depth of 1.5 m (5 ft). Operated in 1954. Reference: WHC-SD-EN-TI-181.	Solid waste mixed with soil	Co-60, Ni-63
100-D-35 Minor Construction Burial Ground No. 1	Burial ground used for the disposal of 100-D Reactor thimbles, rod guides, and miscellaneous waste during the Ball 3X conversion. Burial ground measured 30.5 m x 15.2 m x 7.6 m (100 ft x 50 ft x 25 ft) deep. Operated in 1954. Reference: WHC-SD-EN-TI-181.	Solid waste mixed with soil	Co-60, Ni-63
100-D-40 Minor Construction Burial Ground #5 Hole	Received solid wastes from 100-D/DR Reactor alterations. Site is described as a 12.2-m (40-ft)-diameter pit, 6.1 m (20 ft) deep. Operated in 1956. Reference: WIDS.	Solid waste mixed with soil	Co-60, Ni-63

Table A-1. Area Burial Ground Descriptions. (6 Pages)

Site Name	Current Site Knowledge	Media/ Material	Potential Contaminants
100-D-41 (118-D-18) Construction Burial Ground	Received radioactive and nonradioactive materials from 100-D/DR Reactor alterations. Site was 12.2 m x 12.2 m x 7.6 m (40 ft x 40 ft x 25 ft) deep and was covered with 1.5 m (5 ft) of material. Operated in 1956. Exact location of this solid waste site is uncertain. Reference: WHC-SD-EN-TI-181.	Solid waste mixed with soil	Co-60, Ni-63
100-D-43 (118-D-4C) Buried VSR Thimble Site 4C	Received a VSR thimble removed from D Reactor. Site is believed to contain two trenches in an area 21.4 m x 7.6 m x 4.6 m (70 ft x 25 ft x 15 ft) deep. Operation dates unknown. Reference: WHC-SD-EN-TI-181.	Solid waste mixed with soil	Co-60, Ni-63
100-D-45 (118-D-4B) Buried VSR Thimble Site	Received radioactive and nonradioactive solid wastes from 100-D/DR Reactor alterations. Believed to contain a VSR thimble. Stated site dimensions are 24.7 m x 7.3 m x 5.2 m (81 ft x 24 ft x 17 ft) deep. Exact location of burial site is uncertain. References indicate it was part of the 118-D-4 Burial Ground site. Operation dates unknown. Reference: WIDS.	Solid waste mixed with soil	Co-60, Ni-63
100-D-46 (118-D-4A) Burial Ground 4A	Received radioactive and nonradioactive solid wastes from 100-D/DR Reactor alterations. Stated site dimensions are 45.8 m x 6.1 m x 7.6 m (150 ft x 20 ft x 25 ft) deep. Exact location of burial site is uncertain. References indicate the site was contiguous with the 118-D-4 Burial Ground site and under the 116-D-1A and 116-D-1B Trenches. Operation dates unknown. The principal radionuclide was short-lived Co-60. Reference: WIDS.	Solid waste mixed with soil	Co-60, Ni-63
100-D-47 Construction Burial Ground 4E (118-D-4E)	Received solid wastes from 100-D/DR Reactor alterations. Stated site dimensions are 69.5 m x 57 m x 7.6 m (228 ft x 187 ft x 25 ft) deep. Operation dates unknown. Reference: WIDS.	Solid waste mixed with soil	Co-60, Ni-63
118-D-1 100-D Burial Ground No. 1	Burial ground for the disposal of irradiated reactor parts, dummies, thimbles, rods, gun barrels, and other contaminated solid wastes. Operated from 1944 to 1967. Received approximately 10,000 m^3 (13,079 yd^3) of wastes. Site was divided into four sections with many north-south trenches, measuring 91.5 m x 6.1 m x 6.1 m (300 ft x 20 ft x 20 ft) deep, with 6.1-m (20-ft) spacing between them. Overall site dimensions were 137.3 m x 114.4 m (450 ft x 375 ft). The principal radionuclide was short-lived Co-60. References: WHC-SD-EN-TI-181, WHC-EP-0620, MCACES.	Solid waste mixed with soil	H-3, C-14, Co-60, Ni-63, Sr-90, Ag-108m, Cs-137, Eu-152, Eu-154, cadmium, lead, mercury
118-D-2 100-D Burial Ground No. 2	Primary burial ground for the disposal of 100-D Reactor operation waste. Received an estimated 10,000 m^3 (13,079 yd^3) of solid wastes including irradiated dummies, splines, rods, thimbles, and gun barrels. Operated from 1949 to 1970. Site was divided into four sections with overall dimensions of 305 m x 109 m x 7.6 m (1,000 ft x 357 ft x 25 ft) deep. Contains many east-west trenches and five disposal pits. Soil beneath the site may be contaminated as a result of large quantities of water used to extinguish a fire during the 1960s. The principal radionuclide was long-lived Ni-63. References: WHC-SD-EN-TI-181, WHC-EP-0620, MCACES.	Solid waste mixed with soil	H-3, C-14, Co-60, Ni-63, Sr-90, Ag-108m, Cs-137, Eu-152, Eu-154, cadmium, lead, mercury
118-D-3 100-D Burial Ground No. 3	Primary burial ground for the disposal of 100-DR Reactor operation waste. Received an estimated 10,000 m^3 (13,079 yd^3) of solid wastes including irradiated dummies, splines, rods, thimbles, and gun barrels. Operated from 1956 to 1973. Site also contained a burning pit used for the disposal of low-level radioactive combustible materials. Site was divided into five sections containing several unequally spaced trenches, 61 m x 6.1 m x 7.6 m (200 ft x 20 ft x 25 ft) deep. The principal radionuclide was short-lived Co-60. References: WHC-SD-EN-TI-181, WHC-EP-0620, MCACES.	Solid waste mixed with soil	H-3, C-14, Co-60, Ni-63, Sr-90, Ag-108m, Cs-137, Eu-152, Eu-154, cadmium, lead, mercury

Table A-1. Area Burial Ground Descriptions. (6 Pages)

Site Name	Current Site Knowledge	Media/ Material	Potential Contaminants
118-D-4 Construction Burial Ground	Burial ground received an estimated 20,000 m^3 (26,158 yd^3) of waste materials, primarily reactor components and hardware from special project-type maintenance. The construction waste contained low-level contamination. Operated from 1953 to 1967. Site contained many nonuniform trenches and had overall dimensions of 183 m x 61 m x 7.6 m (600 ft x 200 ft x 25 ft) deep. The principal radionuclide was short-lived Co-60. References: WHC-SD-EN-TI-181, WHC-EP-0620, MCACES.	Solid waste mixed with soil	C-14, Co-60, Ni-63, cadmium, lead
118-D-5 Ball 3X Burial Ground	Burial ground received thimbles from the 105-DR Reactor during the Ball 3X Project in 1954. Site contained two parallel trenches 12.2 m x 6.1 m x 4.6 m (40 ft x 20 ft x 15 ft) deep. The principal radionuclide was short-lived Co-60. References: WHC-SD-EN-TI-181, WHC-EP-0620.	Solid waste mixed with soil	Co-60, Ni-63
118-DR-1 105-DR Gas Loop Burial Ground	Test loop burial ground received about 20 m^3 (26 yd^3) of irradiated stainless-steel assemblies. Originally a gunnite-lined trench used to perform examination and sectioning of test assemblies. Operated from 1963 to 1964. Later, used for the disposal of irradiated metal assemblies from the 105-DR gas loop. Site was 38.1 m x 22.9 m x 8.8 m (125 ft x 75 ft x 29 ft) deep. The principal radionuclide was short-lived Co-60. References: WHC-SD-EN-TI-181, WHC-EP-0620, MCACES.	Solid waste mixed with soil	Co-60, Ni-63
126-D-2 184-D Coal Pit	Former coal storage area used as a demolition and excess material dump for the 100-D and 100-N Areas from the 1970s through 1986. Waste burial site is approximately 122 m x 68.6 m x 6.1 m (400 ft x 225 ft x 20 ft) deep. The location is 91.5 m (300 ft) north of the 183-D Water Treatment Facility. Suspected of containing hazardous materials including low-level radioactive waste because of uncontrolled dumping. Site has been observed to contain wood, asbestos, paint cans, dry chemicals, welding materials, solvent cans, oil drums, acid drums, creosote drums, herbicide cans, and other solid wastes. Some of the waste materials were removed in 1983 and 1984 and backfill was added. Reference: WHC-SD-EN-TI-181.	Solid waste mixed with soil	Chromate, lead, undetermined organic and inorganic chemicals
126-DR-1 190-DR Clearwell Tank Pit	Former site of four 14.2 x 10^6 L (3,750,000-gal) water storage tanks. The tanks were removed during the 1970s and the site became a D&D burial ground. Waste burial site is 160 m x 12.8 m x 6.1 m (525 ft x 42 ft x 20 ft) deep and occupies about 25% of the clearwell pit. Location is directly east of the 183-DR Water Treatment Facility and about 366 m (1,200 ft) southwest of the 105-DR Reactor building. Received D&D rubble, including pipe insulation containing asbestos. Suspected of containing hazardous materials including low-level radioactive waste because of uncontrolled dumping. Site has been observed to contain paint and solvent cans, oil drums, sodium dichromate crystals, alum, creosote drums, herbicide cans, carbon tetrachloride containers, methanol containers, acetone containers, welding materials, laboratory glassware, furniture, and other solid wastes. The site may contain chromates in both the soil and underground piping because of the use of chromates in water treatment. Reference: WHC-SD-EN-TI-181.	Solid waste mixed with soil	Chromate, lead, undetermined organic and inorganic chemicals
100-F-20, PNL Parallel Pits	Two parallel earthen trenches used for disposal of radioactive and nonradioactive wastes from the 100-F Area experimental animal farm. Overall site dimensions are 80 m x 55 m x 6.1 m (262 ft x 180 ft x 20 ft) deep. The GPR and EMI investigations suggest that a significant portion of the debris in the northern trench is metallic. It is believed that the northern trench received non-radioactive experimental animal farm wastes including hardware, lumber, and soft materials. The southern pit may have received radioactively contaminated animal feces and pen sweepings. Operation dates unknown. Reference: DOE/RL-94-65, Appendix L; MCACES.	Solid waste mixed with soil. May include sawdust and animal wastes	Co-60, Sr-90, Pu-239/240
118-F-1, Burial Ground No. 1	Primary solid waste burial ground for the 100-F Area. Site received approximately 20,000 m^3 (26,158 yd^3) of wastes during its operation from 1954 to 1965 consisting of radioactive material and reactor components from the 100-F Reactor. Site contained two north/south trenches, 183 m x 152.5 m x 6.1 m (600 ft x 500 ft x 20 ft) deep. Currently covered with 0.6 m (2 ft) of soil. The principal radionuclide was long-lived Ni-63. References: BHI-00031, WHC-EP-0620.	Solid waste mixed with soil	H-3, C-14, Co-60, Ni-63, Sr-90, Ag-108m, Cs-137, Eu-152, Eu-154, cadmium, lead, mercury

Table A-1. Area Burial Ground Descriptions. (6 Pages)

Site Name	Current Site Knowledge	Media/ Material	Potential Contaminants
118-F-2, Burial Ground No. 2	Received approximately 10,000 m^3 (13,079 yd^3) of low-level radioactive material, including waste generated during maintenance to the reactor effluent system and waste from biological experiments. Operated from 1945 to 1965. Prior to its being backfilled during 1965, the site contained eight trenches of waste from the 105-F Reactor building and one trench of waste from the biology facilities. The site was 112.2 m x 99.4 m x 6.1 m (368 ft x 326 ft x 20 ft) deep. Individual trenches were 76.3 m (250 ft) long and 6.1 m (20 ft) wide. The site is stated to contain low levels of radionuclides. References: BHI-00031, WHC-EP-0620.	Solid waste mixed with soil	Co-60, Ni-63, Sr-90, Cs-137, Eu-152, Eu-154, U-238, Pu-238, Pu-239/240, chromium, lead, mercury
118-F-3, Burial Ground No. 3	Received irradiated parts from the Ball 3X Project at the 100-F Reactor during 1952. Waste was primarily VSR thimbles and step plugs. Site was 53.4 m x 15.3 m x 4.6 m (175 ft x 50 ft x 15 ft) deep. Received about 10 m^3 (13.1 yd^3) of waste prior to being backfilled with clean soil. Thirty-eight thimbles are known to have been buried there and possibly as many as 61. The principal radionuclide was short-lived Co-60. References: BHI-00031, WHC-EP-0620.	Solid waste mixed with soil	Co-60, Ni-63
118-F-5, PNL Sawdust Pit	Received sawdust contaminated with radioactive material from the animal pens at the experimental animal farm from 1954 to 1975. Site measured 152.5 m x 45.8 m x 4.6 m (500 ft x 150 ft x 15 ft) deep. Approximately 7,646 m^3 (10,000 yd^3) of sawdust containing Sr-90 and Pu-239 were disposed at this site. Materials were placed in paper boxes or 208-L (55-gal) metal drums for burial. The site was later backfilled and stabilized with about 1 m (3-4 ft) of clean soil. References: BHI-00031, WHC-EP-0620.	Solid waste, sawdust, and animal wastes mixed with soil	Co-60, Sr-90, Pu-239/240
118-F-6 PNL Solid Waste Burial Ground	Received approximately 10,000 m^3 (13,079 yd^3) of biological waste from animal research studies. Operated from 1965 to 1973. Site contained two rail tank cars and a waste disposal area. Overall dimensions were 122 m x 61 m x 6.1 m (400 ft x 200 ft x 20 ft) deep. Solid waste was covered with about 1 m (2 to 3 ft) of soil. The site contains small amounts of Co-60, Sr-90, and Pu-239/240. References: BHI-00031, WHC-EP-0620.	Biological wastes and solid waste mixed with soil	Co-60, Sr-90, Pu-239/240
118-F-7 Burial Ground/ Hardware Storage Vault	Below-ground concrete vault 4.9 m x 2.4 m x 2.4 m (16 ft x 8 ft x 8 ft) deep with a wooden lid, located a few meters south of the 100-F Reactor building, south of the security fence. Used from 1945 to 1965 for temporary storage of slightly contaminated reactor parts and mixed wastes. Use of the vault was discontinued after shutdown of the 100-F Reactor in 1965 but it continues to hold an inventory of waste material including 134.3 metric tons (148 tons) of lead and 5.4 metric tons (6 tons) of cadmium. The radionuclide inventory is listed in BHI-00031. The principal radionuclide was short-lived Co-60. References: BHI-00031, WHC-EP-0620.	Solid waste in a concrete vault below ground	Co-60, Ag-108m, cadmium, lead
118-F-9 PNL Rad Site	Received miscellaneous solid wastes from animal research studies at the experimental animal farm. Burial ground dimensions are 30.5 m x 4.6 m x 4.6 m (100 ft x 15 ft x 15 ft) deep. Site is located in the southeastern corner of the 126-F-1 ash pit. Operation dates unknown. Reference: BHI-00031.	Animal wastes, sawdust, and solid waste mixed with soil	Co-60, Sr-90, Pu-239/240
118-H-1 100-H Burial Ground No. 1	Primary solid waste burial ground for the 100-H Area. Received approximately 10,000 m^3 (13,079 yd^3) of wastes during its operation from 1949 to 1965. The wastes included process tubing, contaminated lead brick, dummy fuel elements, and miscellaneous hardware. Site dimensions are 213.5 m x 106.8 m x 7.6 m (700 ft x 350 ft x 25 ft) deep. The site contains trenches and pits. Currently the site is covered with about 1 m (3 ft) of soil. The principal radionuclide was long-lived Ni-63. References: BHI-00127, WHC-EP-0620, MCACES.	Solid waste mixed with soil	H-3, C-14, Co-60, Ni-63, Sr-90, Cs-137, Eu-152, Eu-154, cadmium, lead, mercury
118-H-2 100-H Burial Ground No. 2	Two concrete vaults, one containing an irradiated stainless-steel double tube and the other contaminated pipe. Site dimensions are 42.7 m x 30.5 m x 4.6 m (140 ft x 100 ft x 15 ft) deep. Operated from 1955 to 1965. The void space of both vaults has been filled with gravel. The site contains short-lived radionuclides. References: BHI-00127, WHC-EP-0620.	Solid waste in gravel-filled concrete vaults.	Co-60, Ni-63

Table A-1. Area Burial Ground Descriptions. (6 Pages)

Site Name	Current Site Knowledge	Media/ Material	Potential Contaminants
118-H-3 Construction Burial Ground	Received approximately 3,000 m^3 (3,924 yd^3) of reactor components and hardware from 100-H Reactor modification programs. Operated from 1953 to 1957. Site was 91.5 m x 61 m x 7.6 m (300 ft x 200 ft x 25 ft) deep with two or three trenches. Currently backfilled with about 2 m (6 ft) of soil. The principal radionuclide was short-lived Co-60. References: BHI-00127, WHC-EP-0620, MCACES.	Solid waste mixed with soil	Co-60, Ni-63
118-H-4 Ball 3X Burial Ground	Received solid waste from the Ball 3X Project during 1953. Waste burial site was a single trench in an area 45.8 m x 9.2 m x 4.6 m (150 ft x 30 ft x 15 ft) deep that was backfilled with about 1.5 m (5 ft) of clean soil. It is believed that 55 VSR thimbles were buried at the site along with irradiated materials from the 100-H Reactor building. The principal radionuclide was short-lived Co-60. References: BHI-00127, WHC-EP-0620, MCACES.	Solid waste mixed with soil	Co-60, Ni-63
118-H-5 Thimble Pit	Received a single experimental thimble assembly during 1953 and was backfilled to grade. Reopened during 1960 and received contaminated soil from the 105-H pluto crib site. Waste burial site was 9.2 m x 0.6 m x 3 m (30 ft x 2 ft x 10 ft) deep. References: BHI-00127, WHC-EP-0620, WIDS.	Solid waste mixed with soil	Co-60, Ni-63, Sr-90, Cs-137, Eu-152, Eu-154, U-238, Pu-238, Pu-239/240, chromium, lead, mercury
118-K-1 100-K Burial Ground	Received an estimated 10,000 m^3 (13,079 yd^3) of solid waste materials from the 100-K and 100-N Areas. Operated from 1953 to 1975. Site contains numerous trenches and pits of various sizes. Overall site dimensions are 366 m x 183 m x 6.1 m (1,200 ft x 600 ft x 20 ft) deep. Site has six vertical silos, each 3-m (10-ft) diameter and 7.6-m (25-ft) deep, that were used to hold reactor hardware having high dose rates. Site also contains a waste incinerator, which was built over an ash pit and later buried in the site. The principal radionuclide was long-lived Ni-63. References: WHC 1994b, WHC-EP-0620.	Solid waste mixed with soil	H-3, C-14, Co-60, Ni-63, Sr-90, Cs-137, Eu-152, Eu-154, cadmium, lead, mercury
118-K-2 (100-K-2) Sludge Burial Ground	Reportedly received sludge from the 116-KE-4 and 116-KW-3 Retention Basins. The GPR investigation showed a pipeline running through the area. Reported site dimensions are 53.4 m x 18.3 m x 4.6 m (175 ft x 60 ft x 15 ft) deep. Operation dates unknown. References: WHC-SD-EN-TI-239, DOE/RL-92-11.	Solid waste mixed with soil	Co-60, Sr-90, Cs-137, Eu-152, Eu-154, Th-228, Th-232, U-233/234, U-238, Pu-239/240, chromium, lead, mercury

D&D = decontamination and demolition
WIDS = Waste Information Data System (database)
MCACES = Micro Computer-Aided Cost Estimating System
GPR = ground-penetrating radar
EMI = electromagnetic induction

APPENDIX B

RESPONSIVENESS SUMMARY

PUBLIC COMMENT RESPONSES
100 AREA BURIAL GROUND PROPOSED PLAN

I RESPONSIVENESS SUMMARY OVERVIEW

The Hanford Site is located in southeastern Washington. For more than 40 years, the Site produced plutonium for the nation's defense program. Nine uranium-fueled, graphite-moderated, water-cooled, plutonium-production reactors were constructed by the U.S. Government along the Columbia River in the 100 Area of the Hanford Site during the 20-year period from 1943 to 1963. With the exception of the N Reactor (the last reactor constructed), the reactors' operations and the associated wastes and waste disposal practices were similar. Direct land burial in excavated trenches, termed "burial grounds," was used to dispose of solid low-level radioactive materials associated with reactor operations (e.g., equipment and structural debris). Each reactor area (except the 100-N Area) includes burial grounds containing irradiated reactor hardware and other solid waste materials incidental to facility operations, mixed with soil. Each reactor area also has specialty burial grounds where wastes from reactor alterations or other specific activities (e.g., biological research and facility construction) were disposed. These burial grounds range in depth from 2.1 m (7 ft) to 8.8 m (29 ft).

The 100 Area Burial Grounds' contents (i.e., contaminated hard waste and associated contaminated soil) could present a direct exposure concern to human health and the environment through intrusion or biotic uptake. With the possible exception of the 118-F-2 Burial Ground, where the bottom of the burial ground is at or near the maximum recorded water table elevation, no releases of contaminants to groundwater are known to have occurred. This is due to the lack of sufficient water to act as a soil-to-groundwater driving force and the immobile, insoluble nature of the waste in the 100 Area Burial Grounds.

II BACKGROUND ON COMMUNITY INVOLVEMENT AND CONCERNS

The public has been involved in the cleanup of the Hanford Site since the *Hanford Facility Agreement and Consent Order* was signed in 1989. Since 1989, a number of stakeholder working groups and task forces have been used to enhance decision making at the Hanford Site. In January 1994, the Hanford Advisory Board was formed to provide informed advice to DOE, EPA, and Ecology. To date, the board has issued over one hundred pieces of advice, several of which directly relate to 100 Area Cleanup.

III SUMMARY OF MAJOR QUESTIONS AND COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND THE AGENCY RESPONSE TO THOSE COMMENTS

Comments received during the public comment period are presented in this section. Responses to the comments follow each comment. Copies of all comment letters are located in the Administrative Record.

Hanford Advisory Board

1. **Comment:** The HAB believes that this proposed plan is consistent with our previous advice. We support the remove, treat, dispose option for the 100 Area burial grounds.

   Response: The Tri-Parties appreciate the support from the Board. We look forward to continued interaction with the Board regarding 100 Area cleanup and other Hanford cleanup issues.

Gerald Pollet/Heart of America Northwest

1. **Comment:** Additional workshops are needed to discuss and adopt exposure scenarios for risk assessments conducted for the Hanford Site.

   Response: The Tri-Parties held a number of workshops in 1999 to receive public input to the risk assessment (exposure scenario) process. Several changes were made to the 100 Area exposure scenario based on these workshops, including inhalation rate and fish consumption. These changes will be used in assessing the cleanup. In addition, a baseline risk assessment for the 100 Areas will be completed prior to selection of a final remedy. The Tri-Parties welcome a continued dialogue regarding the exposure scenario and at this time plan to work with the Hanford Advisory Board, Environmental Restoration Committee.

2. **Comment:** The exposure scenario comments from the 1999 workshops were not incorporated into the Maximum Reasonable Exposure Scenario used for the 100 Area Burial Ground Focused Feasibility Study.

   Response: The risk exposure comments provided through the 1999 workshops resulted in several changes to the exposure scenario as described above.

3. **Comment:** The ResRad model default assumptions for the Maximum Reasonable Exposure Scenario are significantly less than the MTCA default assumptions and about ten times less than the assumptions presented by the Columbia River Inter-Tribal Fish Commission. ResRad should be run using MTCA inputs and maximum reasonable exposure scenarios that protect individuals. The 1:100,000 threshold should be the basis for decision-making for all carcinogens (radioactive and non-radioactive results should not be separated).

Response: The 100 Area Burial Ground FFS followed current Tri-Party, EPA Region 10, and Hanford Site Risk Assessment Methodology (HSRAM) guidance for risk evaluations. Where appropriate MTCA input parameters were used. The Tri-Parties have not received comments from the Columbia River Inter-Tribal Fish Commission regarding fish consumption assumptions.

4. **Comment:** The focused feasibility study (FFS) fails to meet the basic requirements of the TPA, CERCLA, and MTCA.

   Response: The FFS was developed using TPA, CERCLA, and MTCA guidance. Based on this comment, the FFS was reviewed and several changes were made to assure the FFS is consistent with the proposed plan. These revisions did not result in any change to the preferred alternative.

5. **Comment:** The Focused Feasibility Study and Proposed Plan for the 100 Area Burial Grounds should be re-examined in light of the designation of the Hanford Reach of the Columbia River as a National Monument.

   Response: The FFS addressed potential exposures and risks associated with the 100 Area Burial Grounds for "restricted" and "unrestricted" land uses and protection of groundwater and the Columbia River. These potential land uses cover a broad range of potential human and ecological exposures. The National Monument status for the Hanford Reach of the Columbia River falls within the exposure scenarios evaluated.

6. **Comment:** The focused feasibility study fails to meet SEPA and NEPA requirements.

   Response: The FFS addressed NEPA requirements as part of the CERCLA criteria evaluation (per DOE Order 451.1A). Issues or potential impacts not included in the CERCLA criteria discussion were covered in Section 6.3 of the FFS.

7. **Comment:** Lessons learned from the 300 Area Burial Grounds (618-4 in particular) need to be applied to the 100 Area Burial Grounds. More information is needed regarding the contamination present, the potential for groundwater contamination, and worker protection requirements (especially for radioactive contaminants).

   Response: The data/information available for the 100 Area Burial Grounds was adequate to develop remedial alternatives that address potential human and ecological risks. Most of the material disposed to the burial grounds is expected to be radioactive solid waste. The impact to groundwater from these sites is expected to be far less significant than the liquid waste sites currently under

remediation and will be verified as data is collected during waste site cleanup. Lessons learned from the 300 Area Burial Grounds have been included in the discussions of worker safety requirements for the remove/treat/dispose and containment alternatives (see Sections 6 and 7 of the FFS) and will be revisited during remedial design.

8. **Comment:** The FFS has not addressed potential harm to listed species (e.g., salmon and steelhead) using the Hanford Reach of the Columbia River. If 100 Area Burial Ground releases communicate with the Columbia River, it is considered a contaminant discharge to critical habitat under the Clean Water Act. The Department of Energy and the EPA must show that potential releases would result in no harm to listed species.

   Response: The Endangered Species Act and the Clean Water Act are identified in the FFS and in this ROD as applicable ARARs. One of the primary objectives of these cleanup actions is to assure protection of aquatic species in the Columbia River. The alternatives in the FFS and this remedy address groundwater protection and monitoring to ensure Columbia River protection by removing the source of contaminants from along the river and disposing of the waste in the Environmental Restoration Disposal Facility in the central part of Hanford.

9. **Comment:** The assertion that protecting human health will also protect ecological receptors is incorrect. Many contaminants have ecological cleanup concentrations that are lower than human health protection standards.

   Response: It is true that many contaminants have ecological cleanup concentrations that are lower than human health protection standards. Cleanup levels have been established based on ecological receptors where appropriate.

10. **Comment:** The total cancer risk must be the sum of radioactive and non-radioactive contaminants. The remedial action levels must meet MTCA criteria for total cancer risk.

    Response. The Tri-Party Agencies agree. Section VIII, Remedial Action Objectives, states that the MTCA method B limits for inorganics and organics are being used. MTCA does not address external exposure from ionizing radiation, which is the predominant risk driver in the 100 Area. Therefore, remediation levels for radionuclides have been set at a total exposure of 15 mrem/yr, which is at least as stringent as all applicable state and federal laws.

11. **Comment:** The new data from the Risk Assessment Corporation and the Rocky Flats Soil Action Level Oversight Panel should be used regarding exposure assumptions, flaws in the ResRad model and its default exposure assumptions, and the need to remediate based on fire as an exposure path.

Response: EPA is familiar with recommendations of the Rocky Flats Soil Action Oversight Panel and their recommendation to adopt an exposure scenario of a resident rancher and a fire scenario. Suggested cleanup levels are very similar to those being used in the 100 Area cleanup, and our opinion is that the 100 Area cleanup standards are protective under a wildfire scenario, since the contaminant source will be removed and replaced with clean backfill.

12. **Comment:** The 100 and 300 Areas must have fencing and clear signage warning of the health hazard from remediation and chemical waste contamination to prevent exposure for people on the river or on paths along the river bank. "No trespassing" signs are not adequate. Soil must not be staged outside the exclusion zone.

Response: The Tri-Parties agree. Efforts are underway to place signage along the river shore warning the public of potential dangers. In addition, this ROD requires extensive institutional controls to be in place to protect the public as well as site workers from 100 Area contaminants. The Tri-Parties agree that it is generally preferable to stage contaminated soil within the area of contamination. In certain situations, it may be necessary to allow the use of temporary staging areas outside the area of contamination in order to accommodate efficient cleanup. In such cases, staging will be done in accordance with all applicable or relevant and appropriate regulatory requirements.

13. **Comment:** Site by site analyses without a cumulative impact assessment for the same facilities is not appropriate.

Response: The FFS addressed each site individually and assumed that all 45 burial grounds would be individually remediated to address potential site risks. After all cleanup is completed in the 100 Area, a baseline risk assessment will be performed to address any residual risks.

Greg DeBruler/Cindy DeBruler (Columbia River Keepers)

1. **Comment:** Thank-you for deciding to remove/treat/dispose the 100 Area burial ground wastes. I hope that all 100 Area and 300 Area waste sites are remediated in this manner.

Response: The plan is to continue the remedy of remove, treat and dispose for the remaining soil waste sites in the 100 and 300 Area.

2. **Comment:** The exposure scenario comments from the 1999 workshops were not incorporated into the Maximum Reasonable Exposure Scenario used for the 100 Area Burial Ground Focused Feasibility Study, and there is no mechanism now for getting additional comments from the workshop attendees. This shows a serious failure in the Hanford cleanup public involvement process.

   Response: The Tri-Parties held a number of workshops in 1999 to receive public input to the risk assessment (exposure scenario) process. Based on these workshops, several changes were made to the 100 Area exposure scenario, including inhalation and fish consumption assumptions that will be used to assess these cleanups. In addition, the public had the opportunity to provide comments on the proposed plan for this action. A fact sheet, which explained the proposed action and informed the public that they could request a public meeting, was mailed to approximately 2,000 people. In addition, an article appeared in the bi-monthly newsletter, the *Hanford Update*, detailing the start of public comment. The *Hanford Update* is mailed to over 4,000 people. The Proposed Plans were made available to members of the Hanford Advisory Board. A public meeting was held on June 15, 2000, in Hood River, Oregon, to discuss the cleanup.

Comments from Private Citizens

1. **Comment:** We should develop the appropriate use of nuclear products so the population can reap a financial benefit instead of nuclear waste being a continual drain on our resources. I see little risk to the environment from these waste sites.

   Response: A goal of the FFS was to identify cost-effective remedial actions that could achieve the remedial action objectives and were contingent on potential future land uses at the Hanford Site. The risk estimates presented were developed from available contaminant data for the burial grounds and show that actions are warranted to be protective of human health and the environment.

2. **Comment:** First, I would like to respond to the concept of a streamlined approach for cleanup of the 100 Area. Lumping all of the burial grounds under one planning document was a very forward thinking process. I am hopeful that we will see a much more accelerated schedule for remediation of all of the sites using this strategy.

   I want to see this framework utilized in coordinating the Science and Technology needs for characterization and remediation of these burial grounds. Concurrently, budgetary needs to address this cleanup should be quantified iteratively such that like waste sites are aligned back-to-back for remediation. This could assure the continuity of trained workers who will move progressively through the work to be remediated without "down time" brought on by poor coordination of effort or lack of budget.

Response: It is our plan to incorporate these aspects of the 100 Area Burial Ground approach into future CERCLA decision documents and cleanup activities. The current approach to cleanup of the 100 Area waste sites is to address high priority liquid sites first since they are considered major risk drivers. These sites will be cleaned up soon, and the concept of back-to-back remediation (i.e. reactor Area by reactor Area) will be pursued.

3. **Comment:** Top priority, for me, is the path of Remove, Treat, Dispose for these burial sites. Bounded by milestones through the TPA process, the public can have assurance that the work will meet CERCLA, RCRA, MTCA, and NEPA law.

   Response: We agree with your assessment, and cleanup schedules and milestones will be established under the TPA.

4. **Comment:** The potential for future catastrophic flooding seems low. I believe, though, that we have the moral obligation to mitigate, to the best technology available, all sites within the 100 Area which could potentially impact future generations of people, animals, and aquatic and plant life in this region either because of flooding or release through other unexpected events.

   Response: A variety of potential burial ground releases (exposure pathways) were assessed through the CERCLA process for a range of potential land uses. The recommended remedial alternative (remove/treat/dispose) is believed to be responsive to all reasonably anticipated contaminant releases.

5. **Comment:** Though I am cognizant of budgetary limitations and the reality of the unretrievability of some of the wastes in the 100 Area, I do not like the idea of leaving in place any waste which has the potential of impacting the groundwater and thus the Columbia River in the future. The goal should be retrieval, containment, and management of the wastes for as long as necessary to protect human health and the environment.

   Response: The recommended remove/treat/dispose alternative addresses this goal.

6. **Comment:** I cannot underscore enough the importance of setting points of compliance. But setting defensible and sustainable points of compliance is an exercise in futility without adequate characterization. Although the process of mining historical data has had some limited success, I'm not sure that it is worth the payoff over the long term. I don't believe that we have the luxury of time anymore to wait for all documents to be declassified. I think that there is considerable conflict over the reliability and robustness of old data. I believe that we need to rethink this idea of "balance" between data mining and the quest for new data and error on the side of a much more extensive characterization program. Gross errors in analysis will occur when you assume that old data can

be "fit" into new models for analysis when very different calibrations have been used.

Response: While existing data and information were used to evaluate the need for remedial action at the 100 Area Burial Grounds, new data will be collected during and following site remediation to ensure that site remediation is successful and human health and environmental risks have been resolved.

7. **Comment:** Lastly, I am reflecting on a document I saw many years ago now – called "The Lost Sites." It chronicled narratives from workers who remembered "dumping" wastes but could not remember where. It has become common knowledge that there are sets of satellite photographs – from the CIA, of the Hanford site and photographs held by the Department of Transportation. Possibly these should be utilized to further determine the potential for other burial sites?

   Response: EPA has a number of aerial photographs taken over the years and we have reviewed them to look for "Lost Sites." In addition, the Hanford Site has a process for continually addressing new waste sites and/or sites identified from existing records, newly declassified documents, aerial photographs, and inadvertent discoveries during regular reconnaissance activities. All new waste sites identified are addressed in terms of their potential human health/environmental risk and appropriate remedial responses are developed.

8. **Comment:** The subject plan does not take into account the new National Monument designation for portions of the Hanford Site. The designation document makes it clear that once remedial actions are complete those areas of the site not designated for industrial or research and development will become part of the National Monument. As a taxpayer, I request that the Proposed Plan be protective of human health and the environment, but do so in a cost-effective manner.

   Response: The 100 Area Burial Ground evaluation addressed restricted and unrestricted land use at the Hanford Site. This range of uses is addresses land use considerations associated with National Monument status. The remediation options presented represent cost-effective alternatives associated with the land uses assessed.

9. **Comment:** I believe the plan is overly protective of human health and the environment. This is especially true in light of the recent National Monument designation. Being overly protective also equates to inefficient use of tax dollars.

   Response: The risk estimates presented were developed from available contaminant data for the burial grounds and could have uncertainty due to unknown burial ground contaminants. The goal of this action is to allow for future uses of the area and to minimize the need for extensive institutional

controls. The remedial alternatives developed are cost efficient regarding the land uses evaluated (restricted and unrestricted).

10. **Comment:** How many effects are being avoided by this action? Are the industrial risks to the work force greater than the environmental risk avoided by this action? Let's not do at Hanford what other DOE sites have done. Subject workers to risks that result in significant injury or death to avoid a fraction of a hypothetical health effect at a cost of $200 million to the taxpayers. (The $200 million is the current year cost differential between RTD and Combined Options.)

    Response: The potential risks estimated assumed no action and assessed a range of potential exposure scenarios over a range of land uses. Impacts to workers were evaluated for both the remove/treat/dispose option and for the capping option. Short-term impacts to workers are slightly higher for the remove/treat/dispose option due to the potential exposure to contaminants. The work planned will design adequate health and safety protection to ensure that worker safety is preserved.

11. **Comment:** Portions of Hanford are now within the National Monument and other areas destined for similar designation. Under this designation, the Combined Option as outlined in the Focused Feasibility Study (DOE/RL-98-18) provides the required protection to meet protective standards (as summarized on page 12 of DOE/RL-98-18). This is based to the land use restrictions that negate residential uses. The cost associated with the Combined Option, as defined in the DOE/RL-98-18 should also be re-evaluated based on the recreational scenario. A more valid evaluation of the duration of O&M and a re-evaluation of the need for a second cap in 500 years are required to accurately determine the best option.

    Response: A 1,000-year time period is considered to be a reasonable endpoint for modeling based on the following considerations.

    - A 1,000-year time frame has been recognized by several regulatory programs as being long enough to identify health impacts for residual contaminants. Although some long-lived radioactive materials may remain on these sites as part of the cleanup and disposal process, the peak dose occurs in less than 1,000 years for most.

    - When predicting thousands of years into the future, uncertainties become very large because of major potential changes in the geohydrologic regime at the site over long periods of time. When the potential consequences of exposure to the radioactive source are great, as in the case of a high-level waste repository, distant future calculations may provide some insight concerning the relative magnitude of consequences. However, the consequences of exposure to residual radioactivity at levels approaching background are small, and considering the large uncertainties, long-term modeling is considered to be of little value.

- Time frames greater than 1,000 years are considered to be more appropriate for evaluating long-term performance of disposal facilities as opposed to residual contaminants at sites that have undergone a cleanup action.

State of Washington, Department of Fish and Wildlife

1. **Comment:** There has been insufficient biological characterization of the 100 Area Burial Grounds to allow us to determine an appropriate remedial response.

   Response: Remediation is required if human health, groundwater protection, or ecological risk thresholds are exceeded. For the 100 Area burial grounds where contaminant data are available, protection thresholds for human health have been exceeded, and remediation is required. To address potential ecological risks at the burial grounds, remedial alternatives were developed to break viable ecological exposure pathways, thereby protecting wildlife and plant resources.

   The waste sites are currently sprayed with herbicides to control vegetative growth. Harvester ants are the primary organism that resides on or near these burial grounds. Harvester ants from these sites are surveyed periodically to ensure no contamination is being brought to the surface. In addition, annual sampling of plants and animals occurs in the 100 Areas and is documented in the annual Hanford Site Environmental Report produced by the Pacific Northwest National Laboratory.

   Cleanup of these waste sites will employ the observational approach whereby data is collected as the cleanup occurs. This information will be used in a baseline risk assessment in support of a final ROD for the 100 Areas.

2. **Comment:** A portion of the Hanford Site was designated a National Monument by the President of the United States under the authority of the Antiquities Act on 9 June, 2000. The Monument's boundary includes lands on the west bank of the Columbia River. Several of the waste sites may be within this designation. Clean-up actions should be protective of biological resources for which the National Monument was created.

   Response: The remedial alternatives developed for the 100 Area burial grounds were designed to protect human health and the environment.

3. **Comment:** EPA and USDOE need to consult NMFS and U.S. Fish and Wildlife Service on this action under Section 7 of the Endangered Species Act (ESA) to ensure that the proposed action is not likely to jeopardize the continued existence of any listed species. (16 U.S.C. Sec. 1536 (a)(2)).

Response: DOE will consult with NMFS and Fish and Wildlife prior to implementing cleanup at any waste sites that have the potential to impact the river. In addition, 100 Area cleanup is discussed routinely at the Natural Resource Trustee Council meetings. Implementation of the remedial alternatives developed for the 100 Area burial grounds will include design considerations, pre-construction assessments of the sites, and mitigative actions (as appropriate) to ensure that the proposed action would not jeopardize the continued existence of any listed species.

4. **Comment:** WDFW believes that an ecological exposure/assessment is needed to formulate a conceptual model of the burial grounds and to ensure adequate protection of biota.

WDFW believes that the Tri-Parties need to reassess the current characterization approach and re-align with EPA's ecological assessment guidance.

Given the National Monument designation and the President's directive, implementation of an ecological exposure/effects assessment would appear appropriate now at the Hanford Site.

Response: Remediation is required if human health, groundwater protection, or ecological risk thresholds are exceeded. For the 100 Area burial grounds where contaminant data are available, protection thresholds for human health have been exceeded and remediation is required. To address potential ecological risks at the burial grounds, remedial alternatives were developed to break viable ecological exposure pathways, thereby protecting wildlife and plant resources.