*DOE/ID-11359* *Revision 0* *September 2008*

# Record of Decision

# Record of Decision for Radioactive Waste Management Complex Operable Unit 7-13/14

Aerial view of the Radioactive Waste Management Complex, 2007.

**Operable Unit 7-13/14**
**Idaho Cleanup Project**
**Idaho National Laboratory Site**
**Idaho Falls, Idaho**

DOE/ID-11359
Revision 0

# Record of Decision for Radioactive Waste Management Complex Operable Unit 7-13/14

September 2008

Developed by the
U.S. Department of Energy Idaho Operations Office
Idaho Department of Environmental Quality
U.S. Environmental Protection Agency

# PART 1: DECLARATION

## SITE NAME AND LOCATION

Waste Area Group 7, Operable Unit 7-13/14, Comprehensive Remedial Investigation/Feasibility Study for the Radioactive Waste Management Complex

Idaho National Laboratory Site, Scoville, Idaho

CERCLIS ID No. 4890008952; CERCLA Site ID No. 1000305

## STATEMENT OF BASIS AND PURPOSE

This decision document presents the Selected Remedy for Radioactive Waste Management Complex (RWMC) Operable Unit (OU) 7-13/14 at the Idaho National Laboratory Site. The Selected Remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA),[1] as amended by the Superfund Amendments and Reauthorization Act of 1986,[2] and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan.[3] This decision is based on the Administrative Record file for this site.

## ASSESSMENT OF SITE

Response actions selected in this Record of Decision (ROD) are necessary to protect public health, welfare, or the environment from actual or threatened releases of hazardous substances into the environment. Remedial actions selected in this ROD are designed to reduce potential threats to human health and the environment to acceptable levels. In addition, the U.S. Department of Energy (DOE), the U.S. Environmental Protection Agency (EPA), and the Idaho Department of Environmental Quality (DEQ) (the Agencies) have determined that no action is necessary under CERCLA to protect public health, welfare, or the environment at two operable units located in Waste Area Group 7: OU 7-09 (Transuranic Storage Area releases) and OU 7-11 (three septic tanks and associated drainfields). These two operable units do not pose risk to human health or the environment.

## DESCRIPTION OF THE SELECTED REMEDY

OU 7-13/14, the comprehensive remedial investigation and feasibility study for the RWMC, is the final operable unit planned under CERCLA and implemented under the Federal Facility Agreement and Consent Order[4] for Waste Area Group 7. As the comprehensive remedial action for Waste Area Group 7, the Selected Remedy addresses cumulative risk for the entire RWMC. Remedial actions focus on the Subsurface Disposal Area (SDA), the radioactive waste landfill within RWMC. Except for continued operation of the vadose zone vapor vacuum extraction system, initiated under a previous CERCLA decision, the scope of this action focuses on source control of waste buried in the SDA as described below. Agency objectives for remedial action at the SDA are to prevent exposure of humans, plants, and animals to contaminants of concern in buried waste, and to inhibit migration of contaminants of concern (i.e., radionuclides and chemicals) to the Snake River Plain Aquifer.

High organic content waste that contains solvents (e.g., carbon tetrachloride, tetrachloroethylene, and trichloroethylene) comprises principal threat waste. Carbon tetrachloride has been detected at levels slightly above its maximum contaminant level (MCL) in the aquifer. Principal threat waste is largely contained within targeted waste and will be addressed through removal of targeted waste within 5.69 acres and through treatment of vapors by the vapor vacuum extraction system.

The Selected Remedy controls the source by combining targeted waste retrieval and removal of high-concentration organic solvent waste with in situ grouting, continued vadose zone vapor vacuum extraction and treatment, an evapotranspiration surface barrier, and long-term management and control.[a] The estimated cost is $1.3 billion current value ($912.6 million net present value) for direct work and will take about 20 years to complete. The combination of elements in the Selected Remedy provides the best balance of trade-offs among all the alternatives, striking a balance among waste retrieval, expedited installation of a surface barrier, worker safety, and cost. The major components of the Selected Remedy are as follows:

- **Targeted Waste Retrieval—**Retrieving targeted waste and high-concentration organic solvent waste from 5.69 acres of pit areas[b] will reduce inventories of organic solvent waste to address the current threat to the aquifer, transuranic radionuclides to address stakeholder concerns, and uranium radionuclides to address uncertainty. Targeted waste retrieval activities conducted pursuant to this ROD are anticipated to meet the terms of the Agreement to Implement.[5] Removing targeted waste also would reduce risk at the surface if the barrier or institutional controls fail.

- **In Situ Grouting—**In situ grouting of soil vaults and trench areas totaling 0.2 acres will reduce mobility of technetium-99 and iodine-129 to address future threats to the aquifer. The grouting component provides relatively near-term isolation of the waste pending completion of targeted waste retrievals and installation of the surface barrier over the SDA. Grouting and targeted waste retrievals will be implemented concurrently in advance of surface barrier installation.

- **Vadose Zone Vapor Vacuum Extraction and Treatment—**Operating the existing Organic Contamination in the Vadose Zone vapor vacuum extraction and treatment system (OCVZ system) will continue to remove and treat solvents from the vadose zone. Extraction and treatment will continue in parallel with retrievals except when temporary shutdowns are required to maintain or modify the system. The OCVZ system, coupled with targeted waste retrieval, addresses the greatest and most imminent threat to groundwater quality. Vapor extraction from the vadose zone will continue until cleanup levels in the vadose zone are achieved.

- **Evapotranspiration Surface Barrier—**Constructing an infiltration-reducing evapotranspiration surface barrier over the entire SDA will provide effective source control. To provide a stable foundation for the evapotranspiration surface barrier, potential subsidence of pits, trenches, and Pad A will be addressed before constructing the surface barrier using methods to be determined during remedial design. The surface barrier will inhibit transport of contaminants of concern. Inhibiting transport to the surface by plants and animals addresses future threats to plants, animals, and nearby residents; inhibiting migration into the subsurface addresses future threats to the aquifer. Monitoring and modeling indicate that carbon-14 and technetium-99 could threaten groundwater quality (i.e., exceed risk thresholds) beneath the SDA over the next 100 years. Carbon tetrachloride from solvents already exceeds its MCL, and several other contaminants of concern could exceed MCLs over the next few hundred years. Other secondary contaminants of concern (e.g., uranium-238) could exceed MCLs several thousands of years in the future. To inhibit migration of contaminants from buried waste a surface barrier will be constructed to reduce infiltrating moisture that would move through the SDA and downward toward the Snake River

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a. Historically, long-term management and control activities at the Idaho National Laboratory Site have been addressed under long-term stewardship and institutional controls.

b. As used throughout this Record of Decision, references to 5.69 acres shall mean retrieval of a minimum 6,238 $m^3$ of targeted waste from a minimum acreage of 5.69 acres, with additional retrieval areas, if necessary, determined pursuant to the Comprehensive, Environmental Response, Compensation, and Liability Act. The 5.69 acres includes some portion of Pit 9 and the 1.27 acres being addressed by Accelerated Retrieval Projects I, II, and III in Pits 4 and 6.

Plain Aquifer. The selected evapotranspiration surface barrier will direct moisture away from the buried waste and store excess moisture until it evaporates or is absorbed by plants and transpired to the atmosphere.

- **Long-Term Institutional Controls—**Establishing and maintaining long-term, surveillance, maintenance, monitoring, and institutional controls will preserve integrity of the surface barrier, limit access, and enforce land-use restrictions to ensure continued effectiveness of the remedy. Long-term management and control of the RWMC will continue after construction of the surface barrier is complete and the remedy is declared operational and functional. Post-construction operation and maintenance of components of the Selected Remedy also are long-term management and control activities.

In the interim before the surface barrier is completed (approximately 2028), existing programs will remain in place to restrict access to the RWMC, operate and maintain the OCVZ system, maintain the cover on Pad A, and monitor the environment. The existing monitoring network of lysimeters, suction bailers, groundwater monitoring wells, vapor ports, and advanced tensiometers will be maintained. Samples will be collected, analyzed, and interpreted for the aquifer, vadose zone soil moisture and perched water, and vadose zone vapors. Existing field sampling plans will continue in force until modified. Monitoring results will be summarized and reported periodically. Changes to scope (e.g., sampling frequencies, analytes, analytical priorities, and reporting requirements) will be adjusted as needed with regulatory review and approval.

## STATUTORY DETERMINATIONS

**Statutory Requirements**—The Selected Remedy attains the mandates of CERCLA § 121[6] and is protective of human health and the environment, complies with federal and state requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, and uses permanent solutions to the extent practicable.

**Statutory Preference for Treatment**—The National Oil and Hazardous Substances Pollution Contingency Plan[3] expresses a preference for remedies that use permanent solutions and alternative treatment technologies to the maximum extent possible to reduce toxicity, mobility, and volume. The Selected Remedy employs treatment, which is statutorily preferred to the extent practical, as a principal element of the remedy, as follows: (1) in situ grouting to reduce mobility of technetium-99 and iodine-129, (2) flameless catalytic oxidation and destruction of solvent vapors collected from the vadose zone, and (3) treatment of targeted waste, if needed, to satisfy disposal requirements.

**Five-Year Review Requirement**—A review (in accordance with 40 CFR 300.430 [f][4][ii][3]) is required at a minimum every 5 years if a remedy is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allows for unlimited use and unrestricted exposure. Because the selected remedy will not achieve levels that allow for unlimited use and unrestricted exposure within 5 years, the Agencies have agreed to conduct 5-year reviews in accordance with EPA policy. The 5-year review for this operable unit (OU 7-13/14) will be combined with the comprehensive 5-year review for CERCLA response actions at the Idaho National Laboratory Site, as practical.

# RECORD OF DECISION DATA CERTIFICATION CHECKLIST

The information listed below is included in the Decision Summary (Part 2) of this ROD:

- Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater used in the baseline risk assessment and ROD (see Section 6).
- Contaminants of concern and their respective concentrations (see Section 7). Multiple contaminants of concern with peak risks occurring at various times and in various pathways are involved. Exposure point concentrations are based on modeling future fate and transport. Therefore, contaminants of concern are described in terms of cumulative risk instead of by media concentrations.
- Baseline risks represented by the contaminants of concern (see Section 7).
- Cleanup levels established for contaminants of concern and the basis for the levels (see Section 8).
- Potential land use and groundwater use that will be available at the site as a result of the Selected Remedy (see Section 12).
- Estimated capital, annual operations and maintenance, and total net present value costs for direct work; discount rates; and the number of years over which remedy cost estimates are projected (see Section 12).
- Key factors that led to selecting the remedy (see Section 12).

Additional information can be found in the Administrative Record for OU 7-13/14.

Signature sheet for the *Record of Decision for Radioactive Waste Management Complex Operable Unit 7-13/14* at the Idaho National Laboratory, between the U.S. Department of Energy and the U.S. Environmental Protection Agency, with concurrence by the Idaho Department of Environmental Quality.

[signature] 9/25/2008

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

Date

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9/25/08

Curt Fransen
Deputy Director
Idaho Department of Environmental Quality

Date

Signature sheet for the *Record of Decision for Radioactive Waste Management Complex Operable Unit 7-13/14* at the Idaho National Laboratory, between the U.S. Department of Energy and the U.S. Environmental Protection Agency, with concurrence by the Idaho Department of Environmental Quality.

9/25/08

Richard B. Provencher
Deputy Manager
Idaho Cleanup Project
U.S. Department of Energy Idaho Operations Office

Date

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# ACRONYMS

| | |
|---|---|
| ARAR | applicable or relevant and appropriate requirement |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| DEQ | (Idaho) Department of Environmental Quality |
| DOE | U.S. Department of Energy |
| EPA | U.S. Environmental Protection Agency |
| FFA/CO | Federal Facility Agreement and Consent Order |
| HEPA | high-efficiency particulate air (filter) |
| HWMA | Hazardous Waste Management Act |
| ICP | Idaho Cleanup Project |
| INL | Idaho National Laboratory |
| MCL | maximum contaminant level |
| OCVZ | Organic Contamination in the Vadose Zone |
| OU | operable unit |
| RCRA | Resource Conservation and Recovery Act |
| RI/BRA | Remedial Investigation/Baseline Risk Assessment |
| ROD | record of decision |
| RWMC | Radioactive Waste Management Complex |
| SDA | Subsurface Disposal Area |
| WIPP | Waste Isolation Pilot Plant |

# PART 2: DECISION SUMMARY

This Record of Decision (ROD), prepared in accordance with guidance,[7] documents the Selected Remedy for Operable Unit (OU) 7-13/14 at the Idaho National Laboratory (INL) Site. This Decision Summary, Part 2 of the ROD, identifies and describes the Selected Remedy, explains how the remedy fulfills statutory and regulatory requirements, and summarizes information in the Administrative Record[c] supporting this decision.

## 1. SITE NAME, LOCATION, AND BRIEF DESCRIPTION

OU 7-13/14 is the Comprehensive Remedial Investigation/Feasibility Study for Waste Area Group 7, the Radioactive Waste Management Complex (RWMC), at the INL Site in southeast Idaho. As the comprehensive remedial action for Waste Area Group 7, the Selected Remedy addresses cumulative risk for the entire RWMC. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) identification number for the INL Site is 1000305.

The U.S. Department of Energy (DOE) is the lead agency for cleanup actions at the INL Site. The Idaho Department of Environmental Quality (DEQ) and the U.S. Environmental Protection Agency (EPA) provide regulatory oversight. Together, the three organizations are called the Agencies in the context of cleanup at the INL Site. Roles of the Agencies are defined by authority delegated to DOE and EPA in Presidential Executive Order 12580[8] and responsibilities assigned by CERCLA.[9] Respective roles and authorities are further defined in the INL Federal Facility Agreement and Consent Order (FFA/CO).[4] Because the INL Site is a federal facility, cleanup is funded through the federal budget process with taxpayer dollars.

The INL Site, located in a remote region in southeast Idaho (see Figure 1), occupies approximately 2,305 $km^2$ (890 $mi^2$) and has been a national nuclear energy research facility since 1949. Current land use consists of industrial areas connected by transportation corridors, vegetated desert and rangelands, wetland and surface water drainage areas, and barren lands. Agricultural and residential land uses are not allowed, and all access to the INL Site is administratively controlled.

RWMC is in the southwestern quadrant of the INL Site. It encompasses approximately 72 ha (177 acres) and consists of three major areas: Subsurface Disposal Area (SDA) (39 ha [97 acres]), Transuranic Storage Area (23 ha [58 acres]), and Administration and Operations Area (9 ha [22 acres]) (see Figure 2). In addition to the surface area occupied by RWMC, Waste Area Group 7 includes underlying media (i.e., the vadose zone and aquifer) to the extent that those media are affected by RWMC and its sources of contamination.

Cleanup actions in this ROD address all of Waste Area Group 7, but focus on the primary source of contamination within the facility, waste buried in the SDA radioactive waste landfill. In approximately 14 of the 39 ha (35 of the 97 acres), waste was buried in shallow surface sediments in unlined pits, trenches, and soil vaults and on Pad A (an abovegrade disposal area within the landfill). Waste in the landfill contains radionuclides and hazardous chemicals. Remedial actions specified in this ROD address controlling the source—buried waste—and contaminants migrating to the subsurface and the underlying Snake River Plain Aquifer.

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c. The Administrative Record is a collection of information, including reports and correspondence, used by the Agencies to select this cleanup action. The Administrative Record is accessible on the Internet at http://ar.inel.gov and at libraries as described in Section 3.3.

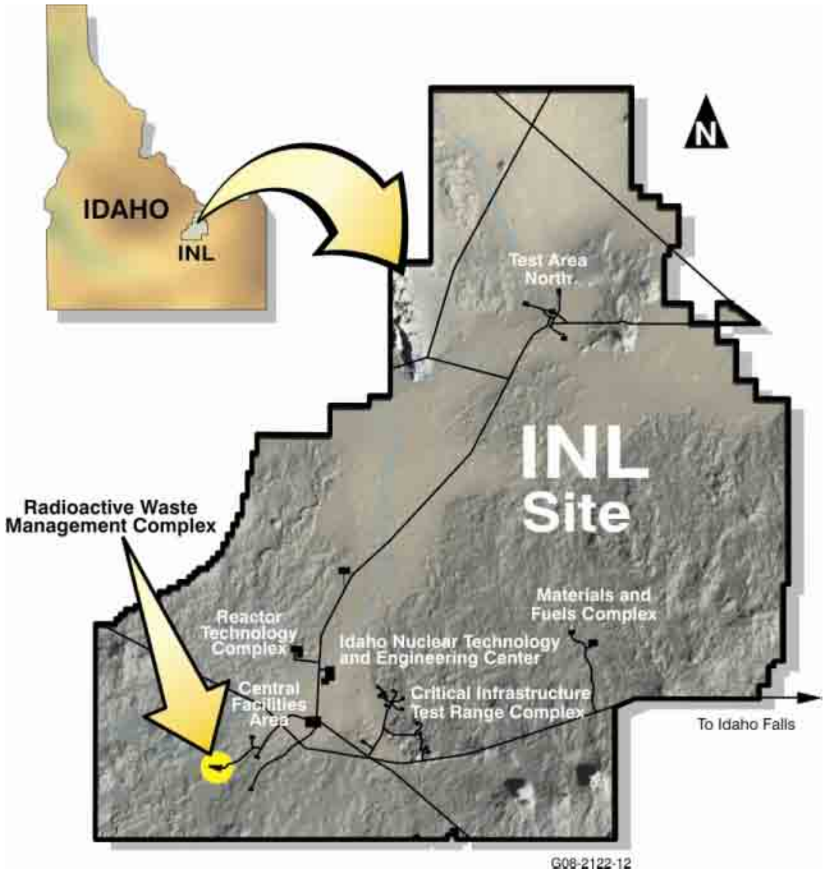


Figure 1. Location of Radioactive Waste Management Complex within the Idaho National Laboratory Site in the State of Idaho.

# 2. SITE HISTORY AND ENFORCEMENT ACTIVITIES

Waste Area Group 7 is composed of 13 operable units, all of which have been investigated and are addressed in this ROD. Sections that follow summarize RWMC operational history, site investigations and cleanup actions, and CERCLA enforcement activities.

## 2.1 Operational History

RWMC was created in 1952 for disposal of radioactive waste. Currently, the facility consists of three major areas: the SDA, the Transuranic Storage Area, and the Administration and Operations Area. The SDA is the focus of remedial decision-making in this ROD because buried waste is the primary source of contamination at RWMC, and analysis of collocated facilities[10] concluded that all facilities, structures, and operations in or near RWMC could be eliminated as contributors to OU 7-13/14 cumulative risk. Therefore, operational history of the SDA is emphasized in the discussion that follows. Section 3 of the Remedial Investigation/Baseline Risk Assessment (RI/BRA)[11] provides a more complete summary of the operational history of the entire RWMC.

The SDA encompasses 39 ha (97 acres), and waste is buried in approximately 14 of the 39 ha (35 of the 97 acres) (see Figure 2). Within the SDA, waste was disposed of in 21 unlined pits, 58 trenches, 21 soil vault rows, and on Pad A, an abovegrade disposal area. Disposal requirements have changed over time in accordance with laws and practices current at the time of disposal.

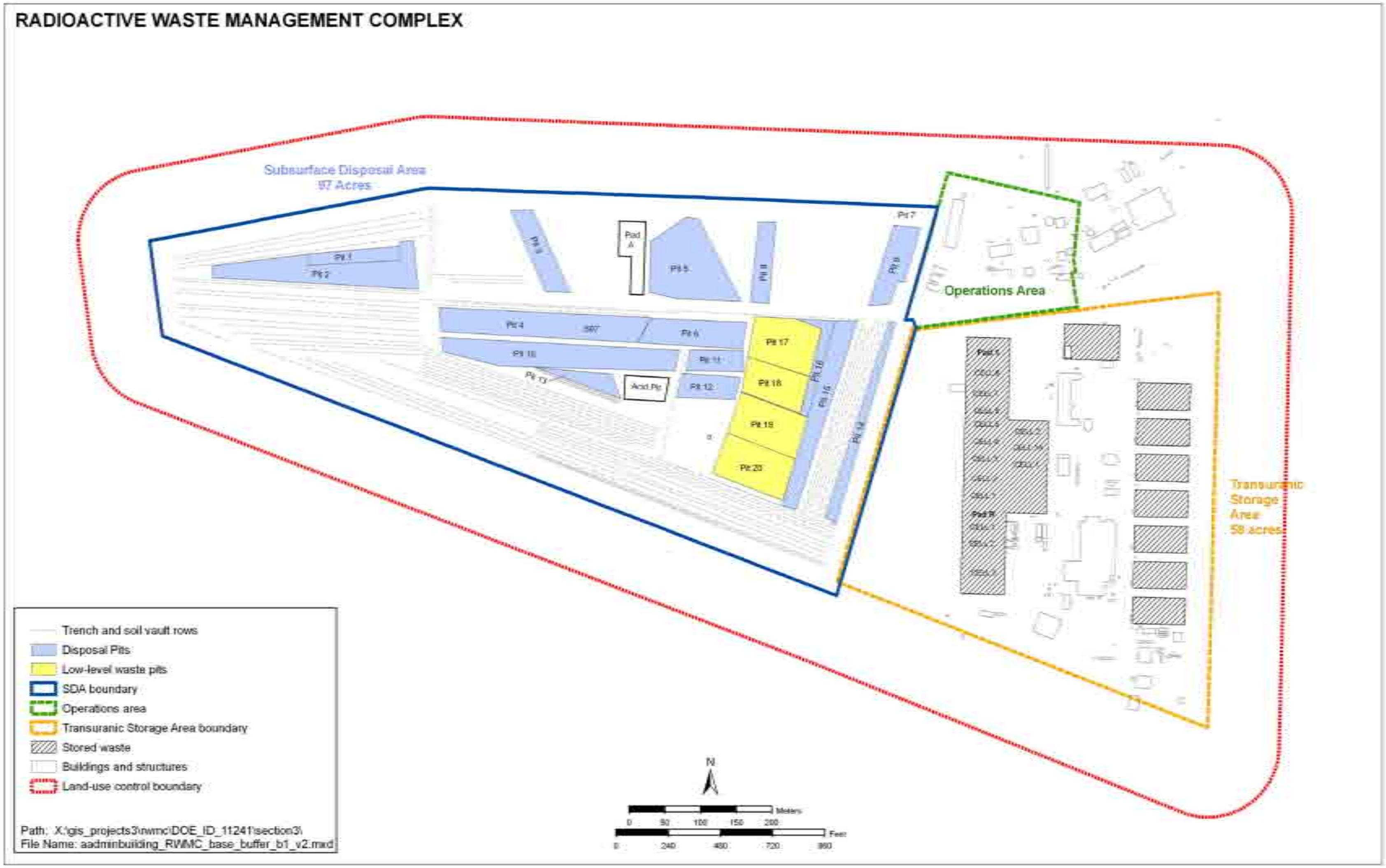


Figure 2. The Radioactive Waste Management Complex showing the Subsurface Disposal Area, Transuranic Storage Area, and support areas.

Initial operations were limited to shallow, landfill disposal of waste generated at the INL Site. In keeping with technology of the day, disposal restrictions focused on worker safety (e.g., minimizing exposure while handling waste). Concern about long-term environmental damage had not yet been recognized and classifications for types of radioactive waste (e.g., low-level, transuranic, and mixed waste) did not yet exist. Hence, there were few restrictions on landfill disposal. Most of the waste was industrial trash contaminated with radioactivity—paper, metal, dirt, construction debris, and other garbage—generated by INL Site reactor research. Some waste contained hazardous chemicals in addition to radioactivity.

Beginning in 1954, the Rocky Flats Plant near Boulder, Colorado, was authorized to send waste to RWMC for disposal. The Rocky Flats Plant was a nuclear weapons production facility with peak operations during the Cold War era. A variety of radioactive waste streams were disposed of, including process waste (e.g., sludge, graphite molds and fines, roaster oxides, and evaporator salts), equipment, and other waste incidental to production (e.g., contaminated gloves, paper, clothing, and other industrial trash). Much of the Rocky Flats Plant waste was contaminated with transuranic isotopes and solvents (e.g., carbon tetrachloride).

In 1970, burial of transuranic waste was prohibited. Transuranic waste was defined as waste contaminated with transuranic radionuclides in concentrations greater than 10 nCi/g. Transuranic waste was placed in segregated, retrievable storage in the Transuranic Storage Area and no longer accepted for landfill disposal in the SDA. In 1982, transuranic waste was redefined as waste material containing an alpha-emitting radionuclide with an atomic number greater than 92, a half-life longer than 20 years, and a concentration greater than 100 nCi/g at the time of assay.[12]

In 1984, disposal practices were modified to eliminate disposal of mixed waste. Since 1984, only low-level waste has been disposed of in the SDA. Disposal of waste from off-INL Site generators was discontinued in the early 1990s. Contemporary disposal operations within the SDA are limited to subsurface burial of low-level waste received from on-INL Site waste generators.

## 2.2 Site Investigations and Cleanup Actions

The SDA has been the subject of many investigations and cleanup actions. Site investigations include literature searches, laboratory analysis, bench-scale and field-scale studies to assess geology and hydrology, field surveys, waste zone probing, environmental monitoring, reconstructing disposal history, technology demonstrations, and much more. This extensive body of information is summarized and referenced in the RI/BRA[11] and Feasibility Study[13] and available in the Administrative Record. Cleanup actions also have provided information used to develop the Selected Remedy. The following sections summarize previous and ongoing remedial actions for Waste Area Group 7.

### 2.2.1 Non-Time-Critical Removal Actions

DOE, with concurrence from DEQ and EPA, has deployed non-time-critical removal actions to grout beryllium blocks and retrieve targeted waste from discrete areas of the SDA. The Agencies selected these CERCLA removal actions to expedite the overall remedy for RWMC.

In situ grouting with a paraffin-based grout was safely executed at locations within the SDA to reduce migration of carbon-14 from buried beryllium blocks into the subsurface and aquifer. Beryllium blocks, used to redirect out-flowing neutrons back into a reactor core, were internal components of several test reactors at the INL Site. Periodically, reflector blocks were replaced. From 1977 to 1993, discarded blocks from INL Site test reactors were managed as low-level waste and buried in the SDA. This waste form was the source of a significant portion of overall carbon-14 being released into the environment. The non-time-critical removal action to grout beryllium blocks was completed in 2004, reducing release into the environment,[14] and was factored into analysis of OU 7-13/14 by modeling. Experience from this action was used to evaluate in situ grouting of other waste types (e.g., waste containing mobile fission products) in the SDA.

Ongoing retrievals are being implemented under action memoranda, signed by the Agencies, for Accelerated Retrieval Projects I, II, and III. These non-time-critical removal actions currently are exhuming particular waste forms, defined as targeted waste, from specified areas in Pits 4 and 6 for disposal at the Waste Isolation Pilot Plant (WIPP) in New Mexico or other appropriate facility. Targeted waste for Accelerated Retrieval Projects are specific Rocky Flats Plant waste forms that are identified and exhumed based on visual observations and methods. Targeted waste forms include Series 741, 742, [d] and 743 sludge, graphite, filters, collocated roaster oxides, and other waste streams mutually agreed to by the Agencies, as the result of operational experience or process knowledge, to be routinely transuranic waste. These waste forms contain significant amounts of solvents, transuranic isotopes, and uranium.

To avoid confusion, the Selected Remedy presented later in this ROD (see Section 12) identifies retrieval of targeted waste from 5.69 acres of pit areas, including some portion of Pit 9 and the 1.27 acres addressed by Accelerated Retrieval Projects I, II, and III (i.e., 0.5, 0.34, and 0.43 acres, respectively). This OU 7-13/14 ROD incorporates Accelerated Retrieval Projects I, II, and III, and any additional targeted waste removal action, and it specifically identifies all retrieval locations included in the final remedy.

### 2.2.2 Existing Records of Decision for Operable Units 7-08, 7-10, and 7-12

The OU 7-13/14 ROD, as the comprehensive remedial decision for the entire RWMC, supersedes three existing RODs addressing portions of RWMC: OU 7-08, Organic Contamination in the Vadose Zone (OCVZ)[18]; OU 7-12, Pad A[19]; and the interim action ROD for OU 7-10, Pit 9.[20] As the comprehensive remedy for all operable units under Waste Area Group 7, this ROD for OU 7-13/14 includes all requirements (e.g., applicable or relevant and appropriate requirements [ARARs]) and remedial activities (e.g., unexecuted or incomplete activities) of these earlier RODs. The Proposed Plan,[21] RI/BRA,[11] Feasibility Study,[13] and other supporting analyses in the OU 7-13/14 Administrative Record incorporate contaminants and risks posed by operable units addressed in these earlier RODs. To the extent that this ROD differs from specific provisions of these previous RODs, public review and comment on the OU 7-13/14 Proposed Plan also support those modifications in accordance with the National Contingency Plan.[3] These previous RODs are described in the following paragraphs.

***2.2.2.1 OU 7-08 Organic Contamination in the Vadose Zone Remedial Investigation and Feasibility Study.*** The OU 7–08 ROD[18] specified extracting organic vapors (solvents) from the vadose zone until remediation goals are met. Solvent vapors within the vadose zone are moving toward the Snake River Plain Aquifer. In several aquifer monitoring wells, carbon tetrachloride has slightly exceeded its maximum contaminant level (MCL) of 5 µg/L (0.005 mg/L). In addition to a no action alternative, the OU 7-08 Remedial Investigation/Feasibility Study[22] examined three alternatives in detail: containment (with a surface barrier), extraction with treatment by vapor vacuum extraction, and extraction with treatment with enhanced vapor vacuum extraction. Based on results of a treatability study and evaluation against CERCLA criteria, the Agencies selected Alternative 2—Extraction with Treatment by Vapor Vacuum Extraction.[18]

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d. Series 742 sludge was not identified as a targeted waste form for Accelerated Retrieval Projects I and II.[15,16] However, Series 742 sludge is identified as targeted waste for Accelerated Retrieval Project III.[17] This modification also applies to areas in Accelerated Retrieval Project II as of July 3, 2008.[5] Previously retrieved areas in Accelerated Retrieval Projects I and II will not be revisited.

The OCVZ system was constructed and became operational in January 1996. As of September 18, 2008, approximately 224,000 lb of solvent has been extracted from the vadose zone and treated. The Selected Remedy for RWMC incorporates continued operation of the OCVZ system, and this comprehensive ROD for OU 7-13/14 assumes operation and maintenance of the system. Duration of operations will be determined based on the overall remedy for OU 7-13/14. Operating timeframes will depend on removal of targeted waste containing solvents (e.g., Series 743 sludge) and meeting vadose zone cleanup levels. Vadose zone cleanup levels (e.g., remediation goals expressed as vapor concentrations in the vadose zone) are specified in Section 12.2.3.

***2.2.2.2 OU 7-10 Pit 9 Process Demonstration Interim Action.*** The OU 7-10 interim action ROD[20] specified a combination of chemical extraction, physical separation, and stabilization technologies to recover contaminants and reduce the source of contamination. Major components of the remedy included removing all waste containing transuranic concentrations greater than 10 nCi/g from the 1-acre Pit 9, treating the waste to remove radionuclides and hazardous constituents, reducing volume of treated waste by 90%, temporarily storing concentrated waste residuals onsite pending final disposal (e.g., WIPP), and returning treated materials to Pit 9 (treated materials would contain less than or equal to 10 nCi/g transuranic elements and meet regulatory standards for hazardous substances). The interim action was intended to test and demonstrate the feasibility of retrieving buried transuranic waste from the SDA and gather information for use in planning cleanup of the rest of the buried waste. However, the interim action described in the OU 7-10 ROD was not performed because of unworkable complications (e.g., technical issues related to chemical separation technology and sensitivity of transuranic assay techniques).

Thus the Agencies modified the Pit 9 ROD in the 1998 Explanation of Significant Differences,[23] which implemented a three-stage strategy. The first two stages were satisfactorily completed,[24] and the third stage (i.e., full-scale retrieval and treatment of Pit 9) was subsequently deferred.[24] Stages I and II consisted of siting and implementing a retrieval demonstration in Pit 9. The OU 7-10 Glovebox Excavator Method Project[25] successfully demonstrated retrieval and provided information that allowed the Agencies to adopt the targeted waste retrieval approach, a less complicated and less costly yet effective strategy for retrieval of buried transuranic waste.

The Selected Remedy for RWMC remediation includes retrieval of targeted waste. Portions of Pit 9 are included in the selected acreage. Therefore, no further requirements remain under the OU 7-10 ROD, and this ROD for OU 7-13/14 supersedes the OU 7-10 Interim Action ROD.[20]

***2.2.2.3 OU 7-12 Pad A Remedial Investigation and Feasibility Study.*** The OU 7-12 ROD[19] specified enhancing the soil cover over the waste on Pad A and maintaining that cover as long as necessary. Pad A is a unique abovegrade asphalt pad used for disposal of waste from 1972 to 1978. In addition to a no action alternative, the OU 7-12 Remedial Investigation/Feasibility Study[26] examined two alternatives in detail: (1) containment by construction of a composite surface barrier and (2) limited action combining maintenance of the existing cover with monitoring. Because Pad A does not exceed risk threshold values, the Agencies selected Alternative 2—Limited Action.[19] Subsequently, the existing soil cover over Pad A waste was enhanced with additional soil and vegetation. Rock armor was added to the south-facing side to reduce wind erosion. Over time, maintaining vegetation proved impractical and was discontinued. Routine maintenance includes repairing damage from subsidence.

The Selected Remedy for OU 7-13/14 includes additional action at Pad A to integrate it into the comprehensive remedial action for the entire SDA. Additional action under OU 7-13/14 is significantly different from the Limited Action selected in the Pad A ROD because measures to address subsidence of Pad A waste may be necessary. To provide a stable foundation for the evapotranspiration surface barrier, potential subsidence of pits, trenches, and Pad A will be addressed before constructing the surface barrier using methods to be determined during remedial design. At a minimum, additional cover material will be included to incorporate Pad A and its cover into the larger surface barrier that will be constructed over the entire SDA. Therefore, this OU 7-13/14 ROD supersedes the OU 7-12 ROD in its entirety. The established surveillance and maintenance program for the Pad A cover[27] will continue until modifications to Pad A are required in preparation for construction of the surface barrier over the entire SDA.

### 2.2.3 Track 1 and Track 2 Operable Units

Nine other operable units were investigated using the Track 1 or Track 2 process for assessing low probability hazard sites at the INL Site as outlined in the Action Plan attached to the FFA/CO.[4] The Agencies concluded that seven operable units in Waste Area Group 7 (see Table 1) should be evaluated in a remedial investigation/feasibility study, as documented in the Administrative Record. All seven of these operable units are associated with the SDA and contaminated media are included in the cumulative OU 7-13/14 analysis. Thus, the Selected Remedy for OU 7-13/14 encompasses these operable units. The other two operable units, OU 7-09 and OU 7-11, are outside the SDA.

OU 7-09, Transuranic Storage Area Releases,[28] was identified to address historical releases that may have occurred within the 58-acre Transuranic Storage Area (see Figure 2). Hazardous Waste Management Act[29] (HWMA) regulated facilities involved in ongoing operations within OU 7-09 will be subject to HWMA closure requirements. The Agencies will evaluate closure sampling data to determine if a release subject to further action under CERCLA has occurred and what remedial action will be required, if necessary, under a separate CERCLA action (see Sec. 12.2.6.8).

OU 7-11 comprises three septic tank systems at RWMC. The Agencies concluded that no action is required because hazardous or radioactive contaminants in the systems were not detected above regulatory limits.[30]

Table 1. Operable units with previous decisions for further evaluation in the OU 7-13/14 remedial investigation and feasibility study.

| Operable Unit | Description | Administrative Record Document Number | Reference |
|---|---|---|---|
| 7-01 | Soil Vault Rows 1-13 | 10034 | 31 |
| 7-02 | Acid Pit | 5055 | 32 |
| 7-03 | Nontransuranic pits and trenches | 5592 | 33 |
| 7-04 | Air pathway | 10017 | 34 |
| 7-05 | Surface water pathways and surficial sediments | 5864 | 35 |
| 7-06 | Groundwater pathway | 5868 | 36 |
| 7-07 | Vadose zone radionuclides and metals | 10004 | 37 |

## 2.3 Enforcement Activities

Because the INL Site is a federal facility and cleanup is managed under a federal facility agreement,[4] fund-financed enforcement activities do not apply. OU 7-13/14 has not been subject to any enforcement activities under CERCLA.

# 3. COMMUNITY PARTICIPATION

A broad range of community participation materials and events provided many opportunities for public involvement. Project-specific outreach relating to decision-making for OU 7-13/14 involved the Citizens Advisory Board, a technical assistance grant, various publications (e.g., Web sites, fact sheets, announcements, newsletters, and the Administrative Record), and meetings (e.g., open houses and briefings). These opportunities to obtain information and provide input fulfilled public participation requirements in CERCLA (§113(k)(2)(b)(i–v) and §17)[9] and the National Contingency Plan.[3] Subsections that follow enumerate many of these opportunities.

## 3.1 Citizens Advisory Board

The INL Site Environmental Management Citizens Advisory Board is a group of 15 volunteers. The group reflects the citizenry of areas affected by the cleanup program at the INL Site. In addition, the DOE, DEQ, and EPA have nonvoting members on the Board. The Board meets every 2 months. Meetings are open to the public and include opportunities for public comment. Agendas are published online, and meetings are announced in local newspapers.

The Board provides informed recommendations and advice to DOE regarding environmental restoration, future land use, long-term management and control, risk assessment, and numerous other topics. Since its inception in 1994, the Board has issued 135 recommendations. Several relate to cleanup of RWMC.

DOE routinely updates the Citizens Advisory Board about the OU 7-13/14 remedial investigation and feasibility study project. Updates included at least three tours of RWMC and numerous briefings. At one meeting, DOE solicited input on how to best involve stakeholders in the Waste Area Group 7 project and received and implemented several suggestions.[38] DOE presented the RI/BRA[11] at the July 2006 meeting and the Feasibility Study[13] and evaluation of remedial alternatives at the July and September 2007 meetings. The most recent Board recommendation[39] addressed the Proposed Plan for OU 7-13/14. The Board recommended acceptance of the Preferred Alternative presented in the Proposed Plan,[21] noting it would be helpful to know if removal of additional waste acreage would provide incremental protection.

## 3.2 Technical Assistance Grant

EPA offers technical assistance grants to citizen organizations to enable them to hire technical advisors to interpret technical information released by a Superfund site and to disseminate this information to the organization and the general public. In mid-2006, two organizations applied: the Snake River Alliance, an environmental interest organization, and the Partnership for Science and Technology, a nuclear technology advocacy organization. EPA awarded a grant to the Snake River Alliance.

In late-summer 2007, the Snake River Alliance received a $25,000 technical assistance grant to hire a technical advisor and to hold community roundtable meetings. As part of the technical assistance grant process, the Snake River Alliance issued a request for proposals to solicit interest from potential technical advisors. Three individuals submitted an application and resume. In mid-September, the Snake River Alliance held meetings in four Idaho cities—Idaho Falls, Pocatello, Twin Falls, and Boise—to allow the public to review the applications and resumes of the three prospective technical advisors. Representatives from DOE, the Idaho Cleanup Project (ICP), and INL attended these meetings. After considering public input on the applicants, the Snake River Alliance chose a technical assistance grant advisor.

The organization requested a briefing and site tour. On December 3, 2007, DOE and ICP contractor staff hosted a tour of the RWMC and Idaho CERCLA Disposal Facility for the Snake River Alliance. ICP staff also attended four Snake River Alliance roundtable meetings (December 3—Idaho Falls; December 4—Pocatello; December 5—Twin Falls; and December 6—Boise), providing additional information on the Waste Area Group 7 project, when requested.

The Snake River Alliance, assisted by its technical advisor, submitted formal comments on the OU 7-13/14 Proposed Plan on December 21, 2007. Four general comments and nine specific comments were submitted. The Snake River Alliance, with a few reservations, generally supported the Preferred Alternative presented in the Proposed Plan.[21] They suggested additional information and public involvement in the future. Section 18 contains the complete set of Snake River Alliance comments and Agency responses.

## 3.3 Publications

Publications, announcements, fact sheets, newsletters, and many technical reports in the Administrative Record have been made available to interested stakeholders. Important publications were placed in Information Repositories and the Administrative Record, available at the following locations:

| | |
|---|---|
| INL/ICP Technical Library<br>DOE Public Reading Room<br>1776 Science Center Drive<br>Idaho Falls, ID 83415<br>208-526-1185 | Albertsons Library<br>Boise State University<br>1910 University Drive<br>Boise, Idaho 83725<br>208-385-1621. |

Many publications also are available online via the ICP Web page or the Administrative Record. An electronic copy of the Proposed Plan was made available via the Internet on the Administrative Record Web site, as required, and also on the ICP home page (https://idahocleanupproject.com). Any library or other facility with Internet access can provide a connection to the Administrative Record.

The following list enumerates some of these publications by date:

**October 1995—**OU 7-13/14 "kickoff" fact sheet was mailed to approximately 5,000 interested citizens.

**October 1995—**Newsletters were published periodically to update the public on the OU 7-13/14 project.

**October 1997—**An update fact sheet on progress of the OU 7-13/14 remedial investigation and feasibility study was sent to approximately 5,000 interested citizens.

**June 2006—**A fact sheet was mailed to approximately 1,200 interested citizens, summarizing the RI/BRA[11] and outlining upcoming public involvement opportunities (e.g., briefings, release of the Proposed Plan, and public meetings). The fact sheet also was translated into Spanish.

**July 2007—**A feasibility study fact sheet was made available to the public, discussing the range of remediation alternatives and outlining upcoming public involvement opportunities (e.g., briefings, release of the Proposed Plan, and public meetings). This fact sheet also was translated into Spanish.

**July 2007—**An OU 7-13/14-specific public participation plan was published.[40] This plan outlined outreach activities and described how the public could be involved in the decision-making process, discussed the planned format for public meetings, and outlined various stakeholder groups that would be contacted for technical briefings.

**August 2007—**Six Idaho citizens, collectively called the Focus Group, reviewed draft fact sheets that ultimately would be available to the public. The Focus Group had little-to-no knowledge of the INL Site and the OU 7-13/14 project. Following their review of the draft fact sheets, Focus Group members recommended changes to make fact sheets more easily understood by the general public. Their comments were incorporated.

**October 19, 2007—**The OU 7-13/14 Proposed Plan was mailed to approximately 1,200 interested citizens. An electronic copy of the Proposed Plan was made available via the Internet on the ICP home page (http://www.idahocleanupproject.com/). The public comment period for the Proposed Plan began October 22, 2007, and was planned to end on November 21, 2007. However, at the request of the public, DOE extended the comment period 30 days to end December 21, 2007.

**Week of October 22, 2007—**Large display advertisements announcing availability of the Proposed Plan and locations of public meetings appeared in regional newspapers in Idaho and Wyoming. These ads appeared in the following newspapers: (1) *Post Register* (Idaho Falls), (2) *Arco Advertiser* (Arco), (3) *Sho-Ban News* (Fort Hall), (4) *Idaho State Journal* (Pocatello), (5) *Times-News* (Twin Falls), (6) *Idaho Statesman* (Boise), (7) *Moscow-Pullman Daily News* (Moscow), and (8) *Jackson Hole News and Guide* (Jackson, Wyoming).

**Week of October 22, 2007—**Postcards were mailed to approximately 1,200 interested citizens, informing them of the comment period and times and locations of upcoming public meetings and open houses.

**October 22, 2007—**An electronic note was sent to all INL Site employees, providing information about the comment period and times and locations of public meetings and open houses.

**October 22, 2007—**A press release was sent to the media, interested Idaho and Wyoming stakeholders, and elected officials concerning the beginning of a 30-day public comment period, pertaining to the OU 7-13/14 Proposed Plan and upcoming public meetings and open houses. The news release gave rise to articles in various newspapers and one Washington, D.C.-based publication. The news release notified the public that OU 7-13/14 documents were available in the Administrative Record section of the INL Information Repositories, located in the INL Technical Library in Idaho Falls, Albertsons Library on the campus of Boise State University, and on the Internet.

**November 2, 2007—**A press release announced the comment period extension for the Proposed Plan, based on a request from the public. A follow-up advertisement ran in newspapers.

**November 2, 2007—**A postcard was mailed to approximately 1,200 interested citizens, reminding them of upcoming meetings and open houses.

**November 2, 2007—**A two-page fact sheet was posted on the ICP Web page, summarizing the Proposed Plan.

**November 2007—**Three "topics" fact sheets were posted on the ICP Web page. These fact sheets addressed previous public comments and concerns related to plutonium mobility, buried waste shipping records, and physical characteristics of the SDA (e.g., potential for floods, earthquakes, and volcanoes).

**November 2007—**Several interested stakeholders received telephone calls, reminding them of public meetings and the comment period, and assessing if a technical briefing was desired.

**December 2007—**A 2-minute video was posted on the Internet to encourage the public to submit comments on the Proposed Plan.

**October 21 through December 21, 2007—**The Agencies received oral and written comments on the OU 7-13/14 Proposed Plan in person, by U.S. mail, and via the Internet. All comments received within the comment period were considered during development of this ROD. Part 3 of this ROD, the Responsiveness Summary, includes responses to all formal comments. Oral and written comments also are included in the Administrative Record for OU 7-13/14.

## 3.4 Meetings

Information was conveyed to many stakeholders during briefings to interested groups, public open houses, and other venues. The following list enumerates some of these by date:

**June 1998 through June 1999—**Numerous city councils, county commissions, and the media received briefings about progress of the OU 7-13/14 remedial investigation and feasibility study.

**May 2004—**An Information Fair was held in Idaho Falls to provide a status of each cleanup project at the INL Site, including the OU 7-13/14 remedial investigation and feasibility study.

**March 2, 2006—**ICP staff attended INL Day at the Legislature at the Boise State Capitol, manned a display on the RWMC project, and discussed the project with legislators and the general public.

**March 2006—**Open houses were held to discuss all significant ICP projects, including OU 7-13/14, in Idaho Falls and Twin Falls, Idaho. The Twin Falls open house coincided with the Citizens' Advisory Board meeting.

**June 2006—**Briefings were held with several environmental interest groups.

**February 27, 2007—**ICP staff again attended the INL Day at the Legislature event at the Boise State Capitol, manned a display on the RWMC, and discussed the project with legislators and the general public. The RI/BRA fact sheet was available at the booth. At a luncheon attended by nearly all legislators, the ICP president gave a presentation, highlighting targeted waste exhumation in Pit 4 and discussing the Waste Area Group 7 project.

**June 13, 2007—**Members of the Shoshone-Bannock Tribes were briefed on the feasibility study, including the range of alternatives evaluated and remedial action objectives.

**July 2007 to November 2007—**More than 35 briefings about the feasibility study were held with city councils, county commissions, civic organizations, environmental interest groups, farming interests, university officials, Congressional staff, and ICP employees. These groups and individuals were encouraged to read the RI/BRA[11] and Feasibility Study,[13] fact sheets, and Proposed Plan, and to attend public meetings and open houses.

**October 29, 2007—**Members of the Shoshone-Bannock Tribes were briefed on the Proposed Plan and Preferred Alternative. Tribal members were encouraged to attend the Idaho Falls public meeting.

**November 2, 2007—**Several interested stakeholders received telephone calls, reminding them of public meetings and the comment period, and assessing if a technical briefing was desired.

**November 3, 2007—**The Focus Group reviewed posters and heard a DOE representative deliver the presentation that would be delivered to the public in upcoming open houses. The group's recommended changes to the posters and presentation were incorporated.

**November 13, 2007—**The Agencies hosted the first of three open houses in Boise, Idaho. Approximately 50 people with no association with the OU 7-13/14 project attended. Each open house included a public meeting with a presentation about the OU 7-13/14 Proposed Plan and opportunities to ask questions. Postage-paid, business-reply forms were available. Forms were used to submit written comments either at the meeting or by mail, and a court reporter was present to take oral comments. Several persons provided oral or written comments.

**November 14, 2007—**The second open house was held in Twin Falls, Idaho. The format was identical to the Boise open house. Approximately 30 members of the public attended; several provided oral or written comments.

**November 15, 2007—**The final open house was held in Idaho Falls, Idaho. The format was identical to the previous two open houses. More than 110 members of the public attended; several provided oral comments or written comments.

**December 11 – 13, 2007—**ICP staff attended the Idaho Environmental Summit in Boise, Idaho, manned an information booth, and discussed the OU 7-13/14 project with some of the 200 summit participants.

# 4. SCOPE AND ROLE OF OPERABLE UNIT 7-13/14

The RWMC remedial action is part of the environmental restoration of the INL Site under CERCLA.[1] The INL Site was placed on the National Priorities List[41] of hazardous waste sites in 1989. In 1991, the Agencies signed the FFA/CO[4] outlining the remedial decision-making process and schedule for cleanup of the INL Site. RWMC is identified as Waste Area Group 7, and OU 7-13/14 is the designation for the comprehensive, final investigation planned for RWMC.

OU 7-13/14 is the final operable unit planned under CERCLA and implemented under the FFA/CO[4] for Waste Area Group 7. Evaluations are complete for the first 12 subsets, as described in Section 2. As such, OU 7-13/14 encompasses all other Waste Area Group 7 operable units. This ROD supersedes all previous RODs for Waste Area Group 7 (i.e., OUs 7-08, 7-10, and 7-12, see Section 2.2.2) and integrates overall cleanup with three ongoing non-time-critical removal actions (i.e., the Accelerated Retrieval Projects.[15,16,17] OU 7-13/14 also encompasses waste disposed of by the ongoing low-level waste program in Pits 17 through 20 (see Figure 2). Disposal of contact-handled waste will continue through the year 2008. Disposal of remote-handled low-level waste likely will continue until the facility is full or until 2015, when the facility must be closed in preparation for final remediation of the SDA.

Major construction elements of the Selected Remedy for OU 7-13/14 are targeted waste retrieval, in situ grouting, mitigating subsidence of pits, trenches, and Pad A, and building an evapotranspiration surface barrier. Concurrently, the OCVZ vapor vacuum extraction and treatment system will continue to extract and treat solvent vapors from the subsurface. Combined, these elements will protect human health and the environment by addressing contaminant migration to the surface and subsurface.

Figure 3 illustrates the approximate schedule and sequence for implementing the Selected Remedy. Targeted waste retrieval already has begun as non-time-critical removal actions (i.e., Accelerated Retrieval Projects) and will continue under this ROD. Surface barrier construction will end approximately in 2028. After construction is complete OCVZ operations and maintenance will continue until vadose zone vapor cleanup levels are achieved. Long-term management and control of RWMC (e.g., post-construction surveillance, maintenance, monitoring, and institutional controls) will continue until modified under the CERCLA 5-year review process.

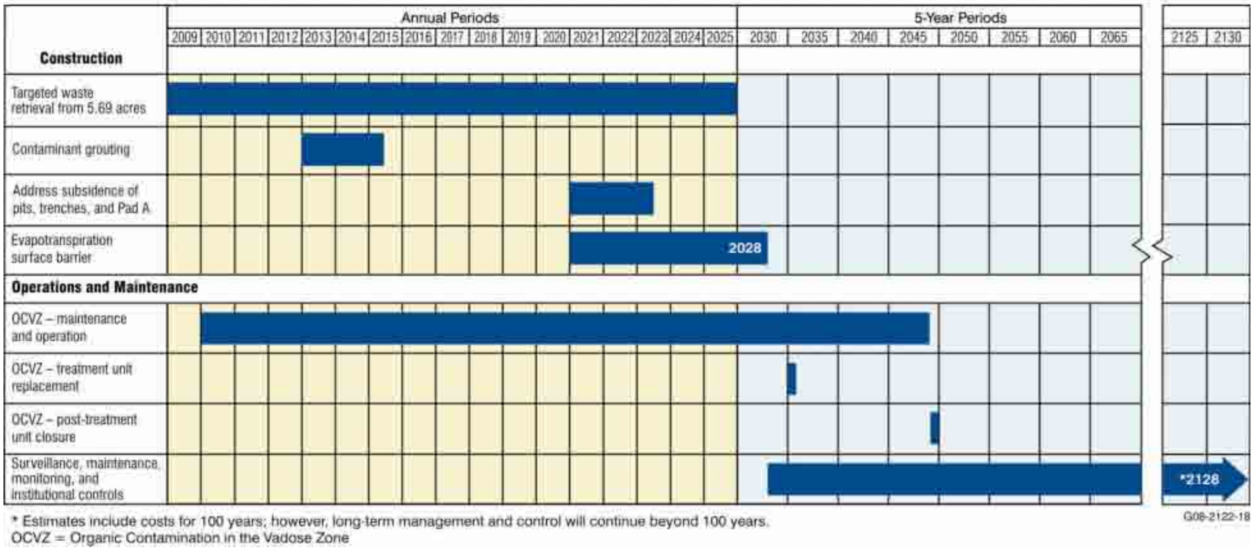


Figure 3. Approximate schedule and sequence for implementing the Selected Remedy.

Because the Selected Remedy for OU 7-13/14 involves various major elements implemented over several years, remedial action will be designed and managed in discrete phases. Actions will be executed in accordance with the FFA/CO[4] and INL guidance.[42] A scope of work and work plan will outline schedule and scope for the Selected Remedy. Details will be defined in subsequent remedial action and remedial design documents.

# 5. SITE CHARACTERISTICS

The INL Site is located in southeastern Idaho (see Figure 1) and occupies approximately 890 $mi^2$ in the northeastern region of the Snake River Plain. Regionally, the INL Site is near U.S. Interstate Highways I-15 and I-86. Idaho Falls and Pocatello are the two largest cities in the area. The INL Site extends nearly 39 mi from north to south, is about 36 mi wide at its broadest southern portion, and occupies parts of five southeastern Idaho counties. RWMC encompasses approximately 72 ha (177 acres) and is located in the southwestern quadrant of the INL Site.

The INL Site region is classified as arid to semiarid because of its low average rainfall of 22 cm (8.7 in.)/year. The Big Lost River, which flows intermittently depending on weather and the amount of water diverted for irrigation, traverses the western part of the INL Site. RWMC has no permanent surface water features, and local surface water conditions are not influenced by the Big Lost River.

The relatively dry region between the surface and the aquifer, referred to as the vadose zone, is a thick sequence of basalt flows and layers of sediment called interbeds. The vadose zone and its interbeds are important features because they tend to filter contaminants and inhibit transport to the underlying aquifer. Seven major interbeds underlie RWMC. The three uppermost interbeds, known as the A-B, B-C, and C-D interbeds, are the best defined. Each interbed contains gaps, though no gaps have been identified in the C-D interbed under RWMC or the immediate vicinity outside RWMC. Perched water—moisture that accumulates (i.e., perches) above a low-permeability layer (e.g., an interbed) in the vadose zone—is typically transitory beneath RWMC. Perched water is observed rarely in three wells at the B-C interbed and consistently in two locations at the C-D interbed.

Beneath the vadose zone at RWMC, at approximately 177 m (580 ft) below ground surface, the Snake River Plain Aquifer flows generally from northeast to southwest. Like the vadose zone, the aquifer also consists of a series of basalt layers and sediment. Regionally, the aquifer is bounded on the north and south by the edge of the Snake River Plain, on the west by surface discharge into the Snake River between King Hill and Twin Falls, Idaho, and on the northeast by the Yellowstone basin. Flow paths in the aquifer from beneath the INL Site discharge miles to the west of Twin Falls at the western terminus of the aquifer.

The RI/BRA[11] evaluated the nature and extent of contamination associated with waste buried in the SDA. Tens of thousands of samples of perched water, soil moisture, sediment, aquifer water, and vadose zone vapor have been collected near RWMC over the past three decades, and more than 100,000 analyses have been performed. Except for background sites, monitoring locations have been chosen to maximize the likelihood of finding contamination. Despite this bias, detections are generally sparse and sporadic, typically near detection limits, and show few trends. With the exception of chemicals from solvents (e.g., volatile organic compounds), the few trends are limited to specific locations in the shallow vadose zone.

Industrial solvents, particularly carbon tetrachloride, are the only widespread contaminants from RWMC in the environment. Carbon tetrachloride is detected routinely in the vadose zone and aquifer. Historically, concentrations slightly above the carbon tetrachloride MCL of 5 μg/L have been detected in seven aquifer wells. Carbon tetrachloride was routinely detected in four aquifer monitoring wells when the RI/BRA was in progress. Currently, concentrations exceed the MCL in only two aquifer wells.[43] Vapor vacuum extraction from the vadose zone by the OCVZ system, started in 1996, is reducing the amount of organic contaminants that reaches the aquifer. Vapor extraction consists of drawing soil gas (i.e., vapor) to the surface by applying negative pressure (i.e., vacuuming). Flameless thermal treatment by catalytic oxidation permanently destroys organic contaminants in extracted vapors. Figure 4 illustrates average concentrations of carbon tetrachloride in the vadose zone from 2004 through 2006. Highest concentrations in that timeframe occurred in the region above the B-C interbed, where the average was less than 80 ppmv compared to the more than 1,000-ppmv average in the same region before OCVZ system operations began in 1996.[44]

Some contaminants are detected in low concentrations at RWMC in the vadose zone and aquifer and are attributable to waste buried in the SDA. Most vadose zone detections are in the interval above the B-C interbed (see Figure 4). The most frequently detected contaminants in the vadose zone, from most to least, are solvent vapors (e.g., volatile organic compounds), uranium isotopes, nitrate, technetium-99, and carbon-14. In addition, strontium-90, chlorine-36, plutonium-238, americium-241, iodine-129, and plutonium-239/240 have been detected sporadically in the vadose zone at concentrations near detection limits.

Because contamination is not widespread (except for solvent vapors), analysis of contaminant transport from the SDA is largely based on modeling. The RI/BRA[11] and Feasibility Study[13] summarize the most recent modeling, which is founded on several earlier efforts.[45–48] Detailed modeling reports also are available in the Administrative Record.[49–52] Contaminant inventories were reconstructed based on disposal records. Section 4.1 of the RI/BRA presents a detailed description of contaminants and data sources, including: (1) total inventories (i.e., curies for radionuclides and grams for nonradionuclides) by major waste generator (Tables 4-2 and 4-3), (2) total inventories by waste stream (Tables 4-4 through 4-7), and (3) density maps (Figures 4-2 through 4-29). These inventories were used as input to simulate release (DUST-MS model) and transport (TETRAD model) of contamination from buried waste. Models produced estimates of future exposure point concentrations for risk assessment in accordance with the conceptual site model. Models applied site-specific information when available and conservative parameter values (i.e., values that tend to overestimate exposure point concentrations and risk) when site-specific information was not available.

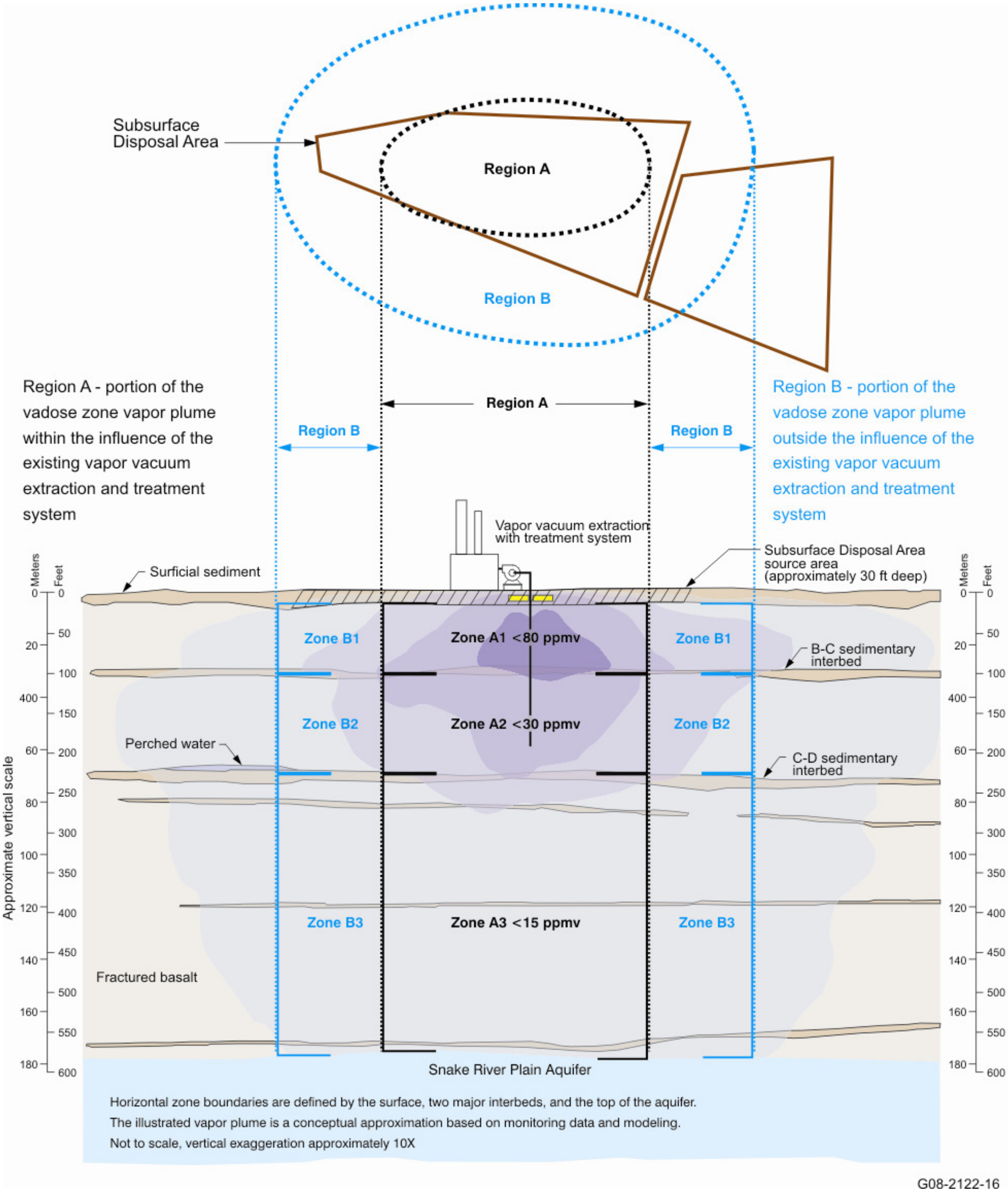


Figure 4. Average concentrations of carbon tetrachloride in the vadose zone from 2004 through 2006.

# 6. CURRENT AND POTENTIAL FUTURE LAND AND WATER USES

The INL Site is approximately 2,305 $km^2$ (890 $mi^2$) in size. Land use and groundwater use on the entire INL Site is restricted, and access to the INL Site and RWMC is controlled. Access to ICP and INL facilities requires proper security clearance, training or an escort, and controls to limit exposures. Though 145 km (90 mi) of public highways pass through the northern and southern portions of the INL Site, public access beyond the highway right-of-way is not allowed. Current and projected land and groundwater uses are summarized below for the INL Site, surrounding lands, and RWMC.

## 6.1 Land Use

DOE administers land within the INL Site, and the Bureau of Land Management (U.S. Department of Interior) administers livestock grazing leases within the undeveloped portion of the INL Site (Figure 5). The Bureau of Land Management classified acreage within the INL Site as industrial and mixed use.[53] The current primary use of the INL Site is to support facility and program operations. Large tracts of land are reserved as buffer and safety zones along the boundary of the INL Site. Portions within the central area are reserved for ICP and INL operations. Remaining land within the core, which is largely undeveloped, is used for environmental research, ecological preservation, and sociocultural preservation.

In the five counties surrounding the INL Site, approximately 77% of the land is rangeland, forest, or barren and roughly 21% is used for farming.[53] Most of the land surrounding the INL Site is owned by the federal government. Private lands near the INL Site are used primarily for grazing and farming.

Future INL Site land use most likely will remain essentially the same as the current use: a research facility within the INL Site boundaries and agriculture and open land surrounding the INL Site. DOE addressed sitewide potential future land use based on long-term future scenarios.[54] Because future land-use scenarios are uncertain, assumptions were made for defining factors such as development pressure, advances in research and technology, and ownership patterns. The following assumptions were applied to develop forecasts for land use within the INL Site:

- The INL Site will remain under DOE ownership and control until at least 2095. The boundary is currently static. DOE will manage portions of the INL Site beyond 2095. Long-term management and control includes surveillance, maintenance, monitoring, and institutional controls of areas that cannot be released for unrestricted land use.

- The life expectancy of current and new facilities is expected to range between 30 and 50 years. Decontamination and dismantlement will commence following closure of each facility if new missions for the facility are not determined.

- Residential development (e.g., housing) will not be allowed within the current INL Site boundaries before 2095 and is not expected to occur after 2095.

- Major, private developments (residential or nonresidential) are not expected in areas adjacent to the INL Site because the INL Site is distant from existing developed areas, infrastructure is not present adjacent to the INL Site to support development, existing urban areas in the region have large areas of undeveloped land nearby that are more suitable for residential development, and INL land cannot be transferred easily to private ownership (for reasons described below).

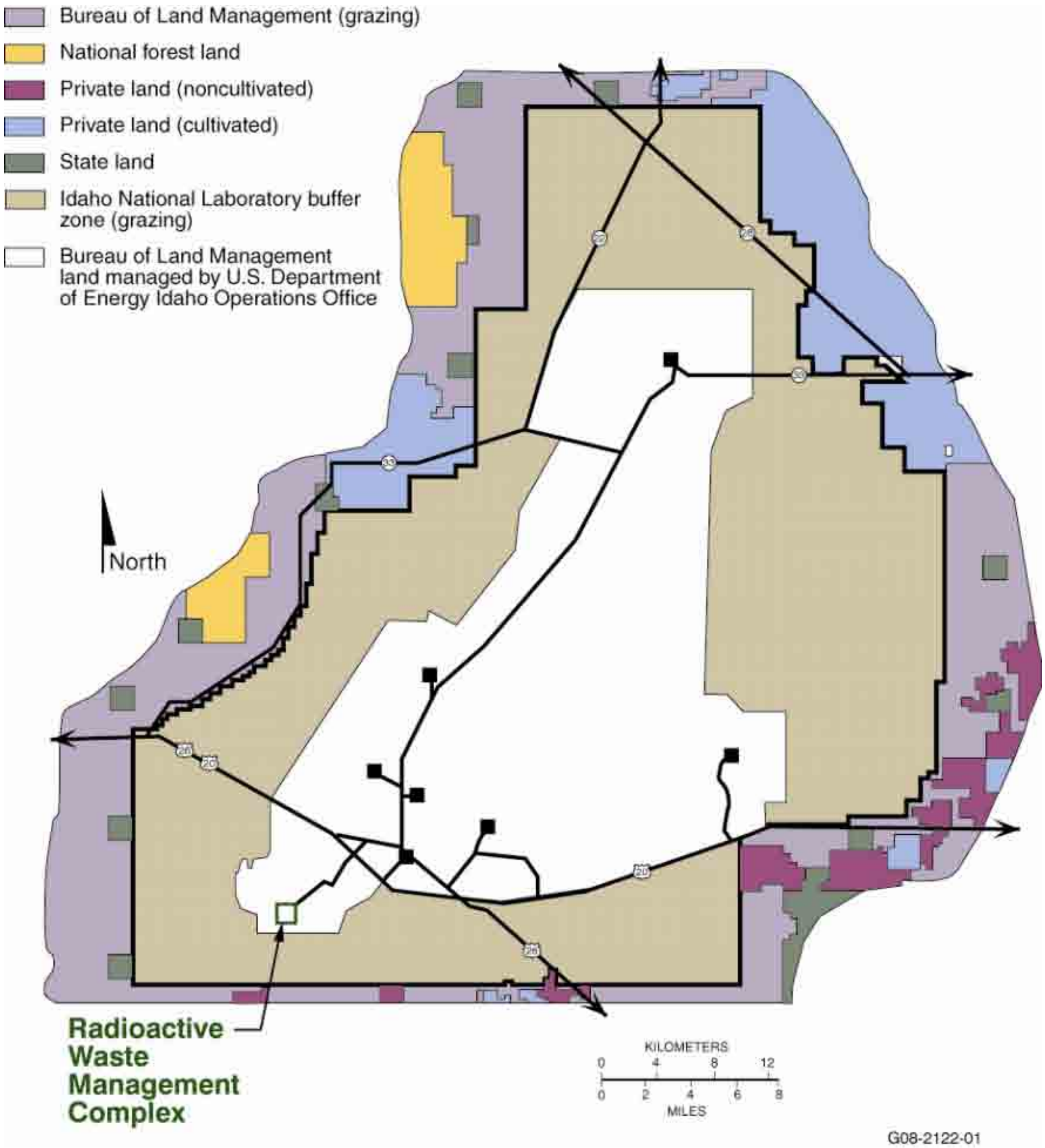


Figure 5. Land ownership and use in the vicinity of the Idaho National Laboratory Site.

Laws and regulations that govern transfer of federal land are presented in the *INL Site-wide Institutional Controls Plan*.[55] These will ensure future protection of human health and the environment through property transfer documentation required by CERCLA § 120[9] and EPA institutional controls policy.[56] Requirements include notices of contamination and remediation history, zoning restrictions issued by the appropriate local land use authority in conjunction with any transfer from federal ownership, restrictions in transfer deeds that preserve institutional controls, warranties and covenants, that all necessary remedial action has been performed prior to transfer of title, and that the government will perform any additional remedial action found necessary after transfer. Most INL Site land was withdrawn from the public domain. Some portions of the INL Site were acquired from previous nonfederal owners. Any transfer of land from federal to nonfederal ownership would require compliance with the detailed property transfer procedures of the Federal Property and Administrative Services Act[57] and other applicable statutes, as well as the restrictions of CERCLA § 120(h).[9] Because of the significant hurdles associated with transfer of federal land containing any residual contamination—including the potential liability of the federal government under CERCLA, tort, contract, and real property law—transfer outside federal ownership, or even to unrestricted access, would be highly unlikely for any such contaminated property at the INL Site. Therefore, the possibility of development of contaminated INL Site land by nonfederal entities, whether for residential or commercial purposes, is remote.

## 6.2 Land Use at Radioactive Waste Management Complex

Current land use at RWMC is limited to industrial applications (i.e., waste management operations and associated support). Waste is received at RWMC for storage, examination, or disposal. Once accepted, waste is transferred to the Transuranic Storage Area or the SDA, as appropriate.

Current operations within the Transuranic Storage Area include the Advanced Mixed Waste Treatment Project. The project is contracted to retrieve and treat approximately 62,000 $m^3$ (81,100 $yd^3$) of transuranic and alpha low-level waste from the Transuranic Storage Area. Operations are expected to be completed no later than December 2018, after which, the facility may undergo closure under the HWMA[29]—which is the implementation of the Resource Conservation and Recovery Act (RCRA)[58] in the State of Idaho—and deactivation, decontamination, and decommissioning.[53]

Several thousand cubic meters of low-level radioactive waste are disposed of in the SDA each year. Disposal of contact-handled low-level waste will continue through the year 2008. Disposal of remote-handled low-level waste likely will continue until the facility is full or until 2015, when it must be closed in preparation for final remediation of the SDA.

Because RWMC does not have a long-term mission, RWMC buildings and infrastructure are anticipated to be removed before the year 2035. However, after the surface barrier is complete and the remedy is certified as operational and functional, long-term management and control will be required at RWMC to maintain the OCVZ system, periodically inspect and maintain the surface barrier, monitor the site, restrict access to residual contamination, and maintain institutional controls. The land-use control boundary around RWMC will be expanded beyond the current fence line (see Figure 2). During remediation, lay-down areas for construction and site access will be required. In addition, the surface barrier and perimeter road will extend beyond the current fence line. Residential development near RWMC in the future is not expected, and the Agencies agree that it is reasonable to assume that the federal government will maintain control and restrict access in the future.

## 6.3 Groundwater Use

The Snake River Plain Aquifer is the source of all water used at the INL Site. RWMC withdraws water from a production well located in the Administration and Operations Area (see Figure 2) for industrial uses such as process water and fire water. Water from this same well is treated to provide potable water for workers.

Residential groundwater use is not allowed on the INL Site, cannot occur before 2095, and is only a remote possibility after that time.[59] For purposes of designing the OU 7-13/14 Selected Remedy, it is assumed that hypothetical future residents could live immediately outside the RWMC land-use control boundary (see Figure 2) and use the aquifer as a source of drinking water and water for other household uses. However, residential development near RWMC in the future is not expected, and the Agencies agree that it is reasonable to assume that the federal government will maintain control and restrict access in the future.

# 7. SUMMARY OF SITE RISKS

The baseline risk assessment evaluated risk to human health and the environment in the absence of any remedial action to reduce exposures. Land use is projected to remain industrial. Residential development near RWMC in the future is not expected, and the Agencies agree that it is reasonable to assume that the federal government will maintain control and restrict access in the future. However, to provide a protective basis for decision-making, the conservative assumption was adopted that a hypothetical future resident could be located immediately adjacent to the current facility fence line 100 years in the future. For purposes of risk assessment, the 100-year period was defined as 2010 to 2110. Figure 6 illustrates the human health conceptual site model.

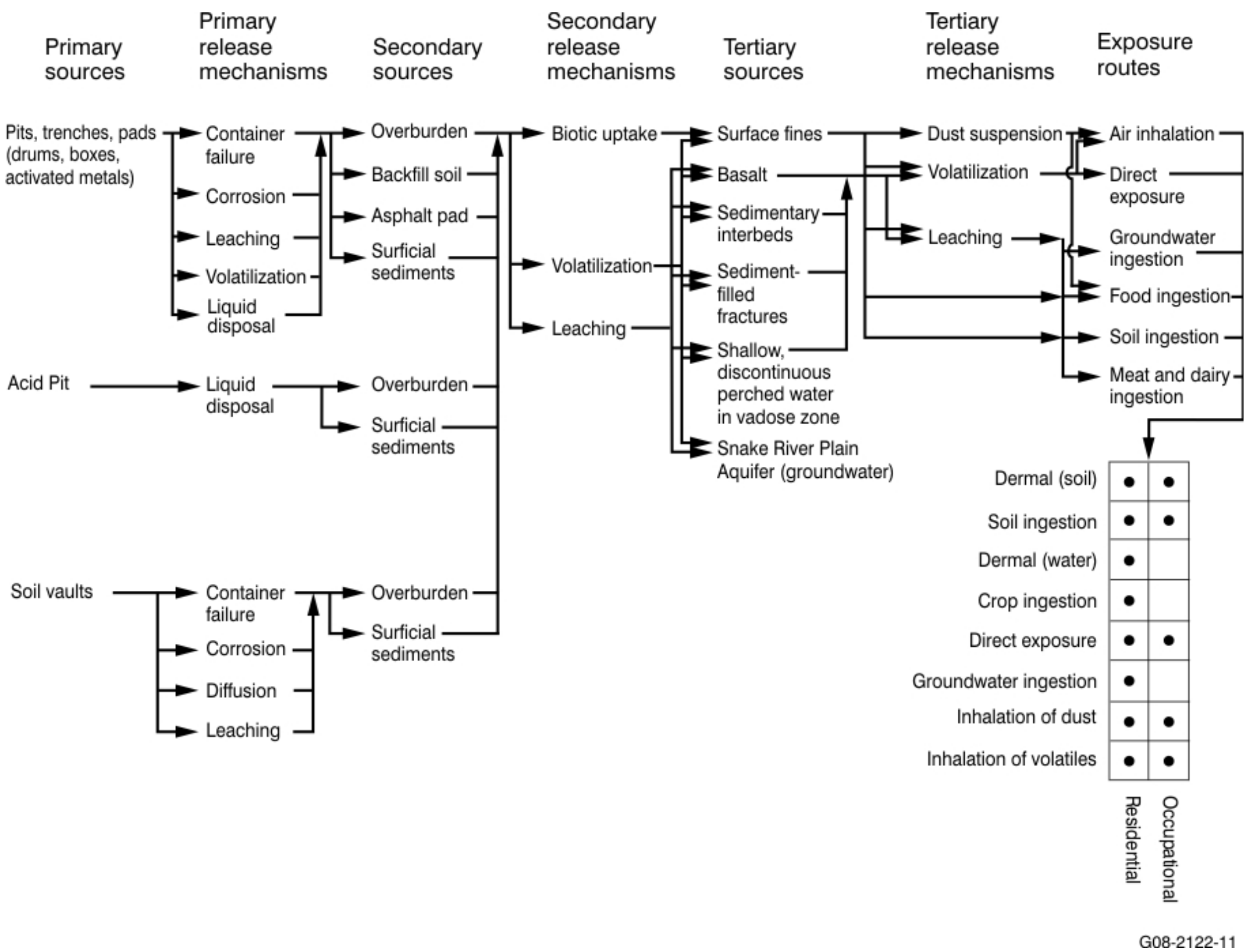


Figure 6. Human health conceptual model.

Three values used to define levels of contamination that warrant risk management are carcinogenic (i.e., cancer) risk, toxic effects, and concentrations in the aquifer. Risk thresholds used to define contaminants of concern based on these values are as follows:

- Probability ranging from $10^{-6}$ to $10^{-4}$ (i.e., E-06 to E-04) of developing an excess cancer
- Hazard index greater than or equal to 1
- Simulated aquifer concentrations that exceed MCLs.

Computer models used to predict future concentrations of contaminants that could affect soil, air, and groundwater[49,52] indicate that risk from OU 7-13/14 could exceed threshold values. Estimated cumulative risk at the end of the hypothetical 100-year institutional control period for the future residential scenario (i.e., when a resident could live adjacent to the SDA) for surface exposure pathways is 7E-03 (70 in 10,000); estimated groundwater ingestion risk is 9E-04 (9 in 10,000). Residential exposure pathways that pose human health risks greater than threshold values are external exposure to radiation, soil ingestion, crop ingestion, inhalation of dust, inhalation of volatiles, dermal exposure, and groundwater ingestion.

In addition to the future residential scenario, the baseline risk assessment evaluated occupational scenarios, risk to a potential inadvertent intruder (i.e., an agricultural well-driller), and ecological risk. Risk exceeds threshold values for these scenarios; however, human health risk estimates are higher for potential future residents than for workers and well-drillers. For example, risk estimates for only one contaminant, cesium-137, exceeded 1E-05 for the well-driller scenario. Cesium-137 was already identified as a contaminant of concern based on the residential scenario. Residential risk from external exposure to cesium-137 is 2E-03 compared to 4E-04 for the inadvertent well driller. Risk for all human health scenarios and environmental risks will be mitigated by a surface barrier designed to deter intruders in combination with institutional controls to limit unauthorized access.

Primary contaminants of concern include radionuclides and chemicals that could migrate to the surface or to the aquifer in concentrations that exceed risk thresholds within 1,000 years in accordance with guidance for cumulative risk assessment at the INL Site.[60] Tables 2, 3, and 4 list primary contaminants of concern that must be addressed through remedial action and risk management at Waste Area Group 7. Tables 2 and 3 provide the following information:

- Radionuclides and chemicals that could pose risk that exceeds threshold values
- Peak (i.e., highest) risk estimates and hazard indexes
- Years the peaks are predicted to occur
- Types of exposure that pose the most risk.

Table 4 lists contaminants of concern based on the potential to exceed MCLs in groundwater. Historically, carbon tetrachloride has been detected in concentrations slightly greater than its MCL of 0.005 mg/L (5 µg/L) in seven aquifer monitoring wells[11]; it continues to slightly exceed its MCL in two locations.[43] Modeling implies that iodine-129 and all six chemical contaminants of concern could exceed MCLs within 1,000 years. Table 4 lists peak simulated groundwater concentrations, years the peak concentrations are predicted to occur, and MCLs.

To address uncertainties associated with groundwater modeling for those radionuclides that did not reach peak concentrations within 1,000-year simulations, the Agencies extended modeling simulations to 10,000 years. As a result, the following long-lived radionuclides were identified as secondary contaminants of concern based on risk screening: actinium-227, neptunium-237, protactinium-231, uranium-233, uranium-234, uranium-235, uranium-236, and uranium-238. Modeling the period from 1,000 to 10,000 years also indicated that concentrations of neptunium-237 and uranium-238 could exceed MCLs thousands of years in the future.

Two general categories of waste are associated with risk: waste received from Rocky Flats Plant weapons production and waste received from INL Site reactor research and operations. Primary contaminants of concern for surface exposure to radioactivity are mostly from Rocky Flats Plant waste, while radiological groundwater contaminants of concern (i.e., iodine-129 and technetium-99) are from waste generated at the INL Site (see Table 2). Almost all chemical contaminants of concern (see Table 3) came from the Rocky Flats Plant. Secondary contaminants of concern, all of which are radioactive, also came mostly from the Rocky Flats Plant. In general, contaminants of concern from INL Site reactor operations are located in trenches and soil vaults, while most contaminants of concern from the Rocky Flats Plant were disposed of in pits.

The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

Table 2. Radionuclide contaminants of concern based on 1,000-year future residential scenario peak risk estimates outside the boundary of the Subsurface Disposal Area in the absence of remedial action.

| Radionuclide | Peak Risk[a] | Year | Primary Exposure Pathways[a] |
|---|---|---|---|
| Americium-241 | 3E-03 (30 in 10,000) | 2594 | External exposure, soil ingestion, and inhalation |
| Carbon-14 | 1E-05 (0.1 in 10,000) | 2110 | Groundwater ingestion and inhalation of volatiles (at the surface) |
| Cesium-137 | 2E-03 (20 in 10,000) | 2110 | External exposure and crop ingestion |
| Lead-210 | 3E-05 (0.3 in 10,000) | 3010 | Crop and soil ingestion |
| Plutonium-239 | 3E-03 (30 in 10,000) | 3010 | Soil ingestion, crop ingestion, and inhalation |
| Plutonium-240 | 6E-04 (6 in 10,000) | 3010 | Soil ingestion, crop ingestion, and inhalation |
| Radium-226 | 7E-04 (7 in 10,000) | 3010 | External exposure and crop ingestion |
| Radium-228 | 3E-05 (0.3 in 10,000) | 3010 | External exposure |
| Strontium-90 | 1E-03 (10 in 10,000) | 2110 | Crop ingestion, external exposure, and soil ingestion |
| Technetium-99 | 5E-05 (0.5 in 10,000) | 2858 | Groundwater ingestion and crop ingestion (crops irrigated with contaminated groundwater) |

a. All exposure pathways that could pose risk are assessed in the Remedial Investigation and Baseline Risk Assessment [11]; those contributing most to risk are listed as primary exposure pathways.

Table 3. Chemical contaminants of concern based on 1,000-year future residential scenario peak risk estimates outside the boundary of the Subsurface Disposal Area in the absence of remedial action.

| Chemical | Peak Risk[a] | Year | Peak Hazard Index[a] | Year | Primary Exposure Pathways[a] |
|---|---|---|---|---|---|
| Carbon tetrachloride[b] | 4E-04 (4 in 10,000) | 2117 | 10 | 2119 | Inhalation of volatiles (at the surface) and groundwater ingestion |
| 1,4-Dioxane[b] | 2E-05 (0.2 in 10,000) | 2110 | NA | NA | Groundwater ingestion |
| Tetrachloroethylene[b] | 4E-04 (4 in 10,000) | 2136 | <1 | 2136 | Groundwater ingestion and dermal exposure |
| Trichloroethylene[b] | 2E-05 (0.2 in 10,000) | 2141 | NA | NA | Groundwater ingestion |

a. All exposure pathways that could pose risk are assessed in the Remedial Investigation and Baseline Risk Assessment[11]; those contributing most to risk are listed as primary exposure pathways.
b. Chemicals contained in organic solvent waste.

NA = not applicable

Table 4. Contaminants of concern based on simulated peak groundwater concentrations that exceed maximum contaminant levels within 1,000 years outside the boundary of the Subsurface Disposal Area in the absence of remedial action.

| Contaminant of Concern | Peak Groundwater Concentration | Year | Maximum Contaminant Level |
|---|---|---|---|
| Iodine-129 | 2.9 pCi/L | 2870 | 1 pCi/L |
| Carbon tetrachloride | 0.28 mg/L | 2133 | 0.005 mg/L |
| 1,4-Dioxane | 0.17 mg/L | 2120 | 0.003 mg/L[a] |
| Methylene chloride | 0.058 mg/L | 2245 | 0.005 mg/L |
| Nitrate | 49 mg/L | 2295 | 10 mg/L |
| Tetrachloroethylene | 0.067 mg/L | 2145 | 0.005 mg/L |
| Trichloroethylene | 0.12 mg/L | 2145 | 0.005 mg/L |

a. A maximum contaminant level is not established, but a health advisory level is available.

# 8. REMEDIAL ACTION OBJECTIVES AND CLEANUP LEVELS

Remedial action objectives describe what site cleanup must accomplish. The generally acceptable risk range for site-related exposures under the National Contingency Plan[3] is $10^{-4}$ to $10^{-6}$. The Agencies agree that the cumulative risk threshold for OU 7-13/14 is at the upper end of this range ($10^{-4}$) based on (1) conservative approaches in risk assessment that tend to overestimate risk, (2) use of $10^{-4}$ in many other risk-management decisions across the INL Site, (3) remote location of the INL Site, and (4) land-use restrictions and institutional controls specified in this ROD. Remedial action objectives for the SDA are listed below:

1. Limit cumulative human health cancer risk for all exposure pathways to $10^{-4}$
2. Limit noncancer risk for all exposure pathways to a cumulative hazard index of less than 1 for current and future workers and future residents
3. Inhibit migration of contaminants of concern into the vadose zone and the underlying aquifer
4. Prevent unacceptable exposure to biota from soil
5. Inhibit transport of contaminants of concern to the surface by plants and animals.

Cleanup levels (remediation goals) are measurable quantities used to demonstrate that remedial action objectives are satisfied. Because candidate remedial actions for the SDA focus primarily on source control,[61] the following performance objectives, rather than contaminant-specific concentrations, are defined as cleanup levels:

1. Reduce carcinogenic risk at the surface to less than $10^{-4}$ by maintaining an effective dose equivalent rate at the surface of less than 15 mrem/year[62] as a measurable performance objective
2. Reduce infiltration, continue to operate the OCVZ system, and remove targeted waste such that concentrations of contaminants of concern in the aquifer are less than MCLs before 2110.

In addition, OU 7-13/14 adopts cleanup goals originally developed by OU 7-08[63] for two regions in the vadose zone (i.e., Zones A1 and A2) (see Figure 4). Operational experience shows that the OCVZ system is effectively removing vapor from current extraction Zones A1 and A2. Retaining goals for Zones A1 and A2, in addition to MCLs in the aquifer, is protective. Cleanup goals to reduce transport of solvents to the aquifer are as follows:

3. Maintain concentrations of carbon tetrachloride in vadose zone soil vapor above the B-C interbed (i.e., Zone A1 approximately the 9 to 30-m [30 to 100-ft] -depth interval) to less than 190 ppmv

4. Maintain concentrations of carbon tetrachloride in vadose zone soil vapor between the B-C and C-D interbeds (i.e., Zone A2 approximately the 30 to 73-m [100 to 240-ft] -depth interval) to less than 39 ppmv.

# 9. DESCRIPTION OF ALTERNATIVES

Six assembled alternatives were developed to assess remedial actions for the SDA. The Feasibility Study[13] developed five assembled alternatives. The Proposed Plan[21] presented a sixth option, the Agencies' Preferred Alternative, which was an optimized combination of elements from alternatives evaluated in the Feasibility Study. Alternatives were developed, evaluated against seven of the nine CERCLA criteria, and compared in accordance with guidance.[64] The last two CERCLA criteria, State and Community acceptance, are evaluated in this ROD.

Technologies that potentially could meet remedial action objectives were identified and screened with respect to their potential effectiveness and technical feasibility. Representative technologies were selected from those retained after screening, and the retained technologies were combined into assembled alternatives, ranging from No Action to Full Retrieval of all waste from the SDA.

## 9.1 Common Elements

The Feasibility Study[13] focuses on remedial alternatives that reduce transport of contaminants from the landfill into the environment. The Agencies concluded[61] early in the study of the SDA that an engineered surface barrier would be a component of every alternative evaluated in the Feasibility Study.[13] Therefore, each alternative developed for the SDA, except No Action, includes a surface barrier. Several additional common elements are necessary to ensure that the selected remedial action protects human health and the environment. Elements common to all action alternatives, including the Preferred Alternative presented in the Proposed Plan and the Selected Remedy in this ROD, are:

- ***Engineered surface barrier***—Each alternative includes a surface barrier to inhibit contaminant transport to the surface by plants and animals and to inhibit infiltration and subsequent transport of contaminants to the vadose zone. Overall thickness of the barrier, coupled with long-term management and control, would preclude inadvertent human intrusion.

- ***Vapor vacuum extraction and treatment***—Continued operation of the OCVZ system established under OU 7-08 is a primary component in each action alternative. The OCVZ system extracts and treats solvent vapors from the vadose zone. Operation and maintenance of the OCVZ system would continue through construction of the surface barrier and beyond until discontinued based on monitoring.

- ***Long-term institutional control***—Analysis for OU 7-13/14 includes 100 years of post-remediation long-term institutional control and other long-term management and control activities as a basis for modeling and cost estimating. However, these activities would not be limited to 100 years. Long-term institutional control would continue indefinitely (i.e., until eliminated through the 5-year review process in accordance with CERCLA). Other long-term management and control activities include surveillance, maintenance, and monitoring after construction of the surface barrier is complete and the remedy is declared operational and functional.

Three particular attributes of the SDA can be addressed by a variety of remedial methods. Each action alternative includes modules to address these elements:

- ***Pretreatment for subsidence control***—Each alternative includes one of three modules evaluating process options to address subsidence to provide a stable foundation for the surface barrier.
- ***Pad A***—Each alternative incorporates one of six modules to address Pad A—a unique abovegrade disposal area with an existing ROD[19]—into the comprehensive remedy.
- ***Near-surface, released solvent vapors***—Each alternative incorporates one of three modules to preclude buildup of solvent vapors immediately beneath or within the surface barrier. These options minimize solvent vapors trapped in the subsurface by the surface barrier and are in addition to continued operation of the existing OCVZ system to extract and treat solvent vapors from the vadose zone. Solvent vapors trapped in the subsurface could increase concentrations reaching the aquifer.

Alternatives developed in the Feasibility Study[13] are (1) No Action; (2) Surface Barrier; (3) In Situ Grouting; (4) Partial Retrieval, Treatment, and Disposal; and (5) Full Retrieval, Treatment, and Disposal. The Preferred Alternative presented in the Proposed Plan is Targeted Waste Retrieval, In Situ Grouting, Vadose Zone Vapor Vacuum Extraction and Treatment, Evapotranspiration Surface Barrier, and Long-Term Institutional Controls. Each alternative is summarized below. Summaries include cost estimates, which include the common elements for a period of 100 years following completion of the engineered surface barrier described above. Both current value and net present value cost estimates for direct work are provided.

## 9.2 Alternative 1—No Action

Alternative 1 consists of environmental monitoring with no remediation to reduce risk. Alternative 1 cannot be selected because it does not meet threshold criteria. Therefore, it is not evaluated further as a potential remedy, but is developed as required under CERCLA and used as a basis for comparison of action alternatives. This alternative would cost approximately $57 million current value ($16 million net present value) for direct work.

## 9.3 Alternative 2—Surface Barrier

Alternative 2 would protect human health and the environment. Coupled with vadose zone vapor extraction and institutional controls, the surface barrier would be effective for all contaminants. Under this alternative, a surface barrier would be constructed to reduce infiltration through buried waste and inhibit contaminant migration to the vadose zone and aquifer. The surface barrier also would inhibit contaminant transport to the surface by plants and animals. Overall thickness of the surface barrier, coupled with long-term management and control, would preclude inadvertent human intrusion and prevent unacceptable exposure to plants and animals from soil.

Many surface barrier designs were examined for the SDA. Two designs were retained for evaluation: Alternative 2a—Modified RCRA Type C Surface Barrier (see Figure 7) and Alternative 2b—Evapotranspiration Surface Barrier (see Figure 8). The surface barrier would be up to 6 m (20 ft) thick. Each subalternative includes the common elements described above. The primary difference between these alternatives is design of the surface barrier. The two subalternatives also incorporate differing approaches to control subsidence, address Pad A, and prevent buildup of vapors beneath the surface barrier.

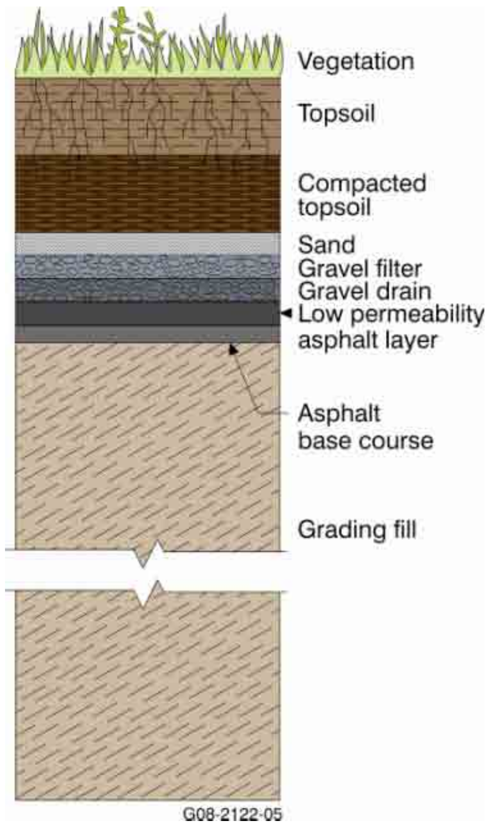


Figure 7. Cross section of a modified RCRA Type C surface barrier (Alternative 2a).

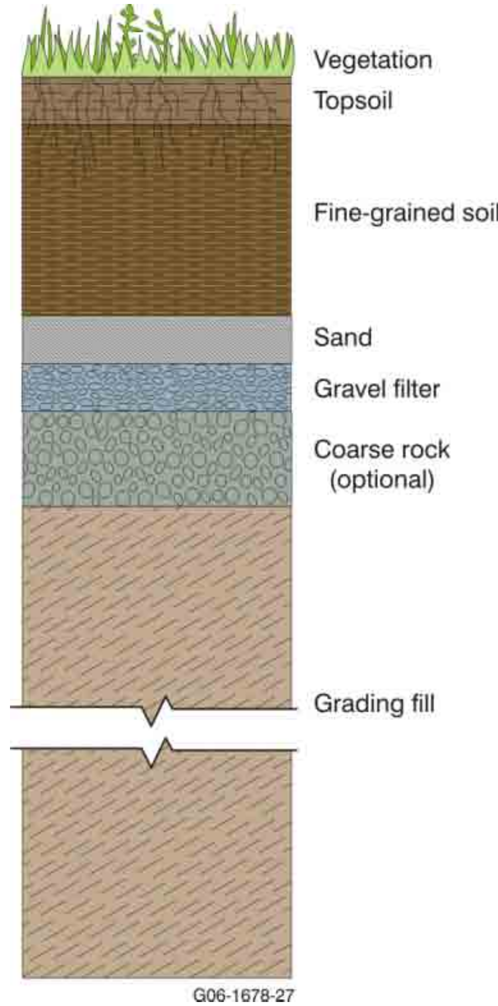


Figure 8. Cross section of a typical evapotranspiration surface barrier (Alternative 2b).

### 9.3.1 Alternative 2a—Modified RCRA Type C Surface Barrier

Alternative 2a includes construction of a modified RCRA Type C surface barrier. The surface barrier would be constructed of multiple thin and thick layers of asphalt and natural materials and covered with vegetation. The design is similar to a standard RCRA[58] surface barrier used at Subtitle C-licensed disposal facilities across the country, but it incorporates a sloped, low-permeability asphalt layer near the base of the barrier to divert infiltrating water to the edges. Because the asphalt layer would be particularly susceptible to damage from subsidence, pits would be pretreated to provide a stable foundation. Pad A would be left in its current configuration, and the surface barrier would be designed to address the elevation difference. Several near-surface vapor vacuum extraction wells would be installed near high concentrations of organic waste to mitigate buildup of vapors beneath the asphalt layer. Construction would require approximately 7 years. Common elements, described in Section 9.1, are critical components included to ensure long-term performance of this alternative. The complete alternative would cost approximately $344 million current value ($176 million net present value) for direct work.

### 9.3.2 Alternative 2b—Evapotranspiration Surface Barrier

Alternative 2b includes construction of an evapotranspiration surface barrier. The surface barrier would be constructed of several layers of natural materials and covered with vegetation. Unlike the modified RCRA Type C surface barrier, an evapotranspiration barrier is designed to store excess moisture until it evaporates or is absorbed by plants and transpired to the atmosphere. The evapotranspiration barrier would be less susceptible to damage from subsidence, though steps to minimize subsidence in pit areas would be included to reduce surface barrier maintenance. Waste would be removed from Pad A and transferred to the Low-Level Waste Pit (i.e., Pits 17 through 20 in Figure 2) to facilitate construction of the surface barrier. The surface barrier would include a layer that inhibits biotic intrusion and collects vapors. An active gas-collection system would be integrated into the evapotranspiration barrier to prevent buildup of vapors. Construction would require approximately 10 years, 3 years longer than for Alternative 2a because of the difference in approaches for Pad A. Common elements, described in Section 9.1, are critical components included to ensure long-term performance of this alternative. The complete alternative would cost approximately $331 million current value ($179 million net present value) for direct work.

## 9.4 Alternative 3—In Situ Grouting

Primary features of Alternative 3 are in situ grouting (see Figure 9), removing solvent vapors from the vadose zone, and controlling potential exposure to contaminants of concern through containment (i.e., source control) with an evapotranspiration surface barrier and long-term management and control. Waste forms containing mobile technetium-99 and iodine-129 would be grouted in place using highly impermeable grout to reduce mobility caused by infiltrating moisture. Specified soil vaults and trench areas totaling approximately 0.2 acres would be grouted. This alternative includes removing Pad A waste, stabilizing it by ex situ grouting, and disposing of it below grade within the SDA. The surface barrier would include a layer that inhibits biotic intrusion and collects vapor. Passive venting would prevent buildup of vapors beneath the surface barrier. Construction would require approximately 10 years. Common elements, described in Section 9.1, are critical components included to ensure long-term performance of this alternative. The complete alternative would cost approximately $385 million current value ($223 million net present value) for direct work.

## 9.5 Alternative 4—Partial Retrieval, Treatment, and Disposal

Alternative 4 comprises two subalternatives: Alternative 4a—4-Acre Retrieval, Treatment, and Disposal; and Alternative 4b—2-Acre Retrieval, Treatment, and Disposal. In addition to removing solvent vapors from the vadose zone and controlling potential exposure to contaminants of concern through containment (i.e., source control) with an evapotranspiration surface barrier and long-term management and control, both subalternatives evaluate retrieval using the targeted waste approach defined for the Accelerated Retrieval Projects. Targeted retrieval involves removing the following specified Rocky Flats Plant waste types[e]: Series 741 sludge, Series 743 sludge, roaster oxides, graphite, and filters. Retrieved transuranic waste would be processed for shipment to WIPP, while retrieved nontransuranic waste would be sent to an authorized facility for treatment, as necessary, and disposal at an appropriate facility in accordance with waste acceptance criteria. The primary difference between these subalternatives is the cumulative sizes of the pit areas that would be retrieved. Other variables between the two subalternatives are options for controlling subsidence in pits and addressing Pad A. In combination, the two subalternatives facilitate scaling up or down to various retrieval area sizes, including or excluding Pad A.

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e. Because Series 742 sludge was not identified as a targeted waste form for Accelerated Retrieval Projects I and II,[15,16] it was not included in Alternative 4 in the Feasibility Study.[13] However, Series 742 sludge is identified as targeted waste as of July 3, 2008, in accordance with the Agreement to Implement.[5]

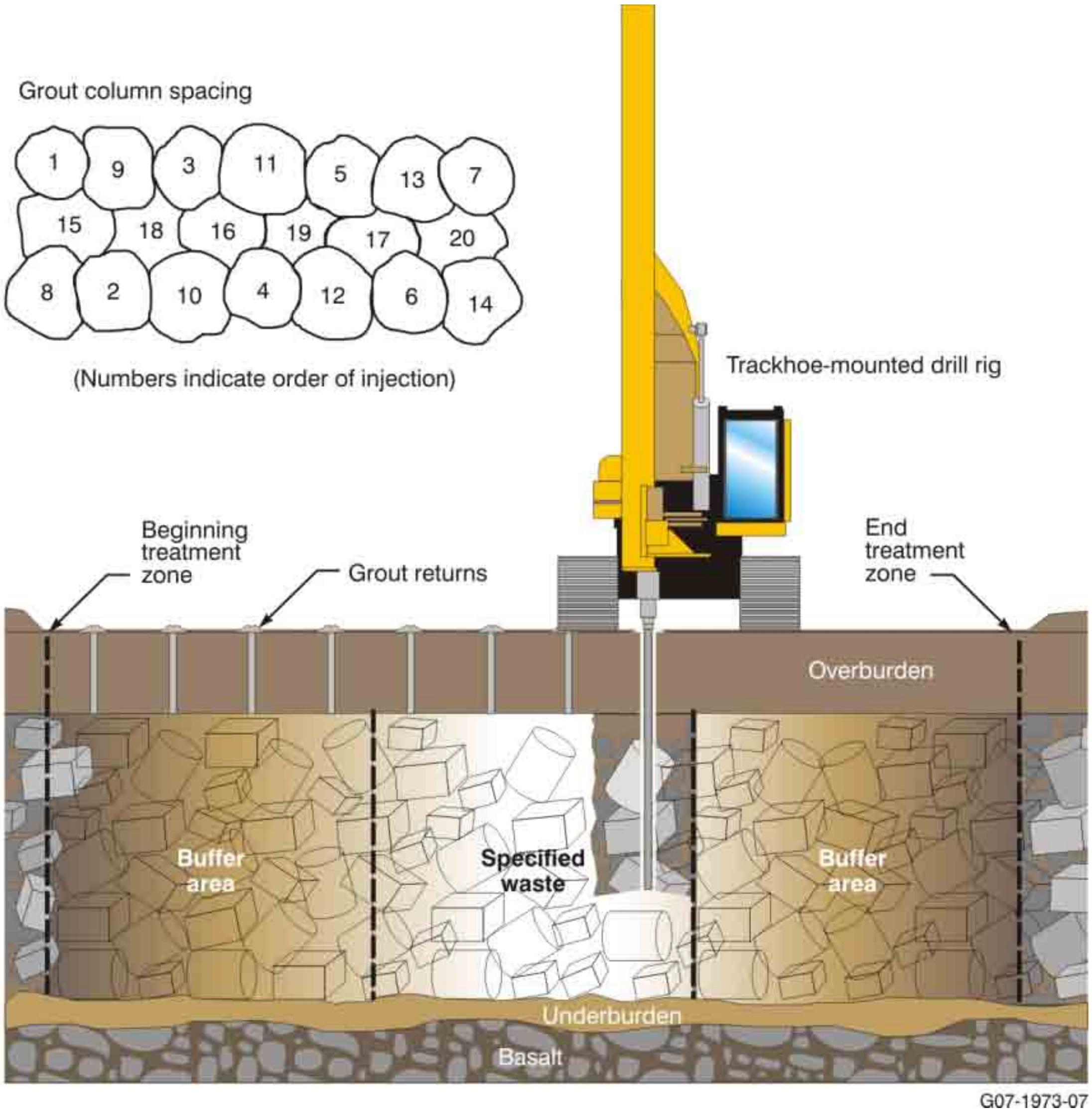


Figure 9. In situ grouting with a trackhoe-mounted drill rig to reduce mobility of contaminants in place within the treatment zone.

### 9.5.1 Alternative 4a—4-Acre Retrieval, Treatment, and Disposal

Alternative 4a identifies pit areas totaling 4 acres for targeted waste retrieval. The Pad A option under Alternative 4a involves transferring Pad A waste to the Idaho CERCLA Disposal Facility for treatment and disposal. A layer in the surface barrier would inhibit biotic intrusion and collect vapors. Passive venting would prevent buildup of vapors beneath the surface barrier. Construction would require approximately 16 years. Common elements, described in Section 9.1, are critical components included to ensure long-term performance of this alternative. The complete alternative would cost approximately $1.1 billion current value ($756 million net present value) for direct work.

### 9.5.2 Alternative 4b—2-Acre Retrieval, Treatment, and Disposal

Alternative 4b identifies pit areas totaling 2 acres for targeted waste retrieval. These 2 acres could be a subset of areas totaling 4 acres, described in Alternative 4a, because experience from the Accelerated

Retrieval Project indicates that targeted waste can be successfully located with an improved level of confidence and precision. Pad A would be pretreated to minimize subsidence and incorporated into the surface barrier. The surface barrier would include a layer that inhibits biotic intrusion and collects vapors. Passive venting would prevent buildup of vapors beneath the surface barrier. Construction would require approximately 12 years. Common elements, described in Section 9.1, are critical components included to ensure long-term performance of this alternative. The complete alternative would cost approximately $705 million current value ($486 million net present value) for direct work.

## 9.6 Alternative 5—Full Retrieval, Treatment, and Disposal

For Alternative 5, all waste within the SDA (approximately 35 acres) would be retrieved and shipped elsewhere. Additional features include removing solvent vapors from the vadose zone and controlling potential exposure to contaminants of concern through containment with a simplified evapotranspiration surface barrier and long-term management and control. Transuranic waste would be processed for shipment to WIPP, while nontransuranic waste would be sent to an authorized facility for treatment, as necessary, and disposed of in accordance with waste acceptance criteria. Some of the waste would require remote-handling techniques because of high exposure rates. Waste with no current disposal path would be stored temporarily in a new facility near the SDA for up to 20 years, pending development of an appropriate disposal facility. Additional actions would include backfilling and compacting excavated areas and finishing with a graded layer of topsoil. Topsoil, grading fill, backfill, and underlying basalt would restore characteristics of undisturbed soil, which is the purpose of an evapotranspiration surface barrier. The surface barrier would reduce infiltration, thus inhibiting further transport of remaining contaminants that may have migrated to the vadose zone. A biotic barrier and gas-venting layer would not be required because all waste would be removed, though operation of the vadose zone vapor vacuum extraction system would continue until remediation goals were achieved. Construction would require approximately 30 years. Common elements, described in Section 9.1, are critical components included to ensure long-term performance of this alternative. The complete alternative would cost approximately $13.7 billion current value ($8.4 billion net present value) for direct work.

## 9.7 Preferred Alternative—Targeted Waste Retrieval, In Situ Grouting, Vadose Zone Vapor Vacuum Extraction and Treatment, Evapotranspiration Surface Barrier, and Long-Term Institutional Controls

The Preferred Alternative as presented and evaluated in the Proposed Plan[21] was an optimized combination of elements from Alternatives 2, 3, and 4. It included the same targeted waste retrieval module analyzed for Alternative 4, scaled for the amount of acreage, to retrieve and manage targeted waste from 4.80 acres of pit areas. In situ grouting of 0.2 acres of trenches and soil vaults, as analyzed for Alternative 3, was included to reduce mobility of technetium-99 and iodine-129. Waste on Pad A would be left in place as evaluated for Alternative 4b. To provide a stable foundation for the evapotranspiration surface barrier, potential subsidence of pits and Pad A would be addressed using methods to be determined during remedial design. The evapotranspiration surface barrier described for Alternative 2b would be constructed. The barrier would be up to 6 m (20 ft) thick. A layer in the surface barrier would inhibit biotic intrusion and collect vapor. Passive venting would prevent buildup of vapors beneath the surface barrier, as evaluated for Alternative 3. Construction would require approximately 18 years. Common elements, described in Section 9.1, are critical components included to ensure long-term performance of this alternative. The complete alternative would cost approximately $1.1 billion current value ($734 million net present value) for direct work. The Selected Remedy in this ROD is very similar to the Preferred Alternative presented in the Proposed Plan. Section 14 discusses the differences.

# 10. COMPARATIVE ANALYSIS OF ALTERNATIVES

This section compares the performance of action alternatives relative to CERCLA evaluation criteria. Alternative 1 (No Action), comprising environmental monitoring with no other steps to reduce exposure, does not satisfy threshold criteria. It does not provide overall protection or satisfy ARARs. Over time, plants and animals would transport contaminants to the surface, resulting in contaminant concentrations in surface soil that could exceed risk thresholds. Concurrently, moisture would continue to infiltrate through buried waste, resulting in contaminant concentrations in groundwater that could exceed risk thresholds.

## 10.1 Overall Protection of Human Health and the Environment

All action alternatives would provide adequate and relatively equivalent protection and would satisfy this threshold criterion, primarily because all action alternatives include (1) a surface barrier and (2) extraction of solvent vapors from the vadose zone. Overall thickness of the surface barrier, coupled with long-term institutional controls, would preclude inadvertent human intrusion and prevent unacceptable exposure to biota from soil. Other long-term management and control activities (e.g., surveillance, maintenance, and monitoring) would ensure continued protectiveness. The surface barrier would inhibit transport of contaminants to the surface by plants and animals and reduce infiltration to inhibit migration of contaminants of concern into the vadose zone and underlying aquifer. Continued operation of the OCVZ system would collect vadose zone vapors to reduce transport of solvents to the aquifer. The Selected Remedy improves protectiveness by reducing uncertainty by performing additional targeted waste retrieval and grouting of specific waste types.

## 10.2 Compliance with Applicable or Relevant and Appropriate Requirements

All action alternatives would comply with ARARs and would, therefore, be eligible for selection based on this threshold criterion. Each alternative would comply with ARARs relating to radiation protection, airborne concentrations, groundwater quality, MCLs, radioactive and hazardous waste management, archeological artifacts, and other chemical-, action-, and location-specific regulations.

## 10.3 Long-Term Effectiveness and Permanence

Evaluation of alternatives under this criterion addresses the anticipated risk remaining after remedial actions are complete (i.e., after construction of the final surface barrier). This criterion highlights the extent and effectiveness of controls that may be required to manage residual risk after construction is complete. The main considerations are magnitude of residual risk and adequacy and reliability of controls.

Long-term effectiveness was qualitatively evaluated for human-health surface exposure pathways and ecological receptors. This approach was adopted because each action alternative includes an engineered surface barrier that inhibits biotic intrusion and subsequent contaminant transport to the surface, thus interrupting surface exposure pathways for receptors. Overall thickness of the surface barrier, coupled with long-term institutional controls, would preclude inadvertent human intrusion. Additional long-term management and controls (e.g., surveillance, maintenance, and monitoring) would ensure continued protectiveness. As a result, effectiveness in addressing surface exposure pathways is not a discriminating factor among alternatives.

Conversely, long-term effectiveness relating to groundwater was quantitatively evaluated. Estimates of contaminant concentrations in the aquifer were modeled for each alternative. Resultant concentrations are addressed in two ways: (1) they are assessed for risk and compared to risk thresholds and remedial action objectives, and (2) they are compared directly to MCLs. The magnitude of residual concentrations and risk are dominating factors in assessing long-term effectiveness for groundwater.

### 10.3.1 Magnitude of Residual Risk

The Feasibility Study[13] described residual risk for three timeframes: 100; 1,000; and 10,000 years from year 2010. Based on land-use projections (see Section 6), groundwater ingestion risk for 100 years was evaluated for residents outside of the INL Site. From 100 to 1,000 years groundwater ingestion risk was evaluated for a hypothetical resident living next to the current RWMC fence line. All action alternatives provide essentially the same level of protection as the Preferred Alternative, with slightly better long-term performance for Alternative 5 in the distant future (i.e., after 500 years). The generally acceptable risk range for site-related exposures under the National Contingency Plan[3] is $10^{-4}$ to $10^{-6}$. The Agencies agree that the cumulative risk threshold for OU 7-13/14 is at the upper end of this range ($10^{-4}$) based on (1) conservative approaches in risk assessment that tend to overestimate risk, (2) use of $10^{-4}$ in many other risk-management decisions across the INL Site, (3) remote location of the INL Site, and (4) land-use restrictions and institutional controls specified in this ROD.

As modeled (instantaneous remediation in year 2010), all action alternatives satisfy remedial action objectives by reducing cumulative risk to less than 1E-04 (1 in 10,000) by the end of the 100-year hypothetical institutional control period (year 2110). However, modeling instantaneous remediation does not account for time required to implement each alternative. In reality, alternatives that require less time to implement reduce the amount of contamination that could accumulate in the vadose zone and potentially reach the aquifer. Thus, Alternative 2 (Surface Barrier) would perform slightly better within 100 years because it would require the least amount of time to implement (i.e., 7 to 10 years). More time would be required for Alternative 3 (In Situ Grouting), Alternative 4 (Partial Retrieval, Treatment, and Disposal), and the Preferred Alternative (Targeted Waste Retrieval, In Situ Grouting, Vadose Zone Vapor Vacuum Extraction and Treatment, Evapotranspiration Surface Barrier, and Long-Term Institutional Controls) (i.e., 10 to 18 years), while substantially more time would be required for Alternative 5 (Full Retrieval, Treatment, and Disposal) (i.e., 30 years).

Results for the 1,000-year timeframe are less sensitive to implementation periods for the respective alternatives. All action alternatives would satisfy remedial action objectives by the end of 100 years and would continue to reduce risk at a roughly equivalent rate until about halfway through the 1,000-year period, when Alternative 5 begins to slightly out-perform other alternatives.

Risk continues to diminish in the 10,000-year timeframe, and any initial sensitivity to implementation timeframes is no longer significant.

Results over time are similar for the cumulative hazard index, though the slight advantage Alternative 5 has over other alternatives is less pronounced because the hazard index is associated primarily with chemicals, while risk is dominated by radionuclides. Chemicals identified as contaminants of concern for Waste Area Group 7 (see Table 3) are not as persistent in the environment as radionuclides.

### 10.3.2 Reliability of Long-Term Controls

All action alternatives provide reliable long-term controls. Alternative 2a would incorporate Pad A into a surface barrier without addressing its potential subsidence; therefore, an increased level of maintenance to ensure surface barrier integrity could be required for some years until subsidence no longer occurred on Pad A.

Long-term surveillance, maintenance, monitoring, and institutional controls would be required for all action alternatives. Control would be required indefinitely (i.e., until discontinued through the CERCLA 5-year review process), involving a combination of active and passive measures to protect human health and the environment. Alternative 5 provides an advantage in terms of adequacy and reliability of controls because all buried waste would be gone; however, the site still would not qualify for unrestricted land use because of concentrations that would have migrated into the vadose zone. Therefore, institutional controls and other long-term management and controls (e.g., surveillance, maintenance, and monitoring) would be required for Alternative 5 as for the other action alternatives.

## 10.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

This evaluation criterion addresses the statutory preference for actions that incorporate treatment technologies, as their principal element, that permanently and significantly reduce toxicity, mobility, or volume of hazardous substances. This preference is satisfied when treatment is used to reduce principal threats by destroying toxic contaminants, reducing total mass of toxic contaminants, irreversibly reducing contaminant mobility, or reducing total volume of contaminated media. High organic content waste that contains solvents (e.g., carbon tetrachloride, tetrachloroethylene, and trichloroethylene) comprises principal threat waste. Because continued operation of the OCVZ system to collect and treat solvent vapors is a component of each action alternative, treatment of principal threat waste is not a discriminating factor in the relative comparison.

Each action alternative employs a surface barrier to reduce infiltration and flameless thermal treatment (i.e., catalytic oxidation) by the OCVZ system to destroy solvent vapors extracted from the vadose zone. The surface barrier would inhibit migration of contaminants by reducing the amount of water that infiltrates into the waste, but would not employ treatment as a principal element. Catalytic oxidation is an important element in reducing toxicity, mobility, and volume of solvent vapors collected from the vadose zone; however, it does not address the source of contamination (i.e., Series 743 sludge) that remains in the buried waste. Because each action alternative includes a surface barrier and continued operation of the OCVZ system to collect and treat solvent vapors from the vadose zone, these components do not offer any discrimination between alternatives.

Alternative 5 and the Preferred Alternative rank high for this criterion. Alternative 5 ranks high because treatments that may be required to meet waste acceptance criteria for treatment, storage, and disposal facilities outside the SDA would be applied. The Preferred Alternative ranks high because it includes both in situ grouting (as described for Alternative 3) and treatment of targeted uranium waste (as described for Alternative 4). Substantial amounts of waste contaminated with solvents and transuranics would be repackaged and disposed of at WIPP. WIPP is a deep geologic repository that isolates waste from the environment. Alternatives 3 and 4 rank slightly lower for this criterion. Alternative 3 treats technetium-99 and collocated iodine-129 waste forms by grouting to reduce mobility and inhibit transport into the vadose zone and aquifer, and retrieval and ex situ grouting of Pad A waste. Alternative 4 also incorporates limited treatment of targeted uranium waste and other waste forms that must be treated to satisfy waste acceptance criteria. Alternative 2 ranks lowest because it applies no treatment other than continued operation of the OCVZ system.

## 10.5 Short-Term Effectiveness

This evaluation criterion addresses risk incurred during construction and implementation of a remedy. Alternatives are evaluated in terms of hazard to remediation workers, collocated workers, and members of the public. Environmental impacts also are considered. Types of risk that can be incurred include exposures to chemicals and radionuclides, typical construction hazards, and transportation.

Transportation accidents include shipping construction material to the SDA from sources within and outside the INL Site. For those alternatives involving retrieval (i.e., Alternatives 4, 5, and the Preferred Alternative), risk associated with transport of waste outside the INL Site is incurred by the receiving facility (i.e., WIPP). Though transporting waste would pose risk, that risk is not double-counted for OU 7-13/14.

In general, short-term effectiveness diminishes with increasing complexity of the alternative and the amount of time required for implementation. Figure 10 illustrates approximate timeframes required to achieve remedial action objectives for each alternative evaluated in the Feasibility Study[13] and Proposed Plan.[21] Post-construction operation and maintenance of the OCVZ system are not elements that affect short-term effectiveness.

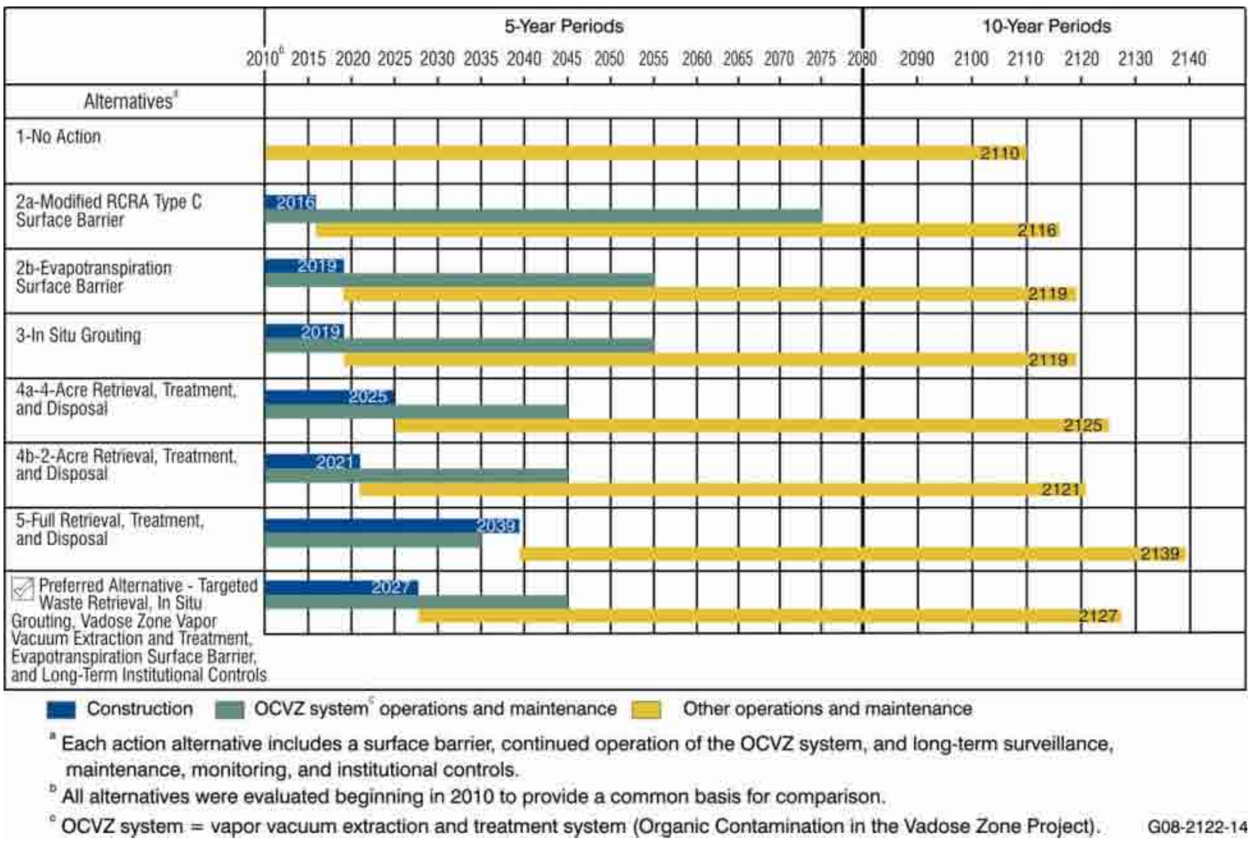


Figure 10. Approximate implementation timeframes for each remedial alternative presented in the Feasibility Study and Proposed Plan.

Alternative 2 performs best in terms of this criterion. Though some element of risk to workers would be associated with surface barrier construction, such risks include routine industrial hazards that could be mitigated readily through engineering and administrative controls. Effects on collocated workers, the environment, and members of the public would be minimal. Alternative 2a does not include retrieval of Pad A waste, so its short-term effectiveness is slightly better than Alternative 2b. Installation of additional near-surface vapor vacuum extraction wells under Alternative 2a involves standard construction techniques that would not substantially influence short-term effectiveness. Implementation timeframes are 7 and 10 years for Alternatives 2a and 2b, respectively. These relatively short implementation periods also reduce the probability that a serious accident would occur.

Alternative 3 is next best. Elements of risk associated with surface barrier construction, Pad A retrieval, and subsidence control for pits are the same as for Alternative 2. A slight amount of additional risk would be incurred as a consequence of additional waste handling required to transport and treat Pad A waste and to deploy in situ grouting in highly contaminated areas. Experience gained by in situ grouting of beryllium blocks in the SDA would reduce risk associated with grouting. The slight increase in risk would be incurred by remediation workers and would not affect collocated workers or the public. The implementation timeframe for Alternative 3 is 10 years, the same as for Alternative 2b. Implementation timeframes for Alternatives 2b and 3 are 3 years longer than for Alternative 2a because of Pad A waste retrieval.

Short-term risk associated with Alternative 4 shows a moderate increase compared to Alternative 3. In general, Alternative 4 is more complex and would require longer implementation times, though engineering and administrative controls could mitigate most risk associated with this alternative. The primary feature that increases risk is potential exposure to contaminants during retrieval and handling of buried waste. Because waste would be disturbed, some potential for airborne release would be incurred, with moderate risk to remediation workers and a slight increase in risk to collocated workers and members of the public. Because of the longer duration involved in retrieving Pad A and a larger cumulative pit area, Alternative 4a (4-Acre Retrieval) would pose slightly more short-term risk than Alternative 4b (2-Acre Retrieval). Implementation timeframes for Alternatives 4a and 4b are 16 and 12 years, respectively—somewhat longer than for Alternatives 2 and 3.

Under the Preferred Alternative, short-term risk would be attributable primarily to retrieval from pit areas (as described for Alternative 4a), with slight increases for mitigating subsidence of Pad A (as described for Alternative 4b) and in situ grouting (as described in Alternative 3). In situ grouting could be deployed concurrent with targeted waste retrieval. The implementation timeframe for the Preferred Alternative is 18 years.

Alternative 5, by a significant margin, poses the greatest amount of short-term risk to remediation workers, collocated workers, members of the public, and the environment. Alternative 5 is highly complex, incorporating substantially more construction for retrieval and interim storage and much more waste retrieval and handling. Retrieving waste from areas totaling 35 acres would greatly increase risk compared to the 4-acre retrieval described in Alternative 4a. Techniques developed for the Accelerated Retrieval Project would not be completely adequate, and remote-retrieval techniques would be required for some waste forms. Necessary engineering and administrative controls would have to be developed to manage risk. This alternative would require three decades to implement, substantially longer than for other alternatives.

## 10.6 Implementability

The implementability criterion addresses technical and administrative feasibility of implementing an alternative and availability of required services and materials. All alternatives would be technically and administratively feasible with sufficient availability of required services and materials with varying levels of ease.

All action alternatives include a surface barrier. Construction of a surface barrier is completely implementable, involving well-developed, standard construction techniques. Competition for borrow source material may require administrative attention to prioritize projects and obtain permit modifications. In particular, topsoil for establishing vegetation on the surface barrier and materials for the biotic barrier within the surface barrier may be in short supply on the INL Site. However, such materials can be transported from sources outside the INL Site, if necessary.

Alternatives 2, 3, 4, and the Preferred Alternative are technically and administratively feasible, with few potential issues and very few discriminating trade-offs. Services, materials, and vendors for each technical component are generally available. For Alternatives 2b and 3, which involve transferring Pad A waste into the Low-Level Waste Pit (without and with treatment, respectively), a potential administrative complication would arise relating to disposal capacity. Space may not be sufficient in the Low-Level Waste Pit or at the Idaho CERCLA Disposal Facility, precluding transfer of Pad A waste. Either an alternative off-INL Site disposal facility would be identified or a new disposal cell could be required. Both approaches are technically and administratively feasible. For Alternative 4 and the Preferred Alternative, the targeted waste approach was developed to reduce problems with implementability while maximizing the amount of targeted waste to be removed. Targeted waste, by definition, must be visually identifiable and excludes large objects, waste with high-exposure rates, and classified waste. The Accelerated Retrieval Project has developed solutions for all expected waste forms, though some uncertainty remains regarding disposition of nontransuranic waste. Strategies (e.g., characterization, treatment, and disposal) for small amounts of unexpected waste would be developed, if needed. A field-scale demonstration of methods to address subsidence in pits or Pad A could be required to develop safety protocols for all action alternatives, a task that is technically and administratively feasible. Some modification to techniques for belowgrade retrieval within a retrieval enclosure could be required to customize the Accelerated Retrieval Project approach for application to abovegrade retrieval of Pad A waste (Alternatives 2b, 3, and 4a). All other aspects of Alternatives 2, 3, and 4 are sufficiently developed, both technically and administratively, such that significant implementability issues or lack of required services and materials would not be anticipated.

Alternative 5 could encounter several implementability obstacles. The Agencies developed this alternative based on the same technical approaches being deployed at the Accelerated Retrieval Project. These techniques would not be adequate to safely retrieve high-exposure-rate waste forms and large objects. Additional strategies, such as remote retrieval and in situ size reduction, would be needed. Alternative 5 incorporates methods developed by the Remote-Handled Transuranic Project to transfer high-integrity containers of waste into and out of the Intermediate-Level Transuranic Storage Facility. These transfers were conducted in open air with no constraints on the height of the crane used to maintain distance and reduce exposure to gamma radiation. A similar operation within a retrieval enclosure would be challenging. A potential administrative difficulty is that a path to disposal would not be available for some retrieved waste forms. This analysis incorporates the assumption that a temporary (less than 20 years) storage facility would be constructed near the SDA to house such waste until an appropriate facility would be developed by another program (a repository constructed and managed by a federal agency or commercial enterprise). Based on difficulties experienced with obtaining approvals for WIPP and Yucca Mountain, potential difficulties for a new facility also could arise. Another administrative issue relates to disposal capacity at WIPP. The facility may not have sufficient capacity to accept all the potentially transuranic waste currently buried in the SDA.

## 10.7 Cost

Estimates for OU 7-13/14 were prepared with the best available information. In general, confidence in the accuracy of cost estimates is high, with expected accuracy of -30 to +50% recommended in EPA guidance.[64] Retrieval modules in Alternatives 4 and 5 and the Preferred Alternative were based on plans for the first two Accelerated Retrieval Project non-time-critical removal actions.[15,16] Actual costs for targeted waste retrieval are higher than estimated costs to date, but still within the range of accuracy of -30 to +50%.

Figure 11 compares and summarizes costs associated with each alternative. Estimates are presented in Fiscal Year 2006 dollars and in net present value for direct work. The No Action alternative, comprising 100 years of environmental monitoring using the existing monitoring system, is the lowest cost alternative. Costs increase for Alternatives 2, 3, 4, and 5, consistent with increasing complexity and implementation timeframes. Net present value cost for the Preferred Alternative is less than for Alternative 4a because it does not include retrieval of Pad A. Estimates for retrieval alternatives—Alternatives 4, 5, and the Preferred Alternative—do not include costs for transportation to WIPP. These costs would be incurred by WIPP and are not double-counted for OU 7-13/14.

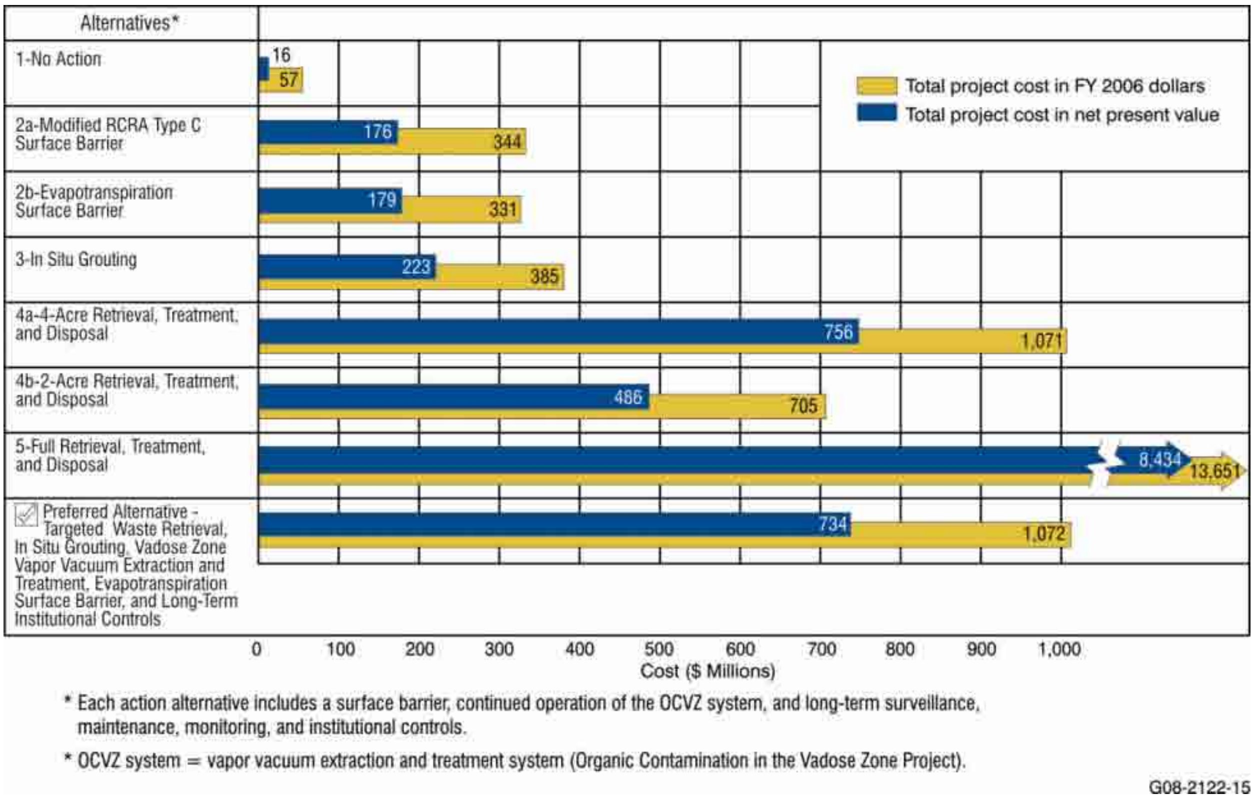


Figure 11. Comparison and summary of cost associated with each alternative evaluated in the Feasibility Study and Proposed Plan.

## 10.8 State Acceptance

The State has been involved in development and review of the OU 7-13/14 RI/BRA, Feasibility Study, and Proposed Plan. In addition, the State participated in all public meetings, reviewed public comments, and offered responses. The State did not concur with the Proposed Plan presented by DOE as to concerns about the acreage subject to retrieval and volume of transuranic waste retrieved. Subsequently, the State of Idaho and DOE entered into an *Agreement to Implement U.S. District Court Order dated May 25, 2006*,[5] effective July 3, 2008. Targeted waste retrieval activities conducted pursuant to this ROD are anticipated to meet the terms of the Agreement to Implement, resolving the State's concerns. The State, therefore, concurs with the selected remedial alternative and is a signatory to the ROD with DOE and EPA.

## 10.9 Community Acceptance

Community participation in the remedy selection process on Proposed Plan review included public meetings held November 13, 14, and 15, 2007. The 30-day public comment period was extended an additional 30 days, from October 22 to December 21, 2007. The Responsiveness Summary, presented as Part 3 of this ROD, includes verbal and written comments received from the public with the corresponding Agencies' responses to comments. Public comments ranged from opinions that the Preferred Alternative required far more than was needed to requesting removal of all buried waste. More than 200 comments were received. More than half of the commenters expressed acceptance of either the Preferred Alternative or less remediation than included in the Preferred Alternative. Many commented that the Agencies should increase the area subjected to targeted waste retrieval to ensure protectiveness and that the Selected Remedy should be consistent with the Settlement Agreement.[65]

# 11. PRINCIPAL THREAT WASTE

High organic content waste that contains solvents (e.g., carbon tetrachloride, tetrachloroethylene, and trichloroethylene) comprises principal threat waste. Carbon tetrachloride has been detected at levels slightly above its MCL in the aquifer. Principal threat waste is largely contained within targeted waste and will be addressed through removal of targeted waste within 5.69 acres and through treatment of vapors by the vapor vacuum extraction system.

# 12. SELECTED REMEDY

The Selected Remedy for OU 7-13/14 is nearly the same as the Preferred Alternative in the Proposed Plan.[21] A larger area (i.e., 5.69 acres) is identified for targeted waste retrieval, and an additional waste form, Series 742 sludge, is identified as targeted waste. Except for continued operation of the vapor vacuum extraction system, initiated under a previous CERCLA decision for OU 7-08 to collect and treat solvent vapors from the subsurface, the scope of this action focuses on source control. Agency objectives for remedial action at the SDA under the FFA/CO[4] are to prevent exposure to contaminants of concern in buried waste by plants, animals, and humans, and to inhibit migration of contaminants of concern (i.e., radionuclides and chemicals) to the Snake River Plain Aquifer. Subsections that follow summarize the rationale for the Selected Remedy, describe the Selected Remedy in more detail, present cost estimates, and describe the expected outcomes.

## 12.1 Summary of the Rationale for the Selected Remedy

The Selected Remedy controls the source by combining targeted waste retrieval and removal of high-concentration organic solvent waste with in situ grouting, continued vadose zone vapor vacuum extraction and treatment, an evapotranspiration surface barrier, and long-term management and control. The estimated cost is $1.3 billion current value ($912.6 million net present value) for direct work and will take about 20 years to complete. The combination of elements in the Selected Remedy provides the best balance of trade-offs among all the alternatives, striking a balance between waste retrieval, expediting installation of a surface barrier, worker safety, and cost. The underlying logic for the major components of the Selected Remedy is as follows:

- **Targeted Waste Retrieval—**Retrieving targeted waste and high-concentration organic solvent waste from 5.69 acres of pit areas[f] will reduce inventories of organic solvent waste to address the current threat to the aquifer, transuranic radionuclides to address stakeholder concerns, and uranium radionuclides to address uncertainty. Targeted waste retrieval activities conducted pursuant to this ROD are anticipated to meet the terms of the Agreement to Implement.[5] Removing targeted waste also would reduce risk at the surface if the barrier or institutional controls fail.

- **In Situ Grouting**—In situ grouting of soil vaults and trench areas totaling 0.2 acres will reduce mobility of technetium-99 and iodine-129 to address future threats to the aquifer. The grouting component provides relatively near-term isolation of the waste pending completion of targeted waste retrievals and installation of the surface barrier over the SDA. Grouting and targeted waste retrievals will be implemented concurrently in advance of surface barrier installation.

- **Vadose Zone Vapor Vacuum Extraction and Treatment**—Operating the existing OCVZ vapor vacuum extraction and treatment system will continue to remove and treat solvents from the vadose zone. Extraction and treatment will continue in parallel with retrievals except when temporary shutdowns are required to maintain or modify the system. The OCVZ system, coupled with targeted waste retrieval, addresses the greatest and most imminent threat to groundwater quality. Vapor extraction from the vadose zone will continue until cleanup levels in the vadose zone are achieved.

- **Evapotranspiration Surface Barrier**—Constructing an infiltration-reducing evapotranspiration surface barrier over the entire SDA will provide effective source control. To provide a stable foundation for the evapotranspiration surface barrier, potential subsidence of pits, trenches, and Pad A will be addressed before constructing the surface barrier using methods to be determined during remedial design. The surface barrier will inhibit transport of contaminants of concern. Inhibiting transport to the surface by plants and animals addresses future threats to plants, animals, and nearby residents; inhibiting migration into the subsurface addresses future threats to the aquifer. Monitoring and modeling indicate that carbon-14 and technetium-99 could threaten groundwater quality (i.e., exceed risk thresholds) beneath the SDA over the next 100 years (see Table 2). Carbon tetrachloride from solvents already exceeds its MCL, and several other contaminants of concern could exceed MCLs over the next few hundred years (see Table 4). Other secondary contaminants of concern (e.g., uranium-238) could exceed MCLs several thousands of years in the future. To inhibit migration of contaminants from buried waste a surface barrier will be constructed to reduce infiltrating moisture that would move through the SDA and downward toward the Snake River Plain Aquifer. The selected evapotranspiration surface barrier will direct moisture away from the buried waste and store excess moisture until it evaporates or is absorbed by plants and transpired to the atmosphere.

- **Long-Term Institutional Controls**—Establishing and maintaining long-term surveillance, maintenance, monitoring, and institutional controls will preserve integrity of the surface barrier, limit access, and enforce land-use restrictions to ensure continued effectiveness of the remedy. Long-term management and control of the RWMC will continue after construction of the surface barrier is complete and the remedy is declared operational and functional. Post-construction operation and maintenance of components of the Selected Remedy also are long-term management and control activities.

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f. As used throughout this Record of Decision, references to 5.69 acres shall mean retrieval of a minimum 6,238 $m^3$ of targeted waste from a minimum acreage of 5.69 acres, with additional retrieval areas, if necessary, determined pursuant to the Comprehensive, Environmental Response, Compensation, and Liability Act. The 5.69 acres includes some portion of Pit 9 and the 1.27 acres being addressed by Accelerated Retrieval Projects I, II, and III in Pits 4 and 6.

In the interim before the surface barrier is completed (approximately 2028), existing programs will remain in place to restrict access to the RWMC, operate and maintain the OCVZ system, maintain the cover on Pad A, and monitor the environment. The existing monitoring network of lysimeters, suction bailers, groundwater monitoring wells, vapor ports, and advanced tensiometers will be maintained. Samples will be collected, analyzed, and interpreted for the aquifer, vadose zone soil moisture and perched water, and vadose zone vapors. Existing field sampling plans will continue in force until modified. Monitoring results will be summarized and reported periodically. Changes to scope (e.g., sampling frequencies, analytes, analytical priorities, and reporting requirements) will be adjusted as needed with regulatory review and approval.

## 12.2 Detailed Description of the Selected Remedy

The Selected Remedy combines targeted waste retrieval and removal of high-concentration organic solvent waste from 5.69 acres of pit areas with in situ grouting of 0.2 acres of trenches and soil vaults, vadose zone vapor vacuum extraction and treatment, construction of an evapotranspiration surface barrier, and long-term institutional control. Components of the Selected Remedy are described below in further detail. However, the remedy may be modified as a result of remedial design and construction processes. Changes to the remedy described below, if any, will be documented using a technical memorandum in the Administrative Record, an explanation of significant differences, or amendment to this ROD.

### 12.2.1 Targeted Waste Retrieval

The focused objective of this component of the Selected Remedy is retrieval of waste that is highly contaminated with solvents, transuranics, and uranium. Over 99% of the waste containing solvents and transuranics was received from the Rocky Flats Plant. The Selected Remedy incorporates the targeted waste approach developed for Accelerated Retrieval Project non-time-critical removal actions.[15,16,17] Targeted waste streams are Rocky Flats Plant Series 741 sludge, Series 742 sludge, Series 743 sludge, graphite, filters, and roaster oxides (see Table 5). Removing targeted waste from 5.69 acres will significantly reduce inventories of organic solvent waste, transuranics, and uranium isotopes while maintaining a balance between worker risk, time to implement, and overall cost benefit. The change in removal acreage from 4.8 acres in the Proposed Plan to 5.69 acres further improves protectiveness by reducing uncertainty by performing additional targeted waste retrieval and is responsive to stakeholder input on retrieving more waste. Vadose zone remediation goals (see Section 12.2.3.2) would be achieved sooner, thus minimizing future OCVZ system operations. Based on concentration maps, the 5.69 acres contains more than 90% of the organic solvent waste in the SDA.

Table 5. Rocky Flats Plant targeted waste.

| Waste Stream | Summary Characteristics |
|---|---|
| Series 741 first-stage sludge | Salt precipitate containing plutonium and americium oxides, depleted uranium, metal oxides, and organic constituents |
| Series 742 second-stage sludge | Salt precipitate containing plutonium and americium oxides, metal oxides, and organic constituents |
| Series 743 sludge organic setups | Organic solvents solidified using calcium silicate, paste-like or grease-like texture |
| Graphite | Broken graphite mold pieces after excess plutonium removed and graphite fines (e.g., scarfings) packaged in small bottles |
| Filters | Discarded HEPA filters contaminated with various radionuclides including plutonium, americium, and uranium |
| Uranium roaster oxide waste | Incinerated depleted uranium, primarily uranium oxide with some metal possible |

HEPA = high-efficiency particulate air (filter)

***12.2.1.1 Areas Selected for Targeted Waste Retrieval.*** Areas selected for retrieval are those areas that contain the highest concentrations of transuranics and organic solvent waste as depicted on maps. Maps were developed using average concentrations per drum based on acceptable knowledge and disposal information (e.g., drums per shipment and locations). Maps have been validated through geophysical investigations, probing, soil gas samples, and retrievals in Pit 9 and Pit 4. During these retrievals unique waste forms and container labels have been found that correlate within feet of the mapped location. The Agencies conclude that concentration maps are credible and provide a solid basis for ongoing targeted waste retrieval. Figure 12 is a concentration map for carbon tetrachloride, the primary solvent of concern, in Accelerated Retrieval Projects I and II.

Other factors were evaluated to determine areas for targeted waste retrieval. Large continuous areas are preferred over small areas because dependency on the accuracy of mapping is reduced. Some disposal locations are better defined than others, so the larger an area is, the less dependency there is on the mapping. Additional factors, such as collocated high-radiation waste and presence of large objects, were evaluated in the context of implementability.

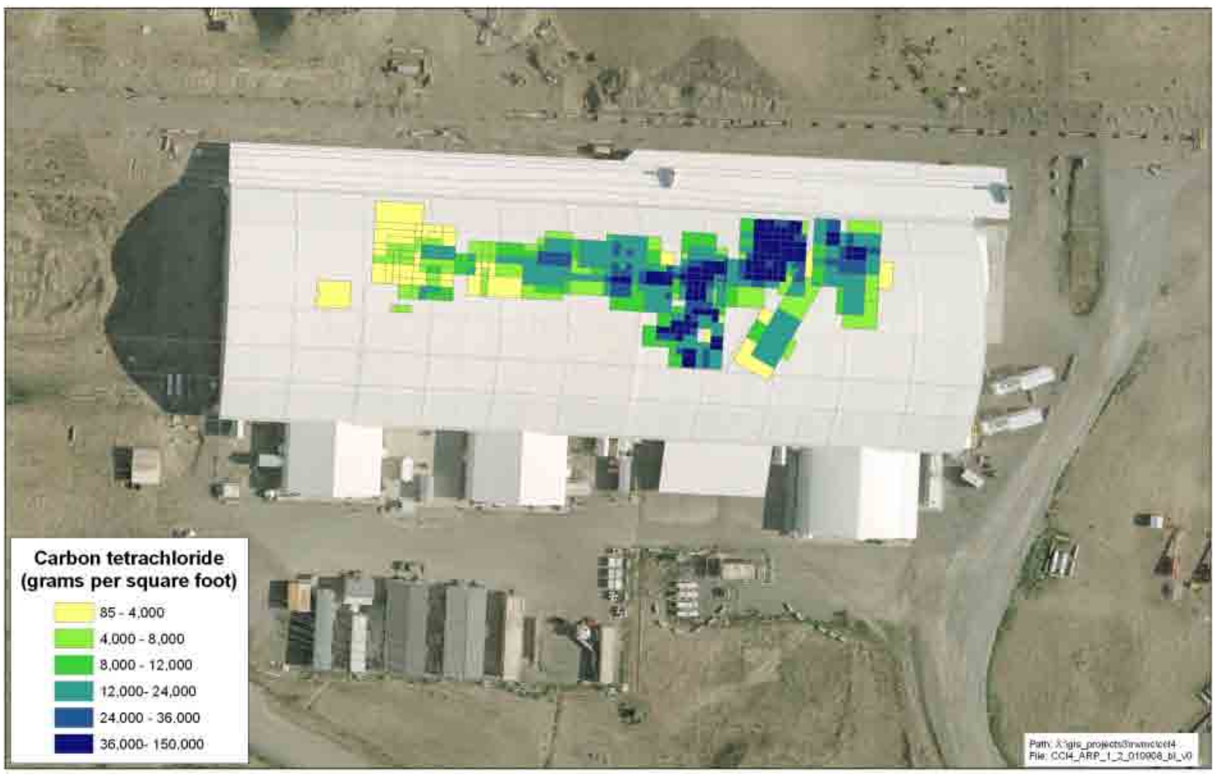


Figure 12. Carbon tetrachloride concentrations in Accelerated Retrieval Projects I and II.

The 5.69 acres identified for targeted waste retrieval and removal of high-concentration organic waste are shown in Figure 13. The area P04P01 is Accelerated Retrieval Project I in Pit 4, P46P01 is Accelerated Retrieval Project II in Pits 4 and 6, and P06P01 is Accelerated Retrieval Project III in Pit 6. Accelerated Retrieval Projects I, II, and III cover a total of 1.27 acres. The balance of the 5.69 acre total is composed of portions of Pits 1, 2, 4, 5, 9, and 10. In general, areas in Pits 1 through 6, Pit 9, and Pit 10 contain high concentrations of transuranic waste. High concentrations of organic solvent waste are present in Pits 4, 6, 9, and 10, while Pits 1, 2, 3, and 5 contain little to no organic solvent waste.


| 5.69-Acre Areas | |
|---|---|
| Area | Acres |
| P02P02 | 1.72 |
| P04P01 | 0.5 |
| P04P03 | 0.4 |
| P05P01 | 0.79 |
| P06P01 | 0.43 |
| P09P03 | 0.27 |
| P09P04 | 0.28 |
| P10P01 | 0.69 |
| P10P03 | 0.27 |
| P46P01 | 0.34 |
| Total | 5.69 |

Figure 13. Targeted waste retrieval areas include portions of Pit 9 and all Accelerated Retrieval Projects.

Waste retrieval increases theoretical risk to workers (short-term risk) and reduces theoretical risk to future residents (long-term risk). Approximations of these risks are compared and shown over the range of potential retrieval acreage in Figure 14. Though engineering and administrative controls will be implemented to mitigate worker risk, this analysis suggests that potential risk to workers overcomes long-term benefit from waste retrieval (in the absence of a surface barrier) at 4 to 7 acres.

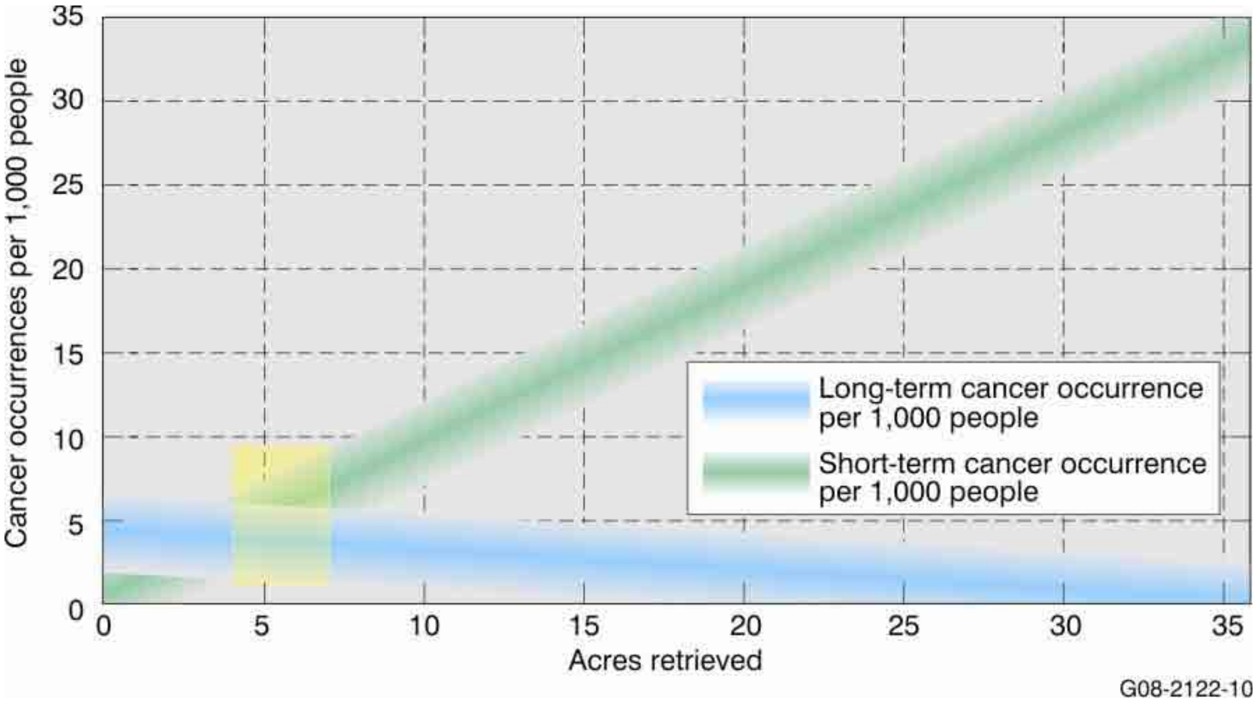


Figure 14. Approximate short-term cancer risk to workers compared to long-term cancer risk to hypothetical future residents (in the absence of a surface barrier) by size of total retrieval area.

The 5.69-acre retrieval area described in this ROD includes a portion of Pit 9 and acreage defined for all Accelerated Retrieval Projects. Thus, it supersedes the Pit 9 ROD[20] and Accelerated Retrieval Project action memoranda[15,16,17] and integrates all retrievals into a comprehensive remedy for OU 7-13/14. Targeted waste retrieval will significantly reduce the source while maintaining a balance between worker risk, time to implement, and overall cost benefit. Based on concentration maps, this cumulative area contains more than 90% of organic solvent waste in the SDA.

***12.2.1.2 Targeted Waste Retrieval Process Description.*** The Selected Remedy will retrieve targeted waste (i.e., Series 741 sludge, Series 742 sludge, Series 743 sludge, graphite, filters, and roaster oxides) and high-concentration solvent waste from 5.69 acres of pit area including portions of Pit 9 and the Accelerated Retrieval Projects. Targeted waste will be visually discriminated from surrounding soil and nontargeted waste by trained personnel. Field screening instrumentation also may be employed in the drum packaging station to assist in identifying targeted waste. Field screening for high concentrations of organic solvents will be implemented. Methodology for field screening during retrieval to identify high-concentration organic solvent waste will be developed and documented in the remedial design/remedial action work plan. Waste identified as having high concentrations of organic solvents will not be classified as targeted waste if it does not meet targeted waste visual identification criteria. Nontargeted high-concentration organic solvent waste material will be containerized separately from retrieved targeted waste streams, and will not constitute any portion of the minimum required retrieval volume of 6,238 $m^3$ stipulated in the Agreement to Implement.[5]

The retrieval process is described below in general terms as it is currently being conducted in Accelerated Retrieval Projects. Remedial work elements (e.g., design, construction, and procedures) will be further defined in the OU 7-13/14 remedial design/remedial action work plan. Interim activities related to implementing targeted waste retrieval will be consistent with existing Accelerated Retrieval Project approaches and documents pending completion of the OU 7-13/14 remedial design/remedial action work plan.

Each defined pit area is sectioned into grids for tracking purposes. Operators excavate and sort through all material in each grid with an excavator before moving to another grid area. The lateral extent of each excavation is defined as shown in Figure 13. Vertically, the sides are excavated, as steeply as possible without compromising slope stability, until reaching basalt bedrock, encountering underburden, or further excavation is not warranted based on other considerations. Trained specialists visually identify removed material as targeted or nontargeted waste and log observations onto forms for records and comparison purposes. Targeted waste is placed in trays and processed through a drum packaging station, where it is examined to remove any WIPP-prohibited items, then transferred to a container (e.g., drum) for characterization to meet treatment and disposal requirements. Transuranic waste that is certified for transfer to WIPP must be packaged and shipped in accordance with various WIPP requirements, including current versions of WIPP waste acceptance criteria[66] and shipment protocols.[67] Nontargeted waste is staged for potential return to the pit.

***12.2.1.3 Performance Objectives for Targeted Waste Retrieval.*** Completion of targeted waste retrieval will be measured by the volume of targeted waste retrieved. A minimum volume of targeted waste of 6,238 $m^3$ will be retrieved from a minimum of 5.69 acres identified in Figure 13, with the need for additional retrievals, if necessary, determined pursuant to CERCLA. Additional retrieval acreage as necessary to meet the performance objective identified above will be defined in the OU 7-13/14 remedial design/remedial action work plan.

### 12.2.2 In Situ Grouting

In situ grouting will reduce mobility of technetium-99 and iodine-129 in the interim before the surface barrier is constructed. The grouting component provides relatively near-term isolation of the waste pending completion of targeted waste retrievals and installation of the surface barrier over the SDA. Waste types specified for in situ grouting are INL Site reactor operations waste containing releasable technetium-99 and iodine-129 (i.e., resins, fuel examination waste, and surface-contaminated waste).

***12.2.2.1 Areas Selected for In Situ Grouting.*** Areas for in situ grouting were selected to maximize the amount of releasable technetium-99 and collocated iodine-129 that would be treated to reduce mobility. Review and analysis of disposal records identified waste streams that have technetium-99 in the most releasable forms. Table 6 lists releasable technetium-99 waste streams and waste stream descriptions. In most cases, releasable iodine-129 is collocated with technetium-99 in these same waste streams. A review of this population identified candidate locations for in situ grouting. The following criteria were used:

1. Maximize the curies of releasable technetium-99 and collocated iodine-129
2. Minimize the number of grouting locations to improve operation efficiencies and reduce the effect of waste location uncertainties
3. Identify only waste disposed of in trenches and soil vaults to improve confidence in identifying specific waste shipment locations.

Table 7 and Figure 15 show treatment locations identified for in situ grouting, and Table 8 lists the estimated releasable curies within these areas.

Table 6. Waste streams containing releasable technetium-99 and iodine-129.

| Waste Stream Code | Waste Stream Description |
|---|---|
| ANL-MOD-2H | Argonne-West fuel-bearing waste such as irradiated and unirradiated undissolved fuel specimens (1971–1983). Principal contaminants were fission products and actinides |
| ANL-MOD-2H/ext | Argonne-West fuel-bearing waste including irradiated and unirradiated dissolved fuel specimens and fuel-contaminated materials (1984–1993) |
| ANL-MOD-3H | Argonne-West fuel-bearing waste including irradiated and unirradiated dissolved fuel and fuel-contaminated materials |
| INTEC-MOD-2H | INTEC leached Vycor glass |
| INTEC-MOD-2R | HEPA filters from various INTEC buildings (excluding the New Waste Calcining Facility), such as the Atmospheric Protection System, that contain mixed fission products and traces of actinides |
| INTEC-MOD-3R | INTEC hot cell waste that contained fission-, trace activation-, and actinide-products from such buildings as CPP-610 |
| INTEC-MOD-5H | HEPA filters from Waste Calcining Facility and other filters from miscellaneous facilities at INTEC |
| INTEC-MOD-6H | INTEC CPP-603 basin sludge and miscellaneous storage basin Zeolite filters |
| INTEC-MOD-7H | Contaminated soil from INTEC Tank Farm spills |
| NRF-MOD-2H | Shippingport fuel, dissolved (1960–1968) |
| NRF-MOD-4H | Miscellaneous NRF enriched fuel, dissolved (1953–1971) |
| NRF-MOD-8H | Liquid, alkaline permanganate-ammonium citrate, and oil from Expended Core Facility and prototype plant operations at NRF (1953–1971) |
| NRF-MOD-9H | Sludge and resins from Expended Core Facility and prototype plant operations at NRF (1953–1971) |
| TRA-603-13N | Filters from TRA |
| TRA-603-1N | Resins from TRA |
| TRA-603-21N | Contaminated bulk materials (e.g., concrete, brick, sand, dirt, wood, and asphalt) from TRA |
| TRA-603-6N | Sludge from TRA |

HEPA = high-efficiency particulate air (filter)
INTEC = Idaho Nuclear Technology and Engineering Center
NRF = Naval Reactors Facility
TRA = Test Reactor Area

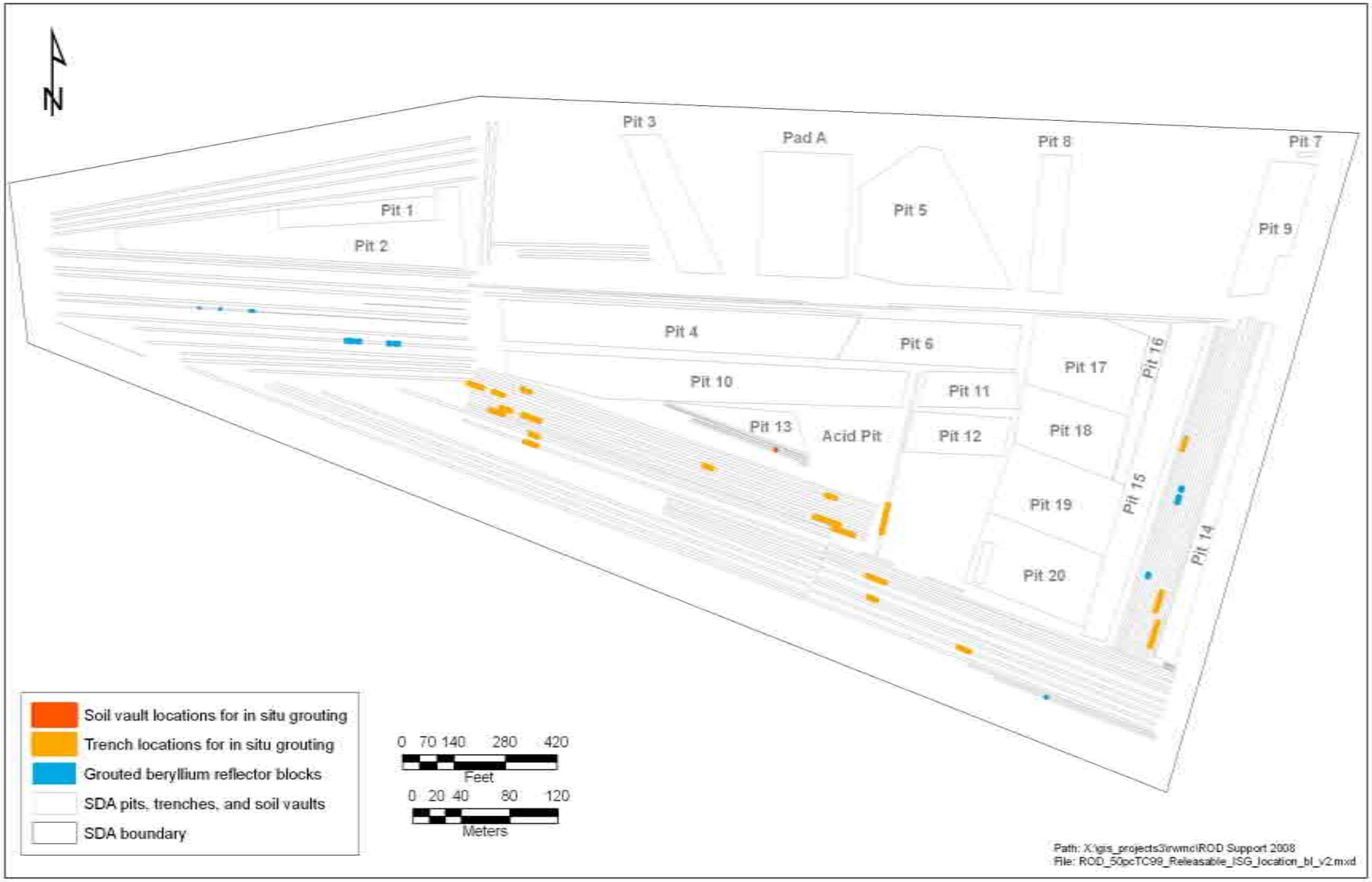


Figure 15. Treatment locations for in situ grouting.

Table 7. Treatment locations for in situ grouting.

| Location | Grouted Length[a] (ft) | Grouted Area[a] ($ft^2$) |
|---|---|---|
| Soil Vault Row 14 | 3 | 10 |
| Trench 25 | 38 | 268 |
| Trench 30 | 30 | 211 |
| Trench 34 | 38 | 267 |
| Trench 35 | 57 | 398 |
| Trench 36 | 29 | 200 |
| Trench 42 | 112 | 783 |
| Trench 44 | 84 | 585 |
| Trench 45 | 166 | 1,170 |
| Trench 46 | 75 | 526 |
| Trench 48 | 54 | 379 |
| Trench 49 | 105 | 729 |
| Trench 53 | 58 | 406 |
| Trench 56 | 37 | 258 |
| Total | 886 | 6,190 |

a. The soil vault dimensions are buffered by adding 1 ft around the vault. Trench dimensions are buffered by 10 ft on each end of the waste location within the trench and by 3 ft (i.e., approximately two grout columns) outside the trench boundaries.

***12.2.2.2 In Situ Grouting Process Description.*** The Selected Remedy will implement in situ grouting in trench and soil vault areas totaling 0.2 acres (approximately 1,000 linear feet). High-pressure jet grouting will encapsulate specified waste types by injecting Portland cement grout[68,69,70] using commercially available equipment.[71] A probe driven by a rotopercussion drill (see Figure 9) will inject liquid grout. Grouted areas, including grout returns and any contamination brought to the surface by the drill stem, immediately will be covered with soil up to grade.

***12.2.2.3 Performance Objectives for In Situ Grouting.*** In situ grouting of selected waste forms containing mobile technetium-99 and iodine-129 addresses Remedial Action Objective 3 (inhibit migration of contaminants of concern into the vadose zone and the underlying aquifer). The grouting component provides relatively near-term isolation of the waste pending completion of targeted waste retrievals and installation of the surface barrier over the SDA. Specific cleanup levels are not identified for in situ grouting. However, each identified location will be grouted with a 3-m (10-ft) buffer side-to-side, and quantities of grout injected into the subsurface will be evaluated to ensure that coverage is achieved. Locations for grouting are defined using the best available historical disposal information and are outlined in Figure 15 and described in Table 7.

Quantities of grout injected into the subsurface will be monitored by approximating the amount of grout injected minus the amount returned to the surface. Quantities injected and returned to the surface will be recorded and evaluated against depth to basalt, mass of the waste in the grouted area, and dimensions of the grouted area. If the injected grout volume is within 20% of the maximum potential volume; grouting will be deemed effective and complete. If grouting is not within 20% of the maximum, the footprint of the grouting area will be increased on at least two sides in order to achieve containment and the 20% maximum volume.

Table 8. Estimated releasable curies within in situ grouting areas.

| Locations | Technetium-99 | Iodine-129 |
|---|---|---|
| Trenches | 6.77 | 0.023 |
| Soil vaults | 0.47 | 0.001 |
| Total | 7.24 | 0.024 |

### 12.2.3 Vadose Zone Vapor Vacuum Extraction and Treatment

The Selected Remedy includes continued operation of the OCVZ system—the existing vapor vacuum extraction and treatment system originally established under OU 7-08—until OU 7-13/14 vadose zone cleanup levels are achieved. The existing system is adequate, and additional wells and treatment units are not required except to modify or replace components of the system that fail over time. This ROD for OU 7-13/14 supersedes the OU 7-08 ROD[18] in its entirety and assumes all operations and maintenance of the OCVZ system as described below.

***12.2.3.1 Vadose Zone Vapor Vacuum Extraction and Treatment Process Description.*** The OCVZ system has been operating since 1996, effectively extracting and treating solvents from the subsurface beneath the SDA. The system is composed of 18 extraction wells, 57 vapor monitoring wells with a total of 168 monitoring ports, three treatment units, and pipelines. Pipelines run across the surface of the SDA from extraction wells to the treatment units.

The 18 extraction wells are cycled through the three treatment units, based on extraction concentrations. When the concentration of carbon tetrachloride decreases in a well, extraction in that well is shut off, and a different well is brought on line. Cycling the wells maximizes extraction efficiency in the 18 wells. Though extraction points were constructed in the deep vadose zone (i.e., below the C-D interbed), operations to date have focused on shallower regions above the C-D interbed.

Operation and maintenance of the system will continue under the current Agency-approved operations and maintenance plan for OCVZ[72] until it is revised and integrated with OU 7-13/14 operations and maintenance plans. Operations and maintenance tasks include: (1) routine activities associated with running the system at optimal efficiency and meeting operational requirements (e.g., stack emissions and preventative maintenance) and (2) periodic activities such as replacing catalysts, updating control systems, and replacing major system components, as needed.

Similarly, use of the OU 7-08 vadose zone field sampling plan[73] will continue until it is incorporated into an integrated plan for all of OU 7-13/14. Groundwater sampling already is integrated with the INL Site-wide monitoring program.[74] Monitoring data for OCVZ will be combined with the annual environmental monitoring report for RWMC. Section 12.2.5 provides additional information about reporting requirements for monitoring.

Some pipelines were moved to accommodate construction of Accelerated Retrieval Project retrieval enclosures and targeted waste retrieval operations. Similar modifications will be required to facilitate construction and operation of components of the Selected Remedy (e.g., additional targeted waste retrieval areas, in situ grouting, and pretreatment for subsidence of pits, trenches, and Pad A). Ultimately, well heads for monitoring and extraction wells will be extended and treatment units will be moved in preparation for constructing the surface barrier. Such modifications will be planned and implemented to minimize the amount of downtime for components of the OCVZ system.

***12.2.3.2 Vadose Zone Vapor Cleanup Levels.*** Extracting solvents from the vadose zone addresses the following remedial action objectives:

1. Limit cumulative human health cancer risk for all exposure pathways to $10^{-4}$
2. Limit noncancer risk for all exposure pathways to a cumulative hazard index of less than 1 for current and future workers and future residents
3. Inhibit migration of contaminants of concern into the vadose zone and the underlying aquifer.

Cleanup levels for the OCVZ system are directed at achieving Remedial Action Objectives 1, 2, and 3. Original goals were established by OU 7-08 based on modeled concentrations of carbon tetrachloride in six regions of the vadose zone.[63] Operational experience demonstrates that the system is effectively removing vapor from current extraction Zones A1 and A2,[75] and the Agencies conclude that retaining established cleanup levels for Zones A1 and A2, in addition to MCLs in the aquifer, is protective. Therefore, cleanup levels established by OU 7-08[63] for Zones A3, B1, B2, and B3 are eliminated. Figure 16 illustrates cleanup levels for vadose zone vapor, showing those that are adopted for Zones A1 and A2 and eliminated for Zones A3, B1, B2, and B3. Cleanup Levels 3 and 4 address transport of carbon tetrachloride and other volatile contaminants as follows:

3. Maintain concentrations of carbon tetrachloride in vadose zone soil vapor above the B-C interbed (i.e., Zone A1, approximately the 9 to 30-m [30 to 100-ft] -depth interval) to less than 190 ppmv

4. Maintain concentrations of carbon tetrachloride in vadose zone soil vapor between the B-C and C-D interbeds (i.e., Zone A2, approximately the 30 to 73-m [100 to 240-ft] -depth interval) to less than 39 ppmv.

To determine that cleanup levels are achieved, the extraction system will be periodically shut down to allow vadose zone vapor concentrations to equilibrate. Samples will be collected and compared to cleanup levels.

Vapor monitoring wells are located throughout Region A in Zones A1 and A2 (see Figure 16). These wells provide contaminant concentration data from areas that are not directly adjacent to extraction points, thus providing an unbiased representation of contaminant concentrations in the subsurface. Wells are sampled and analyzed monthly. Upon achieving the goals within Zone A1 and Zone A2, all extraction units will be shut down for a period of 1 month, allowing the contaminants in the vadose zone to equilibrate (e.g., rebound or increase due to diffusion into a zone of influence, concentration of low volume contaminants in the vadose zone, or external influences; such as vapor pressure barometric pressure). If monitoring data show that concentrations increase, extraction and treatment will resume. If equilibrated concentrations remain below cleanup levels for a full year without requiring startup of the units, cleanup levels will have been met.

### 12.2.4 Evapotranspiration Surface Barrier

Many surface barrier designs were evaluated and tested for application at the SDA.[76–82] Most recently, Mattson et al.[76] conducted a comprehensive evaluation of available surface barrier designs and developed a site-specific preconceptual design for an evapotranspiration surface barrier. The preconceptual design provides a basis for analyzing the expected effectiveness of the surface barrier and developing order-of-magnitude cost estimates. Design information presented here was derived primarily from that work.

The barrier will cover the entire SDA and consist primarily of a vegetated soil layer with an underlying coarse rock layer and grading fill. The barrier will extend beyond the current boundary of the SDA. The total thickness of each layer, exact dimensions, and other specifications will be determined during remedial design.

***12.2.4.1 Evapotranspiration Surface Barrier Process Description.*** Constructing the surface barrier will be accomplished in a series of steps: preparing the foundation, preparing infrastructure, placing surface barrier materials, installing run-off controls (e.g., contouring and drainage channels), and establishing vegetation.

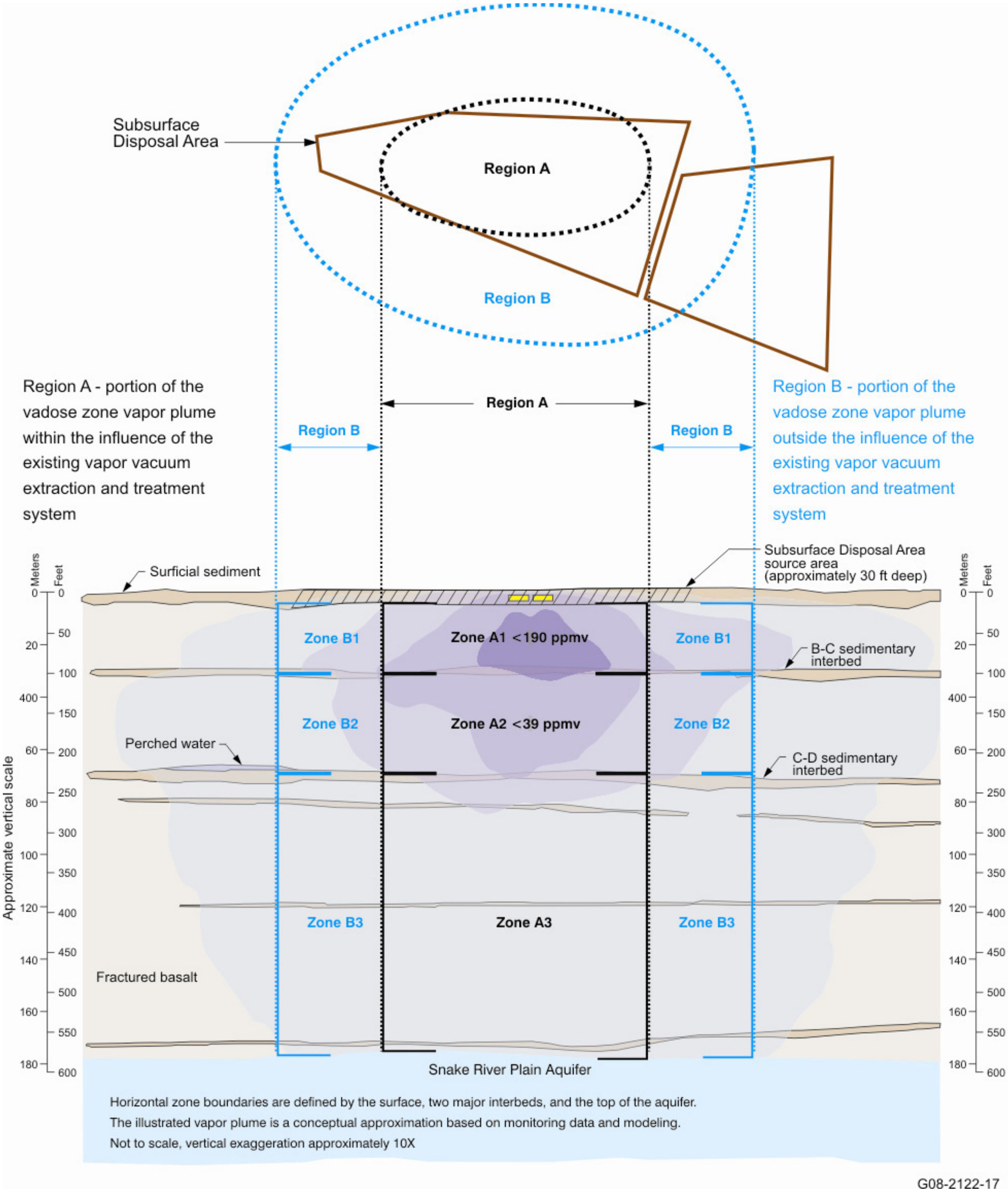


Figure 16. Cleanup levels for carbon tetrachloride vapors in the vadose zone to reduce concentrations in the aquifer to less than the maximum contaminant level of 5 µg/L.

Preparing the foundation will be a critical construction activity. Differential settlement occurs routinely at the SDA. While evapotranspiration surface barriers are, by design, less susceptible to differential settlement, construction techniques that minimize future subsidence will reduce maintenance and repair of the surface barrier in the future. To provide a stable foundation for the evapotranspiration surface barrier, potential subsidence of pits, trenches, and Pad A will be addressed before constructing the surface barrier using methods to be determined during remedial design. A treatability study may be required to support remedial design and define locations in the SDA (e.g., pits, trenches, and Pad A) where subsidence will be addressed.

Existing infrastructure (e.g., utilities and monitoring equipment) at the SDA will be abandoned, relocated, or reconfigured to accommodate construction. The following activities will be performed before constructing the surface barrier:

- Construct a new perimeter access road
- Install a new perimeter fence (including demolishing the old one)
- Modify the existing monitoring network by eliminating and adding wells and instruments as determined during remedial design
- Relocate the three existing OCVZ treatment units to locations outside the surface barrier perimeter
- Extend well-heads upward through the surface barrier (e.g., OCVZ wells, advanced tensiometers, and wells required for long-term monitoring).

After preparing the subgrade and removing surface infrastructure, materials for the surface barrier will be hauled to the SDA from on-INL Site borrow sources. If existing borrow sources are insufficient, new borrow sources or expansions of existing borrow sources will be developed pursuant to Section 104 of CERCLA.

If possible, phased construction will be implemented to reduce infiltration in portions of the landfill while accommodating ongoing landfill operations and remedial actions (e.g., targeted waste retrieval and in situ grouting).

Final construction steps include completing monitoring wells, vegetating the site, and establishing run-off controls. Drainage channels will be constructed around the perimeter, and surrounding terrain will be contoured to direct run-off away from RWMC.

***12.2.4.2 Performance Objectives for the Evapotranspiration Surface Barrier.*** Constructing an evapotranspiration surface barrier addresses all five remedial action objectives:

1. Limit cumulative human health cancer risk for all exposure pathways to $10^{-4}$
2. Limit noncancer risk for all exposure pathways to a cumulative hazard index of less than 1 for current and future workers and future residents
3. Inhibit migration of contaminants of concern into the vadose zone and the underlying aquifer
4. Prevent unacceptable exposure to biota from soil
5. Inhibit transport of contaminants of concern to the surface by plants and animals.

The evapotranspiration surface barrier will be constructed based on a design performance goal to reduce net infiltration through the surface barrier to less than 10 mm/year on average. The barrier will cover the entire SDA to minimize infiltration into and through contaminated media remaining in the SDA, prevent vapor buildup within the surface barrier, and inhibit plant and animal intrusion into the remaining waste. Effectiveness will be demonstrated through surface radiation surveys and environmental monitoring based on the following cleanup levels:

1. Reduce carcinogenic risk at the surface to less than $10^{-4}$ by maintaining an effective dose equivalent rate at the surface of less than 15 mrem/year[62] as a measurable performance objective

2. Reduce infiltration, continue to operate the OCVZ system, and remove targeted waste such that concentrations of contaminants of concern in the aquifer are less than MCLs before 2110.

Extreme weather is accounted for by using a meteorological data set collected over the past 55 years to define design elements (e.g., thickness and slope). The biggest extreme weather concern is potential flooding. Contouring and drainage channels will be integrated with barrier design to direct run-off away from buried waste. Coupled with surface barrier thickness these features will ensure that flooding does not occur at RWMC.

After construction is complete, a grid will be established over the entire surface barrier, and the site will be surveyed to assess ambient radioactivity. Measurements will be adjusted to account for background radiation. Cleanup levels will be achieved if the effective dose equivalent rate at the surface is no more than 15 mrem/year greater than the background rate.

### 12.2.5 Long-Term Institutional Controls

Following construction of the surface barrier, long-term surveillance, maintenance, monitoring, and institutional controls will be implemented to enforce land-use restrictions and ensure effectiveness of the completed surface barrier in meeting all remedial action objectives. DOE plans to maintain control of the site, but will meet all requirements established under CERCLA for transfer of a federal facility if it is determined that another agency should assume responsibility. Because land use will be restricted, 5-year reviews will be conducted to assess the effectiveness of the remedy.

***12.2.5.1 Long-term Surveillance, Operations, Maintenance, and Monitoring.*** An operations and maintenance plan and monitoring plans (e.g., vadose zone and aquifer) will be developed and periodically updated as needed. Surveillance, operations, and maintenance will include inspecting and repairing the surface barrier and peripheral components (e.g., fences and signs) to address observable degradation (e.g., subsidence, erosion, loss of vegetative cover, and biotic intrusion). Operation and maintenance of the OCVZ system will continue until vadose zone cleanup levels are met. Monitoring will include collecting samples and analyzing data from the vadose zone (i.e., soil moisture, soil vapor, perched water, and changes in moisture content) and from the aquifer. Additional wells or other modifications to the monitoring network may be established in monitoring plans or other documents to be developed as part of the remedial action work plan.

Groundwater monitoring will rely primarily on the network of monitoring wells that currently exists (i.e., as of 2008) around RWMC. The monitoring system will provide (1) data necessary to verify that relevant CERCLA cleanup objectives documented in this ROD are achieved and (2) data for 5-year reviews. The system must consist of a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples that are representative of groundwater quality in the vicinity of the SDA as established in the monitoring plan.

***12.2.5.2 Institutional Controls.*** Institutional controls will be used to prevent unacceptable exposure to contamination remaining at RWMC. Active and passive institutional controls will include access restrictions, restrictions on groundwater use (e.g., well-drilling restrictions), restrictions on land use (e.g., limit to industrial applications), and physical security.

The Selected Remedy for OU 7-13/14 includes actions to isolate contaminants and prevent unacceptable exposure through engineered controls. To ensure success of the remedy, institutional controls will be used to prevent land use that would be inconsistent with the Selected Remedy and to ensure that exposure does not occur. Controls include designating land use at RWMC as industrial and restricting groundwater and drilling within the industrial land use area. The approximate boundary of the land use control area is the fence surrounding RWMC plus additional area for the toe and perimeter zone of the surface barrier (see Figure 2). The land-use control boundary will be determined with more precision in the remedial design/remedial action work plan. Institutional controls will be maintained until concentrations of hazardous substances are at levels that are determined, through the CERCLA 5-year review process, to allow for unlimited land use and unrestricted exposure. Such circumstances are not expected to ever develop at RWMC; thus, DOE will maintain control indefinitely or will transfer the property in accordance with CERCLA requirements.

The INL Site-wide institutional controls plan[55] will be updated to incorporate requirements of this OU 7-13/14 ROD. The OU 7-13/14 remedial design/remedial action work plan will reference the ROD and INL Site-wide institutional control plan. The INL Site-wide institutional control plan will manage disturbances of contaminated media by non-CERCLA activities, including ensuring that intrusions in the evapotranspiration surface barrier are repaired properly and in a timely manner. To prevent use of contaminated groundwater, restrictions will be implemented for the portion of the aquifer in proximity to RWMC that exceeds MCLs. In the future, when monitoring results and trends show that groundwater meets MCLs and is acceptable for unrestricted use, groundwater restrictions will be eliminated. The portion of the Snake River Plain Aquifer contaminated by RWMC releases is predicted to meet MCLs by 2110.

DOE is responsible for implementing, maintaining, reporting on, and enforcing institutional controls, including land-use controls that are required under this ROD. Though DOE may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or through other means, DOE shall remain responsible for integrity of the remedy. Institutional controls under this remedy will be detailed in the INL Site-wide institutional control plan and included in the remedial design/remedial action work plan by reference. Current implementation, maintenance, and periodic inspection requirements for institutional controls at the INL Site are described in approved CERCLA work plans and the INL Site-wide institutional controls plan.[55]

***12.2.5.3 Revision to the INL Site-wide Institutional Controls Plan.*** No later than 180 days after the ROD is signed, DOE shall revise and submit the INL Site-wide institutional controls plan to DEQ and EPA for review and approval. The revised plan will include institutional controls required by this ROD and specify implementation and maintenance actions that will be taken, including periodic inspections. The OU 7-13/14 remedial design/remedial action work plan will reference the INL Site-wide institutional control plan. The INL Site-wide institutional controls plan, prepared in accordance with EPA policy,[56] is an Agency-approved document that establishes a consistent approach for implementing institutional controls at the INL Site. It addresses those general requirements to successfully implement institutional controls at all CERCLA sites, as follows:

- Assigning roles and responsibilities for implementing institutional controls
- Listing DOE-controlled INL Site areas and specific institutional controls in place

- Notifying Agencies of activities or situations that may interfere with effectiveness of land-use controls or are inconsistent with land-use control or institutional control objectives, and identifying and implementing corrective actions
- Notifying Agencies of transfers of institutional control sites, including federal transfers
- Establishing requirements for Agency concurrence with modification or termination of land use controls
- Performing annual assessments of institutional controls and reporting results to the Agencies
- Implementing a tracking mechanism that identifies land areas under institutional control and current and projected land uses at the INL Site.

Five land-use control objectives are listed below along with actions and mechanisms for implementing those objectives. DOE will maintain these actions and mechanisms until they are modified or discontinued by the Agencies:

1. Ensure that the area within the land-use control boundary (i.e., the area designated as industrial land use) remains industrial and that use of the property for nonindustrial uses, such as residential housing, elementary and secondary schools, child care facilities, and playgrounds, will be prohibited.[55]

   Implementation Actions and Mechanisms—

   a. Ensure that revisions to the INL Site-wide institutional controls plan[55] continue to require notification to the Agencies before any transfer, sale, or lease of an area with institutional controls to a federal or nonfederal entity (e.g., a state or local government or private party). DOE will coordinate with the Agencies to ensure that appropriate controls (e.g., deed notices and other informational devices) are provided in conveyance or lease documents and protections are in place to maintain effective institutional controls.

   b. Post warning signs in portions of the area designated as industrial land use to caution workers of potential hazards associated with radiological contamination remaining in the area where exposure would cause unacceptable risk.

2. Prohibit use of groundwater for drinking water or irrigation purposes in the portion of the aquifer that exceeds MCLs within the land-use control boundary (i.e., groundwater and drilling institutional control area) until groundwater quality has been restored.

   Implementation Actions and Mechanisms—The INL Site-wide institutional controls plan[55] will include controls to prevent use of groundwater that exceeds MCLs for drinking water or irrigation.

3. Control drilling of new wells and boreholes within the land-use control boundary (i.e., groundwater and drilling institutional control area) to prevent spreading contamination to the aquifer.

   Implementation Actions and Mechanisms—The INL Site-wide institutional controls plan[55] will include a process for Agency review of plans for drilling new wells and boreholes in those areas exceeding MCLs attributable to RWMC releases until water quality has been restored to below MCLs. Agency review and approval will ensure that drilling techniques and planned uses of wells and boreholes will not provide a conduit for accelerated infiltration of contaminants.

4. Control disturbance within the land-use control boundary (i.e., of the evapotranspiration surface barrier and peripheral areas designated as industrial land use) to prevent potential spread of contaminated media that exceed remedial action objectives without advance approval from the Agencies. Disturbances include actions during maintenance, construction, or investigation activities.

   Implementation Actions and Mechanisms—The INL Site-wide institutional controls plan[55] process for review of disturbances of CERCLA sites by non-CERCLA activities will be updated to require a notice of disturbance for maintenance, construction, or investigation activities within the area designated as industrial land use.

5. Maintain the integrity of current and future remedial or monitoring systems in accordance with the OU 7-13/14 ROD and remedial action/remedial design work plan.

   Implementation Actions and Mechanisms—

   a. The INL Site-wide institutional controls plan[55] will include a process to restrict actions or activities that would permanently disrupt or compromise the performance of the evapotranspiration surface barrier.

   b. An operations and maintenance plan will be developed to monitor the integrity of and repair the evapotranspiration surface barrier and associated drainage system.

   c. Monitoring plans will include a mechanism to monitor and maintain the integrity of current and future remedial or monitoring systems.

### 12.2.6 No Action and No Further Action Sites within Waste Area Group 7

Waste Area Group 7 contains 13 operable units. OU 7-13/14 is the comprehensive Remedial Investigation/Feasibility Study addressed in this ROD. RODs for three additional operable units—OU 7-08 (OCVZ), OU 7-10 (Pit 9 Process Demonstration), and OU 7-12 (Pad A)—are superseded by this ROD for OU 7-13/14 (see Section 2.2.2). The Agencies conclude that no action or no further action is required for 10 operable units within Waste Area Group 7. Table 9 lists all operable units in Waste Area Group 7 and the remedial decision for each.

Table 9. Remedial decisions for operable units in Waste Area Group 7.

| Operable Unit | | Remedial Decision |
|---|---|---|
| 7-01 | Soil Vault Rows (1–13) | No further action. This operable unit is addressed under OU 7-13/14. |
| 7-02 | Acid Pit | No further action. This operable unit is addressed under OU 7-13/14. |
| 7-03 | Nontransuranic pits and trenches | No further action. This operable unit is addressed under OU 7-13/14. |
| 7-04 | Air pathway | No further action. This operable unit is addressed under OU 7-13/14. |
| 7-05 | Surface water pathways and surficial sediments | No further action. This operable unit is addressed under OU 7-13/14. |
| 7-06 | Groundwater pathway | No further action. This operable unit is addressed under OU 7-13/14. |
| 7-07 | Vadose zone radionuclides and metals | No further action. This operable unit is addressed under OU 7-13/14. |

Table 9. (continued).

| Operable Unit | | Remedial Decision |
|---|---|---|
| 7-08 | Vadose zone organics RI/FS | Remediation is in progress, in accordance with the OU 7-08 ROD, and will continue under the OU 7-13/14 ROD. The OU 7-08 ROD is superseded by this OU 7-13/14 ROD. |
| 7-09 | Transuranic Storage Area releases | For purposes of the OU 7-13/14 ROD, OU 7-09 is deemed a no action. Ongoing HWMA (RCRA) regulated facilities at OU 7-09 will be subject to HWMA (RCRA) closure requirements. Following HWMA closure requirements, CERCLA activities, as necessary, will be performed under a separate CERCLA action (see Section 12.2.6.8). |
| 7-10 | Pit 9 process demonstration | No further action. The Selected Remedy includes targeted waste retrieval for portions of Pit 9. The OU 7-10 ROD is superseded by this OU 7-13/14 ROD. |
| 7-11 | Septic tanks | No action. Hazardous or radioactive contaminants were not detected above regulatory levels. |
| 7-12 | Pad A RI/FS | Post-remediation maintenance and monitoring is ongoing in accordance with the OU 7-12 ROD. The Selected Remedy incorporates Pad A. The OU 7-12 ROD is superseded by this OU 7-13/14 ROD. |
| 7-13 | Transuranic pits and trenches | See OU 7-13/14. |
| 7-14 | Comprehensive RI/FS | See OU 7-13/14. |
| 7-13/14 | Comprehensive RI/FS | OUs 7-13 and 7-14 were combined into a single comprehensive RI/FS, designated OU 7-13/14. This ROD documents the Selected Remedy. |

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
HWMA = Hazardous Waste Management Act
OU = operable unit
RCRA = Resource Conservation and Recovery Act
RI/FS = remedial investigation/feasibility study
ROD = Record of Decision

The following sections of this ROD summarize information on the 10 No Action and No Further Action operable units. The two no action operable units are release sites outside the SDA (i.e., OUs 7-09 and 7-11). All other operable units are associated with the SDA. The Selected Remedy, which includes an evapotranspiration surface barrier over the entire landfill, will effectively mitigate residual risk associated with the eight no further action operable units in the SDA.

***12.2.6.1 OU 7-01—Soil Vaults.*** Based on screening-level assessment of Soil Vault Rows 1 through 13,[83] the Agencies concluded that waste in soil vaults would be evaluated in the comprehensive remedial investigation/feasibility study to assess potential transport of contaminants to the surface in concentrations that could exceed threshold values.[31] Because the OU 7-13/14 RI/BRA and Feasibility Study encompass all waste within the SDA, including that buried in soil vaults, no further action is warranted under OU 7-01.

***12.2.6.2 OU 7-02—Acid Pit.*** Based on screening-level assessment,[84] the Agencies concluded that more refined modeling was necessary to reduce uncertainty associated with the Acid Pit risk evaluation for mercury.[32] Subsequent refined modeling[46] showed that risk from mercury did not exceed threshold values.[85] The Acid Pit also was partially grouted in 1997.[86] Therefore, no further action is warranted under OU 7-02.

***12.2.6.3 OU 7-03—Nontransuranic-Contaminated Waste Pits and Trenches.*** Specified pits and trenches identified as nontransuranic were evaluated using screening-level techniques,[33] and the

Agencies concluded that these pits and trenches would be evaluated in a remedial investigation/feasibility study.[33] Because the OU 7-13/14 RI/BRA and Feasibility Study encompass all waste within the SDA, including that buried in nontransuranic pits and trenches, no further action is warranted under OU 7-03.

***12.2.6.4 OU 7-04—Air Pathway.*** Potential risk attributable to exposures through the air pathway was evaluated using screening-level techniques.[34] The Agencies concluded that further evaluation in the comprehensive remedial investigation/feasibility study was warranted.[34] The OU 7-13/14 RI/BRA and Feasibility Study assessed risk for this pathway and concluded that risk thresholds could be exceeded (see Tables 2 and 3). Because alternatives evaluated for OU 7-13/14 address these risks, no further action is warranted under OU 7-04.

***12.2.6.5 OU 7-05—Surface Water Pathways and Surficial Sediments.*** Potential risk attributable to exposures through surface water pathways and surficial sediments was evaluated using screening-level techniques.[87] The Agencies concluded that final evaluation would be implemented in the comprehensive remedial investigation/feasibility study.[35] The OU 7-13/14 RI/BRA and Feasibility Study assessed risk for surficial sediments and concluded that risk thresholds could be exceeded (see Tables 2 and 3). Because alternatives evaluated for OU 7-13/14 address these risks, no further action is warranted under OU 7-05.

***12.2.6.6 OU 7-06—Groundwater Pathway.*** Potential risk attributable to exposures through groundwater pathways was evaluated using screening-level techniques.[88] The Agencies concluded that final evaluation would be implemented in the comprehensive remedial investigation/feasibility study.[36] The OU 7-13/14 RI/BRA and Feasibility Study assessed risk for groundwater pathways and concluded that risk thresholds could be exceeded (see Tables 2 and 3). Because alternatives evaluated for OU 7-13/14 address these risks, no further action is warranted under OU 7-06.

***12.2.6.7 OU 7-07—Vadose Zone Radionuclides and Metals***. Potential risk attributable to dissolved-phase contaminants that could migrate from the vadose zone and into the aquifer was evaluated using screening-level techniques.[37] The Agencies concluded that more refined methods would be implemented to address the vadose zone in the comprehensive remedial investigation/feasibility study.[37] The OU 7-13/14 RI/BRA and Feasibility Study assessed risk for groundwater pathways, including potential transport through the vadose zone, and concluded that risk thresholds could be exceeded for groundwater (see Tables 2 and 3). Because alternatives evaluated for OU 7-13/14 address these risks, no further action is warranted under OU 7-07.

***12.2.6.8 OU 7-09—Transuranic Storage Area Releases.*** The screening-level investigation for OU 7-09[28] addressed historical releases within the Transuranic Storage Area, focusing on potential releases from the belowgrade Intermediate-Level Transuranic Storage Facility and from abovegrade storage on Pads 1, 2, 3, and R.

Pad 3 previously underwent closure under HWMA (RCRA) with removal of the asphalt pad.[89]

HWMA (RCRA) closure of the Intermediate-Level Transuranic Storage Facility has been approved by DEQ, and final decommissioning will be completed as a CERCLA non-time-critical removal action under general decommissioning activities for ICP.[90]

Based on information from historical releases in the Transuranic Storage Area, surface soil immediately adjacent to Pad R was identified as the only source that might pose a threat to human health and the environment. Contaminant releases on and adjacent to Pad R are associated with a breached waste box discovered in April 1988. All media contaminated by the 1988 breached drum incident will be removed as part of the HWMA closure of the Transuranic Storage Area retrieval enclosure. HWMA closure will include removal of asphalt Pads 1, 2, and R, with sampling and characterization of underlying soil. The Agencies will evaluate closure sampling data to determine if a release subject to further action under CERCLA has occurred and what remedial action will be required, if necessary, under a separate CERCLA action. After HWMA closure and subsequent CERCLA action, retrieval enclosures may be deactivated, decontaminated, and decommissioned under general decommissioning activities for ICP.[90] Any excavations would be filled with clean soil, uniformly graded, and vegetation established.

***12.2.6.9 OU 7-10—Pit 9 Process Demonstration***. This OU 7-13/14 ROD supersedes the OU 7-10 ROD. No requirements remain, and no further action will be implemented under OU 7-10. Pit 9 was evaluated as a part of OU 7-13/14. As part of the Selected Remedy, portions of Pit 9 will be retrieved using the targeted waste approach under authority of this OU 7-13/14 ROD.

***12.2.6.10 OU 7-11—Septic Tanks and Drain Fields.*** Potential risk attributable to three septic tank systems at RWMC was evaluated using screening-level techniques.[30] Because hazardous or radioactive contaminants were not detected in the systems above regulatory limits, the Agencies concluded that no action is warranted under OU 7-11.

## 12.3 Cost Estimate for the Selected Remedy

Table 10 provides the cost summary for the Selected Remedy. Capital, operations and maintenance, and periodic costs are provided as current value and net present value for direct work. Contingencies are included within the estimates. The base year in calculating net present value is 2006. Targeted waste retrievals already have begun as non-time-critical removal actions for Accelerated Retrieval Projects I, II, and III. The cost estimate includes construction of the balance of the Selected Remedy beginning in 2009 (unlike alternatives evaluated in the Feasibility Study, which were assumed to begin in 2010), with all construction (e.g., retrieval, grouting, and surface barrier construction) ending in 2028. Long-term management and control costs (e.g., for operating and maintaining the OCVZ system and for surveillance, maintenance, monitoring, and institutional controls) are estimated for 100 years following construction. However, long-term institutional control will continue as outlined in this ROD (and as to be detailed in the remedial design/remedial action work plan) until modified by the Agencies (e.g., in a CERCLA 5-year review, INL Site-wide institutional control annual review, or other long-term management and control document).

Information in this cost estimate summary is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in cost elements are likely to occur as a result of new information and data collected during engineering design of the remedial alternative. Major changes may be documented in the form of a memorandum in the Administrative Record file, an explanation of significant difference, or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30% of the actual project cost.

## 12.4 Estimated Outcomes of Selected Remedy

Expected outcomes for the Selected Remedy are as follows:

- Land use and cleanup levels—The Selected Remedy is expected to achieve performance objectives when construction of the surface barrier is complete in approximately 20 years. Land use will remain industrial. Institutional controls and other long-term management and control activities will limit access to the site and enforce land-use restrictions. Carcinogenic risk at the surface will be maintained at levels less than $10^{-4}$ by maintaining an effective dose equivalent rate at the surface of less than 15 mrem/year.[62]

Table 10. Cost estimates for the Selected Remedy.

| Cost Element | Current Value ($M)[a] | | Net Present Value ($M)[a] |
|---|---|---|---|
| **Capital Costs** | | | |
| 5.69-Acre targeted waste retrieval | $1,031.2 | | $798.0 |
| Procurement | | $160.7 | |
| Construction of retrieval enclosures | | $26.4 | |
| Waste excavation | | $194.2 | |
| Deactivation, decontamination, and decommissioning of enclosures | | $42.6 | |
| Assay of targeted waste drums for safe storage | | $181.1 | |
| Storage and shipment of transuranic waste to Waste Isolation Pilot Plant | | $222.0 | |
| Storage and shipment of nontransuranic waste | | $4.7 | |
| Security | | $21.3 | |
| Preoperational plans and final inspection reports | | $6.1 | |
| Project management, construction management, and remedial design | | $172.1 | |
| In situ grouting procurement and implementation | $11.6 | | $9.0 |
| Subsidence mitigation | $8.8 | | $5.6 |
| Procurement and mockup testing (treatability study) | | $1.3 | |
| Soil placement, consolidation, and final compaction | | $3.0 | |
| Security | | $1.6 | |
| Preoperational plans and final inspection reports | | $1.1 | |
| Project management, construction management, and remedial design | | $1.8 | |
| Evapotranspiration surface barrier[b] | $94.6 | | $51.1 |
| Surveying, mobilization and demobilization, relocation of monitoring equipment, and abandonment or extension of existing wells and probes, and institutional controls during construction | | $1.8 | |
| Installation of fence and road | | $1.7 | |
| Installation and modification of wells, relocation of OCVZ treatment units | | $2.0 | |
| Construction of surface barrier | | $66.3 | |
| OCVZ abovegrade piping to wells | | $4.7 | |
| Installation of monitoring wells outside the barrier perimeter | | $2.3 | |
| Contouring for drainage | | $1.4 | |
| Security | | $4.2 | |
| Preoperational plans and final inspection reports | | $1.5 | |
| Project management, construction management, and remedial design | | $8.7 | |
| OCVZ replacements of treatment unit (every 20 years) | $2.3 | | $1.1 |
| **Total Capital Cost** | **$1,148.5** | | **$864.8** |
| **Operation and Maintenance Costs** | | | |
| OCVZ operations | $60.1 | | $33.1 |
| Long-term surveillance, maintenance, monitoring, and institutional controls | $86.6 | | $13.9 |
| Groundwater and vadose zone monitoring | | $58.9 | |
| Surface barrier surveillance, maintenance, and repair | | $13.3 | |
| Technical support | | $10.8 | |
| Project management and remedial design | | $3.6 | |
| **Total Operations and Maintenance Cost** | **$146.7** | | **$47.0** |
| **Periodic Costs** | | | |
| Remedial action, annual summary, and operations and maintenance reports | $4.0 | | $0.6 |
| 5-year reviews | $1.2 | | $0.2 |
| **Total Periodic Cost** | **$5.2** | | **$0.8** |
| **Total Cost (Millions)** | **$1,300.0** | | **$912.6** |

a. Estimates include contingencies for direct work.
b. Procurement costs are distributed throughout tasks associated with surface barrier construction.

OCVZ = Organic Contamination in the Vadose Zone (vadose zone vapor vacuum extraction and treatment system)

- Groundwater use and cleanup levels—The aquifer near RWMC will be restored to beneficial use as an unrestricted source of drinking water for workers and future residents by 2110. Cleanup levels for the aquifer are MCLs. Until MCLs are met, institutional controls will preclude residential use of the portion of the aquifer contaminated by RWMC sources.

- Ecological benefits—The surface barrier will protect biota from exposure to unacceptable levels of contaminants and inhibit biotic transport of contamination to the surface.

# 13. STATUTORY DETERMINATIONS

The Selected Remedy satisfies statutory requirements of CERCLA § 121 (as required by the National Contingency Plan [40 CFR 300.430(f)(5)(ii)]).[3] It will protect human health and the environment, comply with ARARs, be cost-effective, and use permanent solutions to the extent practicable, as described in the following subsections.

## 13.1 Protection of Human Health and the Environment

The Selected Remedy will adequately protect human health and the environment through treatment, engineered source control, institutional controls, and other long-term management and control activities. Continued operation of the OCVZ system, targeted waste retrieval, and removal of high-concentration organic solvent waste will remove solvents, the most imminent threat to the aquifer. The grouting component provides relatively near-term isolation of the waste pending completion of targeted waste retrievals and installation of the surface barrier over the SDA. The engineered surface barrier will inhibit biotic transport of contamination to the surface, thus breaking the pathway to surface exposures for both human and ecological receptors. The barrier also will inhibit infiltration and reduce contaminant migration into the subsurface and aquifer. The combined elements of the Selected Remedy will satisfy performance objectives established for OU 7-13/14. The Selected Remedy improves protectiveness by reducing uncertainty by performing additional targeted waste retrieval and grouting of specific waste types.

## 13.2 Compliance with Applicable or Relevant and Appropriate Requirements

The remedy complies with ARARs. Table 11 lists all ARARs for the Selected Remedy and explains how each ARAR applies. This table includes two nonbinding guidelines that are to-be-considered: EPA Region 10's institutional control policy[56] and DOE Order 435.1.[91] EPA's policy on institutional controls is to-be-considered because contamination will remain in place above levels that would allow for unrestricted use. This policy will be used to develop institutional controls and include them in the INL Site-wide program.[55] DOE Order 435.1 protects the public and the environment from radiation and addresses management of radioactive waste.

Table 11. Applicable or relevant and appropriate requirements and guidelines for the Selected Remedy.

| Requirement and Citation | ARAR Type | | | Comments |
|---|---|---|---|---|
| | Action-Specific | Chemical-Specific | Location-Specific | |
| Clean Air Act and Idaho Air Regulations | | | | |
| "Toxic Substances," IDAPA 58.01.01.161<br>"Toxic Air Pollutants, Noncarcinogenic Increments," IDAPA 58.01.01.585<br>"Toxic Air Pollutants, Carcinogenic Increments," IDAPA 58.01.01.586<br>"Environmental Remediation Source," IDAPA 58.01.01.210.16(a) | | A | | Applies to remediation activities. Compliance with IDAPA 58.01.01.161 requires that release of noncarcinogenic and carcinogenic contaminants into air must be estimated in accordance with IDAPA 58.01.01.210 before start of construction, controlled, and, as necessary, monitored. If these increments cannot be met for remediation sources, compliance with IDAPA 58.01.01.161 will be met in accordance with IDAPA 58.01.01.210.16(a), "Environmental Remediation Source." |
| "Ambient Air Quality Standards For Specific Air Pollutants," IDAPA 58.01.01.577 | | A | | Remediation activities will comply with applicable emission standards and will not cause or significantly contribute to violation of an ambient air quality standard. Modeling will be performed if deemed necessary. |
| "National Emission Standards for Hazardous Air Pollutants," 40 CFR 61.92, "Standard" | | A | | Applies to remediation activities with potential to generate radiological emissions (e.g., waste retrieval). Will be met, because emissions will be below allowable levels. |
| "National Emission Standards for Hazardous Air Pollutants," 40 CFR 61.93, "Emission Monitoring and Test Procedures" | A | | | Applies to remediation activities with potential to generate radiological emissions (e.g., waste retrieval). Will be implemented, as appropriate, based on emissions estimates for the respective activity or source. |
| "National Emission Standards for Hazardous Air Pollutants," 40 CFR 61.94(a), "Compliance and Reporting" | A | | | Applies to remediation activities with potential to generate radiological emissions (e.g., waste retrieval). Will be implemented, as appropriate, based on emissions estimates for the respective activity or source. |

Table 11. (continued).

| Requirement and Citation | ARAR Type | | | Comments |
|---|---|---|---|---|
| | Action-Specific | Chemical-Specific | Location-Specific | |
| "Rules for Control of Fugitive Dust," and "General Rules," IDAPA 58.01.01.650 and 58.01.01.651 | A | | | Applies to activities with potential to generate fugitive dust. Appropriate control measures, including application of water or other appropriate dust suppressants, will be implemented as needed to control fugitive dust. |
| Idaho Hazardous Waste Management Act (Resource Conservation and Recovery Act) | | | | |
| "Hazardous Waste Determination," IDAPA 58.01.05.006 (40 CFR 262.11) | A | A | | Applies to waste types that are placed, treated, stored, or sent to an off-INL Site facility for management. Investigation-derived waste generated and stored under the OU 7-13/14 program will be managed under the scope of this ROD pending identification of suitable, compliant disposal options appropriate for waste characteristics. |
| "General Facility Standards," IDAPA 58.01.05 (40 CFR 264.13(a)(1)(2), 264.15(a)(c), and 264.17(a)(c)) | RA | | | Will be implemented as appropriate for relevant characterization, treatment, or storage activities. |
| "Location Standards," IDAPA 58.01.05 (40 CFR 264.18(b)) | | | RA | Will be met through design and construction as appropriate to prevent washout by a 100-year flood. |
| "Preparedness and Prevention," IDAPA 58.01.05 (40 CFR 264.31 through 264.35) | RA | | | Will be implemented as appropriate for relevant treatment or storage activities and equipment. |
| "Closure and Postclosure," IDAPA 58.01.05 (40 CFR 264.111 (a)(b), 40 CFR 264.114) | RA | | | Will be met as relevant to closure of the SDA and supporting equipment and structures. |
| "Use and Management of Containers," IDAPA 58.01.05 (40 CFR 264, Subpart I) | RA | | | Will be met for container storage areas holding RCRA hazardous waste. |
| "Closure and Post-Closure Care," IDAPA 58.01.05 (40 CFR 264.310(a)(1) through (a)(5), 264.310(b)(1), and 264.310(b)(5)) | RA | | | Will be met for construction and maintenance of the SDA surface barrier. |
| "Temporary Units," IDAPA 58.01.05.008 (40 CFR 264.553) | A | | | Will be met for waste types that are staged, stored, or treated. |
| "Land Disposal Restrictions," IDAPA 58.01.05.011 (40 CFR 268) | A | A | | Will be met for waste types that are placed, stored, treated, or sent to an off-INL Site facility for management. |

Table 11. (continued).

| Requirement and Citation | ARAR Type | | | Comments |
|---|---|---|---|---|
| | Action-Specific | Chemical-Specific | Location-Specific | |
| Toxic Substances Control Act | | | | |
| Polychlorinated biphenyls—Toxic Substances Control Act, 40 CFR 761, Subpart D | A | A | | Will be met for waste types that contain polychlorinated biphenyls above regulated thresholds. Requirements for CERCLA storage facility WMF-698 are subject to risk-based storage provisions outlined in Appendix A of the *Action Memorandum for the Accelerated Retrieval of a Described Area within Pit 4*.[15] |
| Idaho Ground Water Quality Rule | | | | |
| "Ground Water Quality Rule," IDAPA 58.01.11.200 | A | A | | State of Idaho Ground Water Quality Rule's regulated levels of contaminants are equivalent to Clean Water Act MCLs (i.e., 40 CFR 141). Will be met because concentrations in the Snake River Plain Aquifer will be less than applicable State of Idaho groundwater quality standards in 2110 and after. |
| Idaho Shallow Injection Well, Monitoring Well, and Borehole Standards | | | | |
| "Well Construction Standards Rules," IDAPA 37.03.09 | A | | | Will be met for wells and boreholes that are impacted by the remedy and must be abandoned or modified. |
| Historic and Archaeological Protection Regulations | | | | |
| Native American graves protection and repatriation regulations, 43 CFR 10 | A | | | Will be met if archaeological or other cultural resources are encountered (excluding items in buried waste because: (1) the entire SDA is a previously disturbed area and (2) objects disposed of in the SDA will not be recategorized as historic or archaeological resources). |
| Preservation of historic, prehistoric, and archeological data, 36 CFR 800 and 40 CFR 6.301(b) and (c) | A | | | Will be met if archaeological or other cultural resources are encountered (excluding items in buried waste because: (1) the entire SDA is a previously disturbed area and (2) objects disposed of in the SDA will not be recategorized as historic or archaeological resources). |

Table 11. (continued).

| Requirement and Citation | ARAR Type | | | Comments |
|---|---|---|---|---|
| | Action-Specific | Chemical-Specific | Location-Specific | |
| Protection of archaeological resources, 43 CFR 7 | A | | | Will be met if archaeological or other cultural resources are encountered (excluding items in buried waste because: (1) the entire SDA is a previously disturbed area and (2) objects disposed of in the SDA will not be recategorized as historic or archaeological resources). |
| To-Be-Considered Guidelines | | | | |
| "Radioactive Waste Management," DOE Order 435.1 | TBC | | | Will be applied to radioactive waste newly generated from remediation activities. |
| "Region 10 Final Policy on the Use of Institutional Controls at Federal Facilities," U. S. Environmental Protection Agency memorandum[56] | TBC | | | Will be applied to the SDA because contamination will remain in place above levels that allow unrestricted use and access after remediation. Will be met by institutional control approach to be defined subsequent to this ROD (e.g., remedial design/remedial action documents and modifications to INL Site-wide institutional controls and long-term management and control documents). |

A = applicable
ARAR = applicable or relevant and appropriate requirement
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
INL = Idaho National Laboratory
MCL = maximum contaminant level
OU = operable unit
RA = relevant and appropriate
RCRA = Resource Conservation and Recovery Act
ROD = Record of Decision
SDA = Subsurface Disposal Area
TBC = to be considered

## 13.3 Cost-Effectiveness

The Agencies conclude that the Selected Remedy is cost effective because it combines elements that remove a significant amount of waste containing contaminants, continues to remove solvent vapors from the environment, and provides for long-term protection of the Snake River Plain Aquifer. The following definition from the National Contingency Plan was used to make this determination: "A remedy shall be cost-effective if its costs are proportional to its overall effectiveness" (40 CFR 300.130(f)(1)(ii)(D) and 40 CFR 300.430(f)).[3] The Selected Remedy is cost effective because it balances waste retrieval with expediting installation of a surface barrier, worker safety, and cost.

## 13.4 Use of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable and Preference for Treatment as a Principal Element

The Selected Remedy satisfies the statutory preference for treatment to reduce toxicity, mobility, or volume through treatment. The grouting component provides relatively near-term isolation of the waste pending completion of targeted waste retrievals and installation of the surface barrier over the SDA. In situ grouting will reduce mobility of technetium-99 and iodine-129. Retrieved targeted waste (e.g., uranium) will be treated when necessary to meet disposal requirements. Solvents collected from the vadose zone are permanently destroyed through catalytic oxidation by the OCVZ system. In combination, these treatments address a portion of the buried waste. In addition, the Selected Remedy removes a substantial amount of waste contaminated with solvents and transuranics for disposal at WIPP. WIPP is a deep geological repository that isolates waste from the environment.

## 13.5 Five-Year Review Requirements

A review (in accordance with 40 CFR 300.430 [f][4][ii][3]) is required at a minimum every 5 years if a remedy is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allows for unlimited use and unrestricted exposure. Because the selected remedy will not achieve levels that allow for unlimited use and unrestricted exposure within 5 years, the Agencies have agreed to conduct 5-year reviews in accordance with EPA policy.

The next INL Site-wide 5-year review is scheduled for 2010, followed by another in 2015. Five-year reviews for OU 7-13/14 will be combined with INL Site-wide 5-year reviews.

If a 5-year review concludes an existing remedy is not protective of human health or the environment, the Agencies may consider new technologies that were not available when this ROD was finalized. The Agencies can modify the ROD (e.g., ROD amendment) through the CERCLA process when necessary to ensure that the remedy is protective.

# 14. DOCUMENTATION OF SIGNIFICANT CHANGES FROM PREFERRED ALTERNATIVE OF PROPOSED PLAN

The Proposed Plan[21] for OU 7-13/14 was released for public comment in October 2007. The Proposed Plan identified a combination of elements from Alternatives 2, 3, and 4—Targeted Waste Retrieval, In Situ Grouting, Vadose Zone Vapor Vacuum Extraction and Treatment, Evapotranspiration Surface Barrier, and Long-Term Institutional Controls—as the Preferred Alternative for buried waste. The Agencies reviewed all written and verbal comments submitted during the public comment period and determined that two changes to the remedy, as originally identified in the Proposed Plan, are appropriate.

These changes expand the size of the cumulative retrieval area and add a targeted waste form. Based on public review and DEQ's stated intent to reserve judgment on retrieval acreage until after public comments were received, these are reasonably expected modifications and are not fundamental changes to the remedy.

One change is to expand targeted waste retrieval from 4.8 acres, as outlined in the Proposed Plan, to 5.69 acres (see Section 12.2.1.1). The additional acreage recovers more waste containing contaminants of concern, such as solvents, and increases the Agencies' confidence in the effectiveness of the Selected Remedy. The change in removal acreage from 4.8 acres in the Proposed Plan to 5.69 acres improves protectiveness by reducing uncertainty by performing additional targeted waste retrieval of specific waste types. This change also is consistent with comments made by the State of Idaho and the public and is anticipated to meet the terms of the Agreement to Implement.[5]

The second change is to add Series 742 sludge to the list of targeted waste forms. Experience gained during Accelerated Retrieval Projects I and II justifies this change. Visually, Series 742 sludge proved difficult to discriminate from Series 741 sludge (also a targeted waste form). Furthermore, curie content in Series 742 sludge is highly variable; to date, assays show transuranic concentrations greater than 100 nCi/g in a significant number of exhumed Series 742 drums. Because of the inability to visually distinguish between Series 741 and 742 sludges, they were both effectively removed during Accelerated Retrieval Projects I and II excavation. The Agencies determined to further increase confidence in the Selected Remedy by classifying Series 742 sludge as targeted waste in newly exhumed areas. This change became effective at Accelerated Retrieval Project II on July 3, 2008, in accordance with the Agreement to Implement.[5] It also applies to Accelerated Retrieval Project III and the balance of the 5.69-acre retrieval area in the Selected Remedy.

Compared to the Preferred Alternative in the Proposed Plan, the Selected Remedy will take 1 to 2 more years and cost an additional $227.7 million current value ($178.3 million net present value) for direct work. Remediation schedules and cost estimates for the Selected Remedy (e.g., Figure 3 and Table 10) reflect these changes.

# 15. PARTS 1 AND 2 REFERENCES


1. 42 USC § 9601 et seq., "Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA/Superfund)," *United States Code,* 1980.

2. Public Law 99-499, "Superfund Amendments and Reauthorization Act of 1986 (SARA)," U.S. Government, 1986.

3. 40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," *Code of Federal Regulations*, Office of the Federal Register, 2006.

4. DOE-ID, *Federal Facility Agreement and Consent Order for the Idaho National Engineering Laboratory*, Administrative Record No. 1088-06-29-120, U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency, Region 10; Idaho Department of Health and Welfare, 1991.

5. U.S. District Court, *Agreement to Implement U.S. District Court Order Dated May 25, 2006,* Public Service Co. of Colorado v. Batt, No. CV-91-0035-S-EJL (D. Id.) and United States v. Batt, No. CV-91-0054-S-EJL (D. Id.), U.S. District Court, dated July 3, 2008.

6. 42 USC § 9621 et seq., "Cleanup Standards," *United States Code*, 2004.

7. EPA, *A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents*, EPA 540-R-98-031, OSWER 9200.1-23P, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, 1999.

8. Executive Order 12580, "Superfund Implementation," 52 FR 2923, 3 CFR, January 29, 1987.

9. 42 USC § 9620 et seq., "Comprehensive Environmental Response, Compensation and Liability Act (42 U.S.C. 9620)–Section 120, Federal Facilities–Application of Act to Federal Government," *United States Code*, 2008.

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14. Steve L. Lopez, William H. Landman, Donald E. Sebo, and Vivian G. Schultz, *Summary Report for the OU 7-13/14 Early Actions Beryllium Encapsulation Project*, ICP/EXT-04-00646, Rev. 1, Idaho National Engineering and Environmental Laboratory, Idaho Completion Project, 2005.

15. DOE-ID, *Action Memorandum for Accelerated Retrieval of a Described Area within Pit 4*, DOE/NE-ID-11179, Rev. 0, U.S. Department of Energy Idaho Operations Office, 2004.

16. DOE-ID, *Action Memorandum for the Accelerated Retrieval Project II within Pits 4 and 6 of the Subsurface Disposal Area*, DOE/NE-ID-11238, U.S. Department of Energy Idaho Operations Office, 2006.

17. DOE-ID, *Action Memorandum for the Accelerated Retrieval Project III within Pit 6 of the Subsurface Disposal Area,* DOE/ID-11363, Rev. 0, U.S. Department of Energy Idaho Operations Office, 2008.

18. DOE-ID, *Record of Decision: Declaration for Organic Contamination in the Vadose Zone OU 7-08, Idaho National Engineering Laboratory, Radioactive Waste Management Complex, Subsurface Disposal Area*, Administrative Record No. 5761, U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency, Region 10; and Idaho Department of Health and Welfare, 1994.

19. DOE-ID, *Record of Decision: Declaration for Pad A at the Radioactive Waste Management Complex Subsurface Disposal Area at the Idaho National Engineering Laboratory*, Administrative Record No. 5632, U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency, Region 10; and Idaho Department of Health and Welfare, 1994.

20. DOE-ID, *Record of Decision: Declaration for Pit 9 at the Radioactive Waste Management Complex Subsurface Disposal Area at the Idaho National Engineering Laboratory*, Administrative Record No. 5569, U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency, Region 10; and Idaho Department of Health and Welfare, 1993.

21. DOE-ID, *Proposed Plan for Radioactive Waste Management Complex Operable Unit 7-13/14*, DOE/ID-11288, Rev. 0, U.S. Department of Energy, State of Idaho, U.S. Environmental Protection Agency, 2007.

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24. DOE, *Agreement to Extend Deadlines*, *the United States Environmental Protection Agency, the Idaho Department of Environmental Quality, and the United States Department of Energy* Administrative Record No. 25088, U.S. Department of Energy, State of Idaho, U.S. Environmental Protection Agency, 2007.

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# PART 3: RESPONSIVENESS SUMMARY

The period for public comment (i.e., receipt of written and oral comments) on the Operable Unit (OU) 7-13/14 Proposed Plan[1] began October 22, 2007, and ended December 21, 2007. Public meetings on the OU 7-13/14 Proposed Plan were conducted in Boise, Idaho, on November 13, 2007; Twin Falls, Idaho, on November 14, 2007; and Idaho Falls, Idaho, on November 15, 2007. Oral and written comments were submitted during the public meetings. Written comments also were received during the public comment period required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) § 117[2] and the National Oil and Hazardous Substances Pollution Contingency Plan.[3]

This Responsiveness Summary provides responses from the Agencies (i.e., the U.S. Department of Energy [DOE], Idaho Department of Environmental Quality [DEQ], and U.S. Environmental Protection Agency [EPA]) to all comments received on the OU 7-13/14 Proposed Plan. Responses are organized as follows:

- Section 16, general comments (GC)—Five recurring themes were apparent in a significant number of stakeholder reactions to the Proposed Plan. These major themes were condensed into five general comments (in black), each with an Agency response (in blue).

- Section 17, specific comments—Oral and written comments (in black) with Agency responses (in blue) are organized by seven topics: (1) remedy selection (RS), (2) communications and process (CP), (3) risk assessment and modeling (RA), (4) monitoring and 5-year review (M), (5) remedial investigation and characterization (RI), (6) remedial design (RD), and (7) other topics (O). Many comments are provided as received with only minor modifications (e.g., to correct typographical errors) while others are paraphrased for clarity and brevity. In some cases, multiple remarks of similar content are collected under a single, paraphrased comment.

- Section 18, Snake River Alliance (SRA)—The complete set of comments submitted by the Snake River Alliance and their technical assistance grant advisor are included as provided with slight modifications to reduce the number of acronyms, clarify format, and correct typographical errors. Some comments are lengthy because they summarize background information and address multiple aspects of a topic. Responses (in blue) are inserted within the text of the comments (in black). Comments are numbered as originally provided.

- Section 19, Shoshone-Bannock Tribes—Four program offices within the Tribal organization submitted comments. Each set is reproduced in a separate subsection, with comments as submitted (in black) and Agency responses (in blue). Tribal comments were not numbered.

Table 12 provides a partial index to individual comments on the OU 7-13/14 Proposed Plan addressed in Sections 16 and 17. Comments are listed in alphabetical order by last name, organization, or e-mail identifier. In addition, 34 anonymous comments were submitted. Comments are sorted into one of eight categories:

CP = communications and process
GC = general comment
M = monitoring and 5-year review
O = other topics
RA = risk assessment and modeling
RD = remedial design
RI = remedial investigation
RS = remedy selection

Table 12. Oral and written comments on the Operable Unit 7-13/14 Proposed Plan.

| Name, Organization, or E-mail Identifier | Comment Number |
|---|---|
| a2j2 | M-8, RA-15, RD-10, RA-16, RD-11, RS-51, GC-3, GC-4, RS-52, RS-53, O-4, O-5, RD-12, RD-13, RA-17, RD-14, M-9, O-6 |
| Abo, Joetta | RI-2, RS-19 |
| ajc | GC-1 |
| Alex | GC-1 |
| Allgood, M. Lane | GC-1, GC-3, RS-11 |
| Anderson, Philip A. | RS-20, RS-21, RS-22, RS-23 |
| Anderson, Randy | GC-2 |
| Andreason, Sherry | GC-1 |
| | |
| Barraclough, Elaine | GC-1 |
| Barraclough, Jack | GC-1, GC-3 |
| Bechtold, Thomas E. | RS-57, RA-21, O-7 |
| Benz, Brad | CP-5 |
| beutps | GC-1 |
| Bitter, Marcy | GC-1 |
| blackrockforge | GC-2, GC-3, GC-4, GC-5, RS-52, RA-17, M-1, Section 18 (Snake River Alliance) |
| Blurton, Joan | GC-2 |
| Bradford, Jeff | GC-1 |
| Brady, Clifford A. | GC-1 |
| Brady, Jerry M. | GC-1 |
| braivo | RS-77 |
| Brock, Darren W. | RS-38, RS-39 |
| Bronson, Kyle L. | GC-1 |
| Buehler, George | RI-7 |
| | |
| Campbell, Joseph | GC-1, RS-58, GC-3 |
| campbellrl | RS-58, RS-60 |
| Carlson, Nancy | RS-29, RS-30, RI-3, RS-31, GC-1 |
| Carter, Laurie Mckenzie | GC-1 |
| Ceja, Ester | GC-1, RS-66, GC-3, GC-4, RS-67 |
| Chiles, Robb | GC-1, GC-3, RS-13 |
| Chisholm, Bill | RI-2, GC-2, GC-3 |
| Chormel, J. | GC-2 |
| Christensen, Roger S. | RS-12, RS-13 |
| Christopher, Jim | O-14, RS-71, O-15, RS-72, RS-73, RS-74, O-16, O-17, O-18, O-19, RA-29, O-20, O-21, RA-30, RA-31, RA-32, RS-75, M-12, RA-33, O-22, RS-76, O-23, RD-15, O-24, CP-8 |
| Coalition 21 | GC-4, RI-4, RS-26, RS-27 |
| Condie, Cheri | GC-2 |
| Conley, Anita | GC-2 |

Table 12. (continued).

| Name, Organization, or E-mail Identifier | Comment Number |
|---|---|
| Conley, D. S. | GC-2, RS-2 |
| Cox, Phillip | GC-1 |
| Craig, Larry E. | RS-12, RS-13 |
| Crandall, Joseph Y. | GC-2, RS-45 |
| Crapo, Mike | RS-12, RS-13 |
| Crockett, Gregory L. | GC-1, GC-3 |
| | |
| Daly, Katherine | GC-5, Section 18 (Snake River Alliance) |
| Davies, Steve | RS-63 |
| Dieter, Tom | GC-1 |
| dogbreath | GC-1, GC-3 |
| Donnely, Dennis | O-1, RA-13, O-2, RA-14, GC-2 |
| dslzest | GC-1 |
| | |
| Environmental Defense Institute | CP-7, GC-4, RI-2, RS-70, RI-11, GC-2, O-12, O-13 |
| eide | RD-6 |
| Eiven, Max | GC-2, GC-3 |
| Erickson, Coleen | GC-1 |
| Esquirdo, Paul | CP-6 |
| | |
| fanaak | RS-25 |
| Fisher, James E. and Margaret W. | GC-1, GC-3, RS-36, RD-4, M-3 |
| Flowers, Jackie | GC-1 |
| Foster, George | GC-1 |
| Fryberger, Jeremy | GC-2 |
| fuelflea | RS-24, RI-5, GC-2 |
| Fuhriman, Jared | RS-9, RS-10 |
| Furniss, Shanda | GC-1 |
| | |
| Gherke, Robert J. | RS-11, RS-25, GC-1, GC-3 |
| Gifford, John | RS-41, RS-42, RS-43, RS-44, M-4, M-5 |
| Green, Danny | RI-5 |
| Green, Richard C. | RA-34, RD-16, RD-17 |
| greenk | GC-1, RS-3, GC-3 |
| Greer, Sam | CP-1 |
| Grossenbacher, John | GC-1 |
| Grossenbacher, Katherine | GC-1 |
| Grosshans, Ray | GC-1, GC-3 |
| | |
| Haley, Daniel J. | GC-4, GC-3, RA-25, O-8, RS-62, CP-8 |
| Hall, Laurel | GC-1 |
| Halper, Lee | GC-2 |
| Hanawalt, Mark | RS-64, RS-65, O-11, GC-2 |
| Harris, Sarah | GC-2 |

Table 12. (continued).

| Name, Organization, or E-mail Identifier | Comment Number |
|---|---|
| Hartwell, Mary Lynn | GC-1 |
| Henderson, Eltona | GC-2 |
| Heubner, Martin | GC-3, CP-3 |
| Hinckley, Gordon | GC-2, GC-1 |
| howreedjr | GC-1 |
| Huot, Alan | GC-3 |
| Hyatt, Larry | RS-68 |
| | |
| IFC | RS-13 |
| idaho-elk | GC-1 |
| ifsteve | GC-1 |
| INL CAB | GC-1, RI-3, M-1, GC-4, RD-2 |
| | |
| Jines, Alan | RA-5, RA-6, RA-7, RS-15, RA-8 |
| Johnson, Kenlon | GC-1 |
| Johnson, William | CP-2, GC-1 |
| Jones, Jeffrey E. | GC-1 |
| Jull, Paula | RD-8, M-7, CP-4 |
| JW | RA-11, RA-12 |
| | |
| Keller, Kenneth G. | GC-1 |
| Kirkpatrick, Joanna | RI-1, RA-3, RD-1, RS-6, GC-2, GC-3, GC-4 |
| kjholdren | RS-25, RS-55, RS-56 |
| Knighten, B. | RS-25, RS-50 |
| Kotek, J. | GC-1, O-3 |
| | |
| Laflin, Steve | GC-1, GC-3 |
| Larsen, Shawn | CP-2, GC-1, M-1 |
| Law, J. E. | GC-1 |
| Layng, Jenette | GC-2 |
| Leckelt, R. K. | GC-1 |
| lee | GC-2 |
| LeFavour, Nicole | GC-4, RS-69, M-11, RA-27, GC-3, RI-2 |
| Lenkner, Melody and Charlie | GC-2 |
| Leprauil, W. L. | GC-1 |
| Lientz, Amy | GC-1 |
| Lindsay, John | GC-1 |
| | |
| Magnuson | RS-61 |
| markwmhemphill | RA-1, GC-1 |
| Martin, Linda | GC-1, RS-13, GC-3 |
| May, Todd | GC-1 |
| McGeachin, Janice | RS-12, RS-16, M-7, RS-13, RS-17 |
| Medema, Leanne G. | GC-1 |

Table 12. (continued).

| Name, Organization, or E-mail Identifier | Comment Number |
|---|---|
| Miller, Jeffrey S. | RS-25, RS-46, M-6 |
| Miller, John J. | GC-1 |
| MKovach1 | GC-1 |
| Morris, Brian | RS-47, RI-5 |
| Mortimer, Dean M. | RS-12, RS-13 |
| | |
| Nagel, Robert | GC-1 |
| nanbaker | RD-9 |
| Neitzel, Charles R. | RS-11, RS-25 |
| Neitzel, Charles V. | RS-11, RS-25 |
| Neitzel, Chuckie | RS-11, RS-25 |
| Neitzel, Janet A. | RS-11, RS-25 |
| Neitzel, Margarette E. | RS-11, RS-25 |
| Nelson, Jason E. | RD-5 |
| Nichols, Forbes | GC-1 |
| | |
| Oar, Mike | GC-2 |
| Olson, Heidi | GC-2 |
| Ozaki, Calvin | GC-1 |
| | |
| Packer, Natalie | GC-1 |
| Paul, L. | GC-1 |
| Partnership for Science and Technology | GC-1, GC-3, RS-11, RS-25 |
| Peck, Margaret | GC-2 |
| Peterson, Lance | RA-18, RA-19, RA-20, RS-54, CP-8 |
| Pettingill, Larry | GC-1 |
| Philley, Sue | RS-7, RS-8, RA-4 |
| Pollard, Dana | RS-11, RS-25 |
| Preacher, Willie | RI-10, O-9, O-10, RA-26, GC-2 |
| Price, Park | GC-1 |
| | |
| Radford, Dave | RS-12, RS-13 |
| Rankin, Brent | GC-1 |
| Rasmussen, Kami | GC-2 |
| Rearick, Whitney | CP-5, GC-3, RS-123 |
| Reynolds, Tammy | GC-1 |
| Rickards, Peter | GC-2, GC-3, RD-1, RI-2, RI-1, RI-2, RS-19, RS-6, RA-27, RA-28 |
| Regional Development Alliance, Inc. | GC-1, GC-3 |
| Ring, Jeff | GC-1 |
| Ring, Susan | GC-1 |
| rjslottke | GC-1 |
| Robertson, William | GC-1 |

Table 12. (continued).

| Name, Organization, or E-mail Identifier | Comment Number |
|---|---|
| Ross, Brian | GC-2 |
| Ruprecht, Jeff | GC-2 |
| Ruprecht, Judy | GC-2 |
| Russell, Dr. Bill | GC-1, RS-4, RS-5 |
| Rydalch, Ann | GC-1, RS-25, RS-12 |
| | |
| Sali, Bill | RS-12, RS-13 |
| Schubert, Allen | GC-1 |
| Schultz, Carisa K. | GC-1 |
| Searle, Mark L. | RS-25, RS-46, M-6 |
| Shively, Jerry | GC-1 |
| Siler, Joel | GC-1 |
| Simon, Craig | RS-3, RA-1 |
| Simpson, Kathy | GC-1 |
| Simpson, Mike | RS-12, RS-13 |
| Smith, Matt | GC-2 |
| Sponseller, Mike | GC-1, GC-3, RS-11 |
| Staker, Lee | RS-12, RS-13 |
| Stark, Ray | GC-1 |
| Stefer, Betty | GC-2 |
| stevenandbarb | GC-1 |
| Stricker, Nicole | GC-1 |
| Sugden, Elizabeth | GC-2 |
| Swenson, Raymond | GC-1, RS-32, RS-33, RS-34, RS-25, RA-9, RA-10, RS-35 |
| Sylva, Jim | GC-2 |
| | |
| Thompson, R. G. | GC-1 |
| Thorsen, Nancy | GC-1 |
| Toth, Dr. William J. | GC-1 |
| Turner, Kaye | GC-2, GC-3, GC-4 |
| Tvrdy, Joyce | GC-2 |
| Tvrdy, Steve | GC-2 |
| | |
| Waddoups, Fred | GC-4 |
| Weber, John | GC-2, GC-3 |
| WGT | GC-3, GC-1 |
| Wheeler, Douglas R. | GC-1 |
| Williams, Xenia | GC-3, RA-2 |
| Wood, Alan | RS-48, RS-49, RS-2 |
| | |
| Young, Kevin | GC-1 |
| | |
| Zirker, Larry | RS-37 |
| | |

Table 12. (continued).

| Name, Organization, or E-mail Identifier | Comment Number |
|---|---|
| Anonymous 1 | RS-1 |
| Anonymous 2 | GC-1 |
| Anonymous 3 | GC-1 |
| Anonymous 4 | GC-2, RS-14 |
| Anonymous 5 | GC-1, RS-18 |
| Anonymous 6 | GC-2 |
| Anonymous 7 | RD-3 |
| Anonymous 8 | RS-24, GC-2 |
| Anonymous 9 | M-2, GC-2 |
| Anonymous 10 | GC-1 |
| Anonymous 11 | GC-1 |
| Anonymous 12 | GC-1, RS-24, RS-28 |
| Anonymous 13 | GC-2 |
| Anonymous 14 | RS-24, RS-62 |
| Anonymous 15 | GC-2 |
| Anonymous 16 | GC-2 |
| Anonymous 17 | GC-2 |
| Anonymous 18 | GC-1 |
| Anonymous 19 | RS-40, GC-2 |
| Anonymous 20 | GC-2, RS-24 |
| Anonymous 21 | GC-2, RS-24 |
| Anonymous 22 | RD-7, GC-4, GC-1 |
| Anonymous 23 | GC-4 |
| Anonymous 24 | GC-4 |
| Anonymous 25 | GC-4 |
| Anonymous 26 | GC-2 |
| Anonymous 27 | GC-1 |
| Anonymous 28 | RS-59 |
| Anonymous 29 | GC-2 |
| Anonymous 30 | RI-8, RA-22, M-10 |
| Anonymous 31 | GC-1 |
| Anonymous 32 | RI-9 |
| Anonymous 33 | RS-23, RS-24 |
| Anonymous 34 | GC-1 |

CP = communications and process; O = other topics; RI = remedial investigation
GC = general comment; RA = risk assessment and modeling; RS = remedy selection
M = monitoring and 5-year review; RD = remedial design

# 16. GENERAL COMMENTS

Five recurring themes were apparent in a significant number of stakeholder reactions to the Proposed Plan. These major themes were condensed into five general comments (in black), each with an Agency response (in blue).

**Comment GC-1:** The majority of commenters expressed agreement with the Preferred Alternative. Many indicated that, as taxpayers, they conclude that the Preferred Alternative represents an appropriate balance of CERCLA criteria (including long- and short-term risk) and that the Selected Remedy is and should be based on science and technology rather than emotional or political considerations. In addition, commenters agreed that grouting and retrieval components supplement the surface barrier by helping to ensure the remedy is effective.

**Response:** The Selected Remedy enhances the Preferred Alternative in the Proposed Plan. The Agencies expanded the targeted waste retrieval area from 4.80 acres (i.e., the Preferred Alternative) to 5.69 acres (i.e., the Selected Remedy for OU 7-13/14 in this Record of Decision [ROD]). The decision was reached after considering all available information gathered through the Remedial Investigation/Baseline Risk Assessment (RI/BRA) and Feasibility Study and the varied information and issues raised during the public review process. Because the remedial decision-making process is conducted by law under the CERCLA statute, the remedial decision is made through evaluation of the nine CERCLA criteria. Based on that evaluation and as documented in this ROD, the Agencies conclude that the Selected Remedy provides the best balance of all CERCLA criteria. Grouting and retrieval components are not required to meet threshold criteria, based on risk analysis; however, these components provide defense-in-depth to the remedy and address uncertainty. The change in removal acreage from 4.8 acres in the Proposed Plan to 5.69 acres allows for increased removals of contaminants, reduces uncertainty, improves long-term protectiveness, and is responsive to stakeholder input on retrieving more waste.

**Comment GC-2:** A number of commenters expressed a preference for Alternative 5 (Full Retrieval, Treatment, and Disposal) based on their concern that anything less than full retrieval would not be protective.

**Response:** The OU 7-13/14 remedy was selected after considering all available information gathered through the two-phase remedial investigation and feasibility study process and the varied information and issues raised during the public review. Figure 17 illustrates groundwater ingestion risk over 10,000 years for a hypothetical resident living next to the Subsurface Disposal Area (SDA) for alternatives evaluated in the Feasibility Study. Though the Agencies understand that some stakeholders desire that all waste be removed, the remedial decision documented in this ROD was reached through the process mandated by CERCLA that relies on evaluation of the nine CERCLA criteria. Based on that evaluation, and as documented in this ROD, the Agencies conclude that the Selected Remedy provides the best balance of all CERCLA criteria and is protective of human health and the environment. The Agencies evaluated OU 7-13/14 (i.e., Radioactive Waste Management Complex [RWMC]) under the Idaho National Laboratory (INL) *Federal Facility Agreement and Consent Order* (FFA/CO),[4] using processes established in the National Oil and Hazardous Substances Pollution Contingency Plan,[3] CERCLA,[5] and associated EPA guidance.[6]

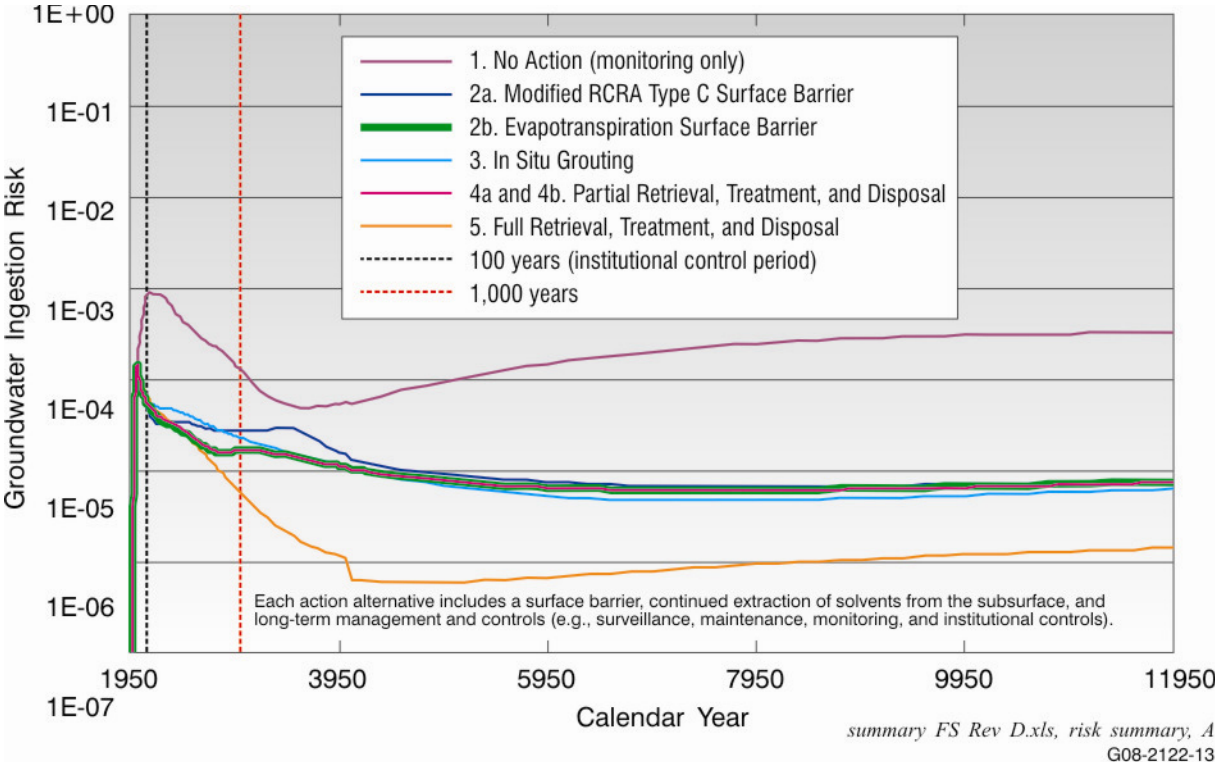


Figure 17. Comparison of long-term effectiveness based on cumulative carcinogenic risk for groundwater ingestion provided by each remedial alternative.

The Agencies' Selected Remedy is more than Alternative 2 and less than Alternative 5. It includes targeted waste retrieval to address stakeholder issues and resolve the State's concern about transuranic waste. It includes in situ grouting to reduce contaminant mobility while retrievals are implemented. Vapor extraction will continue throughout retrievals, and the surface barrier—the most important component for protecting the aquifer—will be constructed as soon as retrievals are complete. The Selected Remedy will cost approximately $1.3 billion (current value) (about four times Alternative 2 and about a tenth of Alternative 5). Among all alternatives, the Selected Remedy provides the best balance of trade-offs, striking a balance among waste retrieval, expedited construction of the surface barrier, worker safety, and cost.

**Comment GC-3:** A number of commenters asked for clarification about the relationship among this ROD, the 1995 Settlement Agreement,[7] and the Agencies' intentions for implementing the Settlement Agreement regarding buried waste.

**Response:** Targeted waste retrieval activities conducted pursuant to this ROD are anticipated to meet the terms of the Agreement to Implement.[8] DOE, EPA, and the State of Idaho (i.e., the Agencies) have determined through scientific evaluation and risk analysis that retrieving a minimum volume of 6,238 $m^3$ of targeted waste from a minimum of 5.69 acres within the SDA, along with the other components of the Selected Remedy—including in situ grouting of mobile radionuclides, operating the vapor vacuum extraction system to remove solvent vapors, installing an evapotranspiration barrier over the SDA and performing long-term institutional controls along with site surveillance, maintenance, and monitoring—meets criteria for overall protection of human health and the environment and is compliant with applicable or relevant and appropriate requirements (ARARs).

The schedule for removing targeted waste is outlined in the ROD based on several factors, including safe work processes, production capability, work environment concerns, and funding. Subsequent remedial design and remedial action documents (e.g., scope of work and work plans) will establish the controlling schedule for targeted waste retrieval.

**Comment GC-4:** Several commenters requested information about the technical basis for selecting 4.8 acres of targeted waste retrieval as part of the Preferred Alternative in the Proposed Plan. Some suggested that more or less than 4.8 acres might be better justified and asked for additional information about residual risk from waste that would be left in place.

**Response:** The SDA has undergone a thorough remedial investigation and evaluation of potential risk to human heath and the environment. The Agencies conclude that action must be taken. Continued operation of the vapor vacuum extraction system, construction of a surface barrier, and indefinite long-term institutional control are necessary to provide protectiveness. In addition, the Agencies agree to retrieve targeted waste and high-concentration organic solvent waste to ensure that the remedy is protective and to address the State's requirements concerning buried transuranic waste. Thus, the primary objectives of waste retrieval are to reduce the source of transuranic isotopes and solvents. Approximately 99% of waste containing these constituents was received from the Rocky Flats Plant.

Disposal records document where waste shipments were buried, and detailed shipping records document how many containers of each waste type were in each shipment. The relative concentrations of transuranics and solvents in each waste type were estimated, and maps have been developed that show distributions of those contaminants in the SDA.

Areas selected for retrieval are those areas that contain the highest concentrations of transuranics and organic solvent waste, as depicted on maps, such as Figure 18. Maps have been validated through geophysical investigations, probing, soil-gas samples, and retrievals in Pits 4 and 9. During these retrievals, unique waste forms and container labels have been found that correlate within feet of the mapped location. Consequently, the Agencies conclude that concentration maps are credible and provide a solid basis for ongoing targeted waste retrieval. In general, areas in Pits 1 through 6, Pit 9, and Pit 10 contain high concentrations of transuranic waste. High concentrations of organic solvent waste are present in Pits 4, 6, 9, and 10, while Pits 1, 2, 3, and 5 contain little to no organic solvent waste. Figure 18 is a concentration map for carbon tetrachloride, the primary solvent of concern, in Accelerated Retrieval Projects I and II.

Other factors were evaluated to determine areas for targeted waste retrieval. Large continuous areas are preferred over small areas because dependency on the accuracy of mapping is reduced. Some disposal locations are better defined than others, so the larger an area is, the less dependency there is on the mapping. Additional factors, such as collocated high-radiation waste and presence of large objects, were evaluated in the context of implementability.

As shown in Section 12, the Selected Remedy includes targeted waste retrieval of a portion of Pit 9 but not the entire pit. Areas in Pit 9 designated for retrieval are those locations that contain high concentrations of targeted waste, including organic solvent waste. Other areas within Pit 9 are associated with relatively low concentrations of targeted waste and are, therefore, not designated for retrieval under the Selected Remedy.

Some areas containing targeted waste contain relatively low concentrations of transuranics and high concentrations of organic solvent waste, and some areas contain little to no solvents and have high transuranic content. The Feasibility Study for OU 7-13/14 evaluated a 2-acre and a 4-acre targeted waste retrieval.

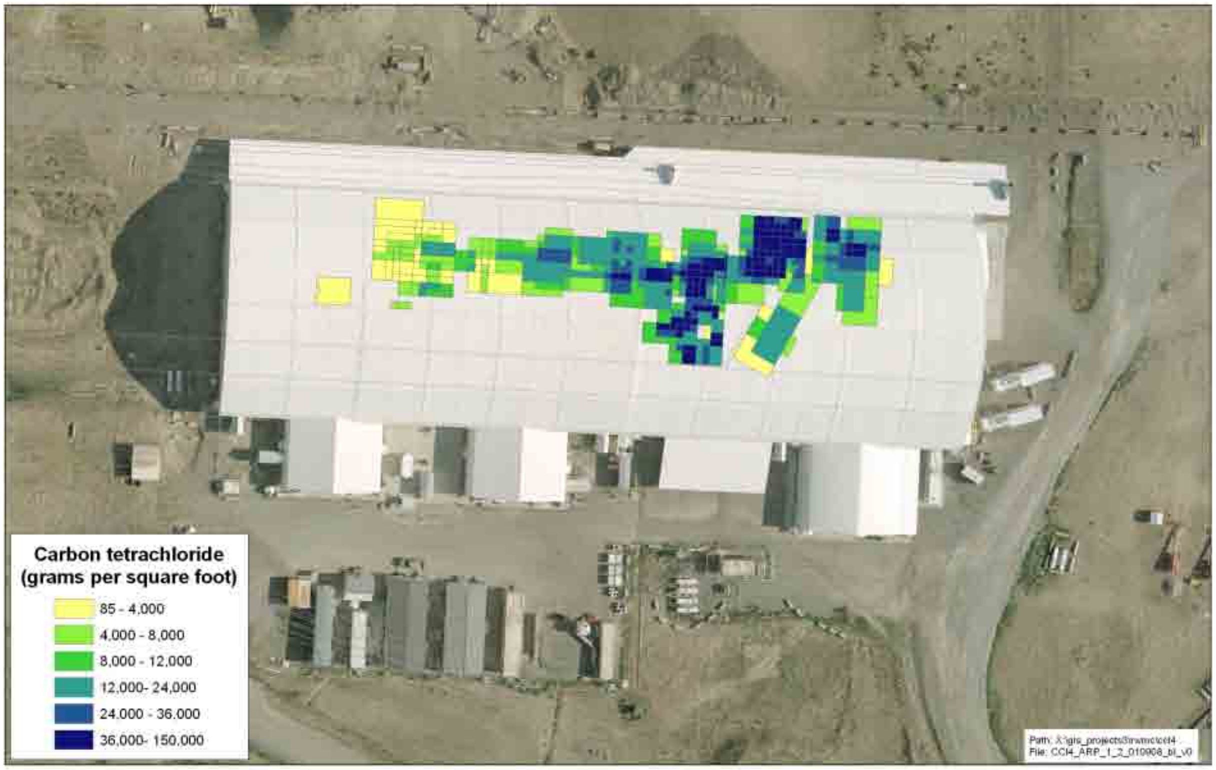


Figure 18. Carbon tetrachloride concentrations in Accelerated Retrieval Projects I and II.

Waste retrieval increases theoretical risk to workers (short-term risk) and reduces theoretical risk to future residents (long-term risk). Approximations of these risks are compared over the range of potential retrieval acreage in Figure 19. Though engineering and administrative controls will be implemented to mitigate worker risk, this analysis suggests that potential risk to workers overcomes long-term benefit from waste retrieval (in the absence of a surface barrier) at approximately 4 to 7 acres.

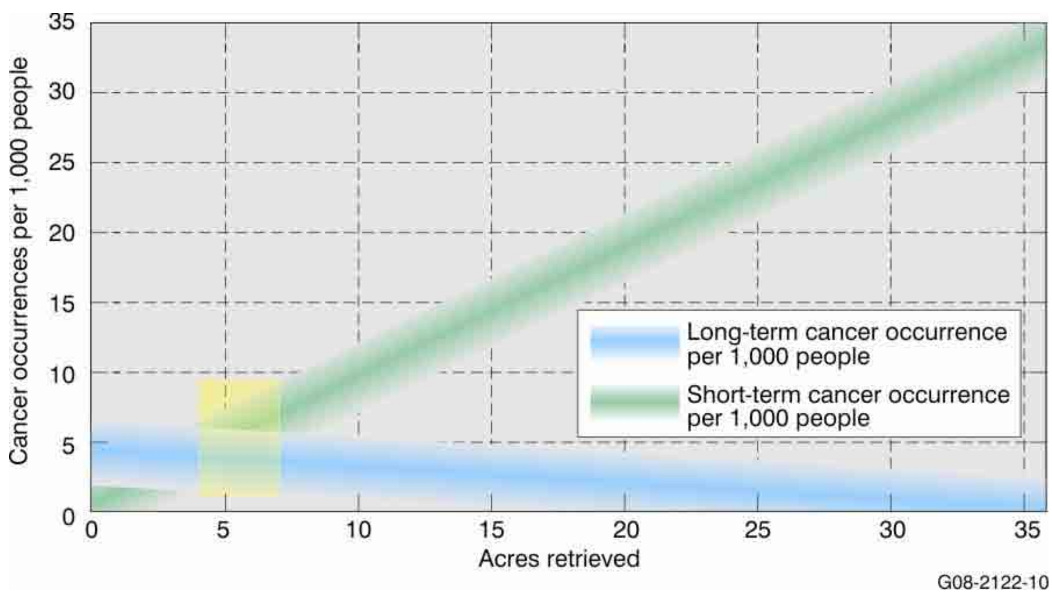


Figure 19. Approximate short-term cancer risk to workers compared to long-term cancer risk to hypothetical future residents (in the absence of a surface barrier) by size of total retrieval area.

The 5.69-acre retrieval described in this ROD will significantly reduce the source while maintaining a balance between worker risk, time to implement, and overall cost benefit. Based on concentration maps, this cumulative area contains over 90% of organic solvent waste in the SDA.

**Comment GC-5:** Several commenters opined that information on monitoring in the Proposed Plan was not detailed enough to evaluate the Preferred Alternative and asked for more information defining long-term monitoring, given the nature of contaminants (e.g., long-lived radionuclides).

**Response:** The Proposed Plan is a summary-level document. The Agencies agree monitoring is a critical element of the Selected Remedy. The ROD specifies that monitoring of the vadose zone and aquifer, patterned after the current program, will continue until construction of the surface barrier is complete (i.e., approximately 20 years). The current program is conducted under three field sampling plans—one for the aquifer,[9] one for vadose zone perched water and soil moisture,[10] and one for vadose zone soil vapor.[11] More details are available in these plans, which are periodically updated and available in the Administrative Record. Results are summarized in annual RWMC monitoring reports.

The Selected Remedy requires post-remediation monitoring because residual contamination at RWMC will preclude unrestricted land use. Post-construction monitoring requirements will be determined during remedial design. Well-heads will be extended through the surface barrier for some of the existing monitoring points, and monitoring of wells outside the SDA, both in the vadose zone and in the aquifer, will continue throughout construction of the surface barrier and beyond.

# 17. SPECIFIC COMMENTS

Oral and written comments (in black) with Agency responses (in blue) are organized by seven topics: (1) remedy selection (RS), (2) communications and process (CP), (3) risk assessment and modeling (RA), (4) monitoring and 5-year review (M), (5) remedial investigation and characterization (RI), (6) remedial design (RD), and (7) other topics (O). Many comments are provided as received with only minor modifications (e.g., to correct typographical errors) while others are paraphrased for clarity and brevity. In some cases, multiple remarks of similar content are collected under a single, paraphrased comment.

## 17.1 Remedy Selection

**Comment RS-1:** A commenter noted that the necessity for grouting technetium-99 and iodine-129 was not clear. The study implies the surface barrier is all that is needed.

**Response:** Grouting technetium-99 and iodine-129 is not necessary to satisfy threshold criteria (i.e., overall protection and compliance with law) according to model results. However, modeling for the Feasibility Study simulated instantaneous remediation in 2010 to avoid biasing the analysis against options (e.g., retrieval) that take more time. In practice, remediation will take years to complete, and migration will continue in the meantime. Therefore, the Agencies included grouting of some mobile waste forms in the Selected Remedy as a secondary line of defense. The grouting component provides relatively near-term isolation of the waste pending completion of targeted waste retrievals and installation of the surface barrier over the SDA.

**Comment RS-2:** Three commenters stated that the most likely consequence of partial removal is that a new contract will be required in the future to complete the job. A new contract would cost more and require more time. The new contractor would have to design equipment and processes for further waste removal, train a new work force, and mobilize new equipment. Risk and cost would far outweigh the risk and cost of completing the waste removal in a continuous and improving process now.

**Response:** DOE will facilitate continuity of operations between contractors to maintain progress. For the reasons noted in response to GC-2, the Agencies are confident that the Selected Remedy will be protective of human health and the environment in both the long and short term. Remobilizing in the future likely would be less efficient; however, the Agencies conclude that additional removals in the future will not be necessary. The Selected Remedy has a very high probability of providing both long-term and short-term effectiveness.

**Comment RS-3:** Two commenters stated the position that Alternatives 1, 2a, and 2b are more reasonable and cost effective and that implementation of retrievals in the Preferred Alternative would be a waste of public funds.

**Response:** All remedies are mandated by statute to be cost effective. Selecting a remedial alternative also is mandated to satisfy threshold criteria (overall protection of human health and the environment and compliance with ARARs) and balance CERCLA balancing criteria, of which cost is one consideration. The Agencies conclude that the Selected Remedy provides the best balance of relevant CERCLA criteria, including state and community acceptance. Including retrievals is warranted in response to these modifying criteria, which are inherent parts of the CERCLA evaluation. Performing retrievals provides defense-in-depth beyond the engineered surface barrier and addresses uncertainty.

**Comment RS-4:** There is undoubtedly a significant amount of emotional attachment to the concerns at this site, and that concern is enhanced by the nature of the contamination at the site. That said, the Preferred Alternative will successfully remediate past damage and will prevent future issues from either growing or appearing. This plan has been thoughtfully prepared with great concern for the environment. The Preferred Alternative also is practical and affordable, represents a balanced strategy that melds cost considerations with protective need, and also undertakes all reasonable measures needed.

**Response:** The Agencies appreciate your interest in cleanup.

**Comment RS-5:** I have worked in depth with the CERCLA process documents at many sites and have studied risk assessments, remedial investigations, feasibility studies, RODs, remedial design and remedial actions, consent decrees, and potentially responsible party agreements for many sites. I am impressed with the thorough and caring approach reflected here as I am impressed with the plan itself. I support and endorse the Preferred Alternative without reservation. The DOE, the DEQ, and the EPA (and their respective consultants and experts) got it right this time. Congratulations on a great, realistic, and appropriate solution to the problems at the SDA.

**Response:** The Agencies appreciate your interest in cleanup.

**Comment RS-6:** Two commenters stated that grouting should be used only to limit potential emissions and facilitate retrieval rather than to remediate the site because of the short duration of grout effectiveness in the environment (i.e., grout will crack in 240,000 years).

**Response:** Grouting the site to facilitate retrieval and emissions control was evaluated as part of the feasibility study process. The Agencies concluded, based on that evaluation and performance of recent retrieval projects (i.e., the OU 7-10 Glovebox Excavator Method Project and ongoing Accelerated Retrieval Projects) that pretreatment for retrieval is not necessary.

The primary purpose of the grouting component of the Selected Remedy is not for long-term contaminant immobilization (i.e., thousands of years) as the comment implies. The grouting component provides relatively near-term isolation of the waste pending completion of targeted waste retrievals and installation of the surface barrier over the SDA. The surface barrier is the primary control. Because remediation will take years to complete, migration will continue. Thus, the Agencies included grouting of some mobile waste forms as a secondary line of defense.

Nonetheless, grouting can effectively isolate waste for a significant time period. Different types of grout and their physical properties have been extensively tested at the INL Site using actual and simulated waste types.[12] While it is difficult to model or predict what could happen over a 10,000-year time period, the grout—if left undisturbed—should provide an effective barrier to any infiltrating moisture and chemical and physical degradation. The design of any grouting will require additional analysis on such aspects as specific contaminant profile, grout mixture and additives, and potential chemical compatibility issues with the waste streams. Also, grouted areas will be covered with up to 20 ft of grading fill and an engineered cover.

**Comment RS-7:** Continue to figure out these cleanup issues before building more nuclear plants. Stress conservation and local green energy options before building new plants.

**Response:** The Agencies appreciate your interest in cleanup.

**Comment RS-8:** Consider risks involved in loss or reduction of government funding for future maintenance.

**Response:** Cost estimates account for long-term monitoring of the site as appropriate for the various remedial alternatives. Assessing risk associated with availability of government funding is outside the scope of the required CERCLA evaluation.

**Comment RS-9:** As a community, we obviously have a vested interest in cleanup projects at the INL Site, and I feel the decisions that are made regarding the cleanup will have a significant impact on our city as well as our state. Having looked at the five proposed alternatives in addressing the buried waste, I strongly endorse the Preferred Alternative, which incorporates elements of Alternatives 2, 3, and 4 as well as DOE's recommendation of expanding current targeted waste exhumations to 4.8 acres. The Preferred Alternative balances short-term and long-term risk reduction while retrieving the most problematic waste.

**Response:** The Agencies appreciate your interest in cleanup. The Selected Remedy involves retrieval of a minimum volume of 6,238 $m^3$ of targeted waste from a minimum of 5.69 acres with additional retrieval area, if necessary, determined pursuant to CERCLA.

**Comment RS-10:** I have complete confidence in the current contractors involved in the cleanup process. For the first time in many years, we have contractors that are walking the talk. As you are aware, there has been a record amount of waste being shipped from the INL, which proves the commitment and ability of the contractors. As a result, I feel the specifics of the Preferred Alternative would be carried out. I appreciate the continued efforts that are made in regard to the complexity of this issue and assure you of our commitment, as a community, to the INL and its future.

**Response:** It is agreed that a significant amount of progress has been made in the cleanup program in recent years. The Agencies are committed to implementing the Selected Remedy in as timely a manner as possible in accordance with applicable regulatory milestones under the FFA/CO.

**Comment RS-11:** Several commenters stated that Alternative 5 is not scientifically justified, it prolongs cleanup, exposes workers to unnecessary risk, and is not the best solution for the Snake River Plain Aquifer. Exhuming the entire site to sweep up every atom is overkill and a waste of taxpayer dollars.

**Response:** The Agencies agree that the evaluation of CERCLA criteria shows that full removal of all waste is not necessary. See response to GC-2.

**Comment RS-12:** Several commenters noted support for the decision to move forward on a decision for buried waste and urged the Agencies to choose the best cleanup alternative based on sound science and engineering. They expressed confidence that technical experts of these agencies will choose a preferred alternative that is technically feasible, economically feasible, and sensitive and protective to the environment and the people of Bonneville County and the State of Idaho.

**Response:** The Agencies also support moving forward on this decision and have concluded that the information gathered from the CERCLA process supports selection of a remedy that is protective of human health and the environment, technically implementable, cost effective, and provides the best overall balance of all nine CERCLA criteria.

**Comment RS-13:** Many commenters requested that the Agencies move to finalize the ROD as quickly as possible and not extend or delay any unnecessary milestones. Keeping cleanup commitments and moving forward with the cleanup are essential to the success of INL and the State of Idaho. If all parties involved work together for the most sound solution that meets the required commitments, INL and DOE will provide a bright future for Idaho, good nuclear policy, and hopefully fulfill future energy needs of this state and nation.

**Response:** The Agencies have issued this ROD as quickly as possible since the close of the public comment period considering the need to balance resolution of the Settlement Agreement[7] and stakeholder concerns. This ROD is issued in keeping with relevant milestones established under the FFA/CO[4] process. Subsequent cleanup milestones for remedial design, remedial action, and operations and maintenance phases of the cleanup action will be established through the required FFA/CO process and will be presented in future remedial design and remedial action documents.

**Comment RS-14:** A commenter suggested that workers could work less hours overall, and DOE could use older workers who would reach the end of their lives by other natural causes before the cancer could develop. DOE could offer wage incentives and let people choose to take this risk working to remove the waste rather than have it affect the health of innocent people in generations to come with birth defects and cancer.

**Response:** The comment addresses employee and labor matters outside the scope of the Proposed Plan. DOE adheres to a policy to keep radiation exposures as low as reasonably achievable to all workers, regardless of age. The Agencies have chosen the Selected Remedy to protect the health of the public now and in the future.

**Comment RS-15:** The selected alternative is appropriate. However, the extent of the grouting should be defined in the Proposed Plan, or at least captured in the ROD. Experience shows that landfills of this type fail for two primary reasons: (1) water penetrates the surface (clay does not perform adequately over time as a surface layer in this environment) and (2) subsidence. Subsidence can be controlled through in situ grouting, but the grouting will increase initial cost. I advocate full grouting, or at least grout columns with intersecting perimeters, rather than using "columns" to support the surface barrier as shown in the Proposed Plan. Columns assume the surface barrier has enough shear strength to support the barrier between columns, and if that was the case, settling of the waste wouldn't cause settling of the surface barrier. Specifying full grouting in the ROD will result in a more stable, low-maintenance landfill.

**Response:** The Selected Remedy includes in situ grouting of approximately 0.2 acres (approximately 1,000 linear feet of trenches and soil vaults), as described in more detail in Section 12.2.2. Grouting is included to reduce mobility of contaminants in specified waste forms in advance of surface barrier construction, not to address subsidence. Grout columns in treated areas will be interlocking to reduce mobility. To provide a stable foundation for the evapotranspiration surface barrier, potential subsidence of pits, trenches, and Pad A will be addressed using methods to be determined during remedial design.

**Comment RS-16:** In combination with continued operation of the vapor vacuum extraction system to extract and treat solvents from the vadose zone, the surface barrier component of each action alternative effectively addresses all remedial action objectives.

**Response:** The Agencies appreciate your interest in cleanup.

**Comment RS-17:** In Idaho, our goals are to: protect human health and the environment, now and in the future; maintain an appropriate balance of risks and benefits; and ensure that DOE and its contractors treat its host state and its citizens with respect, establishing a partnership that will position the INL to help solve problems facing our nation and our world.

**Response:** The Agencies appreciate your interest in cleanup.

**Comment RS-18:** The destination of the material in New Mexico sounds like a safe and viable alternative to the current risk. The only thing that holds me back, however, is my will to be taxed additionally to accommodate the project, from payroll. Sales tax I think is spent irrationally and would do better in this endeavor.

**Response:** The Agencies agree that the Waste Isolation Pilot Plant (WIPP) is a safe and viable location for the portion of transuranic waste that is retrieved, characterized, and transported. Questions of taxation are outside the scope of this project.

**Comment RS-19:** A commenter indicated that removal may be too dangerous and that the waste would become a problem for someone else. The commenter suggested neutralizing the waste with mushrooms or some other means [assumed to intend in situ neutralization].

**Response:** First, the Agencies concur that removal of the waste may pose risk to workers from a variety of sources, including chemical and radiological exposures and industrial safety risks. The Selected Remedy properly balances associated risks to workers and the environment. As also noted in the Proposed Plan, full retrieval would require relocating waste to acceptable repositories (e.g., WIPP), and the volume of waste could exceed the capacity of WIPP, as currently established.

The Feasibility Study for OU 7-13/14[13] evaluated several process options for in situ and ex situ treatment of contaminants of concern. While some process options are applicable to specific contaminants, no single process option was applicable to the heterogeneous mixture of waste types contained in the SDA. Neutralization would be appropriate for acid-containing waste, and chemical or biologic oxidation would be applicable to organic waste, but either might have inadvertent consequences on the separation or in situ mobility of heavy metals, including uranium and transuranic isotopes. Use of a chemical or biologic (e.g., fungal) process for treatment of organic waste (e.g., municipal debris) requires retrieval and separation of these materials from waste containing toxic metals. Because contaminants of concern in the SDA include toxic and radioactive metals, chemical or biotic treatment was not considered directly applicable. Furthermore, no method for chemical or biotic "neutralization" of radioisotopes is known.

**Comment RS-20:** Remove the packages of volatile organic solvents when their retrieval is reasonably feasible. This would be preferable and more reasonable than trying to remove by vacuum extraction the fraction that may have already leaked into the soil.

**Response:** The targeted waste retrieval component of the Selected Remedy will remove the sludge type that contains the vast majority of organic solvents buried in the SDA. The OCVZ vapor vacuum extraction system is the technology being used to remove solvent vapors that have already migrated below the practical retrieval depth. In addition, the Organic Contamination in the Vadose Zone (OCVZ) system will be operated for an extended period of time after waste removal for added protectiveness and to remove the secondary source of solvents already in the subsurface.

**Comment RS-21:** Do not spend a lot of money to remove plutonium, which simply is not very mobile under the conditions that are known in this geographical area and climate.

**Response:** The Agencies agree that plutonium isotopes are relatively immobile in the SDA subsurface. The Selected Remedy retrieves those areas of the SDA that contain the highest concentrations of targeted waste rather than attempting to remove areas with relatively low radionuclide concentrations, thereby limiting the overall retrieval footprint.

**Comment RS-22:** Grouting known fission products is an appropriate and sufficient response to hold them in place until they have decayed.

**Response:** Because technetium-99 and iodine-129 have very long half-lives, decay is not a factor. The grouting component provides relatively near-term isolation of the waste pending completion of targeted waste retrievals and installation of the surface barrier over the SDA. The surface barrier is the primary control. Because remediation will take years to complete, migration could continue if waste containing technetium-99 and iodine-129 is not grouted. Thus, the Agencies included grouting of mobile waste forms as a secondary line of defense and to address uncertainty. Grouting will reduce mobility years before surface barrier construction will be completed.

**Comment RS-23:** Please base the decision *on sound technology* developed by *professional scientists and engineers*, and not on negative, fear-stimulating, sensational reports.

**Response:** The Agencies agree that the remedy must be selected based on an objective evaluation of the information gathered through the CERCLA process, including the RI/BRA and Feasibility Study. Based on this information, the Selected Remedy provides the best balance of all nine CERCLA evaluation criteria for remedy selection.

**Comment RS-24:** Several commenters think that retrieval could be causing more problems by only digging up targeted waste while disturbing the other waste and leaving it behind. Waste was contained before we disturbed it. The process of retrieval destroys all containment. We should remove everything that is disturbed during retrieval. Otherwise, we will have to dig it up again at greater cost in the future.

**Response:** The Agencies share the concern that ongoing retrievals must be effective at removing waste while at the same time not exacerbating site conditions. The assumption in the comment that retrievals are causing greater harm is based on the perception that existing containers provide a barrier that protects against contaminant migration. While this is partially true for the short term for some containers and some contaminants (i.e., nongaseous radionuclides), it is not true for other contaminants. For example, observations indicate a general lack of container integrity; holes caused by rust are almost universally present. Contaminants that move in the vapor phase (e.g., solvents) would generally be able to migrate from these drums. This is why solvent concentrations in the SDA are relatively high and widespread. For other contaminants that move through association with water (e.g., most radionuclides and toxic metals), intact (or nearly intact) drums and packages provide some short-term benefit (i.e., likely not more than a few decades). However, given the long travel times associated with most of these contaminants (e.g., hundreds or thousands of years), the few remaining years of possible containment is not significant in terms of overall site risk. In addition, while drums in the initial Accelerated Retrieval Project area were relatively intact, those encountered in the other portions of the SDA, including the OU 7-10 Glovebox Excavator Method Project area and Accelerated Retrieval Project II area, are significantly degraded or not present at all. Observations of degraded drums and intact bags are consistent with those from the Pit 9 retrieval demonstration (i.e., OU 7-10 Glovebox Excavator Method Project) that gave rise to the targeted waste retrieval approach. Because so many of the bags are still intact, we have an opportunity to identify and remove targeted waste based largely on visual observations performed by trained retrieval specialists as well as personnel certified to visually examine the waste to ensure it conforms with WIPP waste acceptance criteria. However, in assessing long-term risk through modeling, we did not assume the waste remained effectively contained. To assess long-term performance of the engineered surface barrier, all containment in pits was set to quickly fail in the model, either because of targeted waste retrieval or because of steps taken to address subsidence. So, though it may not sound right to increase waste volume and destroy what appears to be effective containment, the model shows that the surface barrier will provide long-term protection after retrievals are complete. Further assurance will be obtained through mandatory environmental monitoring and 5-year reviews.

**Comment RS-25:** Many expressed the opinion that the cover should be installed as quickly as possible to stop migration of contaminants and reduce the water inflow at the surface. Thus, the sooner DOE can cap the site to stop infiltration, the better. Retrieval of waste delays cap installation (thus increases migration), puts workers at risk without accompanying incremental risk reduction, and wastes taxpayer dollars. Any alternative that has intrusion (retrieval) into the disposed of waste zone(s) appears to be very costly without much real benefit.

**Response:** The Agencies concur that installation of the cover, coupled with continued operations of the OCVZ system, is the most effective measure to minimize overall site risk and reduce contaminant migration to the aquifer. However, the Agencies have included additional components to provide defense-in-depth and to address other CERCLA criteria. Retrieval of a limited portion of the SDA containing the highest concentrations of waste containing contaminants of concern as part of the Selected Remedy addresses stakeholder concerns. Grouting of limited areas with highly mobile radionuclides will reduce contaminant mobility while retrievals are being implemented. The OCVZ system will continue to operate to remove significant fractions of solvents that are present or could potentially migrate into the vadose zone in the near term.

**Comment RS-26:** As a matter of principle, we should not waste time and money digging up old waste that would be well off left alone or immobilized by simple means, even though waste generated today and since the early 1970s is buried in more appropriate places. In our opinion, only the volatile organic solvents are worth removing, because (1) they are toxic, (2) they move through the soil, and (3) they can be expected to have a long lifetime under the conditions of the Snake River Plain Aquifer. It makes more sense to remove the packages containing these solvents than to retrieve the solvents by vacuum extraction of their vapors after they have leaked out.

**Response:** Removing waste types with solvents is one of the primary objectives of the retrieval component of the remedy and will minimize the amount of time that the OCVZ system must operate.

**Comment RS-27:** We support grouting the more mobile fission products and putting a natural soil and gravel cap on the entire SDA to prevent infiltration of water through the waste. This should be an inexpensive way to reduce concerns some may have about contamination of the aquifer or the air above the ground with chemicals or radioactivity.

**Response:** The Agencies appreciate your interest in cleanup.

**Comment RS-28:** INL is not the only place in this country where science has taken a back seat to politics, but it is the place where I've seen it firsthand. Politicians in both parties and other opportunists have attached themselves to INL buried waste to win votes and further their careers. As a nation, we face a multitude of challenges for which good science offers a lot more answers than polarized, self-serving grandstanding. We can get off to a good start by choosing a science-based alternative in this case.

**Response:** The Agencies appreciate your interest in cleanup. See response to GC-1.

**Comment RS-29:** Based on my knowledge of Waste Area Group 7 and the environmental and engineering work that went into Pit 9 as well as the Accelerated Retrieval Project, remediating waste in already characterized hot spots and capping the area is the most sensible solution. Worker safety is also a prime consideration as unnecessary exposure must be avoided; thus, only retrieve waste from hot spots, not the entire acreage.

**Response:** The Agencies appreciate your interest in cleanup. The Selected Remedy includes limited retrieval in areas that contain high concentrations of targeted waste. As noted in GC-2, full retrieval is not necessary to satisfy the CERCLA evaluation criteria and would pose significant risks to workers.

**Comment RS-30:** INL has developed fate and transport models for radionuclides in soil. These studies must be factored into a sensible and cost-effective solution. If there is no water, there is no transport; so, capping is a scientifically supported solution.

**Response:** The Agencies concur that installation of a surface barrier, coupled with continued operation of the OCVZ system, is a scientifically supported solution and have included it in the Selected Remedy. The Selected Remedy strikes a balance among all CERCLA criteria, including cost.

**Comment RS-31:** Idaho needs to look at all sources of potential harm to the aquifer. That includes dairy operations, use of agriculture fertilizer and pesticides, naturally occurring radiation, seepage from city landfills, etc. For the INL to contribute to the energy future of this state, nation, and world, we must consider all sources of energy—that includes nuclear energy. The billions DOE is spending on digging up low-level waste is unacceptable as a taxpayer expense. We need to remediate what is "hot" and cap the rest at a sensible cost and allow Congress to appropriate funds for nuclear energy research, not designing tweezers to remove every speck of waste at RWMC.

**Response:** The Agencies agree that removing targeted waste and constructing a surface barrier (components of the Selected Remedy) are more cost effective than removing all the buried waste. Looking at all sources of potential harm to the aquifer (non-INL) and nuclear energy are beyond the scope of this project. The Selected Remedy does include limited retrieval in areas that contain high concentrations of targeted waste rather than full removal of all waste types as is discussed in GC-4.

**Comment RS-32:** Two commenters expressed disapproval of Alternative 5 because the added cost is grossly disproportional to the added benefit, and that the reduction of risk from chasing after lower concentrations of radioactive waste would be imperceptible. Comments indicated that retrieving lower-concentration areas of waste would generate orphan waste types that would not qualify for disposal at WIPP and would have to be returned to the excavation. In addition, complete excavation of all waste in the SDA might be required to verify it is not transuranic waste. It is likely that all areas already being excavated would have to be gone through again to ferret out potential new transuranic waste concentrations.

**Response:** The Agencies' Selected Remedy includes limited retrieval in areas that contain high concentrations of targeted waste. As noted in response to GC-2, the Agencies concur that full retrieval is not necessary to satisfy the CERCLA evaluation criteria and would pose unnecessary risk to workers.

**Comment RS-33:** This buried transuranic material has not observably mobilized in the 50 years that the waste has been in this unlined, uncapped disposal area. Its chemistry makes it highly immobile, and capping the area to prevent infiltration will ensure that no water is present to mobilize it.

**Response:** The Agencies agree that the transuranic isotopes are relatively immobile and that installation of the surface barrier will significantly reduce risk from the site.

**Comment RS-34:** A commenter stated that the additional billions of dollars in added cost for Alternative 5 would be better spent in completing more urgent cleanups at this and other DOE sites (e.g., radioactive liquid waste that threatens the Columbia River at the Hanford Site). Furthermore, normal congressional budget practices would lead to any additional funds devoted to transuranic waste retrieval being subtracted from funding for the INL. As costly as transuranic waste retrieval is, it does not employ a large number of people, and does not create new capital improvements for Idaho or spin off new businesses and employers and new sources of tax revenue for the community and state. A billion dollars invested in the INL could create many high-paying jobs and intellectual and physical property that would pay dividends for decades.

**Response:** The remedy was selected based on CERCLA evaluation criteria. Employment opportunities and tax revenues are not considered as part of the CERCLA process.

**Comment RS-35:** The volume of waste with low-concentrations of transuranics generated by a 100% search and retrieval process would surely exceed the capacity of WIPP, a capacity that is set by statute and cannot be expanded without new legislation and then additional appropriations. The costs used in the Proposed Plan specifically exclude the costs of shipment to WIPP, which are borne by WIPP. They also exclude the cost of expanding WIPP to accept several times the current capacity. The State of New Mexico is reluctant to accept transuranic waste beyond the limit in the current statute. Unless those added costs are incurred, the waste with lower-concentrations of transuranics will be forced to be stored at the INL Site for the indefinite future. Because WIPP takes transuranic waste from various DOE facilities on a "first come, first served" basis, it is possible that this excess of transuranic waste at the INL Site could also force other DOE sites in several states to store transuranic waste for an indefinite period, in violation of agreements or less formal commitments they had made to their host states. Thus, an effort to comply with a simplistic "all transuranic waste" standard requiring shipment out of Idaho would directly prevent achieving that goal. It is very likely that it is physically impossible to ship "all transuranic waste" out of Idaho because of limits on the capacity of WIPP as well as limits on WIPP's budget.

**Response:** The Proposed Plan stated general agreement with the comment for the full retrieval scenario (i.e., Alternative 5) as follows: "Another administrative issue relates to disposal capacity at the Waste Isolation Pilot Plant. The facility may not have sufficient capacity to accept all potentially transuranic waste currently buried in the SDA."

**Comment RS-36:** Overall, we are in agreement with DOE that a limited amount of waste would need to be removed, treated, and disposed of elsewhere. We are also comfortable with the idea of leaving stabilized, grouted waste at RWMC. We understand the small risks (i.e., $10^{-6}$ to $10^{-4}$) to people and the environment this proposed approach will pose. Our comfort level increases with the addition of substantial engineered barriers because we understand that excluding water percolation into the water packages keeps any potential migration issues to levels below regulatory concern.

**Response:** The Agencies appreciate your interest in cleanup.

**Comment RS-37:** We should make good choices on what we spend our money on. Digging up everything seems very expensive. We should use good scientific sense in our work. Good cover and caps seem to be the best because we don't have lots of rainfall to carry the particles into the aquifer.

**Response:** The Agencies agree that an engineered surface barrier will be effective in the arid climate at the INL Site. A surface barrier is a primary component of the Selected Remedy. Additional measures (e.g., focused retrieval and grouting) provide cost-effective defense-in-depth.

**Comment RS-38:** Because the major contaminant to the aquifer from this waste is organic solvents, I would have thought to see a discussion on introducing microbes into the affected areas to break them down. If they can break down jet fuel, why not carbon tetrachloride?

**Response:** Introduction of microbes for treatment of organic waste at the contaminant source (i.e., landfill) was evaluated during technology screening and was determined not to be directly applicable because of waste packaging and heterogeneity of contaminants in the SDA.

**Comment RS-39:** I like the idea, but have a question on the in situ grouting. When the waste material breaks down, it will generate gas. Will the gas escape through the surface, or will the grouting prevent gas escape? If it prevents it, wouldn't that put pressure downward, thus pushing any liquids toward this vadose zone?

**Response:** In situ grouting included in the Selected Remedy is focused on specific disposals within small treatment areas. Waste types targeted for in situ grouting are located in trenches and are not gas-generating waste types.

**Comment RS-40:** As a worker, I have seen the past companies work toward this cleanup goal. As a taxpayer, I think the community is unaware of the dollar waste. I believe the community believes when we make announcements, such as the milestone success with Pit 9, the community believes this is cleaned up. But we know it's not.

**Response:** The Agencies acknowledge misunderstanding in the community regarding specifics of cleanup actions such as in the retrieval demonstration in Pit 9. The OU 7-10 Glovebox Excavator Method Project in Pit 9 was successful in demonstrating a very limited retrieval; that has helped a great deal in simplifying retrieval approaches for Accelerated Retrieval Projects.

**Comment RS-41:** I applaud the fact that something is going to be done to continue to remove the mistakes of our past. I am very concerned about our future because continuing operations are still using pits for disposal of waste coming from the destruction of facilities and ongoing nuclear projects. This is not addressed in the cleanup plan other than mention of Pits 17 to 20.

**Response:** Analysis leading to the Selected Remedy (e.g., RI/BRA and Feasibility Study) included projected inventories for ongoing disposals, and the effect of these was modeled in the baseline risk assessment. Also, waste disposed of currently is very different from waste disposed of in the past before 1970. Pits 17 through 20 do not accept transuranic waste or waste contaminated with organic chemicals.

**Comment RS-42:** New technologies are being discovered on a daily basis, yet there are no provisions stated to use these new technologies as they become available.

**Response:** If the remedy fails, the Agencies have the authority to change it based on new technologies. After a Selected Remedy has been completed, the Agencies review effectiveness of the remedy at least once every 5 years and can identify changes as needed.

**Comment RS-43:** Covering vast areas of known waste with an unproven grout cover could still lead to future people having to deal with this waste. I have to regrout my shower and kitchen areas every 5-10 years, and they are not exposed to the harsh outdoor environment daily. These waste types can move and be around for up to 10,000 years—a time period few of us can even imagine. The ancient Greek cities are currently being excavated. Now, can you imagine uncovering waste types that could kill after this unimaginable timeframe? The fact that the proposal includes a short-term remedy (time of deterioration of cover is not mentioned) versus the long-term life of this waste is not being discussed and needs to be included with ongoing public and government debate. I believe the site should be deemed a cleanup area forever and be identified forever as a toxic, nuclear waste area.

**Response:** The surface barrier will be constructed of soil, rock, and other natural materials. It will not contain grout. The grouting component provides relatively near-term isolation of the waste pending completion of targeted waste retrievals and installation of the surface barrier over the SDA. The primary long-term remedy is the engineered surface barrier. Long-term surveillance, maintenance, and institutional controls will ensure continued protectiveness of the surface barrier in the future. The Agencies will review protectiveness of the remedy no less often than every 5 years through the CERCLA review process. This approach, including the requirement for DOE to maintain the remedy into the distant future, was presented in the Proposed Plan and discussed with stakeholders. The Agencies agree it is reasonable to assume that the federal government will maintain control and restrict access in the future.

**Comment RS-44:** All highly contaminated areas of the site should be retrieved, stabilized, and disposed of to the best of current technology and future technology.

**Response:** The Selected Remedy is a balanced approach based on currently available technologies. If future information shows the remedy is not working, then the Agencies can consider new technologies.

**Comment RS-45:** I was wondering why we would not remove all the waste. In the future, there is a chance they will have to come back and dig up what we left. It would be easier to dig up and segregate now instead of later. I notice we leave a lot behind that should be dug up that the building structure is on. Areas beneath the west wall, north wall, and west wall of the retrieval enclosure have waste that was not exhumed.

**Response:** See response to GC-2 regarding removal of all waste. Retrieval enclosures are located in very specific locations to retrieve those areas that contain the highest concentrations of targeted waste. The wall between Accelerated Retrieval Projects I and II will have to be removed to exhume the targeted waste between the enclosures.

**Comment RS-46:** Use pressurized grout to stabilize in-place those areas that have potential for migration and continue OCVZ operations as needed.

**Response:** The Agencies appreciate your interest in cleanup. The Selected Remedy includes grouting in focused areas of the SDA and continued OCVZ operations until cleanup levels are achieved.

**Comment RS-47:** I have been working at RWMC since 1980 and am very familiar with the types of waste there. I agree with the State that we should extract as much of the waste as possible and repackage it appropriately as can be done safely. We are encountering unknowns in retrieval and endangering workers' health. Some pits with waste measure high enough radiological levels that workers won't be able to retrieve it. Some type of robotics will have to be used. Workers will die if these issues are not addressed.

**Response:** The Agencies do not agree that significant unknowns have been encountered as part of Accelerated Retrieval Project I and II that jeopardize worker safety. Workers are protected through engineering and administrative controls and personal protective equipment. Worker safety, including any unknowns that are encountered, is evaluated in accordance with the safety analyses processes to ensure appropriate controls are put in place.

Locations in the SDA contain types of waste that would require remote systems to support safe retrieval because of gamma radiation. These waste streams were discussed in the context of full retrieval for Alternative 5; however, remote-handled waste was disposed of primarily in trenches and soil vaults, not in pit areas selected for targeted waste retrieval. Radiation is monitored to ensure workers are not exposed to high levels.

**Comment RS-48:** A commenter expressed the opinion that some members of the public hold an irrational fear of the nuclear industry and nuclear waste problem and recommended that the cleanup proceed beyond retrieving 4.8 acres to "go the extra mile" and enhance public opinion of the nuclear industry and help achieve better cooperation for other INL programs.

**Response:** The Agencies selected a remedy based on CERCLA criteria. The remedy includes additional retrieval acreage. Enhancing public opinion of the nuclear industry and achieving cooperation for other INL programs were not considered, though public acceptance of the Selected Remedy was carefully evaluated.

**Comment RS-49:** After we reduce overall curie content, then add in situ grouting.

**Response:** The Selected Remedy includes an in situ grouting component to add defense-in-depth to address mobile radionuclides in trenches and soil vaults.

**Comment RS-50:** My preference would be along the lines of Alternative 2a; however, given the reality of the State and that DOE has already proceeded with retrieval operations in Pits 4 and 6, those pits should be finished and then proceed as in Alternative 2a.

**Response:** The Agencies have included targeted waste retrieval from a minimum of 5.69 acres to address stakeholder concerns and provide defense-in-depth.

**Comment RS-51:** How was it decided that waste would be retrieved and how does this retrieval influence the risk?

**Response:** Retrieval areas were based on high concentrations of targeted waste streams. The decision to propose additional targeted waste retrieval as part of the overall Preferred Alternative was made during development of the Proposed Plan. The Selected Remedy includes retrieval to address stakeholder acceptance, provide defense-in-depth, and accounts for uncertainty.

**Comment RS-52:** Three commenters questioned how the Low-Level Waste Pit can be included in this ROD when the pit is in active use. One thought it operated as a Resource Conservation and Recovery Act (RCRA) site and not under CERCLA.

**Response:** Current and projected future Low-Level Waste Pit inventories were included in the OU 7-13/14 Baseline Risk Assessment. The Low-Level Waste Pit is under current operation as a low-level waste facility under DOE Order 435.1, "Radioactive Waste Management," not RCRA.[14] Final closure of the Low-Level Waste Pit will occur under CERCLA. All other substantive and administrative requirements of DOE Order 435.1[15] are being implemented for the Low-Level Waste Pit, separate from closure actions to be implemented under the CERCLA program.

**Comment RS-53:** Will contaminated groundwater that exceeds the standards be treated or just allowed to be diluted by groundwater flow?

**Response:** The Selected Remedy does not include treatment of groundwater. Historically, seven wells have slightly exceeded the maximum contaminant level (MCL) for carbon tetrachloride. Currently, only two wells exceed the MCL. Both modeling and monitoring lead to the conclusion that groundwater concentrations will naturally attenuate to acceptable levels before the end of the institutional control period (i.e., before 2110). This conclusion will be verified through ongoing monitoring and 5-year review process.

**Comment RS-54:** The concept of "targeted waste removal" is appropriate and could be supported by additional descriptive text or reference to other documents.

**Response:** The Agencies appreciate your interest in cleanup. See the detailed description of the Selected Remedy in Section 12 of the ROD. Additional details are available in Accelerated Retrieval Project design documents. Further details will be developed during remedial design for OU 7-13/14.

**Comment RS-55:** Overwhelming technical evidence indicates the most urgent and important things to do are to isolate the buried waste with a cap and continue extracting solvent vapors. We have known this a long time. We should have capped this landfill 20 years ago. Instead, we are helping contamination to reach the aquifer by delaying the cap while we argue about how much of one type of waste (transuranic) we should remove. But retrieval won't protect the aquifer from radioactive contamination. While we debate, contaminants in nontransuranic waste, stuff we aren't even talking about removing, is migrating toward the aquifer.

I oppose the Preferred Alternative because it takes too long—almost another 20 years. We've already delayed way too long. The longer we wait, the bigger the problem will become until one day, probably within the next 10 to 20 years, we will have crapped up the aquifer. The Agencies should be screaming to get a cap on this landfill as soon as possible, not quibbling over how much to retrieve.

**Response:** The Agencies agree that installing the surface barrier in a relatively short timeframe is important; however, the Agencies also must balance this with considerations related to removal of targeted waste. Enforceable schedules for remedial design, remedial action, and operations and maintenance phases will be established in the remedial design/remedial action scope of work and work plan. As noted above, the retrieval component provides defense-in-depth and addresses uncertainty. Grouting of mobile waste forms is included as a secondary line of defense to address the concerns you raise regarding contaminant migration before the surface barrier is installed. Finally, as documented in the RI/BRA, conservative risk modeling indicates that peak aquifer concentrations for the more mobile radionuclides (i.e., technetium-99, iodine-129, and carbon-14) are within, but do not exceed, the acceptable risk range, even if no remedial action is taken.

**Comment RS-56:** I oppose the Preferred Alternative because it puts our workers at real risk every day. Our workers are getting doses from ongoing retrievals. They'll get to bioassay (poop in a box) for the rest of their lives…and their lives could be shorter (or sicker) than otherwise might have been. For what? Long-term risk is not reduced. I oppose the Preferred Alternative because it costs too much and returns too little. Retrievals consume staggering sums of taxpayer money that could be put to much more beneficial use.

**Response:** DOE and its contractors perform all work under approved radiological controls and other safety and health programs. These programs include requirements for careful planning and control of all work, implementation of administrative and engineering controls, and requirements for personal protective equipment. The overall radiological controls program requires that exposures of workers and the public be maintained as low as reasonably achievable. Finally, all worker doses are closely monitored and controlled to remain within legally mandated exposure levels that are protective of worker health. The significant source term removal that occurs is viewed as appropriate and beneficial as a means to provide defense-in-depth and address uncertainty.

**Comment RS-57:** I am concerned that the greatest risk to implementation of the Preferred Alternative may be ambivalence on the part of decision-makers, so I encourage them to agree to a ROD now.

**Response:** The Agencies also support moving forward on this decision and conclude that information gathered from the CERCLA process supports selection of a remedy that is protective of human health and the environment, is technically implementable, is cost effective, and provides the best overall balance of all nine CERCLA criteria. Milestones for remedial design, remedial action, and operations and maintenance phases of the cleanup action will be presented in the remedial design/remedial action scope of work following finalization of this ROD.

**Comment RS-58:** Two commenters support Alternative 3 because we cannot afford to delay these actions for decades while waste retrievals continue. Studies clearly show that digging up more waste is being done for purely political reasons—the cap, vapor vacuum extraction, and grouting provide more than enough protection to eliminate any excess risk. It is environmentally, fiscally, and morally irresponsible to continue putting workers in harm's way by digging this material up when the risk assessment and feasibility studies show that digging up any more waste not only fails to reduce risk, it delays implementation of the steps that could limit further migration of this waste material. Three separate federal government and state agencies have concurred on the soundness of the RI/BRA and Feasibility Study and have essentially been validated by the Snake River Alliance's own independent technical assistance grant advisor.

**Response:** Retrieval provides defense-in-depth and addresses stakeholder concerns. Other major elements of Alternative 3 (i.e., in situ grouting, vapor vacuum extraction, and surface barrier) are included in the Selected Remedy.

**Comment RS-59:** If the Preferred Alternative proves to be insufficient to mitigate the hazard over time, or if an economical remediation technology is discovered in the future, removal of the remaining waste should be reconsidered and opened up to further public comments and evaluation.

**Response:** Considerations dealing with long-term effectiveness will be reviewed as part of the mandatory 5-year remedy review process and addressed, as needed. Further, additional public review of the action would occur if a fundamental change to the remedy in this ROD became necessary.

**Comment RS-60:** Don't waste billions of dollars pandering to emotional arguments from activists, and instead use the money to develop the new reactor and other energy technologies this country desperately needs.

**Response:** The Agencies appreciate your interest in cleanup. Funds for a new reactor and energy technologies are outside the scope of this project.

**Comment RS-61:** A comparison of risk reduction, over time, achieved through each of the alternatives is lacking from the Proposed Plan and prevents evaluation of the stated balancing criteria: "Are costs in proportion to the overall effectiveness of the alternative?" Specifically, information is lacking to compare the predicted increased benefit in terms of reduced risk from the 4.8-acre excavation ($803.2 million using current value) against the alternative of containment with evapotranspiration barrier and venting ($94.0 million using current value). This relative risk reduction should be included as part of the final decision process.

**Response:** See Figure 17 and response to GC-2. The Agencies considered relative risk reduction, along with all other CERCLA criteria, and conclude that the Selected Remedy provides the best balance of trade-offs.

**Comment RS-62:** Indicate how workers know what to remove in targeted waste excavations.

**Response:** Workers are trained to recognize targeted waste. Training is based on knowledge of processes that generated the waste, disposal history, mapping, and on anticipated changes in appearance caused by disposal (e.g., color, texture, and condition). Experience gained from previous retrievals, including from Pit 9 and ongoing retrievals, is used to update training materials that describe observable characteristics.

The Agencies continuously evaluate effectiveness of the visual approach. The number of targeted waste drums (or drum equivalents) removed from the exhumation area is compared to the number of targeted waste drums (or drum equivalents) found. For example, as of December 13, 2007, 85 drums of roaster oxide were expected in the Accelerated Retrieval Project I area that has been exhumed, and 81 drums have been recovered.

The surface barrier is the primary mechanism to reduce risk. Retrieval provides defense-in-depth by removing significant quantities of transuranics and solvents and addresses uncertainty.

**Comment RS-63:** I'm someone personally involved with retrieval of buried waste at RWMC. I see daily the risk and exposure to the workers who are citizens of southeast Idaho. Removal of buried waste is inherently risky and dangerous. I am not in favor of removal of one ounce more of buried waste than is required to meet the goals as determined by risk analysis. What is the minimum amount of organic and transuranic buried waste retrieval required in addition to vapor vacuum extraction to meet EPA's acceptable criteria?

**Response:** Installation of the surface barrier, along with operation of the OCVZ system for removal of solvents that reach the vadose zone, would reduce risk to within the EPA's acceptable risk range without waste retrieval. However, the Agencies conclude that the Selected Remedy provides the best balance of all nine CERCLA criteria, including state and community acceptance.

**Comment RS-64:** I was very concerned about why the State did not agree to remove all the waste in the first place, the whole 4.8 acres. I was also concerned about what is in situ grouting, and why would they want to grout anything to keep it from seeping underneath. That doesn't make sense to me.

**Response:** After considering public comments on the Proposed Plan and other information, the State of Idaho, along with DOE and EPA, chose to increase the amount of targeted waste included in the Selected Remedy. A minimum volume of targeted waste of 6,238 $m^3$ will be retrieved from a minimum of 5.69 acres with the need for additional retrievals, if necessary, determined pursuant to CERCLA. This ROD also defines the locations associated with this area. In situ grouting is a process for injecting material into the subsurface to encapsulate waste. Grouting will provide defense-in-depth by reducing mobility of selected contaminants in the interim while targeted waste retrievals are completed and the surface barrier is constructed.

**Comment RS-65:** Why do they want to continue the vapor vacuum extraction process instead of just removing the things that are causing the vapor?

**Response:** Operation of the OCVZ system captures and destroys solvents that reach the vadose zone (i.e., subsurface below the waste and above the aquifer). In addition, targeted waste retrieval will remove most of the source. Both actions are included in the Selected Remedy.

**Comment RS-66:** The drilling of columns for grouting areas is concerning. The DOE cleanup plan does not address potential movement or disturbance of the waste toward the aquifer. Grouting the beryllium blocks has not proven to be as effective as they thought it would be; not all the beryllium blocks were grouted completely. And DOE is proposing grouting a section of the burial grounds; but I don't believe they've addressed the potential for areas that may not get completely grouted and migration of those contaminants toward the aquifer.

**Response:** Numerous preremedial design studies have been performed to confirm technical applicability and field implementability of in situ grouting within the SDA.[16,17] Data for effectiveness of beryllium grouting are being collected and evaluated. Grouting included in the Selected Remedy is focused on interim stabilization of INL Site reactor operations waste containing mobile fission products (e.g., technetium-99 and iodine-129). Grouting technetium-99 and iodine-129 is not necessary to satisfy threshold criteria (i.e., overall protection and compliance with law) according to model results. The grouting component provides relatively near-term isolation of the waste pending completion of targeted waste retrievals and installation of the surface barrier over the SDA. Because retrieval will take years to complete and migration will continue in the meantime, the Agencies included grouting of mobile waste forms as a secondary line of defense. Several years will pass while targeted waste retrievals are completed, delaying surface barrier construction. Grouting will reduce mobility years before surface barrier construction could be completed.

**Comment RS-67:** The State of Idaho is responsible to do what is best for Idaho residents, especially those living downstream of the INL Site, and economic public health and environmental impacts of potential contaminants migrating downstream must be considered and weighed in when the State—and DOE—decide what option to move forward.

**Response:** The Agencies developed the Selected Remedy in accordance with requirements of CERCLA. As such, the Selected Remedy balances all CERCLA evaluation criteria—including threshold criteria—by providing overall protection of human health and the environment and complying with law. The Selected Remedy addresses considerations mentioned—including protection of residents downstream of the INL Site, economic, public health, and environmental factors. The Selected Remedy will limit contaminant migration to extremely low levels and satisfy EPA's risk threshold values.

**Comment RS-68:** My feelings are very, very strong that the solution is being presented as a solution and end-all, whereas it's an exploratory surgery of an area of ground about which a great deal is unknown. And it is imperative that it not be stated as reaching any particular milestone, but merely beginning a process that first caps and then explores for and removes material that can be hazardous to the health of the public of Idaho and anyone who wanders by hundreds and thousands of years from now.

**Response:** Targeted waste retrieval will occur before the surface barrier is constructed. Long-term surveillance, maintenance, monitoring, institutional controls, operation of the OCVZ system, and 5-year reviews will ensure that the surface barrier protects human health and the environment in the future. If future data show the remedy is not effective, the Agencies will be able to reevaluate the remedy.

**Comment RS-69:** I'm concerned that this Preferred Alternative was chosen in large part because of cost. I feel that's a breach of the federal government's promise to the people of Idaho that the waste that was buried and dumped in Idaho would be removed.

**Response:** Cleanup decisions for RWMC and the SDA have been developed in accordance with the CERCLA process. Cost is evaluated under CERCLA because it is one of nine criteria that must be considered (see response to GC-2). However, cost is not the most important criterion. The Agencies' Selected Remedy is a balanced approach to cleanup considering environmental risks and worker safety concerns.

**Comment RS-70:** The Preferred Alternative will leave over 1,200 (13 rows) soil vaults (DOE documents show more than 20 rows) permanently in place with only grouting to reduce waste migration. Grouting is a known failed containment method because radiation degrades the grout over time, and grout cannot be injected underneath the waste. Indeed, DOE claims grouting only “reduces transport of contaminants into the vadose zone and aquifer.” [p. 26 of the Proposed Plan]

**Response:** The primary purpose of grouting is to provide relatively near-term isolation of specific waste forms pending completion of targeted waste retrieval and installation of the surface barrier over the entire site. Only one area within the 21 soil vault rows is identified for grouting (see Section 12.2.2.1). Most grouting will be applied in trenches. However, grouting is not the only measure being taken. The surface barrier, which will be constructed over grouted areas and the entire SDA, is the primary control. Because remediation will take years to complete, migration will continue. Thus, the Agencies included grouting of mobile waste forms as a secondary line of defense. Grouting will reduce mobility in the interim before surface barrier construction is complete. Grout can effectively isolate waste for a significant period of time. Different types of grouts and the associated physical properties required have been tested extensively at the INL Site using actual and simulated types of waste.[12]

**Comment RS-71:** Radionuclides and chemicals, left in place under a cap, will remain hazardous and will continue to present a risk to the public for thousands of years. This Proposed Plan contemplates management of the proposed cap for only 100 years. Please present evidence that the Preferred Alternative will remain effective for thousands of years or until radioactive decay and chemical degradation have reduced the risk to acceptable levels.

**Response:** The Proposed Plan states the following: “Analysis for OU 7-13/14 includes 100 years of post-remediation long-term stewardship as a basis for modeling and cost estimating. However, these activities would not be limited to 100 years. Long-term stewardship would continue indefinitely, until eliminated through the 5-year review process, in accordance with CERCLA.”

**Comment RS-72:** Page 8 states targeted waste is being identified and exhumed based on visual observations and methods. What methods? Please advise the public of the effectiveness of using “observations and methods” since these data do not seem to be available in the Administrative Record. Indeed, the Field Sampling Plan for Accelerated Retrieval Project I was published on May 31, 2006, while the Remedial Investigation and Feasibility Study was published nearly 2 weeks earlier, on May 19, 2006. [**Response:** The Remedial Investigation was published in May 2006; the Feasibility Study was published May 2007.] If data regarding the efficacy of removing targeted waste were not available, how can estimates of waste remaining in the pits, after the Accelerated Retrieval Project, be believed? Please advise the public of how much transuranic and chemical waste has been removed under the various Accelerated Retrieval Project removal actions and of how much transuranic and other “targeted waste” is estimated to remain in the pits after the Accelerated Retrieval Project. Just how effective are Accelerated Retrieval Projects I, II, and III in reducing risk?

**Response:** Retrieval specialists are trained to identify targeted waste based on visual observations of the waste. Targeted waste has specific visual characteristics that enable this process. When there is any question regarding this determination, the waste is screened for transuranic and organic content. This process, and the amount of waste expected, is described in the Removal Action Plan for Accelerated Retrieval Projects I and II.[18] The number of targeted waste containers found is routinely compared to the number of targeted waste containers that are expected to be in the excavation area. Targeted waste expected to be in the areas has been found and is being recovered. Accelerated Retrieval Projects remove source term, and additional retrieval is included to address stakeholder acceptance, provide defense-in-depth, and account for uncertainty.

**Comment RS-73:** Page 8 states: "Nontargeted waste will be removed if the Agencies agree that retrieval is warranted and, as determined through visual inspection..." Has any nontargeted waste been removed? If so, how much and of what?

**Response:** The language referenced was written as contingency planning in the event that nontargeted waste meeting certain risk-based criteria was encountered as part of waste retrieval. As an example, Series 742 sludge has been identified as targeted waste because of this process.

**Comment RS-74:** Page 8 states: "The Agencies will review information collected during ongoing retrieval operations to verify use of visual criteria...to evaluate whether to refine retrieval areas." The Administrative Record has no discernable evidence of such a review. If it has occurred, please make any reviews and associated information available to the public in the Administrative Record.

**Response:** The number of targeted waste containers found is routinely compared to the number of targeted waste containers that are expected to be in the excavation area. The amount of targeted waste expected to be in the areas is being found and recovered. Criteria for determining whether an excavation area is complete are detailed in the ROD. Reviews of the removal actions are not documented in the Administrative Record because the reviews are working-level activities among the three regulatory Agencies. Conclusions related to the effectiveness and completeness of retrieval will be a component of the remedial action report that is required by the FFA/CO after the Selected Remedy is complete.

**Comment RS-75:** Page 19, Long-term Stewardship, states: "Long-term stewardship would continue indefinitely..." A sidebar on the same page makes a similar statement: "...the federal government is obligated to continue to manage and control areas that pose a significant health or safety risk until risk diminishes to less than threshold values." Given the very long timeframes for risk presented by the Preferred Alternative, how can any Agency claim, with a straight face and with sincerity to the public it allegedly serves, that the Agency will exist for over a thousand years? When viewed in this way, the Preferred Alternative is laughable on its face and disheartening in its inherent insincerity and falsehood. While removal of both chemical and radioactive waste may present an initial risk to workers (though one might believe the current Accelerated Retrieval Project activities are addressing the "worst" of the waste and thus incurring the highest integrated risk to workers) and will require substantial monetary expenditures, it will provide the surest method of reducing risk to humankind over the expansive timeframes involved. The trade-off is cost and manageable risk now versus very-long-term uncertainty of control in the far future.

**Response:** The Agencies believe that it is reasonable to assume that the federal government will maintain control and restrict access in the future, and conclude that the information in the Administrative Record supports the remedial decision documented in this ROD.

**Comment RS-76:** Past removal actions at the SDA included wax grouting of beryllium blocks to sequester radionuclides. The DOE has failed to provide information in the Administrative Record that demonstrates the long-term effectiveness of this approach, despite inclusion of a report on the long-term effectiveness of concrete-based grout. No such report exists for wax-based grout. Specific unaddressed issues include (1) what is the evidence that wax-based grout will remain effective until the nuclides of interest decay (several thousand years); (2) what is the rate of migration of carbon-14 through the wax; (3) at what rate will the wax become embrittled or degraded by the radiation it absorbs, releasing carbon-14 and other radionuclides; and (4) what is the risk from these failure pathways? Please provide data to the public on these important technical issues to support the current Preferred Alternative, or modify the Preferred Alternative.

**Response:** Numerous preremedial design studies have been performed to confirm technical applicability and field implementability of in situ grouting within the SDA.[16,17,19] These studies address wax-based grouts (e.g., see *Evaluation of the Durability of WAXFIX for Subsurface Applications*[19] in the Administrative Record). This report supports the conclusion that wax-based grouts will effectively limit infiltration of water through the grouted waste. Grouting included in the Selected Remedy focuses on interim stabilization of INL Site reactor operations waste that contains mobile fission products (e.g., technetium-99 and iodine-129). Grouting technetium-99 and iodine-129 is not necessary to satisfy threshold criteria (i.e., overall protection and compliance with law) according to model results. The grouting component provides relatively near-term isolation of the waste pending completion of targeted waste retrievals and installation of the surface barrier over the SDA. Because remediation will take years to complete and migration will continue in the meantime, the Agencies included grouting of mobile waste forms as a secondary, short-term line of defense. Several years will pass while targeted waste retrievals are completed, delaying surface barrier construction. Grouting will effectively reduce mobility years before surface barrier construction is complete.

**Comment RS-77:** In my opinion, DOE, the previous INL contractors, and the current Idaho Cleanup Project (ICP) contractor have failed to do due diligence on the technical feasibility and the economic justification for total SDA cleanup and stabilization using molten basalt technology. This approach would provide a vastly superior end state than retrieving, hand sorting, and ultimately leaving quite large quantities of high-risk material in the ground for future generations.

The contractors have presented a historical approach for minimal retrieval, sorting, shipping, and capping using primarily an economical justification, which in practice has not been shown to be true.

The DOE spent more than $100 million researching glass ceramic waste forms and technologies to manufacture; however, they cancelled all further thermal treatment pursuits with the Jackson Hole lawsuit and the British Nuclear Fuels, LLC Advanced Mixed Waste Incinerator.

Most technical people would classify the current Integrated Waste Treatment Unit project as a thermal treatment system and an incinerator at the primary stage (a pyrolyzer, in fact) followed by additional thermal treatment and off-gas cleaning units. There seems to be no backlash against the current Integrated Waste Treatment Unit system. A processing plant with the throughput of one of the old FMC melters (80 MW) could process the entire SDA in a matter of weeks and in a very stable waste form. Of course, this scale would be out of the question. However, a smaller plant on the order of 5–10 MW would certainly be technically feasible with a glass ceramic stable product. All volatiles and semivolatiles would be thermally separated and treated. All nonvolatiles, including the onsite dirt and metals, would be melted and produced into glass ceramic forms amenable to easier and more accurate enhanced assay methods. A 35-$yd^3$ bucket costs $1–2 million.

A KOMAR triauger, large enough to process truck-size blocks of concrete, costs $5–10 million. A 5–10-MW submerged arc melter (molten basalt) plant costs about $10 million.

A plant could have a workforce no larger than current. A 10-MW plant could have an off-gas flow of less than half the current heating, ventilation, and air conditioning flow of 20,000 cfm in the current Accelerated Retrieval Project units using cold wall condensing precipitators. Transuranic and radioactive assay after treatment would minimize 90% of personnel exposure and hazards now experienced by the workforce. A new plant could have the entire plant exhausting into one of the current Accelerated Retrieval Project units and be no less or no worse than the existing heating, ventilation, and air conditioning exhaust. Maintenance of a new plant could be carried out hands-on within a current Accelerated Retrieval Project tent. For the molten-basalt technology, I would refer to the *Low-Level Radioactive and Hazardous Waste Trial Burn* (1999) report by HGC and Hanjung of South Korea, and the former Melttran Idaho Falls on prototype testing performed at KAERI, South Korea. I would also refer to the hazardous waste vitrification plants currently being run by IET (Richland, Washington) in the U.S. and abroad. Both of these references have roots in the greater than $100 million dollars spent by DOE in the 1970s, 1980s, and 1990s.

An $8-billion price tag for the total retrieve-and-treat option seems way out of line and serves only to promote the legacy preferred option of capping by nontechnical executives. A new molten basalt plant would provide economies of scale not feasible with the current methods and produce a vastly superior end state. The current methods are wasting millions in tax dollars and will ultimately leave a very large problem for future generations. The new INL thrust for nuclear energy deserves a better disposition path for nuclear waste; the people of Idaho and the taxpayers deserve better answers. Why has DOE totally abandoned the above efforts?

**Response:** Thermal treatment of SDA waste to produce glass-ceramic (molten basalt) waste forms was evaluated during technology screening included in the Feasibility Study for OU 7-13/14.[13] Because of chemical and physical heterogeneity of waste buried in the SDA, it was determined that ex situ thermal treatment of SDA waste would not be feasible without extensive waste segregation. Thermal treatment of waste containing nitrate salts might cause rapid oxidation of commingled carbon-containing waste, which could upset heating and off-gas management systems. Pyrolysis of waste containing chlorinated hydrocarbons (i.e., Rocky Flats Plant Series 743 organic sludge) could produce corrosive or poisonous gases that would greatly complicate off-gas management. Waste containing large amounts of alkali metals (i.e., Rocky Flats Plant Series 745 evaporator salts) would require amendment (e.g., additional soil) to maintain waste form quality. While glass-ceramic waste forms are very effective for immobilization of refractory metal oxides (i.e., plutonium), immobilization is not required for shipment of retrieved transuranic waste to WIPP, and immobilization of remaining contaminants would not be significantly more protective than construction and maintenance of a surface barrier. While glass-ceramic waste forms are applicable to long-term management of well-characterized waste streams (e.g., nuclear fuel reprocessing waste), they have limited utility for managing heterogeneous waste and debris resulting from manufacturing at defense production plants.

## 17.2 Communications and Process

**Comment CP-1:** Two commenters noted editorial errors in the Proposed Plan and expressed concern about quality control and possible miscommunication.

**Response:** Revised information was provided to correct these minor errors. An errata sheet was released on October 23, 2007, to replace one page in the Proposed Plan and the label in Figure 5 of the Proposed Plan was corrected for this ROD (see Figure 4).

**Comment CP-2:** Several commenters expressed commendation to the INL for doing an excellent job of informing the surrounding communities of the issues that are relevant to the proposed cleanup of the SDA at INL.

**Response:** Thank you.

**Comment CP-3:** Some of those arguing for exhuming ALL waste may represent themselves as (self-proclaimed) “stakeholders.” In my 40 plus years of participating in over a hundred hearings on environmental issues as a private citizen environmental activist, the only persons ever calling themselves “stakeholders” are always the obstructionists and the fear mongers of the antinuclear groups. Ignore their comments. Such “stakeholders” have neither interest in the well-being of the State of Idaho nor that of the USA. They do not have either the academic training or practical experience to have a valid opinion on such issues, only vague, often irrelevant “concerns.” Your DOE archives will be witness that the “stakeholders” have cost the U.S. taxpayers billions of dollars over the years by delaying DOE’s prompt execution of planned-for projects. Don’t let this be another one where the “stakeholders” prevail over common sense!!

**Response:** In responses to the general comments, the Agencies selected a remedy that meets CERCLA requirements and process by best balancing the nine CERCLA evaluation criteria. As part of that process, state and community acceptance of the remedy are modifying criteria that must be considered and have been given due consideration in arriving at the Selected Remedy.

**Comment CP-4:** I strongly support broad public involvement in the remedial design for the cleanup plan because that is when many of the decisions will actually be made.

**Response:** The Agencies have met or exceeded all requirements for public involvement established in CERCLA and the FFA/CO (see Section 3 of the Decision Summary). Additional participation will be available through the public comment segment of Citizens’ Advisory Board meetings, and additional notices and briefings will be offered in the future. In accordance with CERCLA, the public will have an opportunity to comment if the Agencies identify amendments to the OU 7-13/14 ROD.

**Comment CP-5:** Two commenters disliked the format of public meetings.

**Response:** Public meetings were designed to provide public access to information and informed staff to answer questions and generally support public understanding of the Proposed Plan. The open house format and presentation was intended to answer questions and provide a forum for public comment. The opportunity for public comment was provided through the recording of verbal comments with a court reporter, and submitting written comments at the meeting, by regular mail, or by email.

**Comment CP-6:** I was just wondering what affect our comments would actually have on the process? What criteria would be used either pro or con for this proposal to determine whether it goes through or not? Is there a public record that will be generated from our comments to, for, or against, or would it just be a collection of comments that would just be stored without any statistical way of determining a final decision from the public?

**Response:** This responsiveness summary is prepared in keeping with the requirements of CERCLA to summarize the major comments raised and provide Agency responses to those comments. Community acceptance of a remedy is a modifying CERCLA criterion that must be considered as part of the remedy selection process. As such, it does not function as a statistical voting or approval mechanism for a remedy. Rather, the public involvement process is a means for the Agencies to assemble issues and information from the public that are factored into the remedial decision-making process.

**Comment CP-7:** The Proposed Plan offers no detailed information about waste characterization or current contaminant plumes (except for solvents vapor extraction), so the public is left without crucial data on which to make an informed decision.

**Response:** The Proposed Plan is not meant to contain all the information on which a cleanup decision is based. The Proposed Plan represents an overview of the RI/BRA and Feasibility Study and other technical documents that are contained in the Administrative Record and support remedial decision-making documented in this ROD. The Administrative Record contains detailed information on the nature and extent of contamination in the vicinity of the SDA for those interested in more detail. In addition, the Agencies have published a number of fact sheets and conducted open house portions of the public meetings to explain project details and to answer any specific questions.

**Comment CP-8:** Three commenters indicated that the Proposed Plan should be revised either to provide additional information or to present a different Preferred Alternative.

**Response:** All information used to develop the Preferred Alternative in the Proposed Plan and the Selected Remedy in this ROD is available to the public in the Administrative Record. The major references are the RI/BRA[20] and the Feasibility Study,[13] though many more documents are provided in support. Because the Selected Remedy is nearly the same as the Preferred Alternative in the Proposed Plan, the Proposed Plan will not be revised. The Selected Remedy is fundamentally the same as the Preferred Alternative. According to EPA guidance,[21] the ROD addresses these differences (see Section 14), and revising the Proposed Plan is not required.

## 17.3 Risk Assessment and Modeling

**Comment RA-1:** A commenter stated that too many hypothetical assumptions were involved in the analysis (e.g., hypothetical future and adjacent residents) and that individuals would not be willing or allowed to live next to the site by the federal government.

**Response:** It is concluded that the commenter is referring to the hypothetical future resident that is assumed to locate immediately adjacent to the landfill 100 years in the future. This scenario is included to provide a protective basis for decision-making in the baseline risk assessment. The assumption is consistent with EPA risk assessment guidance as a conservative assumption upon which to base the required risk analysis that is performed, assuming no remedial action is taken (i.e., baseline risk assessment). As stated in the Proposed Plan, residential development near RWMC in the future is not expected, and the Agencies agree that it is reasonable to assume that the federal government will maintain control and restrict access in the future.

**Comment RA-2:** Many people here (implying Jerome County) have become ill with cancer; I know and truly believe that waste contributed to it.

**Response:** The health problems described in your comment have not been caused by RWMC releases because the portion of the aquifer that is contaminated above drinking water standards (i.e., by the volatile organic chemical, carbon tetrachloride) does not extend beyond the INL Site boundary and, therefore, does not extend to any residential drinking water wells near the INL Site or those that are very distant in Jerome County. Radionuclide concentrations, even in the immediate vicinity of RWMC, are far below safe drinking water standards and are generally at or below the levels of detection for the relevant analysis methodologies. The Agencies' remediation plan errs on the side of safety for current workers as well as future residents to ensure contamination does not affect off-Site residents or future on-Site residents.

**Comment RA-3:** Claims that Alternative 5 poses more risk to workers are bogus.

**Response:** The Agencies disagree with this assertion. The comparison of short-term risk, including risk to workers, is a relative comparison for evaluating and ranking alternatives. In general, short-term risk increases with remedy complexity and time for completion. Given the complexity, magnitude, and unknowns associated with Alternative 5 (i.e., full removal of SDA waste), the CERCLA evaluation correctly determined that implementation of Alternative 5 would unequivocally pose more risk to workers than any of the other alternatives. This conclusion is based on detailed risk evaluations that were prepared and presented in the Feasibility Study. Risks inherent to Alternative 5 include not only increased risks from radiation and chemical exposures, but risks from industrial-type accidents and errors that are an inherent part of performing complicated, large-scale construction and remediation work. These risks are known risks that are easily quantifiable.

**Comment RA-4:** In terms of risk, include the genetic mutation to the human race, calculate deaths, injuries, loss of land, and damage to the human race (i.e., go beyond "cancer").

**Response:** The risk assessment was performed in accordance with established EPA guidance that is applied to all CERCLA actions. In general, these methods and parameters used to develop risk estimates are very conservative (i.e., tend to overestimate risk). Genetic effects are accounted for in carcinogenic slope factors and toxicity reference values, which are parameters used to estimate risk based on amounts, durations, and pathways of exposures to harmful substances (i.e., intake).

**Comment RA-5:** The first remedial action objective sets a range as a goal. This puts off some aspects of decision-making such as determining the effectiveness of the remedy during 5-year reviews. For example, if the remedy is found to be reducing risk to the 1E-5 level, is that sufficient? If so, then a higher number, such as 1E-4 is really the goal, and that should be stated. The Proposed Plan should tell the public what the risk goal is: 1E-6, 1E-5, or 1E-4, or some other figure, and document it.

**Response:** The range is consistent with law and avoided the conundrum of having to explain order-of-magnitude versus "bright lines," especially because a proposed plan is not a decision document. The ROD formalizes unambiguous remediation goals and measurement metrics to provide a framework for future 5-year reviews. The remediation goal is "Reduce carcinogenic risk at the surface to less than $10^{-4}$ by maintaining an effective dose equivalent rate at the surface of less than 15 mrem/year[22] as a measurable performance objective."

**Comment RA-6:** The third bullet calls for inhibiting migration of contaminants of concern into the vadose zone and the underlying aquifer. However, allowing surface pathway contaminants of concern to disperse into the vadose zone and the aquifer may reduce surface exposure risk. Consider tightening the remedial action objective to: "Inhibit migration of contaminants of concern that are risk drivers via the groundwater pathway into the vadose zone and the underlying aquifer" or some other wording that captures the concept.

**Response:** Actions are taken to limit transport of contaminants in the subsurface. The remedial action objective intentionally includes all contaminants of concern, not just groundwater contaminants of concern.

**Comment RA-7:** The last remedial action objective calls for inhibiting all contaminants of concern from coming to the surface, even if the contaminant of concern does not drive surface risk. Allowing some contaminants of concern (e.g., solvents) to evaporate through the surface has most likely reduced the solvent inventory remaining in the SDA, and allowing this process to continue would be protective of the groundwater. Table 3 does not provide details on which pathway drives risk, groundwater or surface, so I cannot tell if this is a feasible idea.

**Response:** The last remedial action objective was carefully written to address the mechanism for transport to the surface (i.e., brought to the surface by plants and animals). Some evaporation of solvents is occurring now, is expected to continue, and is allowable, within limits. All pathways listed in Table 3 drive risk (see Footnote a in the table). Pathways that do not contribute significantly to risk for solvents are not listed (e.g., external exposure and crop ingestion).

**Comment RA-8:** Editorial comment: Risk Threshold Values. The first bullet of this section explains that the range "1E-6 to 1E-4" emphasizes that 1E-6 is a point of departure while allowing adjustments for site-specific and remedy-specific factors. However, the text does not explain how a range can emphasize something, nor does it explain how this range emphasizes the point of departure, nor does it explain what a point of departure is. Please clarify.

**Response:** This text means that, while lower risk values are more desirable (i.e., $10^{-6}$ point of departure), they may not always be practical or achievable. Other factors can (and should) be considered that justify cleanup goals at the upper end of the range. The language in the Proposed Plan was paraphrased from the Federal Register.[3] The Federal Register includes this discussion in response to comments on risk range issues in the National Contingency Plan. It also states, "In summary, EPA's approach allows a pragmatic and flexible evaluation of potential remedies at a site while still protecting human health and the environment." In other words, the range is not described by "bright lines" at specific endpoints; it represents orders of magnitude.

**Comment RA-9:** A commenter expressed concern that implementation of Alternative 5 could lead to accidental releases, because of unknowns in waste, that might spread contamination to offsite locations and lead to the need for widespread cleanup, potential public exposures, expenditures for cleanup, property devaluation, and lawsuits. Given that these risks are orders of magnitude higher for Alternative 5 and there is no significant increase in risk reduction from the alternative, the alternative should not be implemented.

**Response:** The Agencies appreciate your interest in cleanup. See responses to GC-1 and GC-2.

**Comment RA-10:** A commenter stated that Alternative 5 should not be implemented for several reasons. It could lead to accidental releases, potential public exposures, expenditures for cleanup, property devaluation, and lawsuits without a commensurate reduction in long-term risk. Transportation for the huge volume of waste over public highways would be required. Transportation risks may exceed the risk reduction from excavation, particularly if transportation risks include additional greenhouse gas emissions and associated implications (e.g., possible need for DOE to cut back severely on other activities simply to be able to ship this huge additional amount of transuranic waste to WIPP).

**Response:** The Agencies concur that Alternative 5 is not the most appropriate remedy. See responses to GC-1 and GC-2. In accordance with EPA guidance, transportation risk for shipping waste off the INL Site is incurred by the receiving federal facility (e.g., WIPP). Risk from transportation within the INL Site and from off-INL Site locations to RWMC for materials to construct the surface barrier is evaluated in the Feasibility Study under "Short-Term Risk." Analysis is limited to assessing the number of accidents that could occur. Statistics from the U.S. Department of Transportation were used to estimate the short-term risks attributable to transportation. The Agencies agree that transportation risks are significant, even if shipments to WIPP are not considered. The Selected Remedy provides the best balance of trade-offs.

**Comment RA-11:** Be cautious when transporting waste.

**Response:** Transportation of radioactive waste is regulated through the U.S. Department of Transportation and involves highly controlled shipments using engineered canisters that are designed to withstand a range of plausible accident scenarios. Risk of exposure to the public from transportation-related accidents is very small as a result—much smaller than risk assumed by most people in every day commuting activities.

**Comment RA-12:** Allow people who never intend to reproduce to work these sites. Radiation is particularly devastating to eggs and sperm. Even the nascent cells can be devastated.

**Response:** Work at DOE sites is tightly controlled such that all worker exposures are as low as reasonably achievable and are managed to be within or below the levels of radiation exposure that are allowable by law and have been shown to be safe. Declared pregnant workers are either reassigned or, if they choose to continue working, are subject to more restrictive exposure goals that protect the child.

**Comment RA-13:** A commenter indicated that the International Commission on Radiation Protection limits on population doses of ionizing radiation are not based on cancer induction, but are based instead on genetic effects (i.e., damage to the gene pool). Genetic effects of radiation are more subtle than cancer-induction effects. By limiting the predicted effects of your modeling to cancer induction alone, you exclude genetic effects of radiation and also the life-shortening effects of radiation (e.g., systemic failure and early death) because of nonspecific causes.

**Response:** The baseline risk assessment considered both carcinogenic and noncarcinogenic effects using methods prescribed by EPA (e.g., Risk Assessment Guidance for Superfund, Health Effects Assessment Summary Tables, and Integrated Risk Information System).[23,24,25] In general, these methods and parameters used to develop risk estimates are very conservative (i.e., tend to overestimate risk). Genetic effects are accounted for in carcinogenic slope factors and toxicity reference values—parameters used to estimate risk based on amounts, durations, and pathways of exposures to harmful substances (i.e., intake).

**Comment RA-14:** Even if we accept cancer induction as the sole criterion for decision-making, the facts presented in this Proposed Plan show that you are choosing to address the wrong issues for future public health. Tables 2 and 3, when compared, show that cancer induction because of radionuclides of concern is more than 10 times greater than cancer induction due to the chemical contaminants of concern, for any one victim's lifetime. If you add up all the victims exposed over the toxic period of plutonium-239 alone, the results are that plutonium effects alone overwhelm the chemical contaminants of concern. The logical approach, if you were interested in optimizing public health, would be for your Proposed Plan to minimize health effects because of radionuclides of concern. But your plan chooses to concentrate on short-term effects, using less drastic measures that permit you to walk away from the real problem by pretending that health effects because of the radionuclides of concern are not important. I demand that you explain your reasons for ignoring the obvious known radiotoxic health effects, as stated in Table 2.

**Response:** All contaminants that pose risk greater than threshold values are addressed by the Selected Remedy, including carcinogenic and toxic effects from both chemicals and radionuclides.

**Comment RA-15:** Have the numerical simulations been able to predict the existing conditions at this site in the vadose zone and groundwater (flow and transport of contaminants through the vadose zone and into the groundwater)? Are these simulations adequate and effective in predicting flow and transport over the anticipated timeframe of the life of the contaminants buried at this site?

**Response:** Except for carbon tetrachloride, contamination in the environment around the SDA is limited, with no plumes in either the vadose zone or aquifer that provide good model calibration targets. Models were calibrated to the extent practicable using carbon tetrachloride, but this solvent moves primarily in a vapor phase. Hence, it is not representative of most contaminants in the SDA because they move in a dissolved phase. Models consistently overpredict concentrations in the aquifer, while both overpredicting and underpredicting concentrations at various locations in the vadose zone. In general, model results are conservative (i.e., tend to overpredict risk) and provide a reasonable basis for remedial decision-making. The Agencies are addressing uncertainty by selecting a remedy that provides defense-in-depth by including targeted waste retrieval, in situ grouting, and long-term institutional control.

**Comment RA-16:** What field studies have been done to show that an evapotranspiration cap can be effective at this site with slow infiltration over extended snowmelt scenarios (months of slow focused infiltration with no evapotranspiration because of spring-like weather and no plant growth at that time to remove the water)? This type of scenario is actually the worst case, not putting a large amount of precipitation in a short time period (as is usually simulated). Because this site appears to have precipitation cycles greater than 7 years, were field studies done for that period to test the proposed cover?

**Response:** Two demonstrations of surface barrier performance at the INL Site suggest that a monolithic evapotranspiration barrier constructed of native soil would meet all performance objectives, including maintainability and long-term performance. The Engineered Barrier Test Facility, constructed immediately adjacent to the SDA, tested the performance of thick (monolithic) soil and capillary break barrier designs.[26] Test regimens included evaluation of performance under extreme rainfall (e.g., flooding event) and without vegetation (e.g., analogous to a post-fire event). Barrier performance rapidly recovered after intentional breakthrough events. The Protective Cap/Biobarrier Experiment was constructed immediately north of the Idaho Nuclear Technology Engineering Center by the Environmental Surveillance, Education, and Research Program. The experiment assessed performance of monolithic evapotranspiration barrier designs over a 7-year period.[27] The experiment also evaluated the effectiveness of capillary-break biobarriers placed shallow and deep within the evapotranspiration barrier. All designs tested in the experiment easily met performance criteria equivalent to those required for RCRA barriers. Experimental results from both projects were used to develop a preliminary design for an engineered surface barrier at the SDA,[28] consistent with EPA's recommendations for alternative covers for landfills and waste repositories (see http://epa.gov/ord/NRMRL/news/news072007.html).

**Comment RA-17:** Have data from the previous grouting indicated that the proposed grouting will be effective to isolate the technetium and iodine from the environment? What is the long-term risk of leaving half the releasable technetium-99 ungrouted?

**Response:** Previous grouting was not applied to waste containing technetium and iodine. Numerous preremedial design studies have been performed to confirm the technical applicability and field implementability of in situ grouting within the SDA.[16,17] Many of these studies focused on stabilization of transuranic waste forms from Rocky Flats Plant that could pose difficulties for the use of Portland cement-based grouts (i.e., nitrate salt and organic sludge). In contrast, grouting included in the Proposed Plan focuses on interim stabilization of INL reactor operations waste containing mobile fission products (e.g., technetium-99 and iodine-129). The grouting component provides relatively near-term isolation of the waste pending completion of targeted waste retrievals and installation of the surface barrier over the SDA. INL Site reactor operations waste was disposed of separately from Rocky Flats Plant transuranic waste; therefore, waste forms that might interfere with in situ grouting are not anticipated in disposal locations identified for in situ treatment. Grouts used for in situ stabilization are expected to reduce mobility for hundreds of years, greatly exceeding the delay to accommodate targeted waste retrieval before surface barrier construction. Therefore, early in situ grouting of specific disposals of INL Site reactor operations waste provides early defense-in-depth; once completed, the surface barrier will inhibit infiltration and consequent migration of all mobile contaminants.

**Comment RA-18:** A commenter requested information regarding the reason for choosing 190 ppmv for Zone A1 (approximately two times the current concentration of 80 ppmv) when the target for Zone A2 is 39 ppmv (current concentration 30 ppmv). Stating the rationale or referencing a technical document would address this.

**Response:** The rationale is based on modeled concentrations (in regions of the vadose zone) that would keep future concentrations in the aquifer below the carbon tetrachloride MCL. Details are provided in *Data Quality Objectives Summary Report for the Operable Unit 7-08 Post-Record of Decision Sampling.*[29]

**Comment RA-19:** A commenter noted that the preliminary remediation goal, "Reduce infiltration such that concentrations of contaminants of concern in the aquifer are less than MCLs," will become a common element of all evaluated alternatives. As such, it was suggested that a schematic depiction similar to Proposed Plan, Figure 12 for carbon tetrachloride, be developed. What is the goal for "reduced infiltration"? A simple figure would provide a mechanism to show this important feature.

**Response:** For modeling purposes, 0.1 cm/year was used as an infiltration rate. The appropriate parameter for the surface barrier design will be defined in the remedial design phase.

**Comment RA-20:** Remedial action objectives are appropriate. The preliminary remediation goal for carbon tetrachloride focuses on the high concentration zone based on demonstrated results of the current system. Presumably, the preferred remedy continues monitoring in Zone B without the necessity of setting a preliminary remediation goal.

**Response:** Monitoring details will be established during the remedial design phase. The stated presumption is correct that monitoring in Zone B will be a continuing element of the overall monitoring strategy.

**Comment RA-21:** It is important that occupational exposures incurred by remediation workers not exceed the anticipated long-term benefits of partial waste removal.

**Response:** The Agencies agree that worker protection is a concern for implementing any remediation work under CERCLA. DOE and its contractors are required by law to manage radiological exposures in compliance with Radiological Controls program requirements and to manage chemical and other industrial hazards in accordance with all provisions of the Occupational Safety and Health Act.[30] A significant portion of the cost of implementing the remedial action goes toward engineering, administrative, and other controls to ensure workers are protected. DOE and the Agencies play a key role in overseeing contractor implementation of the site safety, health, and environmental protection programs to ensure that ongoing remedial activities are compliant, timely, and safe for workers. As a result, the Agencies are confident that implementation of the Selected Remedy will be safe for workers. As remedy complexity and scale increases, so does worker risk, which is one of the major reasons why Alternative 5 does not balance the short-term effectiveness CERCLA evaluation criterion as well as the Selected Remedy. Experience under Accelerated Retrieval Projects demonstrates effective implementation of worker health and safety controls, and continual diligence ensures that risks are effectively mitigated.

**Comment RA-22:** The argument proposed by DOE Idaho Operations Office (DOE-ID) that full retrieval would impose greater health and safety concerns is specious at best. DOE-ID consistently highlights safe operation at its facilities. Administrative, engineering, procedural, and radiation safety controls limit dose rates to employees. These dose rates are monitored, and maximum allowable dose rate criteria are implemented for all employees. Operating a complete retrieval program for these waste types is well within the scope and capability of existing programs maintained at the INL Site.

**Response:** The comparison of short-term risk, including risk to workers, is a relative comparison for evaluating and ranking alternatives. In general, short-term risk increases with remedy complexity and time for completion. Given the complexity, magnitude, and unknowns associated with Alternative 5 (i.e., full removal of SDA waste), the CERCLA evaluation determined that implementing Alternative 5 would unequivocally pose more risk to workers than any of the other alternatives. This conclusion is based on detailed risk evaluations that were prepared and presented in the Feasibility Study. Risks inherent to Alternative 5 include not only increased risks from radiation and chemical exposures, but risks from industrial type accidents and errors that are an inherent part of performing complicated, large-scale construction and remediation work. These risks are known risks that are easily quantifiable as compared to the more uncertain risks associated with long-term contaminant migration and potential future exposures of public receptors from site releases. That being said, it is agreed that actual implementation of remedial activities is closely monitored and controlled such that worker risk from accidents and chemical and radiological exposures is minimized. However, this does not change the fact that the short-term risks for Alternative 5 far exceed that associated with any of the other alternatives on a comparative basis. This was taken into account when balancing all criteria for remedial decision-making.

**Comment RA-23:** Figure 5 shows that at least 15 ppmv, and possibly as much as 80 ppmv, is likely to enter, or has already entered, the Snake River Plain Aquifer. Based on Figure 5 of the Proposed Plan, the carbon tetrachloride contamination beneath RWMC is already over a thousand times greater than the EPA allows in drinking water. Even if INL institutional controls last over 100 years and the vapor extraction system continues to run for 100 years, there is no proof that DOE and its contractors can get the current carbon tetrachloride levels in the aquifer down to 5 ppb. The EPA Web site says that carbon tetrachloride in groundwater can last 5,000 to 10,000 years. This is a lot longer than the institutional control timeframe, so someone could drill a well near RWMC and get contaminated water. The MCL goal for carbon tetrachloride was set at zero, and the MCL has been set at 5 ppb because EPA believes, given present technology and resources, this is the lowest level to which water systems can reasonably be required to remove this contaminant should it occur in drinking water. These drinking water standards, and the regulations for ensuring these standards are met, are called National Primary Drinking Water Regulations, so they are applicable everywhere in the USA, including Idaho. All public water supplies must abide by these regulations. Because 1 ppm is 1,000 times greater than 1 ppb, the RWMC proposal would allow contaminants in groundwater to be over 1,000 times greater than drinking water regulations allow. Many MCLs have been reduced over the years because the laboratory detection technology has improved and because the original limits were not protective enough. It is likely that in 100 years, the MCL for carbon tetrachloride will be lower than it is today. So, 0 ppb should be the standard that is applied.

**Response:** The concentrations presented in Figure 5 of the Proposed Plan represent vapor-phase concentrations in the vadose zone, not concentrations in the aquifer. One of the preliminary remediation goals established for OU 7-13/14 is to "Reduce infiltration such that concentrations of contaminants of concern in the aquifer are less than MCLs." MCL goals are not appropriate cleanup levels in the OU 7-13/14 context and typically are not used as cleanup levels under CERCLA. Groundwater modeling simulations have been performed and are relied on to estimate potential future concentrations of carbon tetrachloride in the aquifer. The Agencies conclude, based on professional judgment and modeling results, that achieving MCLs is probable. However, if MCLs are not achieved, then risk management actions beyond source control measures associated with the Selected Remedy could be identified. Possible approaches that could be considered include defining a groundwater exclusion zone (i.e., a buffer zone), expanding the OCVZ system, or implementing an aquifer pump and treat system.

**Comment RA-24:** Groundwater studies and predictions are only as good as their assumptions. This RWMC study appears to assume that leakage from buried barrels and other types of waste won't get any worse than it is today. However, leaving any waste buried in the ground at RWMC ignores the very real possibility that buried barrels that are intact today will rust out and leak more chemicals and waste into the groundwater in the future. The groundwater contamination source is likely to get worse before it gets better. Furthermore, even more barrels could rupture after 100 years when DOE says they are done.

**Response:** Groundwater modeling accounts for container failure. The modeling assumes that all containment, including inner plastic bags, lose integrity after a period of 45 years (median) from the time of disposal. Thus the assertion that releases from degrading drums in the future has been ignored is not correct. Further, the Selected Remedy includes retrieval of the primary targeted waste stream that contains 99% of the carbon tetrachloride mass in the SDA. As a result, planned retrievals will remove approximately 90% of the remaining source of carbon tetrachloride in the SDA. Continued operation of the OCVZ system will address residual carbon tetrachloride that has already migrated into the vadose zone and future releases that will occur until the source term is fully depleted.

**Comment RA-25:** As stated in the Proposed Plan, the primary risk posed by the SDA is from iodine-129, certain organics, and nitrates. This is not surprising to those of us who have worked in the environmental arena. However, the public perception is that transuranics buried in the SDA pose the greatest risk.

Therefore, it is incumbent upon the Agencies to better explain why the transuranics do not pose an unacceptable risk.

**Response:** Documents available to the public, including the Proposed Plan, RI/BRA, Feasibility Study, and a specific informational fact sheet (published November 2007), provide information explaining the relative risk contribution from transuranic isotopes. Transuranics do pose an unacceptable risk to a future hypothetical resident through surface pathway exposures. Risk at the surface is greater than groundwater risks posed by technetium-99, iodine-129, organics, and nitrate. The Selected Remedy will mitigate risk, both at the surface and in groundwater.

**Comment RA-26:** Another concern I have is some of the issues with roaster oxide uranium. The issue of that type of waste when exposed to air catches fire—it spontaneously combusts. We have a concern for the safety of the workers. I think this is an issue that needs to be addressed.

**Response:** The commenter is correct that uranium roaster oxide waste can be pyrophoric. Pyrophoricity is limited because the uranium was incinerated, or "roasted," at Rocky Flats Plant prior to shipment to the INL Site. In some instances, combustion of uranium at Rocky Flats Plant was not complete, leaving unoxidized uranium metal, which is pyrophoric if in small-sized particles (e.g., shavings or chips), in the buried waste. This was an anticipated condition and is accounted for in operations and emergency response procedures, safety analysis, and fire hazards analysis. Consequently, risk to workers and the environment has been mitigated through implementation of appropriate controls to manage the fire hazard posed by the unoxidized uranium in the roaster oxide waste stream.

**Comment RA-27:** I understand that there are prohibitive costs, but I was not satisfied with what was described as the risks to workers, which was just that this was hazardous work, not that the technology was inadequate or that they couldn't be protected from exposures. Frankly, with $13 billion, they could be protected from exposure.

**Response:** The comparison of short-term risk, including risk to workers, is a relative comparison for evaluating and ranking alternatives. In general, short-term risk increases with remedy complexity and time for completion. Given the complexity, magnitude, and unknowns associated with Alternative 5 (i.e., full removal of all SDA waste), the CERCLA evaluation determined that implementation of Alternative 5 would unequivocally pose more risk to workers than any of the other alternatives. This conclusion is based on detailed risk evaluations that were prepared and presented in the Feasibility Study. Risks inherent to Alternative 5 include not only increased risks from radiation and chemical exposures, but risks from industrial-type accidents and errors that are an inherent part of performing complicated, large-scale construction and remediation work. These risks are known risks that are easily quantifiable. Actual implementation of remedial activities is closely monitored and controlled such that worker risk from accidents and chemical and radiological exposures is minimized. However, this does not change the fact that the short-term risk for Alternative 5 far exceeds that associated with any of the other alternatives on a comparative basis.

**Comment RA-28:** The risk analysis avoids the true inhalation dose from plutonium-238 and, therefore, understates the risk posed by the plutonium.

**Response:** Carcinogenic risk for plutonium-238 inhalation was estimated in accordance with EPA guidance (e.g., Risk Assessment Guidance for Superfund, Health Effects Assessment Summary Tables, and Integrated Risk Information System). In general, the OU 7-13/14 risk assessment was conservative (i.e., tended to overestimate risk). Despite conservatisms, estimated risk from all exposure pathways combined was 1E-06 for plutonium-238, less than the applied screening value of 1E-05, and plutonium-238 was not identified as a contaminant of concern. However, actions being taken to address other inhalation contaminants of concern (e.g., americium-241, plutonium-239, and plutonium-240) also will reduce risk attributable to inhalation of plutonium-238.

**Comment RA-29:** Page 10 states: "Approximately 220,000 lb of solvent has been extracted from the vadose zone..." EDF-ER-301,[31] Table 1, indicates an estimated solvent total from 743 sludge "...buried at the INL Site." The report also indicates wide variances between calculations in the engineering design file and the Historical Data Task.[32] Please provide to the public (not buried in a remedial investigation and feasibility study) the solvent estimates DOE is using in calculating risk at the SDA so that the public has some idea of the estimated mass of solvents remaining for sequestration under a cap and removal using the OCVZ.

**Response:** The detailed information requested is included, as is appropriate, in the RI/BRA, which is available to the public through the Administrative Record. Approximately 50% of the original carbon tetrachloride mass (i.e., at time of disposal), was assumed to remain, as recommended in *Estimating Carbon Tetrachloride and Total Volatile Organic Compound Mass Remaining in Subsurface Disposal Area Pits*.[33] With an original mass of 7.90E+08 g, 50% remaining would be 3.95E+08 g.

**Comment RA-30:** Page 15, Table 4 lists: "Contaminants of concern...that exceed MCLs...outside the boundary of the SDA in the absence of remedial action." This statement is confusing because OCVZ has been removing solvents (the carbon tetrachloride identified in the table). Should this table state: "...ADDITIONAL remedial action..."? Or does the table assume OCVZ will continue? What are the bases for this statement and this table?

**Response:** The table is presented in the context of baseline risk as is explained in the Proposed Plan. The RI/BRA accounted for solvent mass removed through July 2007 and for projected removal to 2010. OCVZ operations were not assumed to continue beyond that timeframe for evaluation of baseline risks.

**Comment RA-31:** Page 16 identifies the remedial action objectives, including concentrations of carbon tetrachloride at various depths. However, Figure 5, on page 6, indicates these remedial action objectives are already met. Please inform the public whether operation of OCVZ will continue, in light of the apparent fact that current carbon tetrachloride concentrations in the vadose zone meet the remedial action objective.

**Response:** The Proposed Plan clearly communicates that OCVZ operations will continue to address ongoing release of solvents from the SDA. Vapor concentrations in the vadose zone do not currently satisfy cleanup goals. Continuation of OCVZ operations is a critical component of the Selected Remedy in this ROD.

**Comment RA-32:** The Preferred Alternative extols OCVZ as a proven methodology to reduce risk to the public from carbon tetrachloride in the groundwater. While OCVZ has removed approximately 220,000 lb of solvents from the shallow vadose zone, Figure 5, on page 6, indicates that a plume of carbon tetrachloride exists far below the relatively shallow OCVZ extraction wells. Please provide to the public an estimate of the total mass of carbon tetrachloride in the vadose zone below the extraction capability of the OCVZ, and how the current Preferred Alternative will, or will not, address that mass of carbon tetrachloride and its future risk to the public.

**Response:** The mass of solvents below the C-D interbed (i.e., Zones A3 and B3) has not been estimated, though it is much less than in regions above (see Figure 4 in this ROD). From 2004 through 2006, average carbon tetrachloride concentrations were less than 15 ppmv in Zone A3, compared to less than 80 ppmv and 30 ppmv in Zones A1 and A2, respectively. The Selected Remedy addresses overall risk attributable to solvents, not just solvents in Zone A3. Total risk from solvents will be mitigated by targeted waste retrieval and continued extraction from the vadose zone. Extraction will continue as long as is needed to satisfy groundwater remedial action objectives. Extraction points have been installed in Zone A3, and can be activated if necessary to meet objectives. In general, extraction from deep in the vadose zone is not implemented at the SDA because it could draw concentrations of solvents from above downward toward the aquifer.

**Comment RA-33:** Page 39, Vadose Zone Vapor Vacuum... states: "Coupled with targeted waste retrieval, this addresses the most imminent threat to groundwater quality." It seems the most imminent threat is not the carbon tetrachloride in the shallow vadose zone, but that in the deeper vadose zone, beyond reach of OCVZ. It seems DOE is failing to address the more imminent threat or, possibly, has failed to recognize the most imminent threat. Please explain to the public why the carbon tetrachloride in the deep vadose zone, beyond OCVZ, is not the most imminent threat to groundwater, especially in light of the fact that aquifer samples from several monitoring wells, as well as the RWMC drinking water well, exceeds the MCL for carbon tetrachloride.

**Response:** The OCVZ system typically extracts above the C-D interbed to maximize removal efficiency and to inhibit vapor transport to deeper zones. However, the OCVZ system does have wells that are installed and screened to depths below the C-D interbed (i.e., the current system has the capability to treat solvents from the lowest portion of the vadose zone). Given the relatively low concentrations of solvents in the deeper zones, extraction efficiency and solvent removal is enhanced by focusing on the shallower zones. If necessary, based on monitoring data, extraction from beneath the C-D interbed can occur.

**Comment RA-34:** One commenter opined that the risk assessment is deficient because it is based on chemicals and radioisotopes that were initially disposed of without accounting for additional constituents that could be generated from chemical reactions, radiolysis, or bacterial activity.

**Response:** Interactions between waste forms (e.g., reactive chemistry) were considered but not modeled for the following reasons:

- Buried waste poses a heterogeneous, highly complex system with variations of hazardous and radioactive constituents, oxidation state, oxidation/reduction potential, moisture content, and other physical properties. Obtaining sufficient data for predictive, reactive chemistry models is not practical for such a complex system. Even if a reasonably representative reactive chemistry model could be developed and additional chemical species were identified, the overarching conclusion—buried waste poses risk that exceeds threshold values—would not change.

- Excluding degradation and other reactions is protective because it tends to overpredict cumulative baseline risk (i.e., estimates are conservative). These processes would reduce contaminant concentrations over time. Many constituents pose higher risk in their original forms. For example, carbon tetrachloride, the major solvent in the Rocky Flats Plant Waste, is more toxic than chloroform, a chemical produced as carbon tetrachloride decomposes.

Ongoing waste exhumation and continued sampling have not detected additional hazardous constituents resulting from mixing that would pose greater risk to human health and the environment than that already predicted. The chemical reactions observed have generally resulted in waste degradation and waste container oxidation. Furthermore, the controls adopted to protect facility workers during waste retrieval are inherently robust to encompass a range of radiological and hazardous chemical conditions that may arise and do not depend for their adequacy upon prediction of additional constituents.

## 17.4 Monitoring and 5-Year Review

**Comment M-1:** Several commenters expressed concern about long-term impacts from waste left in place. If monitoring shows that contaminants are mobile in the environment, there must be a commitment that the surface cap and remedy will not interfere with future investigations and possible removal of the contaminants. Further public comments and evaluation may be appropriate.

**Response:** The Agencies share this concern regarding the need to ensure the remedy functions as required in the long term. The Selected Remedy requires long-term management and 5-year reviews under CERCLA to ensure continued performance of the remedy. Environmental monitoring includes routinely collecting and analyzing multimedia samples for contaminants of concern. Institutional controls and other long-term activities will be managed by a federal agency (e.g., DOE) to ensure that effective protection is maintained or corrective measures are implemented, if needed. Members of the public will be able to access monitoring data. Major changes in the remedy, if any, will be subject to public involvement requirements under CERCLA.

**Comment M-2:** Why aren't measurements from wells immediately adjacent to the INL Site extending southward all the way to the Snake River part of your reporting? Wouldn't DEQ have access to every well of every fish farm, feed lot, farmer, rancher, private residence well in the state? To what level of yellow, orange, or red alert should all of us downstream be concerned?

**Response:** See response to GC-5.

**Comment M-3:** Nowhere in this Proposed Plan did you describe the detailed efforts needed for planned surveillance, maintenance, monitoring, and institutional controls planned for the first 100 years after closure. You've assigned less than $150,000/year to this task, so presumably you are assuming there will be little needed effort. However, this needs to be more clearly defined for the public to understand and feel comfortable about.

**Response:** The ROD contains more details about requirements for long-term institutional control. Presumably, the commenter estimated $150,000/year using the net present value estimate of $14.3 million (from Table 5 in the Proposed Plan) divided by 100 years. A more accurate sense of the expected level of effort would be obtained by dividing the $86.6 million current value estimate by 100 years—$866,000/year. The Selected Remedy requires annual surveillance of observable degradation of the surface barrier (e.g., subsidence and cracks), repairs, routine environmental monitoring of the subsurface and aquifer, maintaining access restrictions (e.g., fences and signs), and enforcing institutional controls (e.g., land-use restrictions). Details will be developed during remedial design.

**Comment M-4:** Monitoring of all contaminants to the environment must be funded and continued to be monitored forever. If this monitoring is done correctly, a plan must be in place to correct any abnormalities of waste. We must test to see the effectiveness of the plan and have a long-term set of criteria in place if something goes wrong. Long-term stewardship of this area must be addressed for the future inhabitants of this area.

**Response:** Long-term institutional control is a critical element of the Selected Remedy. Activities include surveillance, maintenance, monitoring, and institutional controls. These activities will continue until eliminated through the CERCLA 5-year review process. Because 5-year reviews will never find the area suitable for unrestricted land use, the area always will be managed under a long-term institutional control program. An operations and maintenance plan will be developed, in accordance with the normal CERCLA process, to implement maintenance and monitoring.

**Comment M-5:** The flaws in the plan will be apparent only after the current planners are retired or dead. The waste will remain for many lifetimes and must be considered forever. We cannot call this a final plan but an ongoing remedial plan to protect the immediate future of our vital water source.

We must continue using the newest technologies available now and in the future to protect this aquifer forever. Funding must be guaranteed forever, much like our national parks, to continue to clean up this mess as long as it is a threat to our environment.

**Response:** The Selected Remedy, including long-term institutional control, is formalized in this legally binding ROD. Funding for long-term institutional control is a firm obligation to be met through the federal budget process.

**Comment M-6:** Continue institutional control of the area indefinitely.

**Response:** The Selected Remedy involves institutional control of the area indefinitely.

**Comment M-7:** Monitoring the site after removal and treatment is essential and must be ongoing. DOE must make a commitment to permanent monitoring and memorialize the site to protect it from future disturbances.

**Response:** The Agencies concur with the importance of effective monitoring of the RWMC during and after remediation activities are completed. The Selected Remedy requires long-term management and 5-year reviews under CERCLA to ensure continued performance of the remedy. Environmental monitoring includes routinely collecting and analyzing multimedia samples for contaminants of concern. Institutional controls and other long-term activities will be managed by a federal agency (e.g., DOE) to ensure that effective protection is maintained or corrective measures are implemented, if needed.

**Comment M-8:** All caps are basically a one-off design. Monitoring immediately below the cap only shows that the cap is locally effective. There is also lateral flow of moisture, as shown by the U.S. Geological Survey (fast and in preferential pathways), as well as localized subsidence and recharge from snow melt documented at this site. Contaminants that continue to move downward, below the cap, over time may be transported by gas flow or water transport; therefore, monitoring should be done at both shallow (surface sediments) and deep depths below this site.

This is an incredibly geologically and hydrologically complex site (fractured rock) with a minimum of currently monitored vadose and groundwater monitoring wells (for vadose zone, about 60, and for groundwater, 10s instead of 100s, as found at other sites like Savannah River Site). Because a monitoring plan is not included in the report, it is unclear what and how this site will be monitored. The understanding of flow and transport in deep vadose zones and groundwater in fractured rock (and more so in fractured rock) is just now being explored and better understood. Consequently, numerical simulations probably fall short in predicting long-term contaminant transport, and so there has been a heavy reliance on monitoring. This necessitates that the effectiveness of any cap be monitored in the shallow and deep vadose zone at this site. The recent drying trend that was seen in the deep vadose zone and wetting from 100 to more than 200 ft in months to about a year indicates recharge can occur rapidly at this site. Because it was not detected in many of the wells, it suggests that even the current monitoring will not pick up all large events due to preferential flow.

The low number of groundwater wells at this site and the shape of the plumes defined at this site already suggest that the groundwater monitoring system is not effective in delineating the location of the existing plumes. This is common at fractured rock sites like the RWMC. Also looking at the local groundwater map that shows the immediate RWMC area suggests that on a local scale, the direction of groundwater flow has not been adequately characterized. The monitoring system for both the short-term and long-term needs to be expanded and enlarged to better understand what contaminants have reached groundwater and where the plumes are located. Maps showing the solvent (EM DOE 2007, assumed to be by Cresap et al.[34]) plumes show one lobe of the RWMC plume (near the large scale infiltration pond) disconnected from the major plume located under and upgradient of the disposal area. Any site with this level of complexity needs additional assurances to the State that it is being monitored adequately. What will happen if the precipitation increases from the current drought conditions we have experienced in the past decade and more recharge in and around the disposal area is combined with flow in the Big Lost River (and spreading areas) that the U.S. Geological Survey showed routed water laterally below the disposal area (rapidly transporting any contaminants at those depths to groundwater)? This will influence flow and transport in both the vadose zone and groundwater. Because the monitoring plans are not presented, it is impossible to tell if they will be effective to catch a release in a timely manner.

We are relying on numerical simulations of a highly complex site to determine the risk to the public (the best we can do for prediction). While this may seem reassuring to those not familiar with those that have modeled complex systems as seen at the RWMC, the key to this site is the actual data collected from this site and the monitoring results from physical samples. As such, it is impossible to determine if this plan is correct or adequate when a monitoring and contingency plan is not included.

**Response:** The existing monitoring network at RWMC includes instruments both inside and outside the SDA at various depths in the vadose zone and in the aquifer. The current monitoring program calls for monthly vadose zone vapor, quarterly vadose zone soil moisture, and semiannual aquifer sampling, as specified in field sampling plans.[9,10,11] This strategy will continue until the surface barrier is constructed. Post-construction monitoring requirements will be determined during remedial design. Well-heads will be extended through the surface barrier for some of the existing monitoring points, and monitoring of wells outside the SDA—both in the vadose zone and in the aquifer—will continue throughout surface barrier construction and beyond.

**Comment M-9:** Monitoring and contingency plans should be prepared and reviewed by the public prior to signing the ROD.

**Response:** See response to GC-5. Monitoring plans for the vadose zone and aquifer are already in place and are available to the public in the Administrative Record. These plans are modified, as needed, to accommodate changing conditions and priorities. Modifications will be required based on implementing the Selected Remedy. These changes will be specified during remedial design. Contingencies, if they arise in the future, will be addressed during 5-year reviews.

**Comment M-10:** Economics is the primary driver for all decisions by DOE-ID. Once projects are completed and DOE-ID closes operations in Idaho, the State of Idaho will be left with the costs to implement further remediation actions to safely secure this area for the public.

Reliance on the Office of Legacy Management within the Office of Environmental Management to provide adequate future funding to control this area is a large leap of faith, given the status of the INL in relation to funding demands for other national labs (e.g., Oak Ridge, Hanford, Los Alamos, and Pantex).

**Response:** Long-term stewardship includes surveillance, maintenance, monitoring, and institutional controls. The Proposed Plan indicates that long-term stewardship would continue indefinitely. It is one of the three common elements, listed on page 19 of the Proposed Plan, described as "…necessary to ensure that the selected remedial action protects human health and the environment." The ROD stipulates long-term institutional control requirements, thus ensuring that DOE will fund and maintain institutional control or meet all CERCLA requirements for transferring the responsibility to another agency.

**Comment M-11:** In the cost under the Preferred Alternative, I'm not quite certain that monitoring and perpetuity have been taken into account. I would like to be more assured of that.

**Response:** As documented in this ROD, DOE will maintain administrative control beyond 100 years. The site would not be released until a 5-year review concludes that the land qualifies for unrestricted use. Because of the long-lived radionuclides in buried waste, RWMC will never qualify. The 100 years was used only as a basis for modeling and cost estimates.

**Comment M-12:** Page 25 of the Proposed Plan, side-bar, estimates the net value of the Preferred Alternative as $734 million, with operating, maintenance, and periodic costs of $48 million. Yet, DOE also has stated that long-term stewardship will continue "...until risk diminishes to less than threshold values." Please inform the public of the timeframe used to estimate the estimated costs presented in the side bar and whether this estimate is valid, based on the "until risk diminishes" commitment. What is the true long-term estimated cost, given an indefinite stewardship period? Figure 20, page 36, indicates an operating and maintenance period ending in 2127. Why is "...until risk diminishes to less than threshold values" not reflected in the figure? This figure seems intended to give a false impression to the public that DOE's stewardship responsibilities will end at that time. Please correct the figure to reflect DOE's, and the Agencies', true belief regarding the time that DOE will be responsible for maintaining this site under the current Preferred Alternative.

**Response:** The Proposed Plan states the following: "Analysis for OU 7-13/14 includes 100 years of post-remediation long-term stewardship as a basis for modeling and cost estimating. However, these activities would not be limited to 100 years. Long-term stewardship would continue indefinitely, until eliminated through the 5-year review process, in accordance with CERCLA." (See p. 19 under "Description of Alternatives.") Long-term controls will be required at RWMC, regardless of the remedial alternative, because residual contamination will remain at the site at levels that preclude unrestricted land use. It is impracticable to remove all hazardous substances from the site under any remedial alternative.

## 17.5 Remedial Investigation and Characterization

**Comment RI-1:** Several commenters expressed the opinion that research indicates buried plutonium-contaminated waste at the INL Site has already begun infiltrating into the Snake River Plain Aquifer.

**Response:** Monitoring data do not support a conclusion that plutonium has migrated through the 580-ft-thick subsurface to the aquifer. Transport of plutonium in the vadose zone beneath the SDA has not been observed, nor is it anticipated. Though some historical analyses concluded that migration was evident, subsequent investigations refute that conclusion.

**Comment RI-2:** Commenters expressed concern that the SDA is in a floodplain and, as a result, has been allowed to contaminate the surrounding soil, threaten the aquifer, and compromise effectiveness of the future cap.

**Response:** RWMC lies within a natural topographic depression that is associated with the fluvial systems of the Big Lost River and the Big Southern Butte. Some RWMC soil may be derived from historical stream deposits from the Big Lost River; however, evidence of erosion by these systems during the last 10,000 years is not evident. Based on current analysis, the RWMC is hydrologically isolated from surface water in the Big Lost River.[35] Though three floods have occurred at RWMC since disposal operations began, these floods were caused by local run-off generated by snowmelt. Flooding is now prevented by a containment dike around the landfill. Remedial design features of the surface barrier will account for conditions anticipated from local run-off generated by snowmelt.

**Comment RI-3:** Several commenters, including the INL Site Environmental Management Citizen's Advisory Board, agree that the level of knowledge as to the location and characterization of the site appears to be sufficient. The Board agrees with the DOE, the State of Idaho, and EPA that the waste has been characterized as well as reasonably possible.

**Response:** The Agencies appreciate your interest in cleanup.

**Comment RI-4:** In regard to the transuranic waste, 460 measurements looking for plutonium and americium in the aquifer under the SDA have found mostly none at all, see report DOE/ID-11271, pp. 4-171 to 4-192.[36] In the few samples that gave positive results, the amounts apparently found were so small as to be at the limits of the capability of the measurements and were later judged to be false positives. Even assuming these results are real, one can calculate that at most 1/1000 of an ounce of plutonium has reached the aquifer in the 35 years that an estimated ton of it has been sitting near the ground surface. This lack of mobility can be expected indefinitely into the future, judging by the products of the nuclear chain reaction that occurred in a uranium ore deposit in the Gabon, West Africa, about 2 billion years ago. The plutonium produced there was found to have moved only a short distance from where the reactions took place. Therefore, transuranic material found in the absence of chlorinated solvents should be left in place. Specifically, there is no justification for any retrieval from Pits 1 and 2.

**Response:** The Agencies concur that plutonium in the SDA is not mobile. See response to GC-4 regarding acreage for retrieval.

**Comment RI-5:** Several commenters indicate that much of this waste has been here for such a long time that there is a good chance the records are inaccurate as to what is actually buried. The condition of the containers is also unknown and in all probability degraded severely, as demonstrated by the condition of some of the containers retrieved at Advanced Mixed Waste Treatment Project. Often the contents do not match records.

**Response:** Shipping records have proven to be a valuable and mostly accurate resource for determining waste amounts, locations, and types. Excavations have largely confirmed the accuracy of waste locations, amounts, and types. The shipping records were just one data point to determine the nature and extent of contamination. Many other sources of information were used, including environmental monitoring, personal interviews, receipt records, photographs, and actual waste samples. These sources were generally consistent and gave a good picture of the kinds, amounts, and locations of the waste. Waste examination occasionally leads to instances that do not agree with available acceptable knowledge. However, observations to date in the Accelerated Retrieval Project retrievals have shown that these disagreements are minor in nature and do not lead to concerns regarding the validity of the risk assessment that supports the Agencies' conclusions.

Drums containing waste have degraded over time. This was accounted for in the risk assessment. The targeted waste retrieval approach will remove some of the more mobile contaminants in the SDA, while the evapotranspiration cover will greatly reduce infiltration through the remaining waste.

**Comment RI-6:** A commenter stated that DOE has not adequately assessed the site and has not adhered to CERCLA requirements under Section 120(e), and knowledge of nuclides and mixed waste locations should be supplemented with sampling rather than relying on simply reviewing historical records.

**Response:** EPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA*,[6] Chapter 3 (Site Characterization), contains the following statement, "…agencies will have to decide on a site-specific basis which of the activities described in this chapter must be conducted to adequately characterize the problem…." Scope for OU 7-13/14 was established and modified several times under CERCLA and the FFA/CO.[4] The Agencies modified scope primarily to collect more information to characterize the site. Characterization tasks included laboratory studies, waste sample analysis, geophysics, surveys, waste zone probing, and monitoring. However, the SDA is a landfill. As such, its contents are variable. Ultimately, disposal records are the most reliable source of site characteristics. Fortunately, records for most of the SDA have been preserved. The Agencies agree that available information provides a sufficient basis for remedial decision-making.

**Comment RI-7:** I strongly support the most thorough and effective measures available to prevent buried waste at INL "migrating" into the Snake River Plain Aquifer. For years—decades—the public was assured that there was absolutely no possibility of toxic waste entering the aquifer. This history tends to make me skeptical of public information emanating from "the site." However, the fact that contamination of the aquifer is now accepted as a real possibility, and the existence of this project, gives me some modest hope that the situation will finally be dealt with.

**Response:** Historical understanding of contaminant migration and risks has improved significantly over the last several decades. Some contamination, primarily solvents (e.g., carbon tetrachloride), have migrated to the aquifer at unacceptable levels. For other, less-mobile contaminants, including most radionuclides, the earlier predictions are more accurate, and the spread of contamination has been limited, with only sporadic detections of contamination at concentrations near detection limits. All contaminants, with the exception of carbon tetrachloride, are currently below drinking water standards. The Agencies are confident that the Selected Remedy will minimize further contaminant migration and reduce concentrations of all contaminants of concern to safe levels.

**Comment RI-8:** Documentation provided by various shippers and records maintained by the receiver for material received and buried at various locations within RWMC has always contained discrepancies. Resolution of the discrepancies has never occurred, even though historically, an effort by the operating contractor was initiated to ensure all documentation supported various nuclear material types, fuel matrices, quantities, form, and location for all material received at the RWMC. This task could never be completed. DOE-ID and the current contractor have performed sampling. However, no information has been provided relating to the statistical confidence that the sampling accounted for all material received at this facility. A confidence level of three standard deviations, at a minimum, must be used to provide the State of Idaho confidence that all material types are known. DOE-ID has a demonstrated history of facilitating accelerated milestone completions with little concern for full implementation of requirements, as demonstrated by repeated errors in documentation and shipment of materials to WIPP in attempting to meet State of Idaho Consent Agreement enforceable milestones. DOE-ID, in conjunction with the current operating contractor, is proposing to limit the scope of actions for removal of all material from RWMC. The State of Idaho must insist on a complete inventory of all materials received and buried at the facility before credible closure options can be evaluated by the public.

**Response:** Inventory reconstruction has been completed for all major waste generators. See Section 3.3 of the RI/BRA.

**Comment RI-9:** I'm concerned that the interpretation of what "all" means has gone askew. If a cap is used to cover the rest of the 88 acres, do contaminants still have a chance to find their way to the aquifer? We've had two earthquakes in the area since 1959: the Yellowstone and the Mount Borah. When's the next one? We can see cracks in the soil on the surface and recover them, but what about the cracks below the surface that we can't see? How big are they, and how deep will they go?

**Response:** Infiltrating water is the primary mechanism that causes migration to the aquifer. The Selected Remedy includes an infiltration-reducing surface barrier; and the sooner it is constructed, the less migration will occur. Two seismic monitoring instruments are located near RWMC. Though historical seismic activity in Yellowstone and in mountain ranges surrounding the INL Site has been detected near RWMC, the facility has not incurred any damage. Probabilities of earthquakes causing damage at RWMC are very small. Section 2 of the RI/BRA[20] contains a more complete description of INL Site seismic analysis.

**Comment RI-10:** A commenter expressed concern that DOE is focused on transuranic waste and perhaps carbon tetrachloride in the 4.8 acres. The commenter suspects that other issues and other types of waste may exist that could be just as hazardous to the environment and to future generations as transuranic waste. The concern is that those other types of waste are not being addressed and that the waste inventory information is not complete.

**Response:** The RI/BRA and Feasibility Study evaluated all major waste types and contaminants of potential concern within the SDA and did not limit the focus to transuranic waste. The Selected Remedy protects human health and the environment primarily through installing a surface barrier over the entire SDA and operating the OCVZ system. Additional measures (e.g., grouting limited areas with mobile radionuclides and retrieving targeted waste) will provide defense-in-depth.

**Comment RI-11:** DOE fails to acknowledge that about 90.28 metric tons of spent nuclear fuel was dumped in the SDA. This action literally puts future generations that rely on the Snake River Plain Aquifer at significant and indefinite risk for potentially thousands of years (the toxic radioactive half-life of much of this waste).

**Response:** Historically, small quantities of waste with characteristics of spent nuclear fuel, totaling approximately 90 metric tons, were disposed of in the SDA. This waste typically was generated during materials testing and examination. Regardless of the label that may or may not be applied, inventories associated with these waste streams were included in the risk assessment, as shown in Table 4-4 of the RI/BRA.[20] See, for example, the second item under U-235, "Unirradiated and irradiated fuel specimens from natural [i.e., with the same uranium isotopic ratios as found in nature] and depleted fuel mock-ups."

## 17.6 Remedial Design

**Comment RD-1:** Two commenters indicated that various factors can compromise the efficiency of HEPA filters (e.g., alpha recoil, criticality, and water in fire scenarios). Further studies are needed to determine actual HEPA filter efficiencies. Because of these issues, the assumed efficiencies are not correct, and therefore, estimated emissions are understated, posing unacceptable risk to human health.

**Response:** Use of HEPA filters to control particulate radionuclide releases is consistent with state-of-the-art industry practice, and the associated control efficiencies are widely accepted throughout DOE and Nuclear Regulatory Commission facilities.

Continuous air monitoring is being performed for ongoing retrievals in the SDA, as is required by the ARARs that apply to the source. Monitoring performed downstream of the HEPA filtration systems has continually shown that releases are effectively controlled and are only a very small fraction of the allowable dose from the facility.

**Comment RD-2:** In reviewing all potential surface barriers, the INL Site Environmental Management Citizen's Advisory Board believes that the evapotranspiration cap proposed by the Preferred Alternative provides the desired solution. The proposed evapotranspiration cap is of sufficient size to meet the CERCLA requirement to be protective.

**Response:** The Agencies appreciate your interest in cleanup.

**Comment RD-3:** I was the operations and then facility manager for RWMC/Stored Waste Examination Pilot Plant for the period of the late 1980s and early 1990s. One area that was not addressed concerning the surface barrier was the possible intrusion of rabbits and rodents through the barrier into the remaining waste stacks and the possibility and corrective actions for subsidence as the waste stacks or containers collapse due to age and decay.

**Response:** The surface barrier design will address both biointrusion and subsidence. Biointrusion will be mitigated by overall thickness of the surface barrier. Other features, such as a layer of coarse materials, also may be included, depending on remedial design. To provide a stable foundation for the evapotranspiration surface barrier, potential subsidence of pits, trenches, and Pad A will be addressed using methods to be determined during remedial design.

**Comment RD-4:** We are concerned that subsidence-mitigation methods are not well understood. We believe this could be the Achilles heel of this plan because the surface barriers could become compromised or rendered less effective if gaps are created in the subsurface. The estimated costs associated with solving this problem, as defined on page 31 of the Proposed Plan, seem very optimistic considering you don't have a proven approach yet.

**Response:** To provide a stable foundation for the evapotranspiration surface barrier, potential subsidence of pits, trenches, and Pad A will be addressed using methods to be determined during remedial design. The cost estimate for the Selected Remedy includes $8.8 million (current value) to address subsidence.

**Comment RD-5:** I am a former employee of Advanced Mixed Waste Treatment Project and Accelerated Retrieval Project. My suggestion is to remove all transuranic waste, but through a different process. I think the Accelerated Retrieval Project should modify an airlock to handle cargo containers. Place the cargo container inside, open the doors, place plastic or some kind of containment around the door openings to maintain the outside of the container clean. Then place the retrieved waste into the cargo container, when it is full, close the doors, decontaminate as necessary, and send the container across the canal to the hot cells at the Advanced Mixed Waste Treatment Project process facility. There, they could receive the container, open it in-cell, and remotely process the waste, placing it inside the puck drums, compacting them, and send the processed waste to WIPP in TRUPACT containers. Make modifications as necessary at Advanced Mixed Waste Treatment Project so the containers could be maintained clean on the outside and send them back to Accelerated Retrieval Project to be filled up again.

**Response:** Acknowledged. The comment has been routed to appropriate engineering and operational staff for consideration.

**Comment RD-6:** There is more risk associated with removing the RWMC underground waste than there is in leaving the waste in the ground. However, you need to ensure that RWMC will not be flooded in the future, because it appears that floods could result in rapid transport of some radionuclides to the aquifer.

**Response:** Historically, three floods have been recorded at the RWMC landfill. All were caused by local basin run-off from snowmelt, rain, and warm winds. In response, dikes and drainage channels were constructed around the perimeter of the landfill. The last flood occurred in 1982. None of the floods were caused by flow in the Big Lost River. The design of the evapotranspiration surface barrier will include features (e.g., contoured slopes and drainage channels) to direct run-off away from the site and ensure that local flooding does not occur in the future.

**Comment RD-7:** Risks to the aquifer would be minimized if the waste that is not removed was compacted prior to being returned to the burial location. The method of transport for contaminants appears to be liquids (water) passing through the waste zone materials. With the disturbance of materials to identify the higher risk items, the materials are removed from a semicompacted state and are opened when in closed containers. This would appear to allow for a greater probability for liquids to pass through the materials, potentially picking up more contaminants from lower risk items. This potential could be reduced if the materials were compacted or baled using commercially available techniques that are readily available (e.g., cardboard balers or landfill balers). This would accomplish a reduction in the size of the waste materials being reburied and would reduce the probability of liquid being able to penetrate and flow through the waste. It would limit the possibility of future subsidences and minimize the probability of significant maintenance to the cap, and would reduce the hazards that are currently being mitigated during the work process (e.g., related fire in nontargeted wastes) as the waste materials would not be in an unconfined configuration.

**Response:** Minimizing the amount of moisture passing through the waste zones is one of the key elements of a successful remedy. To provide a stable foundation for the evapotranspiration surface barrier, potential subsidence of pits, trenches, and Pad A will be addressed using methods to be determined during remedial design. Your proposal to use commercial balers is an excellent example of types of methods that may be employed. Some problems with using a baler or other waste-compression device include control of airborne contamination during bailing: (1) stacking of waste or placement of adjacent bales still allows significant void space between bales and (2) worker safety issues in dealing with mechanical equipment that has to be operated and maintained near the dig site.

**Comment RD-8:** I am concerned that Pad A will probably be compressed and its contents left in place. I want to know why the nitrates and uranium will not be removed. I am also concerned that any contaminants not removed should be stabilized to ensure that they do not migrate from where they are now.

**Response:** To provide a stable foundation for the evapotranspiration surface barrier, potential subsidence of pits, trenches, and Pad A will be addressed using methods to be determined during remedial design. Because the surface barrier reduces migration of water into the subsurface to a very low level, risks for nitrates and uranium are reduced to levels that are protective of human health and the environment. Treating waste forms containing nitrates and uranium is not necessary to achieve remedial action objectives. As proposed, grouting of limited areas containing mobile radionuclides (technetium-99 and iodine-129) is planned to reduce mobility of these contaminants before the surface barrier is installed. The grouting component provides relatively near-term isolation of the waste pending completion of targeted waste retrievals and installation of the surface barrier over the SDA.

**Comment RD-9:** The proposal to cover beryllium pits with paraffin sounds very temporary. Is there a plan in place for a more permanent cover? If so, why is it not included in the project information? If not, why not?

**Response:** Yes, a more permanent cover is part of the Selected Remedy. The Selected Remedy does not include a proposal to cover beryllium pits with paraffin. (It does include grouting of limited areas of the SDA [approximately 0.2 acres] that contain mobile radionuclides technetium-99 and iodine-129.) Presumably the comment refers to the previous removal action described in the Proposed Plan that involved grouting of several locations that contained buried beryllium blocks in order to inhibit migration of carbon-14.

**Comment RD-10:** Why weren't engineered plastic caps (Hyplon or other plastics) presented as a potential alternative for use at this site?

**Response:** A surface barrier incorporating a plastic membrane was not developed as an alternative because use of plastic geomembranes was evaluated and eliminated during technology identification and screening for the Feasibility Study (see Appendix A, Table A-13). Natural materials in the surface barrier would outlast all artificial components.

**Comment RD-11:** This plan is missing details on how the cap will be designed (e.g., depths) and does not include criteria for how the effectiveness of the cap will be measured. This needs to be added to the plan for the public to comment on. How much infiltration will be allowed, and how much contamination will be allowed to migrate to the aquifer?

**Response:** Details addressed in the comment will be developed in remedial design documents. The ROD requires the Selected Remedy to "...inhibit migration of contaminants of concern into the vadose zone and underlying aquifer..." and "...reduce infiltration such that concentrations of contaminants of concern in the aquifer are less than MCLs."

**Comment RD-12:** On Pad A, you indicate that they were not able to get sufficient grass to grow. That seems to contradict the Proposed Plan to use an evapotranspiration cap. Could you address this apparent clarification problem in greater detail?

**Response:** It proved difficult to establish grass on Pad A because steep slopes prevented the soil layer from retaining enough moisture to sustain plant growth through the dry season. The evapotranspiration surface barrier included in the Selected Remedy will be engineered to allow seasonal infiltration and water retention sufficient to support growth and perpetuate annual and perennial plant species. Performance modeling used to develop the preliminary design for the evapotranspiration surface barrier[28] was conservative because it was assumed that seasonal moisture loss was by evaporation only (roughly equivalent to simulating loss of surface vegetation from fire or long-term drought).

**Comment RD-13:** Why is the evapotranspiration cap shown with an optional coarse rock barrier? Should and will it be there, or not?

**Response:** The surface barrier has not been designed. The figure in the Proposed Plan is conceptual. The evapotranspiration surface barrier will include design features to (1) prevent accumulation of volatile contaminants and landfill gases and (2) inhibit intrusion of plant roots or burrowing animals into contaminated media. Engineered features (e.g., layers) and materials for surface barrier construction will be specified during remedial design.

**Comment RD-14**: Will the passive venting be run through the thermal treatment system?

**Response:** Passive venting will not be run through the thermal treatment system. The Feasibility Study evaluated active venting that would be run through the thermal treatment system. The approach selected will be determined in the remedial design stage of the action.

**Comment RD-15:** One theory of solvent migration through the vadose zone attributes the migration not to rain and snow infiltration, but to changes in barometric pressure, sometimes called atmospheric pumping. The Preferred Alternative includes a cap that is 20 ft thick to address moisture infiltration. Please address how the proposed cap will address solvent migration due to atmospheric pumping in addition to the theory of moisture infiltration.

**Response:** Barometric pumping typically brings vapors to the surface rather than force them into the subsurface. The Preferred Alternative, as described in the Proposed Plan, included scope for including a passive venting system in the surface barrier design. The Selected Remedy in this ROD includes this detail that will be developed beyond the conceptual level during the remedial design phase. Solvent movement in response to barometric pressure changes is a phenomenon that will occur regardless of the surface barrier. Installation of the venting system ensures that vapors do not accumulate under the surface barrier and inadvertently force migration of contaminants toward the aquifer.

**Comment RD-16**: The Proposed Plan does not adequately address the potential for fires that could occur during targeted waste retrieval. Controls for mitigating fire risks are not specified.

**Response**: Some waste forms are known potential fire hazards. For example, roaster oxide (depleted uranium) was not completely roasted (oxidized) at the Rocky Flats Plant. Potential fires were evaluated in detail for Accelerated Retrieval Projects, and hazards were addressed in design and safety documents and operating procedures for retrievals. These controls have been safely and successfully implemented on multiple occasions. These engineering details are not included in the Proposed Plan.

Controls in the safety basis ensure worker protection for those limited scale fires that may occur during waste retrieval, such as burning of metals or hydrides in roaster oxide wastes or the combustion of accumulated combustible gases released during drum venting. This approach was chosen because these fires cannot practically be prevented in every instance. Fires of this type have occurred, and the effectiveness of the controls imposed has been demonstrated successfully.

Staging retrieved waste in the facility is governed by combustible controls designed both to lessen the likelihood of fire occurring and to limit fire size (the amount of waste material involved) should fire occur.

**Comment RD-17**: The Proposed Plan should address the risk and potential consequences of subsurface fire within buried waste after the surface barrier is constructed.

**Response**: The surface barrier will limit infiltration to reduce contaminant transport, and waste will not become completely dry; moisture will equilibrate with adjacent native soil. The SDA contains significantly less organic (combustible) matter than a municipal landfill or tire disposal area; therefore, chemical oxidation or biological decomposition is not likely to rapidly generate heat. The surface barrier also will limit oxygen influx, reducing the rate or even preventing sustained combustion. As an example, a scenario involving nitrate compounds rapidly decomposing to produce oxygen for combustion and creating a sustained subsurface fire beneath the evapotranspiration surface barrier was examined and is not a credible scenario for waste buried in the SDA.

## 17.7 Other Topics

**Comment O-1:** A commenter stated that the Preferred Alternative amounts to walking away from a major environmental problem and pretending it does not exist. The commenter stated that the conclusion was based on the “Interagency Review Group on Nuclear Waste Management Report to the President,” 1979. The commenter indicated that the report states that proper long-term management of radioactive waste from weapons production and from the nuclear fuel cycle must guarantee that such waste is permanently isolated from the biosphere, because health effects from spread of these contaminants in the biosphere is unacceptable. The commenter contended that the Preferred Alternative would guarantee that such contaminants will be introduced to the biosphere.

**Response:** The conclusions of the Interagency Review Group and subsequent policy decisions related to management of waste types with long-lived radionuclides (e.g., WIPP Land Withdrawal Act and associated regulations found in 40 CFR 191, “Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes”[37]) are relevant to management of newly generated radioactive waste. In other words, these policy considerations and regulations are not appropriately viewed in the context of historical or previously buried waste. SDA waste was already in the biosphere in 1979 when the referenced Interagency Review Group proceedings were held. To attempt to apply these recommendations to waste already buried is to ignore many important worker safety and environmental protection considerations associated with removing the waste from the original disposal location. Evaluating the waste under CERCLA is the legally appropriate framework for decision-making associated with waste buried in the SDA. The CERCLA process balances all relevant considerations associated with remediation (e.g., cost, worker safety, long-term effectiveness, and implementability) and ultimately leads to a remedy that protects human health and the environment and satisfies the actual legal standards that are applicable or relevant and appropriate to the action. The Agencies are confident that the Selected Remedy satisfies these threshold criteria. See response to GC-2 for additional information.

**Comment O-2:** I find your Proposed Plan indistinguishable, morally, to the Nazis' "final solution" to their perceived problems with cultural minorities they deemed to be socially and politically unacceptable. You dismiss as too expensive the measures required to protect public health from known threats from the waste of nuclear arms and nuclear power industries. The Nazis too used economic exigencies to justify working some people to death, and, after that moral step, everything else in their holocaust follows.

**Response:** The Agencies followed the CERCLA process, as is their legal obligation, to select a remedy that best balances the CERCLA evaluation criteria, including cost, and that satisfies the statutory mandates of CERCLA. As noted in GC-2, risk reduction from implementing the full retrieval alternative would not be significantly greater than for the Selected Remedy. The Selected Remedy will reduce risks from the site to levels that are consistent with or lower than the risk range that is mandated in the National Contingency Plan. Further, the Agencies must also balance current risk to site workers. As shown in the response to GC-4, short-term risk exceeds long-term risk, in the absence of a surface barrier, with retrieval of approximately 4 to 7 acres.

**Comment O-3:** Regardless of which alternative is finally agreed to by DOE, EPA and the State of Idaho, I urge DOE to request adequate funding from Congress each year to implement the agreement, lest DOE lose additional credibility with the people of Idaho.

**Response:** The Agencies agree with the recommendation and will follow Section 28 of the FFA/CO[4] regarding communication and submission of timely funding requests related to CERCLA work at the INL Site.

**Comment O-4:** I heard that nitrate salts are in Pad A along with organics. Previous investigators said that if they were to try to dynamically compact this pile, there could be an explosives hazard. Is this correct?

**Response:** There are nitrate salts on Pad A. Safety considerations associated with mitigating subsidence of the waste in Pad A will be evaluated during remedial design.

**Comment O-5:** Because Pad A was placed on an asphalt pad (due to presence of transuranics), why isn't it being retrieved like the similar waste in the Transuranic Storage Area?

**Response:** Pad A waste does not contain significant quantities of transuranic waste (i.e., defined as 100 nCi/g). Unlike waste in the Transuranic Storage Area, Pad A is managed under CERCLA. Pad A will be integrated into the OU 7-13/14 evapotranspiration surface barrier.

**Comment O-6:** Have the data from this site been evaluated (peer reviewed) by scientists at INL or other national laboratories for their input?

**Response:** Yes. Several INL scientists were primary contributors to many components of the RI/BRA and Feasibility Study (e.g., seismology, hydrology, vadose zone chemistry, fate and transport modeling, plutonium chemistry, and more), and others reviewed technical content of draft reports. This project has been reviewed extensively by INL scientists and by external parties, including personnel from other national laboratories. A partial list of references follows:

J. Fabryka-Martin, G. Gee, and A. Flint, *Peer Review Team Report on Conceptual Models and Field Verification of Radionuclide Transport through the Vadose Zone at INEEL*, Final Report, November 5, 1998, Administrative Record No. 531975, prepared by Los Alamos, U.S. Geological Survey, and Pacific Northwest National Laboratory for Idaho National Engineering and Environmental Laboratory, 1999.

Dr. Matt Kozak, Dr. Man-Sung Yim, and Dr. Terry Sullivan, *Independent Peer Review of Source-term Modeling for the INEEL Subsurface Disposal Area*, ICP/EXT-03-00081, Rev. 0, prepared by Brookhaven National Laboratory for Idaho National Engineering and Environmental Laboratory, Idaho Completion Project, 2003.

Peter Martian, *Verification and Benchmark Testing of the TETRAD Simulator, Version 12.7ms,* RPT-335, Idaho National Laboratory, Idaho Cleanup Project, 2007.

R. G. Riley and C. A. Lo Presti, *Recommended Parameter Values for INEEL Subsurface Disposal Area Source Release Modeling*, PNNL-14742, Pacific Northwest National Laboratory, 2004.

Robert C. Roback, Deward W. Efurd, Michael T. Murrell, Robert E. Steiner, and Clarence J. Duffy, *Assessment of Uranium and Plutonium in the Saturated and Unsaturated Zones Beneath the Surface Disposal Area*, *INEEL*, LA-UR-00-5471, INEEL/EXT-01-00771, Rev. 0, Los Alamos National Laboratory, 2000.

Joseph P. Rousseau, Edward R. Landa, John R. Nimmo, L. DeWayne Cecil, LeRoy L. Knobel, Pierre D. Glynn, Edward M. Kwicklis, Gary P. Curtis, Kenneth G. Stollenwerk, Steven R. Anderson, Roy C. Bartholomay, Clifford R. Bossong, and Brennan R. Orr, *Review of the Transport of Selected Radionuclides in the Interim Risk Assessment for the Radioactive Waste Management Complex, Waste Area Group 7 Operable Unit 7-13/14, Idaho National Engineering and Environmental Laboratory, Idaho*, USGS Scientific Investigations Report 2005-5026, U.S. Geological Survey; DOE/ID-22192, U.S. Department of Energy Idaho Operations Office, 2005.

**Comment O-7:** Decision-makers must ensure that renewal of the ICP contract does not prolong completion of the surface barrier used for final closure of the SDA.

**Response:** The contract renewal process for DOE contractors does not influence or delay remedial work that is required by the FFA/CO. Enforceable milestones will be established in the remedial design and remedial action scope of work and work plan, which will define the schedule for implementing the Selected Remedy.

**Comment O-8:** The Preferred Alternative states that "...some portion of Pit 9..." would be remediated. As you know, Pit 9 was the focus of the initial remedial actions, and countless millions of dollars have been spent on that unsuccessful effort. Although the Agencies may have stated publicly in other policy documents why they chose to defer completion of Pit 9, it seems disingenuous to not restate those decisions in this Proposed Plan. The Proposed Plan should clearly state why only a portion of Pit 9 needs remediation; what waste will be left behind, and why is that considered not unacceptable?

**Response:** The Proposed Plan explained that this comprehensive ROD for OU 7-13/14 supersedes the Pit 9 ROD in its entirety. As noted in the Proposed Plan, successful completion of Stages I and II of Pit 9 led to the targeted waste retrieval approach that is incorporated into the Accelerated Retrieval Projects and the retrieval component of the Selected Remedy in this ROD. This approach is more selective and targets waste types that are of most concern. As an interim action, the Pit 9 ROD is superseded appropriately by the comprehensive remedy documented in this ROD. To address the comment, this ROD presents the portions of Pit 9 undergoing remediation and explains the waste types targeted for removal. Also, see response to GC-4.

**Comment O-9:** The inventory of the waste that is not removed with the targeted waste is a concern as well. Where are they putting it? How are they inventorying it? And, at some point, do they know what type of waste is being left in the ground and being put back in? And at some point, maybe that can be a concern if they don't know what it is.

**Response:** The inventory of waste that is not removed is referred to as nontargeted waste. Nontargeted waste is staged for potential return to the pit. Nontargeted waste is characterized as to type and associated contaminants through project inventory documentation and Acceptable Knowledge documentation that was prepared to support project CERCLA documentation (i.e., RI/BRA and Feasibility Study).

**Comment O-10:** One of the other issues that was mentioned at one time was the footing for Accelerated Retrieval Project II. The foundation for Accelerated Retrieval Project II was inadvertently placed, and there is waste, which could be targeted waste, underneath the footings. They try to retrieve it, but if they retrieve too much underneath [the footings], it reduces the stability of the foundation, causing [the facility] to lean. And so I feel that there is probably waste that's still underneath the Accelerated Retrieval Project that has not been accounted for.

**Response:** Targeted waste retrieval Accelerated Retrieval Project focuses on retrieving a portion of the waste in Pits 4 and 6 that are located within the retrieval structures. Waste located outside the defined retrieval areas (e.g., waste potentially located underneath the foundations) is not targeted for retrieval. Efforts to retrieve this waste have not been pursued. An issue with differential settlement of the foundations did occur and has subsequently been remedied, but did not relate to removing waste from areas adjacent to the foundations. See response to GC-4 for an explanation of goals that relate to the targeted waste retrieval component of the Selected Remedy.

**Comment O-11:** I wanted to know where the things [targeted waste] would go that would be removed.

**Response:** A number of disposal paths are required for retrieved waste, depending on radionuclide and chemical characteristics. The primary disposal path for targeted waste streams is WIPP in New Mexico. Waste types that do not qualify for WIPP are sent to various other disposal locations, upon verification that the waste satisfies the governing waste acceptance criteria.

**Comment O-12:** DOE-ID, DEQ, and EPA must suspend the INL/RWMC/SDA Buried Waste Cleanup Plan until the above greater than Class C final environmental impact statement is published in the Federal Register. The Nuclear Regulatory Commission regulations prohibit greater than Class C waste disposal in near-surface landfills, and requires that greater than Class C waste be disposed of in a geologic repository.

**Response:** The National Environmental Policy Act of 1969[38] evaluation process that is referenced in the comment is not applicable to the OU 7-13/14 CERCLA action. The waste site is being evaluated under the appropriate legal framework through the CERCLA evaluation process. This ROD establishes the binding legal decision regarding the appropriate management of the waste buried in the SDA in accordance with requirements of CERCLA and the FFA/CO. The basis for the decision is presented in this ROD and the supporting CERCLA documentation in the Administrative Record file.

**Comment O-13:** The RWMC near-surface waste landfill violates Nuclear Regulatory Commission disposal regulations for high-level spent nuclear fuel, greater than Class C, and transuranic waste—all of which are in the RWMC/SDA in significant quantities.

**Response:** Waste in the SDA is being evaluated under the appropriate legal framework through the CERCLA evaluation process. Regulations that address burial of newly generated waste (e.g., 40 CFR Part 191 for transuranic waste disposal[37]) do not apply retroactively to waste in the SDA. The CERCLA process provides a balanced evaluation, based on statutorily mandated evaluation criteria, that Congress established for evaluation of historical or abandoned waste sites. CERCLA does not mandate specific waste acceptance criteria for abandoned waste sites, but does ensure that remedies are designed to be protective of human health and the environment.

**Comment O-14:** Past proposed plans have identified specific ARARs for the project. This one does not. Please provide to the public the ARARs for the alternative contemplated in the future ROD.

**Response:** The Proposed Plan presented a summary of key ARARs that affect performance of the Preferred Alternative (e.g., Safe Drinking Water Act MCLs).[39] Section 13 of this ROD presents ARARs for the Selected Remedy in more detail.

**Comment O-15:** Page 7 of the Proposed Plan states: "Disposal operations [at the SDA] likely will continue until the facility is full or until it must be closed in preparation for final remediation…in approximately 2015." Is DOE lying to the public or simply incompetent? Current operational plans at the SDA call for cessation of operations in early 2008; and the SDA is not full. Please explain the apparent dichotomy between reality and information, presented to an unsuspecting public, in the Proposed Plan. If DOE cannot get this small fact straight, why should the public believe DOE on issues of greater importance?

**Response:** The language in the Proposed Plan was written in anticipation of a *possible* continuation of disposal operations in the Low-Level Waste Pit beyond the current operational planning. As noted in the comment, present operational planning does indicate that contact-handled low-level waste disposals would be curtailed in 2008, and remote-handled disposals would be curtailed in 2009. However, as indicated in the Proposed Plan, if additional capacity is available, the Low-Level Waste Pit could continue to receive remote-handled waste until it must be closed in preparation for the surface barrier installation.

**Comment O-16:** Page 9 states: "The OU 7-13/14 ROD will incorporate ARP I and II..." What about Accelerated Retrieval Project III? In what ROD will it be included? If initiated after ROD signature, Accelerated Retrieval Project III should be considered remediation rather than removal.

**Response:** The Accelerated Retrieval Project III removal action is also incorporated in this ROD. The Accelerated Retrieval Project III Engineering Evaluation/Cost Analysis was issued and made available to the public in June 2008. The comprehensive remedy incorporates all Accelerated Retrieval Projects and any additional targeted waste removal action.

**Comment O-17:** Page 9 states that OU 7-09 will be managed under a separate closure action (presumably RCRA). Please indicate how OU 7-09 has been formally removed from the FFA/CO, or under what CERCLA documentation the future RCRA closure will be addressed.

**Response:** This ROD formally designates OU 7-09 as a no action operable unit under CERCLA. See Section 12.2.6.8.

**Comment O-18:** As a separate comment regarding OU 7-09, a future RCRA closure is not authorized to address risk from radionuclides. Please inform the public how risk from radionuclides at OU 7-09 will be managed, if not under the CERCLA program.

**Response:** See response to O-17.

**Comment O-19:** Page 9 states, regarding OU 7-11: "The Agencies concluded that no action is required because hazardous or radioactive contaminants in the system were not detected above regulatory levels." Are the Agencies incompetent or simply ignorant? Remediation, under CERCLA, is based on RISK, not 'regulatory levels.' Please inform the public of the true state of affairs regarding OU 7-11.

**Response:** The Track 1 risk assessment for these septic tanks[40] found no hazardous substances above levels that would pose a risk. Conclusions were based on risk criteria consistent with the regulations implementing CERCLA (i.e., National Oil and Hazardous Substances Contingency Plan[3]).

**Comment O-20:** Page 12 includes a discussion of Pad A. The Preferred Alternative will replace the current ROD for Pad A, stabilizing the waste and including it under a cover. Transuranic waste in the SDA was buried prior to 1970, and its disposal is not addressed under federal transuranic waste regulations or DOE orders. However, transuranic waste was stored on Pad A from 1972 to 1978 and IS controlled, for disposal, under DOE orders, which should be a to-be-considered ARAR identified in this Proposed Plan and future ROD. The Preferred Alternative for Pad A constitutes disposal of this stored waste. Please inform the public why the to-be-considered ARAR of disposal at a geologic repository has not been selected as part of the Preferred Alternative, and why the to-be-considered ARAR is being ignored. Please include an alternative that complies with federal regulations and DOE orders regarding disposal of transuranic waste currently stored at Pad A, or show why a formal ARAR waiver will be implemented.

**Response:** Waste on Pad A is appropriately being managed under CERCLA as "...a release or threat of release of hazardous substances..." as agreed to by DOE, DEQ, and EPA in the FFA/CO[4] and the specific ROD for Pad A. Pad A is not an actively managed storage facility subject to RCRA regulation. The Proposed Plan merely supports that classification formally made by all the responsible government agencies nearly two decades ago. The additional work proposed will not alter the character of Pad A as a long-standing disposal of mixed radioactive and hazardous waste. Because the disposal was determined long ago to have taken place, proposed modifications to the prior ROD for Pad A do not constitute new disposal and do not trigger application of requirements or standards that apply to new disposals. The 1970 U.S. Atomic Energy Commission "Policy Statement Regarding Solid Waste Burial"[41] to "retrievably store" solid transuranic waste does not meet the definition of an ARAR that would need to be incorporated into the design of a remedial action under CERCLA, Section 121. The policy[41] is not a standard, requirement, criterion, or limitation of a federal environmental law or a promulgated standard, requirement, criterion, or limitation of a state environmental or facility citing law. Because the policy does not include guidance or requirements that are necessary to achieve a protective remedy for OU 7-13/14, the policy is not identified as to-be-considered in this ROD. Further, the definition of transuranic waste was changed in 1982 to raise the minimum transuranic concentration threshold from 10 nCi/g to 100 nCi/g. Considering the inventory information for Pad A, the Agencies conclude that it is highly unlikely that excavation of Pad A would result in generation of waste streams that would qualify for management as transuranic waste because average transuranic concentration would be far less than 100 nCi/g.

**Comment O-21:** Pad A waste is characterized as containing high concentrations of nitrates. Solid nitrates meet the definition of a RCRA ignitable waste. Nitrate waste at Pad A was considered "in storage" under the RCRA program. Please inform the public how compliance with RCRA ARARs for disposal of this hazardous waste will be demonstrated.

**Response:** Waste on Pad A is appropriately being managed under CERCLA, as established in the 1991 FFA/CO and documented through the Pad A remedial action ROD.[42] Pad A is not managed under storage requirements of RCRA or under the purview of any RCRA permits or other agreements established for active management of solid waste at RWMC. Under the joint management of DOE, DEQ, and EPA, Pad A has consistently been classified and remediated as an historical, inactive waste site under the FFA/CO.

**Comment O-22:** Page 43, OU 7-09 states: "…final decommissioning will be completed as CERCLA non-time critical removal actions…" Please explain under what ROD this removal action will be documented. As an alternative, it seems inappropriate to call for decontamination and decommissioning of this currently operational building [Intermediate-Level Transuranic Storage Facility] as a CERCLA removal action. Elsewhere in the Proposed Plan, DOE and the Agencies claim that OU 7-09 will be addressed as a closure under another program (presumably RCRA). The RCRA closure should ensure that risk, from RCRA hazardous constituents, meets appropriate risk levels and that additional cleanup is not required under CERCLA. Assuming this is true, the only reason for conducting decontamination and decommissioning as a CERCLA removal action would be long-term risk from radionuclides. However, this Proposed Plan also states that any radioactive contamination remaining at the end of the project is expected to be shallow and easily retrievable (presumably not contributing to any long-term risk at the site). Again, if these statements are true, where is the risk that would justify a decontamination and decommissioning action under CERCLA? Please justify this approach, or abandon the concept of decontamination and decommissioning of this risk-free facility under CERCLA.

**Response:** The Intermediate-Level Transuranic Storage Facility is included for decontamination and decommissioning, as outlined in the *Engineering Evaluation/Cost Analysis for General Decommissioning Activities under the Idaho Cleanup Project*.[43] The engineering evaluation/cost analysis outlines the rationale and is consistent with the joint DOE and EPA *Policy on Decommissioning of Department of Energy Facilities Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)*.[44]

**Comment O-23:** Beryllium blocks were disposed of in the SDA after 1970. It is now known that beryllium blocks are transuranic waste (50% of the block mass exceeds 400 nCi/g, and more than 96% of the block mass exceeds 100 nCi/g),[45] and that disposal in the SDA, after 1970, does not comply with federal regulations or DOE orders. Compliance with ARARs is required in a removal action only to the extent practicable. However, compliance with ARARs is required in a ROD, unless the ARAR is specifically and formally waived. Please explain why and how the appropriate ARARs for transuranic waste disposal are not discussed in this Proposed Plan, and why compliance with them is not demonstrated in this Proposed Plan. Please revise the Preferred Alternative to demonstrate compliance with ARARs, or show why the ARARs have been waived.

**Response:** Beryllium blocks were used to reflect neutrons back into nuclear reactor cores and improve the efficiency of chain reactions. At the time of disposal, the beryllium blocks were understood to not constitute transuranic waste. The action of disposal as low-level radioactive waste was considered at the time to be compliant with applicable requirements, based on the then-current knowledge of material in the beryllium blocks. A subsequent calculation raised the possibility that elements in the beryllium blocks, which were not transuranic when the blocks were fabricated, later became transuranic elements through neutron absorption and transmutation while the blocks were in use. It is not the intent and purpose of

CERCLA to manage historical disposals as new disposal problems. Most Superfund sites involve past disposals of hazardous substances that, under now-current laws (e.g., RCRA), would have been prohibited. CERCLA does not mandate that all disposed of materials be retrieved from the ground and be placed into current legally compliant channels for disposal at licensed RCRA treatment, storage, and disposal facilities. Rather, the intent and purpose of CERCLA is to choose and implement response actions that protect human health and the environment in light of the fact that a disposal has occurred. Where hazardous substances have already been disposed of, and the threat of further release to the environment beyond the disposal site can be removed by immobilization measures or constructing a surface barrier to prevent infiltration of rainwater through the waste, EPA does not generally require that the waste be removed, apart from certain "hot spots" of the highest concentration of contaminants that present the greatest risk of a secondary release of hazardous substances into groundwater. In the case of beryllium blocks, a removal action (WAXFIX grouting) was performed to address release of carbon-14 (radionuclide risk driver). The surface barrier will further reduce moisture contact and carbon-14 migration. A regulation that governs the method and location of a new disposal does not specifically address materials already disposed of, so the regulation is not an ARAR that is relevant to the current Proposed Plan.

**Comment O-24:** Please identify the ARAR, or formal ARAR waiver, allowing polychlorinated biphenyl waste to remain stored in the SDA. Please identify the ARAR waiver that will allow disposal of this waste within a flood plain. While RCRA regulations allow "building-out" of a flood plain, regulations for polychlorinated biphenyls offer no comparable option. The RWMC is known to lie within a closed-basin floodplain; that is the reason the berm was constructed. Mere construction of the berm does not remove RWMC from the flood plain under regulations for polychlorinated biphenyls.

**Response:** The subject waste at the SDA was disposed of prior to 1978. The Toxic Substances Control Act[46] does not require cleanup of soil contaminated with polychlorinated biphenyls before 1978 regardless of concentration, unless the regional administrator makes a finding that spills, leaks, or other uncontrolled releases or discharges from the site constitute ongoing disposal that may present an unreasonable risk of injury to health or the environment.[47] Neither the Regional Administrator, nor DOE, acting under authority of CERCLA Section 121[5] and Executive Order 12580,[48] has made a finding that an unreasonable risk exists from exposure to polychlorinated biphenyls in the SDA. Because OU 7-13/14 is being addressed under CERCLA, the risk evaluation for the SDA was prepared in accordance with requirements of the FFA/CO, including review by the EPA program manager for the INL Site. The RI/BRA did not identify polychlorinated biphenyls as contaminants of concern for OU 7-13/14.

# 18. SNAKE RIVER ALLIANCE COMMENTS

The Snake River Alliance, assisted through an EPA technical assistance grant by Mr. Peter Strauss, submitted formal comments on the OU 7-13/14 Proposed Plan. Four general comments and nine specific comments were submitted. Subsections that follow contain the comments as provided (in black) with Agency responses (in blue). Comments are numbered, as received.

## 18.1 General Comments

**Comment SRA-1:** The primary objectives should be to prevent additional contaminants from reaching the aquifer and to protect public health.

The SDA of the RWMC is a shallow land burial disposal facility for radioactive and other waste at the INL. Pits and trenches have average depths of approximately 10 to 15 ft bgs. It contains a variety of radioactive and nonradioactive waste from on-Site activities and from DOE facilities, particularly Rocky Flats Plant. Rocky Flats Plant manufactured plutonium triggers for the nuclear arsenal, and much of the waste that was shipped to INL was uranium isotopes and transuranic waste, the most prevalent of which was plutonium. The SDA contains waste with half-lives of greater than 10,000 years.

The SDA is situated 580 ft above the Snake River Plain Aquifer, which is a sole-source aquifer. It is the only source of drinking water for more than 200,000 people in southern Idaho and a major source of irrigation water for regional crops and fisheries. It is this aquifer that should be protected from contamination. The Proposed Plan should not only protect this aquifer, but it should prevent any additional contamination from reaching the aquifer. Though several layers of rock (i.e., basalt) inhibit the downward flow of water, carbon tetrachloride, which is buried in the SDA, has already reached the aquifer. This should be a clarion call for INL that over the past 50 years, these layers have not reliably stopped the downward flow of contaminants.

**Response:** The Agencies concur that carbon tetrachloride and other solvents migrate in the gas-phase and are not stopped by basalt and interbed sediments; however, interbed sediments do impede migration of dissolved-phase (i.e., aqueous-phase) contaminants (e.g., uranium, plutonium, and most other constituents in the SDA), as corroborated by extensive monitoring data collected over decades. Because of fractures, fissures, and voids, basalt was not considered an impediment in evaluating potential migration. The Selected Remedy will protect the aquifer by continuing vapor extraction to remove carbon tetrachloride (and other vapor-phase contaminants) from the subsurface and by constructing an evapotranspiration surface barrier to reduce infiltration and inhibit contaminant migration to the subsurface and aquifer. Targeted waste retrieval and in situ grouting will provide additional protective measures.

**Comment SRA-2:** Because the Proposed Plan will leave long-lived carcinogens in the subsurface, INL and DOE should commit to general principles that isolate the waste, and maintain and monitor the remedy.

The Snake River Alliance recognizes that any remedy for a landfill that will contain radioactive elements for tens of thousands of years is a daunting task. We developed general principles that would provide the basis for long-term protection. These principles form the basis of most of our specific recommendations. These principles are:

- Isolation of waste must be reliable and permanent
- Contaminants must be stable or stabilized to ensure immobilization

- The "stable" contaminant mass must be able to withstand foreseeable environmental changes for the life of the contaminant
- The subsurface must be able to be documented and monitored efficiently and effectively for the life of the facility to ensure that contaminants are not moving
- If monitoring indicates that contaminants are mobile in the environment, there must be a commitment that the surface cap and remedy will not hinder future investigations and possible removal of the contaminants
- Highly contaminated areas should be retrieved, stabilized, and properly disposed
- The site should be memorialized for long-term identification and protection from human intrusion.

**Response:** The Agencies agree, in general, as demonstrated by features of the Preferred Alternative in the Proposed Plan. However, some of the principles listed above are somewhat subjective or are not measurable. The Selected Remedy in this ROD will isolate the waste and will maintain and monitor the remedy. Long-term effectiveness and permanence will be assessed through the CERCLA 5-year review process. If monitoring data examined during a 5-year review show that the Selected Remedy is not effective, the Agencies must determine what further action is appropriate. A beneficial feature of an evapotranspiration surface barrier is the relatively simple design consisting of a soil and other natural materials. If warranted, this barrier could be augmented or removed and replaced without sacrifice of the materials used.

**Comment SRA-3:** The Proposed Plan should acknowledge that over the long term, even with the best-engineered design of a remedy, much of the remedy would fail. As such, long-term monitoring and stewardship, combined with future adaptations to the remedy, should be emphasized in the Proposed Plan and the ROD.

**Response:** The Agencies expect the Selected Remedy to provide long-term effectiveness and permanence and not fail. The Proposed Plan lists long-term institutional control tasks (including monitoring) as critical elements to ensure long-term performance. The ROD emphasizes these elements. Future adaptations, if any, will be determined through the CERCLA 5-year review process.

**(continued)** The Proposed Plan incorporates five lines of defense for inhibiting migration of contaminants to the aquifer. These are the surface cover, partial retrieval, removal of vapors from the vadose zone, in situ grouting, and long-term stewardship and monitoring. If properly executed, these lines of defense can appreciably limit contaminants from reaching the aquifer. However, as described below, three lines of defense will in all likelihood fail to prevent mobilization of contaminants over the long period of time that the remedy must be protective. We expect that if the vapor extraction system is operated properly, it will be protective, and at some point in the future it may be turned off. However, it does not eliminate contaminants that have already migrated substantially from the waste zone. The last line of defense, that is, the monitoring system, combined with an aggressive stewardship and maintenance program, must be robust to detect movement of radionuclides and moisture.

The first line of defense is the evapotranspiration cover, designed to prevent infiltration of water. We generally support this type of cover in semiarid areas, as it has been shown to be more effective at self-repair than covers that use clay or asphalt barriers to prevent infiltration. The evapotranspiration barrier works by establishing a vegetative cover in soil deep enough to hold water during critical storm or snowmelt events, which can later transpire. Especially important is the design of this system—slope, vegetative cover, depth of soil, soil mixture—because these factors are crucial in preventing water from reaching the waste. If water does reach the waste, contamination has a much higher probability of migrating downward. However, we cannot emphasize strongly enough that over the long term, it is probable that this cover will fail to meet even the strictest of performance goals—preventing any water from reaching the waste zone.

**Response:** The remedial action objective is to inhibit migration into the vadose zone and aquifer to meet the remediation goal of reducing infiltration to keep aquifer concentrations from exceeding MCLs. Objectives and goals are so formulated because completely "preventing any water from reaching the waste zone" is neither necessary nor achievable over time. Localized, temporary "failure" of the surface barrier is a foreseen circumstance that would be evaluated through surveillance, maintenance, and monitoring.

**(continued)** The second line of defense is retrieval of waste that has the potential to migrate even in the absence of water. Almost all the waste being retrieved is Rocky Flats waste, and a portion of it also contains the remaining organic chemicals, some that have already reached the aquifer. If other waste is found during the retrieval process, it may be recovered and disposed of. Retrieval represents a small portion of the total waste at the site; no matter how much is retrieved, contaminants will remain in the subsurface. While retrieval may eliminate some of the source, there is no doubt that it will fail to eliminate the principle threat of contamination of the aquifer. We note that in the "Action Memo for the Accelerated Retrieval Project," DOE stated that:

> Compared to volatile organic compounds, release and migration potential of the Rocky Flats Plant [i.e., Rocky Flats Plant] radiological contaminants of concern is much slower. In general, peak estimated aquifer concentrations for radionuclide contaminants of concern are hundreds or even thousands of years in the future. However, regardless of this slower release rate and migration potential, modeling indicates that relatively long-term migration into the subsurface will occur. Removal of targeted waste streams containing contaminants of concern will reduce the source term radiological and chemical inventory.

**Response:** Targeted waste retrieval and removal of high-concentration organic solvent waste will remove most carbon tetrachloride remaining in the waste. Continued operation of the vapor vacuum extraction system will significantly reduce vadose zone concentrations, thus minimizing what reaches the aquifer. Natural attenuation (and degradation) also will decrease vadose zone and aquifer concentrations. In the refined baseline risk assessment, carbon tetrachloride risk reaches a maximum in 2117 with no retrieval and no extraction (i.e., No Action). The Selected Remedy will completely address the most imminent threat to the aquifer—carbon tetrachloride—by keeping that peak risk from occurring. This component of the Selected Remedy is not particularly vulnerable to failure.

**(continued)** The third line of defense is stabilizing waste that has a particularly high probability of mobilizing. This may add short-term protection but is not sufficient for the long term if water reaches the waste.

**Response:** Near-term protection is the purpose for in situ grouting; it will reduce mobility of technetium-99 and iodine-129 during the delay before building the surface barrier. The grouting component provides relatively near-term isolation of the waste pending completion of targeted waste retrievals and installation of the surface barrier over the SDA. Delay in construction of the surface barrier is necessary to accommodate retrieval of targeted waste. The surface barrier will provide long-term protection.

**(continued)** The vapor extraction system adds a considerable line of defense by preventing additional organic compounds from reaching the aquifer. However, because some of these compounds have already reached the aquifer, there may still be some additional contaminants that are not captured by this system and reach the aquifer. This system can, if properly managed, halt most of this vertical migration; however, it will not eliminate all contaminants that have already migrated.

**Response:** Though carbon tetrachloride has been detected in concentrations that exceed MCLs in the aquifer near RWMC, the vapor vacuum extraction system is expected to achieve remediation goals and reduce aquifer concentrations well before the end of the hypothetical institutional control period (i.e., 2110). Organic compounds that have already migrated beyond reach of the system will attenuate or degrade and will not pose a threat to human health or the environment.

**(continued)** The last line of defense is the long-term monitoring program and institutional controls (i.e., long-term stewardship). Without a robust monitoring system that can detect movement of water and movement of radionuclides before they reach the aquifer, the other lines of defense will be for naught. The long-term operations and maintenance of the above remedial system and the long-term monitoring system, combined with institutional controls and a concerted effort by DOE to fund and maintain an institutional and community memory of waste buried at the site is, in our view, the most important aspect of this proposal. As we will discuss below in specific comments, we were disappointed that the Proposed Plan did not emphasize and explain this in more detail.

**Response:** Long-term stewardship includes surveillance, maintenance, monitoring, and institutional controls. The Proposed Plan indicates that long-term stewardship would continue indefinitely. It is one of the three common elements, listed on page 19 of the Proposed Plan, described as "…necessary to ensure that the selected remedial action protects human health and the environment." The ROD stipulates long-term institutional control requirements, thus ensuring that DOE will fund and maintain institutional control or meet all CERCLA requirements for transferring the responsibility to another federal agency.

**Comment SRA-4:** Because of numerous uncertainties regarding inventory of waste, location of contaminants, movement of contaminants, waste forms, toxicity of the contaminants, and global factors, such as climate change, the Alliance recommends that a robust remedy with multiple lines of defense is necessary. The remedial action objectives should be as health conservative as possible, such as limiting predicted excess cancers to one in one million ($10^{-6}$), rather than a range between $10^{-4}$ and $10^{-6}$. Seemingly redundant actions, such as removing waste and stabilizing soil not removed, are logical and justified given the long timeframe and the degree of uncertainty.

**Response:** Uncertainties (e.g., source term and fate and transport) were evaluated by performing sensitivity cases to evaluate potential impact. The generally acceptable risk range for site-related exposures under the National Contingency Plan[3] is $10^{-4}$ to $10^{-6}$. The Agencies agree that the cumulative risk threshold for OU 7-13/14 is at the upper end of this range ($10^{-4}$) based on (1) conservative approaches in risk assessment that tend to overestimate risk, (2) use of $10^{-4}$ in many other risk-management decisions across the INL Site, (3) remote location of the INL Site, and (4) land-use restrictions and institutional controls specified in this ROD.

**(continued)** The Baseline Risk Assessment tries to identify major points of uncertainty. First, it notes that the total inventory of waste disposition is not known with certainty, nor is the packaging, the waste form (e.g., solid, liquid), or how much contamination has already been released. It notes that early records of waste placed in trenches were poor or nonexistent. From 1954 to 1957, records for Rocky Flats Plant disposals did not accompany those shipments. Instead, an annual summary of disposals provided total radionuclide content and waste volume. Rocky Flats Plant transuranic-contaminated waste, packaged in drums or wooden crates, was stacked horizontally in pits and trenches with National Reactor Testing Station mixed-fission-product waste.

**Response:** Conservatisms (e.g., measures that tend to overestimate risk) are adopted to ensure that decisions are protective. Relating to inventory, Table 6-10 of the RI/BRA[20] concludes that risk is overestimated.

**(continued)** Second, the rate of infiltration is not completely understood. For example, the complexity of saturated water movement through fractured basalts is not well understood. An early U.S. Geological Survey report noted: "The Snake River basalt is more permeable than the sediments, but the permeability differs from layer to layer and laterally within layers so the rate and direction of percolation of fluids in individual layers cannot be predicted." Also, the Feasibility Study reports that, beginning with Pit 17 in 1980, explosive fracturing was used to deepen pit excavations. Fracturing could have the unfortunate effect of creating a preferential pathway. There is no mention of any analysis regarding this feature of the SDA.

**Response:** Infiltration cannot be "completely" understood, though, in general, infiltration rates for the system are well justified,[49,50,51] and risk is likely overestimated (Table 6-10 of the RI/BRA). Modeling conservatively adopts the approach that basalt does not retard contaminants. Interbeds are the more salient features.

**(continued)** Third, transport in the vadose zone and aquifer also is controlled by the tendency of each contaminant to sorb onto the soil and sedimentary matrix. Even forms of plutonium that are relatively insoluble will be affected by the presence of solvents, organic materials in the soil, and other factors. The presence of acidic materials in the soil, for instance in the form of discharges of pollutants, such as nitric acid, could aid in the rapid transport of transuranic radionuclides. Many actinides, including plutonium, americium, and neptunium, exhibit multiple oxidation states. If chemicals are present beyond the buffering capacity of the soil, they also reduce the capacity of the soil to adsorb positively charged metal ions like plutonium and americium.

**Response:** Transport of plutonium and americium in the vadose zone beneath the SDA has not been observed, nor is it anticipated. Characterization of samples collected from Pit 9 during the OU 7-10 Glovebox Excavator Method Project removal action[52] demonstrated that plutonium and americium were strongly absorbed to soil contaminated during waste retrieval. Sequential leach studies performed on these samples suggest that collocated waste types have not affected the buffering capacity of soil in the waste zone, even though Pit 9 had experienced flooding. Soil associated with the most contaminated media (i.e., graphite molds) exhibited an affinity (i.e., distribution coefficient [$K_d$]) for plutonium and americium several orders of magnitude higher than the more conservative value used for fate and transport modeling. Concentrations of inorganic anions are insufficient to complex plutonium or americium, and the density of organic residues throughout the SDA is unlikely to support biotransformation of metals in the buried waste. As an extra measure of conservatism, the RI/BRA assumed that 3.7% of the plutonium-239 and plutonium-240 inventory was mobile, by any mechanism, and would move through soil surrounding the waste and the A-B interbed without sorption. Sorption then would occur in the nearly continuous B-C and C-D interbeds. Under these conditions, peak concentrations of plutonium-239 and plutonium-240 in the aquifer remained 10 orders of magnitude below the EPA-recommended MCL throughout the 1,000-year simulation period.

**(continued)** Items that were not called out in the RI/BRA as uncertain are the toxicity of the materials of concern, the synergistic effects of multiple contaminants, and "global" uncertainties such as changing climate. Another area of uncertainty identified was the exact location of the trenches. Originally, trench locations were identified and recorded by metal tags along the barbed-wire enclosure that surrounded the landfill. This procedure was discontinued in the late 1950s, and concrete survey monuments were placed at the ends of the centerline of each trench and at the corners of each pit. The Feasibility Study reports that although older disposal sites were retrofitted with monuments, the "accuracy of the locations is uncertain."

**Response:** See Table 6-10 (p. 6-114) of the RI/BRA[20] for qualitative assessment of uncertainties in risk assessment. In general, risk is likely overestimated. "Global" uncertainties (e.g., changing climate) cannot be predicted or modeled with reasonable credibility. Geophysics is used to confirm trench boundaries and modify maps, as needed.

**(continued)** An alternative perspective for dealing with uncertainty is through application of the Precautionary Principle. It was drafted in 1998 to deal with threats to the environment that are not well understood. It states that:

> When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically. In this context the proponent of an activity, rather than the public, should bear the burden of proof. The process of applying the precautionary principle must be open, informed and democratic and must include potentially affected parties.

Instead of asking the basic risk-assessment question, "How much harm is allowable," the precautionary approach asks, "How little harm is possible." This is a logical approach for dealing with a problem of such magnitude. Thus the precautionary principle lends support to a robust remedy with multiple and redundant lines of defense.

**Response:** The Selected Remedy incorporates multiple and redundant lines of defense—consistent with the CERCLA decision-making process—to address uncertainty and ensure long-term protection of human health and the environment.

## 18.2 Specific Comments

**Comment SRA-1: Retrieval of Waste, Background:** The Rocky Flats waste forms contain various radiological and nonradiological contaminants. The material shipped from Rocky Flats included plutonium and uranium isotopes. Plutonium isotopes included plutonium-238, -239, -240, -241, and plutonium-242. Uranium isotopes (i.e., uranium-234, -235, -236, and uranium-238) were shipped to the RWMC in the form of depleted uranium oxides. Also included in the waste shipments were americium-241 and trace quantities of neptunium-237. The isotopes americium-241 and neptunium-237 are daughter products resulting from the radioactive decay of plutonium-241. At the Pit 4 retrieval, the extra americium-241 is a significant contributor to the total radioactivity. A number of radionuclides (e.g., cobalt-60, cesium-137, and strontium-90) from INL waste generators were also disposed of in the pits. The non-Rocky Flats waste streams include radioactively contaminated sewage sludge and a number of combustible and noncombustible debris waste forms.

The buried Rocky Flats transuranic waste is located primarily in disposal Pits 1–6, Pits 9–12, and Trenches 1–10. Trenches 11–15 also may contain Rocky Flats waste. Contaminants in the SDA include chemicals, contact- and remote-handled fission and activation products, and transuranic radionuclides. Initially, containers were stacked in pits. This practice was later changed, and containers were dumped into the pits rather than stacked to reduce labor costs and personnel exposures. The RI/BRA estimated that stacked containers last 31 years, plus or minus 14 years. If dumped into the pits or trenches, the containers were estimated to last only 11 years, and 28% would fail immediately.

Based on review of documentation, numerous oxidizers (e.g., chromate, nitrate, perchlorate, permanganate, and peroxide) have been identified in processes that generated the waste. Bottles of chemicals, including oxidizers, possibly were buried in the SDA (which could mobilize radionuclides).[18]

The Proposed Plan states that targeted waste (i.e., those intended for retrieval) is "specific Rocky Flats waste forms that are identified and exhumed based on visual observations and methods developed by the Accelerated Retrieval Projects." These waste streams include Series 741 sludge, Series 743 sludge, graphite, filters, and roaster oxides, which contain solvents, and transuranic and uranium isotopes.

The Alliance supports removing the most highly contaminated waste, stabilizing it, and redisposing of it in a safe fashion. We note that the risks to the Snake River Plain Aquifer, in the short term, come from organic chemicals such as carbon tetrachloride; in the long term, more risk is associated with activation products from reactor operations and research at INL (e.g., carbon-14, iodine-129, and technetium-99) as well as from transuranic waste (e.g., plutonium series, americium-241) that was disposed of as part of the weapons production process (i.e., Rocky Flats waste).

However, the Proposed Plan does not provide detail on the precise methods for retrieval. Nor does it provide information that is necessary for the public to evaluate this action. For example, it is difficult to evaluate a proposal that states it will retrieve waste from 4.8 acres out of a 35-acre disposal area without additional information (i.e., metrics). The Proposed Plan does not discuss the decision criteria that were used to select the targeted waste, nor those used to select areas that will be excavated. It does not include the precise location of the waste to be removed—only hypothetical retrieval areas are presented. INL did not provide evaluation of larger retrieval areas, although they have been considered in the past. Finally, the Proposed Plan does not consider nor even suggest additional protective measures that could be used to immobilize the waste forms.

a. The Proposed Plan should include a specific description of methods used to identify waste, sort waste, retrieve and stabilize waste, and how waste that is not retrieved will be handled.

**Response:** The ROD describes targeted waste criteria and the visual approach used to identify targeted waste and precise exhumation locations. Retrieval of targeted waste is a pragmatic approach agreed to by the Agencies to remove source term in the most efficient manner possible. Areas identified for retrieval are those that optimize recovery of targeted waste and achieve a balance among the nine CERCLA criteria.

**(continued)** One of the critical methods to identify waste is using visual criteria. As stated in the Action Memorandum for the Accelerated Retrieval Project, "To best understand why the visual segregation technique for removing targeted waste was chosen, the range of waste types buried in the pits must be considered, as well as the unique visual characteristics possessed by the targeted and non-targeted waste. Considering physical form, there are five primary types of waste in the pits: (1) graphite, (2) filters, (3) uranium roaster oxide, (4) debris, and (5) sludge. Waste types (1)–(3) are types of targeted waste and possess physical features and packaging requirements that generally make identification straightforward."

While this may be so, Series 741 sludge is expected to contain the largest curie content as well as plutonium content. The Alliance needs to fully understand how this waste will be identified, particularly because we expect that the containers have deteriorated. We also understand that some sludges have distinct physical properties, but that is not discussed in the Plan. Moreover, the Plan needs to identify methods that will be used to retrieve contaminated soil surrounding the targeted waste.

**Response:** Workers are trained to recognize targeted waste. Training is based on knowledge of processes that generated the waste, disposal history, mapping, and anticipated changes in appearance caused by disposal (e.g., color, texture, and condition). Experience gained from previous retrievals, including from Pit 9 and ongoing retrievals, is used to update training materials that describe observable characteristics. It can be difficult to differentiate between the two types of inorganic sludge: Series 741 sludge is targeted, and Series 742 sludge was nontargeted. To eliminate this ambiguity, Series 742 sludge was added to the list of targeted waste forms beginning with Accelerated Retrieval Project III. Soil is not targeted waste, though some is retrieved coincidentally because it contains some amount of targeted waste.

**(continued)** The Action Memorandum also states, "The Agencies will review information collected during ongoing ARP and ARP II operations to (1) verify the use of visual criteria and instrumentation and (2) evaluate whether to refine the retrieval area." This includes verification of the waste information database and location, and sampling to determine if visual identification is effective. We have not reviewed any reports that determined the effectiveness of visual criteria.

**Response:** The Agencies continuously evaluate effectiveness of the visual approach. The number of targeted waste drums (or drum equivalents) removed from the exhumation area is compared to the number of targeted waste drums (or drum equivalents) found. For example, 98 drums of roaster oxide were expected in the Accelerated Retrieval Project I area, and upon completion of waste exhumation in this area, 96 drums were recovered.

**(continued)** The Accelerated Retrieval Project documents state that once segregated, targeted waste will be repackaged into suitable containers (e.g., drums or boxes). Field screening (with radiological instrumentation) will be used to identify waste associated with high-energy gamma and neutron radiation to ensure that the associated waste is managed appropriately and that potential radiation exposure of operations personnel is appropriately controlled. The ROD should discuss what types of objects are likely to be encountered and what the procedures will be if these are encountered.

**Response:** The ROD describes the Selected Remedy with sufficient detail to provide a basis for the decision and its associated cost estimate. Subsequent documents that support remedial design and remedial action will describe specific procedures and other operations and engineering details. For example, see Table 5 of the waste inventory estimate for Accelerated Retrieval Project II, EDF-5447[53] (cited in a comment below).

**(continued)** Documents also state that after an area within the pit is excavated, if the volume is not completely filled with returned waste, the excavated area could be filled using several methods, including: filling the open area with a retrievable grout or transferring additional soil material into the retrieval area. The ROD and subsequent documents need to provide detail on these methods. As we will discuss later in the section, we are proposing that INL investigate whether there are additives to the returned waste and surrounding soil that will immobilize the waste by altering its oxidation state.

**Response:** Operational experience to date indicates that the volume in an exhumation area is completely backfilled due to waste expansion and addition of secondary waste generated by retrieval operations. Modifying geochemical conditions in the SDA poses substantial risk of inadvertent consequences. Analysis of soil gas in Pit 4[54] suggests that reducing-conditions currently exist in portions of the buried waste; however, heterogeneity in the nature and extent of buried waste forms precludes definitive assessment of geochemical conditions at any one location in the SDA. Information does not support reactive chemistry modeling or other ways to assess the potential consequences of modifying local chemistry. Therefore, any suggestion that amendment of waste or manipulation of geochemical conditions would be generally beneficial is highly speculative. Common additives (e.g., Portland cement) could increase local soil pH and accelerate migration of uranium. Amendment of organic waste to accelerate degradation of volatile contaminants of concern could accelerate migration of toxic metals, including uranium. Use of hydroxyapatite has been proposed for in situ sorption of actinides in nuclear waste repositories; however, use of hydroxyapatite for environmental remediation has been extremely limited, and this process option is neither mature nor commercially available. In conclusion, introducing exogenous materials (i.e., additives) into the SDA following removal of targeted transuranic waste is not necessary to reduce risk and could, in fact, compound the problem by causing unforeseen changes in local chemistry in this highly heterogeneous situation.

**(continued)**

b. We propose that the draft ROD contain the following metrics, not just the acreage covered: how much waste is expected to be removed (total volume, as a percent of total volume of waste in the subsurface, as a percentage of transuranic waste, and total volume that is expected to be left in retrieval areas); and how much radioactivity is expected to be removed (total curies [Ci], as a percent of total curies of waste in the subsurface, as a percentage of transuranic waste, and total curies that is expected to be left in retrieval areas). This would provide the public a better sense of what exactly is being removed.

**Response:** One metric used to evaluate success of retrieval is a comparison of the number of targeted waste drums (or drum equivalents) found in the excavation to the known number of targeted waste drums disposed of. This metric was established for the Accelerated Retrieval Project and has proven to be effective.

**(continued)** The public has been given information only about the amount of acreage from which the DOE intends to retrieve waste. In our opinion, this does not make sense, and provides the public with little information that would enable it to evaluate whether this is sufficient.

We note that several documents for the Accelerated Retrieval Projects have some of the basic information comparable to what we are requesting. For example, we cobbled together information from an engineering design file[53] and other sources to construct the following table:

| Waste Category | **Targeted** | Waste Volumes in Inaccessible Region of SDA Retrieval Area 1 ($ft^3$) | Waste Volumes in Accessible Region of SDA Retrieval Area 1 ($ft^3$) | Waste Volumes in Balance of ARP II Retrieval Area ($ft^3$) | Total Waste Volumes ($ft^3$) | Ci |
|---|---|---|---|---|---|---|
| **741 sludge** | **X** | **629** | **3,792** | **99** | **4,520** | **12,778** |
| 742 sludge | — | 437 | 6,377 | 3,375 | 10,189 | — |
| **743 sludge** | **X** | **2,358** | **24,611** | **1,000** | **27,969** | **88** |
| 744 sludge | — | 403 | 1,646 | 708 | 2,757 | 74 |
| 745 sludge | — | 3 | 5,541 | 6,390 | 11,934 | 3 |
| Miscellaneous sludge | — | 0 | 15 | 13 | 28 | ?? |
| Beryllium | — | 84 | 370 | 259 | 712 | — |
| **Roaster oxide** | **X** | **151** | **990** | **505** | **1,646** | **??** |
| **Graphite** | **X** | **0** | **0** | **10** | **10** | **??** |

| Waste Category | Targeted | Waste Volumes in Inaccessible Region of SDA Retrieval Area 1 ($ft^3$) | Waste Volumes in Accessible Region of SDA Retrieval Area 1 ($ft^3$) | Waste Volumes in Balance of ARP II Retrieval Area ($ft^3$) | Total Waste Volumes ($ft^3$) | Ci |
|---|---|---|---|---|---|---|
| **Filters** | **X** | **515** | **4,292** | **759** | **5,566** | **182** |
| RFP line-generated waste | — | 143 | 1,112 | 36 | 1,291 | 2,070 |
| Combustible debris | — | 3,139 | 23,078 | 11,131 | 37,347 | 2,226 |
| Noncombustible debris | — | 3,369 | 29,530 | 21,587 | 54,486 | 1,073 |
| Totals | — | 11,408 | 104,043 | 48,521 | 163,970 | 18,494 |
| Percentage of targeted waste as a percentage of disposed waste | | 32.0% | 32.4% | 4.9% | 24.2% | |
| ARP = Accelerated Retrieval Project<br>RFP = Rocky Flats Plant<br>SDA = Subsurface Disposal Area | | | | | | |

In addition, the removal of the targeted waste forms from the entire Accelerated Retrieval Project II retrieval area (containing approximately 13,048 Ci) would provide a transuranic activity reduction of approximately **71%** (13,048 Ci/18,494 Ci). Retrieval of the accessible SDA Retrieval Area 1 region should provide a transuranic activity reduction of approximately 74.5% for the area excavated, or approximately **58.9%** (10,902 Ci/18,494 Ci) for the full Accelerated Retrieval Project II retrieval area.

These figures are available and would have been a more appropriate way to discuss this removal action.

c. There is little discussion in the Proposed Plan as detailed as that in the Accelerated Retrieval Project documents. We cannot discern from the basic documents why some areas were considered for retrieval, as well as all the waste forms that were not included as targeted waste. We propose that the ROD and subsequent documents (e.g., the Accelerated Retrieval Project III engineering evaluation/cost analysis) contain decision criteria and other information that would allow the public to make informed comments regarding the retrieval. In addition, the Proposed Plan, RI/BRA, and Feasibility Study do not identify what waste forms went into the pits and trenches, and where they are located.

**Response:** The ROD describes the basis for retrieval. The definition of targeted waste was established to maximize removal of transuranics, uranium, and solvents received from Rocky Flats Plant and to use visual methods to identify the targeted waste. The Agencies have concluded that removal of other waste (nontargeted) is not warranted under CERCLA.

The entire SDA source term was evaluated and described in numerous inventory reports that support decision-making for OU 7-13/14. These documents are cited in Section 3.3 (Source-term Assessment) of the RI/BRA.[20] The RI/BRA also provides density maps and waste stream tables at the end of Section 4. Details similar to those provided in engineering design files and other support documents for the 1.27 acres addressed by Accelerated Retrieval Projects I, II, and III will be compiled for the additional 4.42 acres included in the Selected Remedy.

**(continued)** The targeted waste and nontargeted waste were not fully described in the Proposed Plan. We have briefly described them below, based largely on information found in documents relating to the Accelerated Retrieval Project. Targeted waste is in **bold**. However, we do not know if materials identified in the Accelerated Retrieval Project documents include all materials and waste forms that were deposited in other pits, or if there are additional types of materials that were disposed. For example, the category of fire-related waste from the fires at Rocky Flats is not included in the Accelerated Retrieval Project documents.

**Response:** Targeted waste in the additional acres is collocated with other types of waste, including some waste forms that are not present in Accelerated Retrieval Projects I and II. Inventory estimates similar to those in EDF-4478[55] and EDF-5447[53] will be prepared.

**(continued)** **Series 741 sludge**, also called first-stage sludge, was produced from various plutonium recovery operations. The process produced a precipitate that carried some plutonium and americium oxides. The precipitates were filtered to produce a sludge containing 50 to 70 percent weight water. The water was absorbed, to some extent, by the addition of Portland cement. As noted in the previous section, Series 741 sludge contains by far the highest curie content of any waste form.

Series 742 sludge, also called second-stage sludge, was generated in a fashion similar to the Series 741 sludge from aqueous streams that were lower in transuranic content than the streams generating the Series 741 sludge and generally contains lesser amounts of plutonium or americium. We note that this is nontargeted waste, although it should contain some radioactivity.

**Series 743 sludge**, also called organic setups, is the result of stabilizing various types of organic waste (e.g., carbon tetrachloride, trichloroethylene, tetrachloroethylene, Texaco Regal Oil, and other miscellaneous oils and degreasing agents). These types of liquid waste were mixed with calcium silicate to form a grease or paste-like substance. This waste also contains some radioactivity.

Series 744 sludge, also called special setups, contains organic liquids that were stabilized with cement rather than calcium silicate. Containers of Series 744 sludge are expected to be firm monoliths. This waste also contains some radioactivity.

Series 745 sludge comprises nitrate salt residues from evaporation ponds. The chemical makeup of these salts is expected to be 60% sodium nitrate, 30% potassium nitrate, and 10% miscellaneous inorganic compounds. This waste stream was generated from the liquid effluent from the second stage treatment process and is expected to be low in transuranic content.

Beryllium waste was identified as coming from Rocky Flats buildings 444, 776, or 777 and designated on the trailer load lists as containing beryllium. "It is not clear whether this material was beryllium metal, other materials that were contaminated with beryllium, or a combination of the two."

**Roaster oxide waste** is incinerated depleted uranium. It is nontransuranic waste.

**Graphite** was used as molds for certain casting operations. The plutonium was recovered to the extent practical before the graphite was disposed of. "Data from various studies and measurements indicate that this graphite waste may have some of the highest transuranic contamination levels."

Waste filters are HEPA filters. Other types of process filters may also be included in the shipments designated as filters. Some contain fine plutonium particulates.

Line-generated waste contains various waste materials removed from the plutonium-processing glove boxes, including items such as glove box gloves, combustible waste, graphite, and filters.

Combustible debris is paper, plastic, wood, and other combustible materials.

Metal debris is predominantly metallic (e.g., pipe, equipment, conduit, and empty drums) waste material.

(These last two categories were generated at both Rocky Flats and INL. In addition, the waste disposed of in the Accelerated Retrieval Project II retrieval area included miscellaneous sludge from Rocky Flats and INL. Also the Pit 4/6 retrieval project identified radioactivity in nearly all the waste, including these last two categories.)

The waste was received in a number of container types. Generally, Rocky Flats sludge was contained in 55-gal drums. The slopes of the retrieval trench intersect the waste zone with the suspected highest densities of waste. This procedure seems too discretionary, and we recommend additional excavation to capture most of the waste from a given shipment.

**Response:** The Agencies review information collected during ongoing retrieval operations to verify use of visual criteria and instrumentation and to evaluate whether to refine retrieval areas.

**(continued)** Little discussion in the Proposed Plan is equivalent in detail to the Accelerated Retrieval Project documents. We don't know exactly what areas were considered and why. For example, Pit 3 is not included in the retrieval, although this pit contains plutonium isotopes that originated from Rocky Flats. DOE[g] has stated that the volume and concentration of waste in this pit does not warrant retrieval. The Proposed Plan does not identify this or any other criteria that it used to select where and how much waste to retrieve.

**Response:** An objective of the Proposed Plan is to summarize information used to develop the Agencies' Preferred Alternative. Details are provided in the ROD.

**(continued)** We are also concerned that some waste that would seem to be a candidate for retrieval was not targeted. For example, there were shipments of fire-related waste from Rocky Flats. Two fires took place at Rocky Flats, leaving plutonium-contaminated waste. The Action Memorandum for the Accelerated Retrieval Project engineering evaluation/cost analysis stated that: "Special notations were used to identify the waste on the disposal records. These records indicate the fire waste was buried in Pits 10, 11, and 12. The majority of the fire waste was later retrieved from Pits 11 and 12, starting in 1974, and was then placed in the Transuranic Storage Area. Remediation of the remaining fire waste will be determined in the OU 7-13/14 ROD." Yet, it is still not clear whether this waste is targeted for retrieval.

**Response:** Targeted waste was defined to optimize recovery of transuranics, uranium, and solvents. Fire waste is largely debris (e.g., glove boxes and machine tools), but does include some targeted waste (e.g., filters). The defined 5.69-acre area includes two portions comprising 0.96 acres in Pit 10. These areas in Pit 10 contain high concentrations of targeted waste that is collocated with debris from the Rocky Flats Plant fire.

**(continued)** The Proposed Plan states that during retrieval, other types of waste could be revealed that are not targeted waste. Some of this waste may be retrieved if the Agencies agree that retrieval is

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g. Please note that when we (Snake River Alliance) refer to DOE, we include DOE cleanup contractors.

warranted and—as determined through visual inspection or field screening—the subject waste meets the following three criteria: (1) waste poses a potential risk of contamination to the underlying aquifer if left in place, (2) potential risk is sufficient to warrant removal at that time rather than leaving it to be addressed by OU 7-13/14, and (3) waste can be managed safely using the personnel, facilities, and equipment readily available at INL for retrieval of targeted waste stream. These three criteria are somewhat confusing. For example, what does it mean by "rather than leaving it to be addressed by OU 7-13/14"? Will each of the Agencies review nontargeted waste that is revealed and make independent decisions?

The Agencies continually monitor waste retrievals to ensure that waste exhumed is waste that was expected. Criteria for identifying additional targeted waste were established to ensure that if something unexpected is found it is appropriately considered for removal.

In our opinion, criteria for targeted and nontargeted retrieval should be very clear and decisive, and fully vetted among the Agencies and the public. Below, we have posited some additional criteria, decision factors, and questions that should be used or answered to determine waste retrieval:

**Response:** Criteria for targeted and nontargeted waste were determined by the Agencies and presented to the public through meetings related to Accelerated Retrieval Project non-time-critical removal actions.

| | |
|---|---|
| • Reduction of source term as a function of cost and time (benefit/cost analysis) | • The ROD includes this information. |
| • Removal of transuranic uncontainerized waste (waste that is no longer in containers because of container failure) | • Containers are not necessary for effective waste identification. |
| • Removal of waste that cannot be identified because of poor markings or package deterioration | • Markings or packaging is not necessary for effective waste identification. |
| • Reduction of potentially mobile radionuclides (some INL waste) | • Source reduction of nontargeted waste forms was evaluated under Alternative 5 (full retrieval). This analysis led to the Agencies' proposal to grout mobile forms of technetium-99 and iodine-129 as an extra protective measure. The grouting component provides relatively near-term isolation of the waste pending completion of targeted waste retrievals and installation of the surface barrier over the SDA. |
| • Identification of waste where there is an alternative disposal pathway | • All targeted waste has an identified path to disposal. |
| • Reduction of co-contaminants that could mobilize radionuclides (e.g., solvents, acids, oxidizers) | • The vast majority of the remaining solvents are in targeted waste. Facilitated transport attributable to collocation of other chemicals is not evident. |

| | |
|---|---|
| • Removal of liquids found in containers, or adding sorbent and removal | • Management of liquids will be described in the remedial design/remedial action work plan. |
| • Management or removal of large items covering waste | • The Agencies conclude that removal of large objects beyond the limits of the excavator is not necessary. |
| • Waste in close proximity to gamma fields that may increase risk of exposure | • The ROD describes this process. |
| • Procedures for waste that is targeted but not found | • The ROD describes this process. |
| • Procedures for removing waste that cannot be identified through physical appearance, including how to remove waste that is clearly of concern but is mixed with soil or is inaccessible | • The targeted waste approach is based on visual criteria. If waste is indeterminate, it is placed in a tray and evaluated using screening tools. When targeted waste is mixed with soil, the soil also is removed. |
| • Removal of waste from Rocky Flats Plant fires | • Some targeted waste types (e.g., filters) include waste from the fire and some targeted waste is collocated with fire waste. In general, fire waste is not targeted because it is largely debris (e.g., large glove boxes and machine tools, such as lathes). |

**(continued)**
c. [sic] The precise locations of the planned retrievals should be delineated, as well as evaluating an alternative that removes a larger amount of waste than 4.8 acres, but is not the total retrieval of the entire SDA.

**Response:** The ROD includes a map of targeted retrieval areas (see Figure 13). Numerous retrieval scenarios have been evaluated by the Agencies, who determined that a minimum volume of 6,238 $m^3$ will be retrieved from a minimum of 5.69 acres with the need for additional retrievals, if necessary, determined pursuant to CERCLA. This remedy provides additional protection to address some uncertainty and provide the Agencies with confidence that the Selected Remedy will provide long-term protection.

**(continued)** The Proposed Plan states, "When issued in 2008, the ROD will identify all retrieval locations included in the final remedy." In our opinion this is too late to make a considered comment. The precise location of anticipated targeted retrieval needed to be incorporated into the Proposed Plan, for a number of reasons. We cannot comment about a removal where we don't have the complete facts.

**Response:** Public comments were reviewed and considered in development of the ROD. The ROD specifies precise locations for retrieval of targeted waste.

**(continued)** Also, the Feasibility Study evaluated two options for partial retrieval: one for 2 acres, another for 4.0 acres. Both options added the existing retrieval activities at Pits 4 and 6 (0.8 acres). What was missing was an option that included a larger area. Because the 4.0-acre retrieval will be a removal action, we recommend that the ROD should leave open the possibility of removing a larger area. We note that in a recent Freedom of Information Act request, the Alliance was provided a letter that included a statement that if remediation was extended to cover 5.6 acres (not including the 0.8 acres from Accelerated Retrieval Project II), it would extend the date when low-level waste operations had to end (2018).[h]

**Response:** A minimum volume of targeted waste of 6,238 $m^3$ will be retrieved from a minimum of 5.69 acres. DOE is terminating contact-handled waste disposal in the Low-Level Waste Pit in 2008. However, the Low-Level Waste Pit could continue to receive remote-handled waste until full or until operations interfere with construction of the evapotranspiration surface barrier.

**(continued)**

c. [sic] INL should investigate additional protective measures to immobilize nonretrieved waste and areas around the waste pits and trenches.

Waste that is exposed, but not removed, should be subject to study to determine whether amendments should be added to immobilize the waste forms. If the bottom of the pit is exposed, injecting grout at pressure may provide an extra layer of protection. Stabilization amendments, such as apatite, should be added to all areas excavated to slow mobility of the waste that remains in the pits. Recent studies at Yucca Mountain provide chemical evidence of radionuclide precipitation as a likely mechanism for naturally enhanced radionuclide retardation in the Yucca Mountain unsaturated zone. Increased pH and temperature were both factors that enhanced mobility of radionuclides. Other studies have shown that biological reduction of radionuclides can enhance retardation.[i]

**Response:** Construction of an evapotranspiration surface barrier will protect human health and the environment. Contaminants will be effectively contained. The Agencies have included targeted retrieval and in situ grouting to provide additional protection and address uncertainty. Risk assessment does not justify further action to immobilize nontargeted waste. Modifying geochemical conditions in the SDA poses substantial risk of inadvertent consequences. Analysis of soil gas in Pit 4[54] suggest that reducing-conditions currently exist in portions of the buried waste; however, heterogeneity in the nature and extent of buried waste forms precludes definitive assessment of geochemical conditions at any one location in the SDA. Information does not support reactive chemistry modeling or other ways to assess potential consequences of modifying local chemistry. Therefore, any suggestion that amendment of waste types or manipulation of geochemical conditions would be generally beneficial is highly speculative. Common additives (e.g., Portland cement) could increase local soil pH and accelerate the migration of uranium. Amendment of organic waste to accelerate degradation of volatile contaminants of concern could accelerate migration of toxic metals, including uranium. Use of hydroxyapatite has been proposed for in situ sorption of actinides in nuclear waste repositories; however, use of hydroxyapatite for environmental remediation has been extremely limited, and this process option is neither mature nor commercially available. In conclusion, introducing exogenous materials (i.e., additives) into the SDA following removal of targeted transuranic waste is not necessary to reduce risk and could, in fact, compound the problem by causing unforeseen changes in local chemistry in this highly heterogeneous situation.

**Comment SRA-2: Grout:** The purpose of the grout is to stabilize iodine-129 and technetium-99, both activation products from nuclear research or operations. Both of these radionuclides are highly mobile. The areas to be grouted are either in trenches or in soil vaults. We have numerous concerns about the

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h. Letter from Ronald Slotke, CWI [CH2M WG Idaho, LLC], to Wendy Bauer, DOE [U.S. Department of Energy], February 5, 2007, see page 2 of attached Cost Estimate Support Data Recapitulation.

i. See "Biotransformation of Radioactive Waste: Microbial Reduction of Actinides and Fission Products," *Journal of Nuclear and Radiochemical Sciences,* Vol. 6, No.1, pp. 17–20, 2005.

in situ grouting. We do not believe that enough is known about how the grout (using cement) will hold up over time. We recommend that all types of grout be investigated before a final a decision is made.

**Response:** Many years have been spent studying the performance of various grout formulations. For examples, see References 12, 19, and 56. The resulting information led to the proposal to implement in situ stabilization. Because grouting is an interim and additionally protective measure, it is not necessary for grout to maintain complete integrity indefinitely. Technical reviews and analysis will be conducted during the design phase to ensure that the best grout mix is implemented.

**(continued)** Our concerns about the solidification and stabilization techniques, of which grout is a major technique, are as follows:

| | |
|---|---|
| • Future use of the site and environmental conditions may erode the materials used to stabilize contaminants, thus affecting their capacity to immobilize contaminants. | • The surface barrier is the primary line of defense. |
| • Very little data exist to support solidification and stabilization products' durability over their indefinite disposal life. Long-term monitoring is necessary to ensure that contaminants have not been remobilized. | • Long-term monitoring is a critical element of the Selected Remedy. |
| • Certain waste streams are incompatible with variations of this process, and each application must be carefully tested for long-term compatibility before it is used. | • Grouting studies have been completed, and information to select a grout is available. |
| • When radioactive contamination is present, other types of hazardous waste (e.g., organic chemicals) may interfere with solidification. Treatability studies are needed to demonstrate that the solidification and stabilization process works in this specific environment. | • Grouting studies have already been completed. |
| • With in situ solidification and stabilization, consideration must be given to any debris, such as barrels, metal scrap, and wood pieces, that may interfere with the solidification process. | • Debris is not an impediment when using jet-grouting techniques. |

**Response:** Numerous preremedial design studies have been performed to confirm technical applicability and field implementability of in situ stabilization for known waste forms within the SDA.[16,17] Many of these studies focused on stabilization of Rocky Flats Plant waste forms that could pose difficulties for use of Portland cement-based grouts (i.e., nitrate salts and organic sludge). In contrast, grouting included in the Selected Remedy is focused on interim stabilization of INL Site reactor operations waste containing mobile fission products (e.g., technetium-99 and iodine-129). The grouting component provides relatively near-term isolation of the waste pending completion of targeted waste retrievals and installation of the surface barrier over the SDA. INL Site reactor operations waste was disposed of separately from Rocky Flats Plant waste; therefore, waste forms that might interfere with in situ stabilization are not anticipated in disposal locations identified for in situ stabilization. Grouts used for in situ stabilization will reduce mobility for hundreds of years, greatly exceeding the time needed to complete targeted waste retrievals and construct a surface barrier. Therefore, early in situ stabilization of specific disposals of INL Site reactor operations waste provides defense-in-depth because the surface barrier will inhibit infiltration and consequent migration of all mobile contaminants once it is completed. The Agencies will evaluate current technologies and use the best available design.

**(continued)** We also note that it is estimated that grout would only immobilize 50% of the releasable technetium-99. Notwithstanding our concerns about grout, we do recognize that it may provide some short to medium-term protection. Therefore, we recommend that grout (i.e., in situ grouting) be applied liberally and that all or most of the releasable technetium-99 be located and treated. If this cannot be accomplished, please explain the reasons in detail. We also recommend that the grout operations be implemented as soon as possible.

**Response:** Mobile technetium-99 and iodine-129 are scattered throughout the SDA. Most waste forms with technetium-99 and iodine-129 contain very low concentrations (see Figure 4-16 on page 4-55 of the RI/BRA).[20] Grouting 100% would require treating almost all trenches and soil vaults, most of several pits, and portions of other pits. The Selected Remedy includes in situ grouting of approximately 0.2 acres in high-density areas of mobile technetium-99 and iodine-129 as an additional measure of protection to address uncertainty. The grouting component provides relatively near-term isolation of the waste pending completion of targeted waste retrievals and installation of the surface barrier over the SDA. However, the primary line of defense is the evapotranspiration surface barrier. Grouting a portion of the mobile technetium-99 and iodine-129 will reduce mobility in the interim while targeted waste retrievals are under way. Schedule details will be developed during remedial design.

**(continued) Cover System:** We endorse the evapotranspiration cover if it is tested properly before installation and meets critical requirements. At Rocky Mountain Arsenal outside Denver, a similar cover is being put in place. Rocky Mountain Arsenal tested various seed mixtures, soil depths, slope, and irrigation measures to establish a vegetative cover. Each test plot was built over a large lysimeter (a device used to measure the degree of infiltration). A design was decided upon after three growing seasons. Before the decision is reached to install an evapotranspiration cover over the SDA, test covers should be developed for "proof of performance." We note that there are no performance criteria in the Proposed Plan, although this would be useful information. Presumably, this will be left to the design phase, although performance criteria would be useful for the public.

**Response:** Two demonstrations of surface barrier performance at the INL Site suggest a monolithic evapotranspiration barrier constructed of native soil would meet all performance requirements, including maintainability and long-term performance. The Engineered Barrier Test Facility, constructed immediately adjacent to the SDA, tested the performance of thick (i.e., monolithic) soil and capillary break barrier designs.[26] Test regimens included evaluation of performance under extreme rainfall (e.g., flooding event) and without vegetation (e.g., analogous to a post-fire event). Barrier performance rapidly recovered after intentional breakthrough events. The Protective Cap/Biobarrier Experiment was constructed immediately north of the Idaho Nuclear Technology and Engineering Center by the Environmental Surveillance, Education and Research Program. The experiment assessed performance of monolithic evapotranspiration barrier designs over a 7-year period.[27] The experiment also evaluated the effectiveness of capillary break biobarriers placed shallow and deep within the evapotranspiration barrier. All designs tested in the experiment easily met performance criteria equivalent to those required for RCRA barriers. Experimental results from both projects were used to develop a preliminary design for an engineered surface barrier at the SDA[28] consistent with EPA's recommendations for alternative covers for landfills and waste repositories (see http://epa.gov/ord/NRMRL/news/news072007.html.[57])

**(continued)** In our opinion, if the evapotranspiration barrier cannot be shown to prevent water from infiltrating the waste, then one of the alternative cap designs should be reconsidered. This includes the modified RCRA cap that is evaluated in the Feasibility Study or the Hanford Cap (a nine layer cap that is 15 ft thick). There is no reason to select one now, as it will take several seasons to determine if the evapotranspiration cap can "prevent" infiltration. The timeline for construction of the cap allows for at least five growing seasons.

**Response:** The word "inhibit" is used to describe surface barrier performance with the expectation that the surface barrier will prevent infiltration in most circumstances. A limited amount of infiltration in extreme events would not compromise long-term protection.

**(continued)** The most important factors for success of the evapotranspiration cover are precipitation and the atmospheric parameters that influence evapotranspiration. In cold climates where transpiration is essentially nonexistent during the winter, a cover should be capable of storing all or most of the precipitation that occurs during that period. We recommend using extreme event precipitation data for that period, as well as other events that are likely to stress the system. For example, the scenario that would stress the system the most is if there were heavy spring rain with subsequent increased vegetation, followed by a summer wildfire and heavy snowfall with sudden melt. The cover should be designed for such an extreme event. We suggest that the ROD lay out as many design features and parameters (e.g., performance criteria) as possible, understanding that this will be comprehensively addressed in the remedial design.

**Response:** Contouring to promote run-off is a critical element of surface barrier design, perhaps even more important than storage capacity when frozen ground precludes infiltration. The ROD provides sufficient design detail to justify the Selected Remedy and develop +50% to -30% cost estimates, as specified in CERCLA guidance.

**(continued)** The Alliance also recommends that every effort be taken to begin the cover at the soonest possible time. It appears that the targeted retrieval is the critical path item, but after grouting operations are completed (2013), construction of the cover could begin on the western half of the SDA. Design and foundation preparation may overlap grouting. DOE has told the public that as soon as it can get the cover on, it will prevent water from getting into the waste, with a subsequent decreased risk of waste mobilization.

**Response:** Getting the surface barrier on as quickly as possible is desirable, and options for implementation of a phased approach during construction will be evaluated during remedial design.

**(continued)** It is also important to note that as Rocky Mountain Arsenal has been cleaned up, contractors have uncovered additional contaminants (nerve agents) on the site. This highlights the point that large areas of INL are not characterized for contamination. If borrow soil for the landfill (evapotranspiration cover) is going to be taken from the INL Site, there should be a sampling regime in place to see that soil is not contaminated and workers are not exposed.

**Response:** Borrow sources are "approved" before materials are transferred.

**Comment SRA-3: Pad A:** Pad A was constructed within the SDA in an area unsuitable for subsurface disposal. A considerable amount of waste is stored on Pad A, estimated at 20,000 cartons, boxes, and drums. Waste contains uranium, nitrate salts, and "roaster oxides" (i.e., small pieces of uranium metal that can burst into flames when exposed to air). It is assumed that most of the containers are already breached. In an earlier "removal action," Pad A was covered, making Pad A 30 ft higher than surrounding pits.

The Proposed Plan addresses Pad A by leaving the waste in place and most likely compressing it. After stabilization, it will be covered by the evapotranspiration cap. This will be accomplished using "a combination of methods to be determined during the remedial design." The Proposed Plan also states that "some design and testing may be required to develop an optimal strategy for addressing subsidence of Pad A and the pit areas" (p. 29).

The planned approach for Pad A is much too vague to enable the public to provide a considered recommendation. The option selected would most likely entail compressing the cover substantially. This option runs the risk of spreading uranium waste in an uncontrolled fashion. The RI/BRA identified technetium-99 at a high concentration (1,480 pCi/L) in a lysimeter below Pad A. [**Response:** This anomalous detection was outside of SDA to the south, not near Pad A.] If technetium-99 is coming from Pad A, which the RI/BRA suggests, then spreading it in an uncontrolled fashion will exacerbate its migration. During public comment on the Accelerated Retrieval Project, DOE stated that methods used to retrieve waste will minimize the mixing of waste with soil and will significantly reduce the spread of radiological contamination. It is important that this be a goal for any stabilization of Pad A.

**Response:** Minimizing spread of contamination is a goal, both to protect workers and to provide long-term protection. DOE and ICP promote as-low-as-reasonably-achievable principles and plan and implement work accordingly.

**(continued)** An alternative may be to solidify the waste, remove it to the Idaho CERCLA Disposal Facility, and treat it as one waste stream. Another option may be to monitor any movement of the contaminants in the subsurface, while injecting and mixing soil amendments (e.g., apatite) to the waste mass to reduce its potential mobility. For example, at the Lawrence Livermore National Laboratory Pit 7 complex, DOE evaluated building a permeable reactive barrier wall made of fish bone char (hydroxyapatite) to reduce uranium in groundwater. We envision a similar system to prevent lateral and vertical mobility of uranium in soil around Pad A.

**Response:** Risk assessment does not lead to a conclusion that such measures are necessary. To provide a stable foundation for the evapotranspiration surface barrier, potential subsidence of pits, trenches, and Pad A will be addressed using methods to be determined during remedial design. Pad A then will be incorporated into the surface barrier. Also see the last paragraph of the response to SRA-1 regarding geochemistry.

**(continued)** In any event, because every approach for Pad A involves a good deal of uncertainty and/or risk, it is unfortunate that the alternatives were not discussed in the Proposed Plan. They should, therefore, be discussed in detail in the ROD.

**Response:** Alternatives are summarized in the ROD. Details are in the Feasibility Study, with evaluated options ranging from no action to complete removal. The Selected Remedy includes a combination of compaction techniques (e.g., preloading, proof-rolling, and vibratory compaction) to mitigate potential future subsidence of Pad A and pits. A post-ROD treatability study will support remedial design by identifying the optimal combination of compaction techniques for the SDA and determining where those techniques will be applied.

**Comment SRA-4: Low-Level Waste Disposal:** Several thousand cubic meters of low-level radioactive waste are disposed of in the SDA each year. Under the Performance Management Plan, the goal is to continue disposal of contact-handled low-level waste through the year 2008 and to continue disposal of remote-handled low-level waste through the year 2009. The Feasibility Study confirmed this. The Proposed Plan states that the Low-Level Waste Disposal Pits are scheduled to operate until 2015. The reason for the change in the closure dates is not detailed in the Proposed Plan and should be discussed.

**Response:** The change is to promote maximum usage of the available facility while alternative disposal paths are being developed for remote-handled waste. This information is included in the ROD.

**(continued)** As we have already indicated, the Alliance received information regarding the life-extension of Low-Level Waste Pits – specifically for the remote-handled waste. Continued operation is of some concern. As this Proposed Plan presents a closure plan, disposing of additional material (for another 8 years) creates a level of risk that was not analyzed in the RI/BRA, and may create problems with the timing of implementing the remedy. We have questions pertaining to how DOE will incorporate new information that will surely arise as a result of continued operations. Will final closure of the remote-handled waste-vaults be subject to community and regulatory review before a final cover is emplaced?

**Response:** The RI/BRA included the projected source term for the Low-Level Waste Pit. DOE will carefully evaluate any proposed disposal that exceeds the source term considered in the RI/BRA to ensure that the Selected Remedy will remain protective. Given the conservatisms in the RI/BRA that tend to overestimate risk, keeping the Low-Level Waste Pit open is not expected to jeopardize conclusions. Final closure of remote-handled waste vaults is included in the Selected Remedy for the entire SDA. Hence, the Proposed Plan and ROD provided community and regulatory review. The Agencies also will participate in remedial design.

**(continued)** The Alliance recommends that the Low-Level Waste Pits be closed on the schedule consistent with that stated in the Feasibility Study. If not, the Baseline Risk Assessment should be amended. In addition, we are concerned that the reasoning behind the extension of the Low-Level Waste vaults would set a precedent, and may lead to further delay. Remote-handled low-level waste will be generated at the site for some time, but if there is no alternative pathway, the generator will place pressure on the cleanup project to extend keeping the Low-Level Waste Pits open.

**Response:** The Baseline Risk Assessment included projected disposals in the Low-Level Waste Pit.

**(continued)** When we analyzed the Proposed Plan, we asked the question whether the cover could be started earlier. The targeted removal is the critical path item, but after grouting operations are completed (2013), construction of the cover could begin on the western half of the SDA. DOE has told the public that as soon as it can get the cover on, it will prevent water from getting into the waste. That said, if the Low-Level Waste Pits, which are in the southwestern section of the SDA, remain open, there would be little reason to begin sooner. The 2015 shutoff date for the Low-Level Waste Pits is meant to allow time for preparation of the cover foundation.

**Response:** The western half of the SDA includes Pits 1 and 2, portions of which are identified for targeted waste retrieval. Pits 1 and 2 most likely will be excavated near the end of the retrieval campaign. The active Low-Level Waste Pit (i.e., Pits 19 and 20) is in the *eastern* portion of the SDA. The Low-Level Waste Pit will be closed before its operation interferes with constructing the surface barrier. Nonetheless, getting the surface barrier on as quickly as possible is desirable, and options for implementation of a phased approach during construction will be evaluated during remedial design.

**Comment SRA-5: OCVZ Cleanup:** Carbon tetrachloride has been detected in the aquifer slightly above the MCL, but concentrations appear to be leveling off, which may be the result of vapor vacuum extraction by the OCVZ (i.e., OU 7-08). It is important to continue this extraction, as it is noted that some organic chemicals make the radionuclides more mobile in the environment. We are also concerned about catalytic destruction of organic compounds, which in some cases could lead to the creation and emission of dioxin and furans. Dioxin and furans are some of the most toxic substances known to man. As opposed to organic compounds that are toxic at the parts per billion levels, dioxin and furans are toxic at the parts per trillion levels.

Formation of these compounds is a complicated chemical process. It must include a chlorinated compound, such as carbon tetrachloride. DOE representatives have stated that they use state-of-the-art continuous air monitoring systems, and none of these compounds have been detected. The treatment facility is expected to run for another 20 years. Even if these products are not generated, continuous air monitoring and regular maintenance of the facilities is mandatory. In addition, at some point, the system will have to be optimized, which may entail developing additional extraction points. The cover must be designed so that optimization of this system can occur.

In addition, several chemical reagents and biological amendments break down chlorinated compounds such as carbon tetrachloride in groundwater and soil. INL did not consider any enhancements to the soil that could help in breaking down the carbon tetrachloride before it reaches the aquifer. These could be biological enhancements like injecting hydrogen or oxygen compounds (leading to more rapid biological breakdown), chemical enhancements that directly break down chlorinated compounds (in situ chemical oxidation), or even reducing agents such as ferrous iron (used in permeable reactive barriers), and chemical additives (e.g., sodium dithionite) that reduce naturally occurring iron in the soil into ferrous iron. We recommend that INL study these techniques to determine if any will enhance the vapor extraction system.

**Response:** Continued vapor extraction is included in the Selected Remedy, and monitoring and maintenance are routine requirements for OCVZ operations. Biological and chemical enhancements were not evaluated because ongoing extraction and source removal are expected to meet remediation goals. Modifications to the OCVZ system to accommodate surface barrier construction are included in the Selected Remedy. However, the existing system includes extraction points that are not currently in use. If necessary, based on 5-year reviews, additional extraction points can be activated. A complete feasibility study was prepared under OU 7-08.[58] Enhanced extraction was evaluated, but not selected. Ongoing extraction and source removal are expected to meet remediation goals without enhancements.

**Comment SRA-6: Long-Term Monitoring and Stewardship:** Long-term stewardship activities must be designed to maintain the integrity of the remedy, prevent intrusion, memorialize the site in-perpetuity, as well as monitor the site so that contaminants are detected well before they reach the aquifer. INL has developed a Long-Term Stewardship Strategic Plan.[59] This plan adopts the following definition of long-term stewardship:

> …long-term stewardship refers to all activities necessary to ensure protection of human health and the environment following completion of remediation, disposal, or stabilization of a site or a portion of a site. Long-term stewardship includes all engineered and institutional controls designed to contain or to prevent exposures to residual contamination and waste, such as surveillance activities, record-keeping activities, inspections, groundwater monitoring, ongoing pump and treat activities, cap repair, maintenance of entombed buildings or facilities, maintenance of other barriers and containment structures, access control, and the posting of signs.

However, neither the Proposed Plan nor the Long-Term Stewardship Strategic Plan contains substance or specificity about particular elements of long-term stewardship and monitoring. We recommend that the ROD contain specific measures and commitments about how this program will be implemented. In addition, the Strategic Plan should be updated and made specific to the RWMC. We have highlighted the following three elements of long-term stewardship: monitoring, remembering activities at the site, and maintenance.

**Response:** The ROD outlines long-term institutional control requirements for OU 7-13/14. These requirements will be defined in detail in the OU 7-13/14 remedial design/remedial action work plan and integrated with INL Site-wide long-term institutional control.

a. **Monitoring:** Leaving contaminants with a long-life span in the subsurface requires that they be monitored for potential mobilization long before they present a health hazard (e.g., contaminating the Snake River Plain Aquifer). At most CERCLA sites the responsible party states how it will monitor the site after the remedy is selected. Because this is such a crucial element to the remedy, we recommend that a monitoring and contingency plan be developed prior to remedy implementation that specifies how DOE will monitor the site over the long term and what it will do in case of contingencies. A contingency plan would describe how DOE and regulatory agencies plan to address foreseeable problems, including routine, long-term contingencies and uncontrollable events (e.g., severe flooding) that could affect the stability of the proposed remedy. Potential contingencies can be divided into Technical Contingencies (e.g., failure of grout, an increase in contaminant detections in the vadose zone), Logistical Contingencies (e.g., changes in personnel, funding, or land or building use), and Regulatory Contingencies (e.g., significant changes in regulatory standards or redefinition of the roles and responsibilities of the different responding agencies). We also recommend that DOE provide an outline in the final ROD of how it intends to monitor the site after it is covered.

**Response:** Monitoring plans for the vadose zone and aquifer are already in place. These plans are modified, as needed, to accommodate changing conditions and priorities. Contingencies, if they arise, will be addressed during 5-year reviews. The ROD outlines long-term monitoring.

**(continued)** The monitoring plan should be robust and transparent, and the public should be involved in the development of the plan and have access to the monitoring data. Several types of sensors that measure mobility of radionuclides and changes in moisture in the subsurface are either in development or in use. We suggest that because the entire 97-acre area will be covered, the interstitial area between the 35-acre waste disposal area and the boundary of the cover be used for redundant moisture detectors and sensors. For example, electrochemical sensing wire cables could be installed to sense moisture coming through the cap. Numerous monitoring methods are described in a 2004 EPA document.[60]

**Response:** The Agencies participate in developing monitoring plans. They help determine type and frequency of monitoring as well as analytical priorities for small sample volumes. These plans are publicly available.[9,10] Monitoring data are reported in externally available annual reports,[61,62] and raw data are available on request.

b. **Preventing intrusion and memorializing the site:** The Proposed Plan includes institutional controls, although it does not detail how the controls will be implemented and enforced. We assume they will be designed to prevent intrusion, restrict well drilling, and notify potential residents that may live near the site. In the past, institutional controls have been violated or ignored. It is important that if DOE is going to rely on institutional controls, it make a commitment to track them and enforce them for the life of the contaminants. Long-term public involvement should be encouraged to enforce these controls. EPA and the National Academy of Sciences have recommended that institutional controls be layered and redundant. The Alliance agrees.

**Response:** The Agencies will establish institutional controls for OU 7-13/14, which ultimately will combine with the INL Site-wide long-term institutional control program. DOE will continue to manage these controls or transfer them in accordance with CERCLA requirements for federal facilities.

**(continued)** However, we cannot emphasize strongly enough that for the long-term, other measures need to be taken to memorialize the site. At the Alliance public meeting in Idaho Falls, one audience member suggested that there is little reason to believe that institutional controls will be effective over the long term. Alternatively, he suggested that as a society, we remember where we have buried our dead. Religions have lasted. Native Americans remember their sacred sites. It is, therefore, important that DOE take to heart some of the principles that the National Academy of Sciences recommended for long-term stewardship.[63] In particular, a core principle is to develop appropriate and substantive incentive structures, including long-term funding and encouragement of active community participation. This could involve funding memorials such as a museum at the site. (A museum of this sort has been one of the hallmarks of the Weldon Spring Long-Term Stewardship program. Weldon Spring is a large site in Missouri that processed uranium. A landfill cap covered the site.) The Shoshone-Bannock tribal headquarters at Fort Hall could also be a repository of information, if funded adequately.

**Response:** Long-term institutional control of RWMC will involve site surveillance (e.g., routine visits to note cracking, subsidence, or other observable degradation of the surface barrier), maintenance (e.g., repairing and replacing signs and fences), monitoring (e.g., collecting and analyzing aquifer samples), and institutional controls (e.g., access and land-use restrictions) following completion of the Selected Remedy. DOE will continue to manage long-term institutional control at the INL Site, including RWMC, until (if ever) INL Site land is transferred to another authority, in accordance with CERCLA requirements for federal facilities.

c. **Maintenance of the site:** The site should be maintained to protect the engineering controls. However, normal inspection and repair are not sufficient over the long term. There must also be a continuous undertaking to develop additional scientific and technical information. As we learn new techniques for contaminant reduction and better ways to isolate the waste, the remedy should be adapted to incorporate them.

**Response:** Long-term institutional control includes surveillance and maintenance, but continued research to develop additional scientific and technical information is not within the scope of the Selected Remedy. The Agencies will review new methods and technologies that become available if, during a 5-year review, it is determined that the remedy is not effective.

**Comment SRA-7: Inconsistencies in information:** Several inconsistencies appear in the RI/BRA and the Feasibility Study that may be of concern. First, the risk assessment is slightly different between the two documents. Please highlight and explain the differences.

**Response:** Section 7.2.3 of the RI/BRA concluded that several refinements to risk assessment should be implemented to support development of the feasibility study. These refinements were executed as summarized in Section 1.4.2 and described in detail in Appendix D of the Feasibility Study.

**(continued)** Second, Table 1-3 in the Feasibility Study identifies the pits as being the destination of all the Rocky Flats Plant waste. Table 3-15 in the RI/BRA identifies Trenches 1 through 10 and Trench 32 as also receiving Rocky Flats Plant waste. Other documents state that Trenches 11 through 15 may include Rocky Flats waste. Some of the reported volumes of the above referenced trenches are significant. Please resolve these inconsistencies, and explain if they had any bearing on the decision to retrieve waste only from the pits. Also, please identify what types of waste were deposited in the trenches, if different from the pits.

**Response:** These differences represent refinements in the source-term assessment, not inconsistencies. Table 1-3 in the Feasibility Study[13] identifies general locations of primary contaminants of concern as a basis for developing remedial alternatives. In general, most Rocky Flats Plant waste containing primary contaminants of concern is located in pits; hence, pits are listed as areas of highest concentrations for these contaminants. Inventory assessments in the 1990s expressed some uncertainty relating to waste generators associated with Trenches 11 through 15. Source-term inventory evaluations conducted to support the RI/BRA[20] concluded that Trenches 11, 13, 14, and 15 did not receive waste from Rocky Flats Plant. Shipping records are not available for Trench 12. Though some other trenches (e.g., Trenches 1 through 10) did receive waste from Rocky Flats Plant, pits are identified for retrieval because they contain the highest concentrations of targeted waste. Table 3-15 on p. 3-68 of the RI/BRA lists all the trenches along with their primary waste generators, dates of operation, trench volumes, and areas.

**Comment SRA-8: Remedial action objectives and risk goals:** The following are the remedial action goals for RWMC:

- Limit cumulative human health cancer risk for all exposure pathways to $10^{-6}$ to $10^{-4}$
- Limit noncancer risk for all exposure pathways to a cumulative hazard index of less than 1 for current and future workers and future residents
- Inhibit migration of contaminants of concern into the vadose zone and the underlying aquifer
- Prevent unacceptable exposure to biota from contaminated soil
- Inhibit transport of contaminants of concern to the surface by plants and animals.

We recommend two minor modifications. First, we propose that the first remedial action objective be changed to read "Limit cumulative human health cancer risk for all exposure pathways to *$10^{-6}$*." Second, we recommend changing the third remedial action objective to "*Prevent* migration of contaminants of concern into the vadose zone and the underlying aquifer."

**Response:** First, the generally acceptable risk range for site-related exposures under the National Contingency Plan[3] is $10^{-4}$ to $10^{-6}$. The Agencies agree that the cumulative risk threshold for OU 7-13/14 is at the upper end of this range ($10^{-4}$) based on (1) conservative approaches in risk assessment that tend to overestimate risk, (2) use of $10^{-4}$ in many other risk-management decisions across the INL Site, (3) remote location of the INL Site, and (4) land-use restrictions and institutional controls specified in this ROD. Second, the remedial action objective is to *inhibit* migration into the vadose zone and aquifer to meet the remediation goal of reducing infiltration to keep aquifer concentrations from exceeding maximum contaminant levels. Objectives and goals are so formulated because completely preventing any water from reaching the waste zone is neither necessary nor achievable over time. Localized, temporary failure of the surface barrier is a foreseen circumstance that would be addressed through surveillance, maintenance, and monitoring. The word "inhibit" is used to describe surface barrier performance with the expectation that the surface barrier will prevent infiltration in most circumstances. Limited infiltration in extreme events would not jeopardize long-term protection and is a reasonable compromise.

**Comment SRA-9: Superfund process related issues and public outreach:** Details on whether the proposed remedy is sufficient to form the necessary protection of human health and the environment are only sketched out in the Proposed Plan. This remediation project, as planned, will take 20 years to complete. Much is left for the design phase of the remedial action, with no obligation for DOE to solicit the community's opinion or make changes that would help build strong community acceptance of this project. The Alliance objects to leaving so many important decisions to the "remedial design" phase.

It is, therefore, important that the potentially affected community participate in these later decisions. Expansive public outreach for the decisions that are not articulated in the Proposed Plan is of utmost importance, because it will create public awareness and possibly broader support of the project. This outreach should include not only briefings to the Citizens Advisory Board, but also a far broader effort to bring others into the process.

The broad community should be involved in decisions that this plan leaves to later years, including:

- Non-time-critical removal actions (the third Accelerated Retrieval Project, and possible extensions of the waste retrieval area, probably next year)
- Remedial design of Pad A
- Final cover design
- Low-Level Waste Pit closure
- Decommissioning and closure of the Transuranic Storage Area
- Development of a long-term monitoring and contingency plan
- Long-term institutional controls
- 5-year reviews
- ROD amendments and explanations of significant differences
- Future adaptations to the remedy
- Development of the long-term stewardship program
- Development of criteria for shutting off the vapor extraction system.

**Response:** The Agencies have met or exceeded all requirements for public involvement established in CERCLA and the FFA/CO (see Section 3 of this ROD). Additional participation will be available through the public comment segment of Citizens Advisory Board meetings, and additional notices and briefings will be offered to the public in the future. In accordance with CERCLA, the public will have an opportunity to comment if the Agencies identify amendments to the OU 7-13/14 ROD.

# 19. TRIBAL COMMENTS

Four programs within the Shoshone-Bannock Tribes provided comments. Subsections that follow contain the comments as provided (in black) with Agency responses (in blue). Comments were not numbered, as received.

## 19.1 Director Tribal DOE Program Comments

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RE: Shoshone-Bannock Tribes comments regarding the proposed remediation plan for OU 7-13/14

**Willie Preacher, Director Tribal DOE Program, Shoshone-Bannock Tribes**

We wish to thank DOE and CH2M-WG Idaho, LLC for allowing us to comment on this OU-7-13/14 issue. I have also included comments from the Tribal Air Quality Program, the Heritage Tribal Office, and the Tribal DOE Monitoring Program.

### 19.1.1 General Comments

From the beginning, the area that is now identified as the INL Site had been used by the Shoshone-Bannock people with migratory trails to and from hunting grounds near Salmon, Challis areas, and also to the Camas prairie to procure camas roots. This area had been used for generations upon generations for this type of use. The caves and belowground lava tubes also were used for storing of food and shelter from elements while they traveled across the desert. The trails have been there for hundreds of years, and one of the trails was later identified to be the original paved highway from Rockford to Arco. When the government, in the 1940s, condemned this area, the Tribes did not understand why and for how long; now it seems that Tribal people will never use this land again. The above soil has been contaminated over years of testing, and now the water below is affected.

We applaud the amount of cleanup that has been done at the site, but the Tribes feel that DOE and the contractors have determined the end state for the INL Site without any type of consideration from Tribes or stakeholders. There is an enormous push to decontaminate and decommission all the facilities, whether it is to demolish, remove, or cap and leave in place the contamination. The initial discussion given to the Tribes in 2003 gave the Tribes the indication that all the contamination would be cleaned up or removed. Now, it looks like the answer is to cap any areas that may have some contamination in the subsurface, regardless of the levels of contamination.

**Response:** OU 7-13/14 comprises RWMC. The Agencies have extended numerous opportunities to the Tribes and stakeholders to receive briefings, tour RWMC, attend Citizens Advisory Board meetings, and make comments on the Preferred Alternative. We have respected the Tribes' relationship and have provided opportunities to discuss the proposed actions with the Tribes prior to discussions with the public. Sitewide issues are not within the influence of the remedy for RWMC.

**(continued)** Above all, DOE has indicated that protection of the aquifer was of the highest priority to the INL, but we feel that capping does not fully protect the aquifer. We feel that risk modeling does not accurately determine if the aquifer will be protected. Nature has its way of doing its thing, and as the current weather and nature conditions are today, it is evident that seasons may change, and the current modeling may not be accurate in the future. This area is prone to an enormous amount of seismic activity, which may in turn affect what has been left underground.

**Response:** Constructing a surface barrier to reduce infiltration is an important feature of the Selected Remedy for protecting the aquifer. The longer it takes to construct the surface barrier, the more contaminants may migrate downward. In fact, full retrieval is less protective of the aquifer in the near term because full retrieval would require decades to complete. The Agencies conclude that a surface barrier (along with continued removal of solvents from the subsurface) will fully protect the aquifer, based on several lines of evidence, not just modeling. These lines of evidence include retrieval demonstrations, laboratory studies, environmental monitoring, seismic analysis, and literature studies. However, the Agencies also recognize uncertainty and selected a remedy that goes beyond just meeting requirements to address uncertainty and ensure that the Selected Remedy will be protective in the future. Effectiveness of the remedy will be reviewed every 5 years. If the remedy is shown to be inadequate or a protective measure fails (e.g., the surface barrier), the Agencies must take action.

**(continued)** As we all know, the yearly weather conditions have been changing globally. Spring or thaw run-off from heavy snows may happen within only a number of years, and based on modeling, may not affect the contamination in the perched layers of water. But the contamination is going to be there for a long period of time, and heavy seasons may have an impact on the perched layer. The years for protecting and monitoring until the risk is at an acceptable level is based on a 100-year administrative control mechanism, but the contamination will last much longer than that.

**Response:** DOE will maintain administrative control beyond 100 years. The site would not be released until a 5-year review concludes that the land qualifies for unrestricted use. Because of the long-lived radionuclides in buried waste, RWMC will never qualify. The 100 years was used only as a basis for modeling and cost estimates.

**(continued)** Future technology regarding cleanup may be developed, and we would accept that to be an option for a remedy if it may eliminate or further protect the aquifer. We would also like to see a yearly update on what the test results have been on monitoring of the contamination. Currently, the Tribes and DOE have addressed the issue of a Tribal program to also take part in sampling and monitoring the contaminated areas.

**Response:** Future technology developments will be considered if, during 5-year reviews, the Agencies conclude the Selected Remedy is not effective. Currently, RWMC-specific monitoring reports are published every year.[61,62] Future reporting requirements will be detailed in the remedial design work plan to be developed after the ROD is finalized. DOE expects to maintain the current, cooperative relationship with the Tribes. Tribal participation in sampling and monitoring is under consideration.

### 19.1.2 Proposed Plan for OU 7-13/14

The Shoshone-Bannock Tribes have indicated to DOE that this SDA area that sits above the aquifer on the further southern boundary of the INL Site needs to be cleaned and removed from this area. The issue of only removing targeted waste and leaving others behind does not make sense if you honestly intend to protect the aquifer. It seems that you only want to remove waste in Pits 4, 6, and maybe others, but we feel that many other contaminated waste and chemicals may contaminate the aquifer, as well as the technetium-99, plutonium, and iodine, to name a few. The document indicates that the Preferred

Alternative is to cap the entire SDA with little waste removal. The public meeting should have indicated what is in all of the pits and trenches at the SDA; then they could make a more definitive judgment on this proposed cleanup plan. This issue will be ongoing for a number of years and affect generations to come.

**Response:** See response to GC-4.

**(continued)** If the Preferred Alternative is selected and the cap is placed, the Tribes request that DOE allow the Tribal DOE Sampling and Monitoring Program to sample and submit the samples for analysis along with the other Agencies to determine if the cap is performing to the best of its ability. These sample results will then be shared with the current leadership of the Shoshone-Bannock Tribe.

**Response:** A cooperative agreement is in place.[64] DOE expects to maintain the current cooperative relationship with the Tribes.

**(continued)** One other issue has raised a bit of concern as to what and where in the SDA is buried waste? There has been analysis of uranium in one of the wells near Pit 4, and at a recent Tribal meeting with DOE, the question was raised as to where it came from. We still have not had a response to that question.

**Response:** Uranium in Well IE6 is likely from buried waste. A sample is collected from Well IE6 four times a year. Uranium concentrations are not increasing at this location, and monitoring data do not clearly indicate the specific source (e.g., which pit). Monitoring to assess concentrations and possible sources will continue.

**(continued)** In closing, the Tribes feel that a serious attempt should be made to clean up all the legacy waste that has been deposited in the SDA as well as the targeted transuranic waste. Other types of waste in this area, at this time, may seem to be of no concern but may be of concern at a later date. We also feel that the cost associated with the initial recovery of nontargeted waste in the future would be beneficial later.

**Response:** See response to GC-4.

**(continued)** There is a little confusion with the concept of cleanup within DOE and the CWI contractors. The high-level waste tanks in the tank farm at the Idaho Nuclear Technology and Engineering Center facility have been cleaned thoroughly and have been highlighted nationally; but when it comes to RWMC and the SDA, the cleanup will only be done within budgetary standards and only portions identified for cleanup.

**Response:** Cleanup decisions for RWMC and the SDA have been developed in accordance with the CERCLA process. Cost is evaluated because it is one of nine criteria that must be considered (see response to GC-2). However, cost is not the most important criterion. The Agencies' Selected Remedy is a balanced approach to cleanup that will cost roughly three times more than an action that would meet minimum requirements.

## 19.2 Heritage Tribal Office Comments

Heritage Tribal Office (HeTO)
Shoshone-Bannock Tribes
Carolyn Smith, Cultural Resource Coordinator
Jo'Etta Buckhouse, Cultural Resource Technician
Larae Buckskin, Cultural Resource Research Assistant

RE: Comments Proposed Plan for Radioactive Waste Management Complex—
Waste Area Group OU 7-13/14

This plan objective is to clean up 4.5 acres of radioactive waste that is situated above the Snake River Plain Aquifer. The geology above the aquifer consists of layers of basalt rock. The plan proposes that radioactive waste trapped within the basalt layers will remain there with grout and preventing water infiltration through the ground surface. The Shoshone-Bannock Tribes are concerned with this proposed cleanup, as the aquifer is the sole source of water for southern Idaho, and water is culturally important, viewed as life-sustaining, and is considered a cultural resource. The Shoshone and Bannock people have been entrusted by our ancestors to protect and preserve our cultural and natural resources on our aboriginal lands. These resources are integral to preserving and sustaining our unique cultural heritage. Our people believe that life is a circle, and all things created are related to each other—connected to one another. This premise serves to guide our people in their interactions with the natural environment. Shoshone and Bannock people believe water is a significant resource, and it is treated in a respectful manner. Water plays an integral role in prayer, self purification, and traditional spiritual ceremonies. Water is recognized for the life-sustaining properties it holds.

### 19.2.1 General Comments

The cleanup of OU 7-13/14 is an important project, as it begins to address the buried waste present at RWMC. The concerns Heritage Tribal Office has with this project are as follows:

**Monitoring:** Monitoring programs and plans need to be robust to identify movement of radioactive contaminants; and if movement does occur, the plan will address protocol and give guidelines on how to remedy radioactive movement. This monitoring plan or contingency plan needs to be written and in place before implementation of any selected alternative.

**Response:** Monitoring plans for the vadose zone and aquifer are already in place. These plans are modified, as needed, to accommodate changing conditions and priorities. Modifications will be required based on implementing the Selected Remedy. These changes will be specified during remedial design. Contingencies, if they arise in the future, will be addressed during 5-year reviews.

**Consultation:** The Tribes have not been consulted on this project; the consultation that has occurred is in the form of project presentations. Consultation and Tribal participation is essential to a successful cleanup. Consultation is mandated under National Historic Preservation Act[65]; the National Environmental Policy Act[38]; Executive Order 12875, Enhancing the Intergovernmental Partnership[66] (October 26, 1993) (the federal government must consult with Indian tribal governments on matters that significantly or uniquely affect tribal governments); Executive Order 12898, Environmental Justice[67] (February 11, 1994) (federal government must consult with tribal leaders on steps to ensure environmental justice requirements); Executive Order 13007, Sacred Sites[68] (May 24, 1996) (federal government is obligated to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners, avoid adversely impacting the physical integrity of sites, and facilitate the identification of sacred sites by tribes); Executive Order 13084, Consultation and Coordination with

Indian Tribal Governments[69] (May 14, 1998) (places burden on federal government to obtain timely and meaningful input from tribes on matters that significantly or uniquely affect tribal communities); Executive Order 13175, Consultation with Indian Tribal Governments[70] (November 6, 2000) (the federal government shall seek to establish regular and meaningful consultation with tribes in the development of federal policies affecting tribes). The Tribes strongly disagree that general public forums are an adequate substitute for consultation. The Tribes are not ordinary stakeholders in this proceeding, and the Tribes are a sovereign nation where DOE-ID has a solemn trust obligation to the Tribes. As such, the Shoshone-Bannock Tribes request to participate in the 5-year evaluation of the project success in preventing the mobilization of radioactive contaminates, and in long-term surveillance, maintenance, monitoring, and institutional control. Consultation has the capacity to monitor the institutional controls, providing a needed "watch dog" to report violations and noncompliance of institutional controls if they should occur. The Tribes recommend that DOE-ID require consultation with the Tribes on all matters that may impact Tribal treaty rights, interests, cultural properties, or historic resource preservation.

**Response:** DOE expects to maintain the current cooperative relationship with the Tribes. The INL FFA/CO[4] entered into by DOE, DEQ, and EPA governs actions such as this OU 7-13/14 ROD. The FFA/CO establishes a formal, three-party process for deciding how to remediate OU 7-13/14, pursuant to CERCLA § 120.[71] All final cleanup decisions are reached only after evaluating, through public notice and comment, the feasibility and safety of a full range of alternatives. Under the FFA/CO, selection of the final cleanup decision for the buried waste is the joint responsibility of DOE, DEQ, and EPA. DOE has entered into an Agreement-in-Principle[64] with the Tribes that defines their working relationship and recognizes DOE's trust responsibility. The CERCLA process has provided for full participation of the Tribes; DOE and EPA, as federal agencies, are charged with recognizing and implementing their trust responsibilities to the Tribes for the INL CERCLA cleanup. DOE has provided numerous informational briefings to the Tribes and Tribal members. Tribal participation in the 5-year remedy is under consideration.

**Construction of the soil cover:** This is an essential component to prevent the migration of water through the soil to the radioactive contaminates to the aquifer. If monitoring indicates the soil cover is failing, then a protocol or guidelines are needed to address when to replace the cover with a design that will achieve the end desired result.

**Response:** Long-term institutional control of this site by the federal government will be required indefinitely along with continual maintenance and repair of the surface barrier to ensure effectiveness.

## 19.3 Tribal DOE Environmental Manager Comments

4 December 2007

Mark R. Arenaz, Idaho Cleanup Project
DOE Idaho Operations Office, Mail Stop 1222
P.O. Box 1625
Idaho Falls, ID 83415-1222

From: Richard Malloy, Tribal DOE Environmental Manager
RE: Shoshone-Bannock Tribes comments regarding the proposed remediation plan for OU 7-13/14

The Shoshone-Bannock Tribal staff has reviewed documents relevant to the proposed alternatives discussed in addition to attending the public meetings. Based on the information presented, we have reservations based in the following:

- A lack of information as to why the DOE selected only 4.8 acres for removal
- An apparent contradiction in the information presented as to the location of transuranic waste in the SDA
- Why there isn't an alternative or option developed that removes just targeted and transuranic waste
- Adequacy of the cap
- Site monitoring and contingency plan
- Future relevance of the 1995 Settlement Agreement[7] to prevent nuclear wastes from coming into Idaho.

These issues will be discussed separately as to the concerns about each in the body of this letter.

### 19.3.1 General Comments

DOE did not make clear what criteria or formula was used to settle upon what waste is to be removed in the 4.8 acres of the Preferred Alternative. It was divulged in public meetings that primarily the disposal records were relied upon, and reliance upon this information would remove approximately 80% of the buried transuranic waste. However, there is no disclosure of where in the SDA transuranic waste will remain, what specific nuclides, in what concentrations, and importantly, why it is being left, especially when one considers high concentrations such as the plutonium-240 in Pit 3. One could conclude that there would remain buried a substantial amount of transuranic waste from the statement that "WIPP may not have sufficient capacity to accept all the potentially transuranic waste buried at the SDA…" (Proposed Plan p. 37). Because it is primarily records that are dictating where the removal actions will take place, are those records complete and accurate enough to reliably predict where all potential transuranic and mixed waste hazards are located, especially given that the SDA has been receiving waste over a 50-year period?

**Response:** See response to GC-4.

**(continued)** Public assurance in the Preferred Alternative's removal action is undermined when a contradiction exists in the location of transuranic waste in SDA, as represented in differing maps provided by DOE. For example, a slide presented in public meeting PowerPoint presentations shows a color-coded map of the SDA. This map's sole purpose is to show where the transuranic waste is located and clearly delineates trenches and pits containing transuranic waste from those that contain no transuranic waste. However, this map contradicts mapped illustrations in the RI/BRA, such as Figures 4-9 and 4-10, which show high concentrations of neptunium-237 and plutonium-238 in trenches and pits that are labeled as "nontransuranic" in the PowerPoint map presented in public meetings. Further, in the RI/BRA, lower concentrations of all transuranic waste nuclides exist in nearly every trench and pit at the SDA. What is the reasoning behind this contradiction, and why was this information omitted from the public meetings? Such inconsistencies do not instill confidence for selection of the Preferred Alternative. We feel this information should have been disclosed, allowing the public to make a more informed decision.

**Response:** Presumably, the color-coded figure in the slide presentation was Figure 3-19 on p. 3-67 of the RI/BRA.[20] This figure illustrates general locations of transuranic and nontransuranic waste. However, a pit or trench that is shown as nontransuranic can contain transuranic isotopes in low concentrations. Density maps, as in Figures 4-9 and 4-10 of the RI/BRA, show where highest and lowest concentrations are, but do not show what areas would or would not be considered transuranic waste. For example, Figure 4-9 in the RI/BRA shows that neptunium-237 is present in many pits and trenches. However, the total neptunium-237 inventory in the entire SDA is only 1.18E-01 (0.118) Ci, so its presence does not indicate that the waste is transuranic.

**(continued)** The public has now been given the opportunity to review the proposed alternatives and make comment regarding the amount of acreage to be excavated. However, to make a selection based on the removal of waste, the public has been presented with a Hobson's choice in that they can only accept or reject the Preferred Alternative; the public can choose between the 4.8-acre removal alternative or the exorbitantly costly, risky, and therefore, undoable entire removal actions of Alternative 5. Thus, the way in which the alternatives are presented doesn't allow the public to give valuable informed judgment. For example, some valuable information would have been to illustrate to the public in an incremental measure how many acres would yield a certain percentage of removal. Would 5.5 acres remove 85% of the transuranic waste, and what would be the associated cost increase? Or, to at least have a more comprehensive excavation plan, the public then would know what exactly is proposed to be removed. Certainly, information such as this would have given more value to the public's input and have given the Agencies involved a better grasp of public sentiment.

**Response:** See response to GC-4.

**(continued)** We question why Alternative 5's complete removal was not developed to incorporate options such as including only targeted waste and transuranic waste. This question is posed for two reasons. First the complete removal action includes waste streams that pose great risk to worker safety, has no pathway for disposal—thereby requiring storage provisions, and likely has a very high removal cost—thereby making the selection of Alternative 5 much less desirable. Second, the mobile waste types, such as the 0.2 acre to be grouted and the highly active fission materials, are not transuranic and thus are not specified or mandated for removal by the 1995 Settlement Agreement.[7] Therefore, Alternative 5, with some minor modifications, could have allowed for compliance not only with the human health concerns but also the legal requirements of the Settlement Agreement at a much lower cost and risk to worker safety. We would be interested to know what the reduction of worker risk and lowered cost by grouting, rather than removing the 0.2-acre waste stream and the highly active materials would have on cost and viability of Alternative 5.

**Response:** During development of the Feasibility Study,[13] the Agencies determined that assessing 2- and 4-acre targeted waste retrievals was appropriate to facilitate scaling to higher acreages, if required. The Agencies have evaluated larger areas using this approach, as shown in response to GC-4. The cost of removing the 0.2 acres is a small fraction of the overall cost in Alternative 5.

**(continued)** The Preferred Alternative's primary barrier to moisture, thus containing contaminants, is the cap. However, this most important aspect of the Preferred Alternative lacks any demonstrated proof of performance. Where has it been used in the past, and are conditions like those found at the INL Site? Would this cap contain all meteoric precipitation should there be a fire that destroys the surface vegetation? Fires are a common visitor to the INL Site. Has this scenario been taken into account? The Tribes are uncertain that the cap is adequate, as there is no information related to its performance.

**Response:** Fires would be a consideration in designing features such as contouring and water storage capacity. Two demonstrations of surface barrier performance at the INL Site suggest a monolithic evapotranspiration barrier constructed of native soil would meet all performance requirements, including maintainability and long-term performance. The Engineered Barrier Test Facility, constructed immediately adjacent to the SDA, tested the performance of thick (monolithic) soil and capillary break barrier designs.[26] Test regimens included evaluation of performance under extreme rainfall (e.g., flooding event) and without vegetation (e.g., post-fire event). Barrier performance rapidly recovered after intentional breakthrough events. The Protective Cap/Biobarrier Experiment was constructed immediately north of the Idaho Nuclear Technology and Engineering Center by the Environmental Surveillance, Education and Research program. The experiment assessed performance of monolithic evapotranspiration barrier designs over a 7-year period.[27] The experiment also evaluated the effectiveness of capillary break biobarriers placed shallow and deep within the evapotranspiration barrier. All designs tested in the experiment easily met performance criteria equivalent to those required for RCRA barriers. Experimental results from both projects were used to develop a preliminary design for an engineered surface barrier at the SDA[28] consistent with EPA recommendations for alternative covers for landfills and waste repositories (see http://epa.gov/ord/NRMRL/news/news072007.html).[57]

**(continued)** This leads into another concern, monitoring of the site. Are the monitoring wells in close enough proximity to ascertain if the contaminates begin to migrate? Are they screened to adequately assess the contaminate concentration of a potential plume? As an example, a well with a 30-ft screen across an aquifer will demonstrate appreciably lower concentrations in a plume than one screened at 5-ft intervals; thus, one well will show cleanup standards are met while the second may not. And, most importantly, is there a contingency plan in place to remediate any potential future release at the site? It would lend some comfort to illustrate that potential weaknesses in the proposed action have been thought through.

**Response:** Monitoring plans for the vadose zone and aquifer are already in place. These plans are modified, as needed, to accommodate changing conditions and priorities. Modifications will be required based on implementing the Selected Remedy. These changes will be specified during remedial design. Contingencies, if they arise in the future, will be addressed during 5-year reviews.

**(continued)** We believe the 1995 Settlement Agreement[7] is an ARAR, and as such, the Preferred Alternative does not meet this CERCLA threshold requirement. In addition, it causes us great concern that leaving transuranic waste in the ground will violate this agreement, thereby setting a precedent that leaves it in a weakened and compromised state. Because the meaning of the agreement has been adjudicated to mean all transuranic waste, we believe the best course of action is to negotiate and draft a very specific addendum to the Settlement Agreement addressing only the transuranic waste *if* it is to be permanently left in the SDA. This is the appropriate way to satisfy the ARAR prior to issuance of a ROD. Moreover, only a modification such as this would leave the spirit and strength of the agreement intact. This is especially important as future missions at the INL have already been proposed that would encounter the Settlement Agreement as a barrier. Such proposals as the greater than Class C waste storage at the INL Site or Global Nuclear Energy Partnership would introduce civilian waste nearly identical to transuranic waste in addition to spent nuclear fuels. The Tribes do not wish to return to a condition where there is no compact between DOE and the State of Idaho establishing limitations on nuclear waste at the INL.

**Response:** The actions occurring under the ROD are anticipated to meet the requirements of the Agreement to Implement.[8]

**(continued)** Given the available information presented, the Tribes cannot endorse the proposed action based on the amount or acreage of waste that should be removed. The simple addition of 4 acres to the Accelerated Retrieval Project seems arbitrary and lacking in specificity. Based on the lack of a removal criteria presented to the public, the limitations regarding removal actions, and remediation in the alternatives presented, and the apparent contradiction in information presented leaving high concentrations of transuranic waste in the SDA, we cannot endorse the Preferred Alternative's 4.8-acre removal action. We can only conclude that the amount we would agree on lies somewhere in a region greater than 4.8 acres.

**Response:** See response to GC-4. The Selected Remedy in this ROD includes targeted waste retrieval and removal of high-concentration organic solvent waste from a minimum of 5.69 acres including Accelerated Retrieval Projects I, II, III, and portions of Pit 9.

## 19.4 Tribal Air Quality Office Comments

December 20, 2007

Mark R. Arenaz, Idaho Cleanup Project
DOE Idaho Operations Office, Mail Stop 1222
P.O. Box 1625
Idaho Falls, ID 83415-1222

**SUBJECT: Air Quality Comments, Proposed Plan for RWMC, Operable Unit 7, 13/14**

The Shoshone-Bannock Tribes' Air Quality Office appreciates the opportunity to comment on the Proposed Plan for the buried waste. We are very concerned about the contaminants in the soil and groundwater from past practices at these INL facilities, the additional risks posed by the advent of inadequate cleanup at the RWMC, and the risks posed by resultant contamination migrating into the Snake River Plain Aquifer.

The permanent homeland for the Tribes, the Fort Hall Reservation, lies just 40 miles from the INL. The INL lands are within the aboriginal land area of the Shoshone-Bannock Tribes. The Tribes have used the land and waters within and surrounding the INL for fishing, hunting, plant gathering, medicinal, religious, ceremonial, and other cultural uses since time immemorial. These lands and natural resources provided the Tribes their home and way of life. When the Tribes signed the Treaty of Fort Bridger in 1868 with the United States, the Tribes protected their rights to subsistence and traditional activities on the unoccupied lands of the federal government, which includes the INL Site.

The Reservation consists of approximately 544,000 acres of land and is the homeland for more than 4,000 Tribal members. It is the center of the culture and government of the Tribes and is essential to the survival of the Shoshone-Bannock people. Since the creation of the INL Site, many activities there have damaged the land and natural resources both on the Site and off-Site. The Tribes may be adversely affected by the possibility of shipping and storing waste from the RWMC.

**Response:** DOE recognizes that the Shoshone-Bannock Tribes (the Tribes) are concerned that INL is within the aboriginal land area of the Tribes and that historically land and waters within and surrounding INL were used for fishing, hunting, plant gathering, medicinal, religious, ceremonial, and other cultural uses before the Shoshone-Bannock Reservation (the Reservation) was established. DOE also recognizes a distinctive obligation of trust incumbent upon the government in its dealings with the Tribes. The scope of the trust is defined by specific duties and obligations contained in treaties, agreements, executive orders, and statutes. However, DOE cannot afford the Tribes more rights than DOE has under the law and implementing regulations. Unless a specific duty has been placed on DOE with respect to the Tribes, DOE's trust obligations are discharged through compliance with general regulations and statutes not specifically aimed at protecting the Tribes. As a mutually agreeable vehicle to discharge statutory responsibilities and implement applicable federal policies, DOE has entered into the *Agreement-in-Principle Between the Shoshone-Bannock Tribes and the United States Department of Energy* with the Tribes[64] to define their working relationship and recognize DOE's trust responsibility. DOE and its contractors have worked and will continue to work with the Tribes to provide input to INL planning and access to the INL as necessary or required by the National Historic Preservation Act,[65] the Archaeological Resources Protection Act,[72] the National Environmental Policy Act,[38] the Native American Graves Protections and Repatriation Act,[73] the American Indian Religious Freedom Act,[74] and any other applicable laws and agreements. While DOE recognizes that the Tribes retained the right under the Fort Bridger Treaty to hunt on "unoccupied" lands, the property encompassing this project is not expected to ever become "unoccupied" such that hunting would arise consistent with the use of the property. As long as the property is fenced and has other indications of occupancy, it will remain occupied. Separate from Treaty rights discussed above and in regard to Tribal aboriginal rights to the INL, in 1968 the Tribes entered into a stipulated judgment before the Indian Claims Commission in Shoshone-Bannock Tribes, Ft. Hall, Idaho et al. v. United States, 19 Ind. Cl. Comm. 3,[75] wherein all claims to aboriginal title to lands off the Reservation were extinguished for a specified amount. Any claims by the Tribes based on rights to aboriginal lands would be barred by the stipulated judgment.

### 19.4.1 Specific Comments

The 88-acre plot is the location where thousands of radioactive waste bins were dumped in trenches and pits, including 16 pits and 54 trenches (all unlined), representing a very poor waste-handling history, one that will cost the taxpayers millions of dollars. And if the Preferred Alternative is selected, very toxic waste would still be left in unlined soil for the indefinite future. The Shoshone-Bannock Tribes could have helped DOE and saved federal money as the Tribes have always opposed open dumping of radioactive waste into the INL Site.

Radioactive contamination, including small amounts of plutonium and uranium, has been found in the aquifer below the burial grounds. A substantial amount of organic solvents has also reached Idaho's drinking water. A report by the Institute for Energy and Environmental Research concludes that the long-term protection of the Snake River Plain Aquifer requires the removal of nuclear and hazardous waste to ensure groundwater isn't contaminated further.

In 1995, the State of Idaho entered into a binding contract with DOE and the U.S. Department of the Navy, commonly referred to as the 1995 Settlement Agreement.[7] This document gives a timeline for the removal from Idaho 65,000 $m^3$ of transuranic waste, spent nuclear fuel, treatment of high-level waste, and restricts the shipments of spent naval fuel to Idaho. This compact of 12 years ago addressed all the then-known radioactive waste at the INL Site. Clearly, it is a document intended to clean up and remove waste types known at that time. Unfortunately, DOE has started a step-wise effort to allow the INL Site to become a nuclear waste dump site for much of the DOE and U.S. Department of Defense's nuclear inventories. The Tribes support the earlier promises of DOE to remove the waste at the INL Site.

The DOE has left some significant gaps in the RI/BRA and Feasibility Study. Normally, before a major remedial investigation and feasibility study is complete, a federal agency is required to adequately characterize the contamination and remediation options. In this case, DOE has not adequately characterized the waste area nor adequately inventoried the waste in the pits and trenches. This gap in knowledge is reflected in the fact that DOE has proposed three retrieval land areas: 2 versus 4 versus 35-acre option. However, DOE presented no rationale for selecting these targeted sizes or no hard data to justify retrieval acreage sizes. In meetings, it was revealed that DOE is in discussion with the Agencies to make the retrieval size decision in the future, as more data are collected. It appears that DOE has arbitrarily selected the 35-acre option so that if the Tribes or other parties supported full treatment and removal, the costs of moving the soil under this acreage would be astronomical. DOE should have prepared a better targeted retrieval research effort for acreages between 4 and 35. The Shoshone-Bannock Tribes are effectively eliminated from being able to make a learned recommendation on retrieval with this gap in information. In this respect, both the RI/BRA and the Feasibility Study are inadequate and do not adhere to CERCLA regulations, including Section 102(e) et al.,[71] and they prevent a reader of the documents from being able to make a decision on retrieval options.

**Response:** EPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA*, Chapter 3 (Site Characterization), contains the following statement, "…agencies will have to decide on a site-specific basis which of the activities described in this chapter must be conducted to adequately characterize the problem…."[6] Scope for OU 7-13/14 was established and modified several times under CERCLA[71] and the FFA/CO.[4] The Agencies modified scope primarily to collect more information to characterize the site. Characterization tasks included laboratory studies, waste sample analysis, geophysics, surveys, probing, monitoring, and much more. However, the SDA is a landfill. As such, its contents are variable. Ultimately, disposal records are the most reliable source of site characteristics. Fortunately, records for most of the SDA have been preserved. The Agencies agree that available information provides a sufficient basis for remedial decision-making. The Agencies selected variable sizes of retrieval areas to provide a full range of remedial alternatives for analysis in the feasibility study. The 4- and 35-acre areas were selected to represent partial and full retrieval. The Agencies added the 2-acre partial retrieval area to facilitate scaling retrieval sizes up or down for other possible choices during remedy selection. See response to GC-4 regarding 5.69 acres in the Selected Remedy.

**(continued)** DOE has not adequately assessed the mobility of the organic compounds in relation to iodine-129 and technetium-99. In situ stabilization options should have been presented to the Tribes in terms of grout options that could ensure that decisions to be made on stabilization materials would adequately prevent mobilization of the mixture of organic compounds and radionuclides existing in the site. Unfortunately, DOE did not offer accurate information with respect to the inventory of organic compounds, and these compounds could interfere with grout efficiency. The Tribes would feel more comfortable in recommending a cleanup alternative if the RI/BRA and Feasibility Study or this document had fully addressed this issue. DOE has stated that they plan future grout testing, but this doesn't help the Tribes make comments on this cleanup. This further indicates that DOE failed to provide the full information required under CERCLA guidance for remedial investigation and feasibility study completeness. It appears that DOE has failed to adhere to CERCLA requirements under Section 120(e)(2)[71] of the statute. These incomplete investigations need to be completed by DOE and then re-presented to the Tribes to provide us with sufficient information to render an informed opinion on DOE's inventory of waste and the best remediation option. The air quality department believes that DOE should extract and treat the most highly contaminated sections of the site and dispose of this treated waste off the INL Site. However, DOE has not provided details of their location, how segregated these contaminants are in these pits and trenches, or how DOE made their initial acreage estimates for targeted retrieval.

**Response:** Numerous preremedial design studies have been performed to confirm technical applicability and field implementability of in situ stabilization for known waste forms within the SDA.[16,17] Grouting included in the Selected Remedy is focused on interim stabilization of INL Site reactor operations waste that contains mobile fission products (e.g., technetium-99 and iodine-129). The grouting component provides relatively near-term isolation of the waste pending completion of targeted waste retrievals and installation of the surface barrier over the SDA. INL Site reactor operations waste was disposed of separately from Rocky Flats Plant waste; therefore, collocated waste forms that might interfere with in situ stabilization, such as organic compounds, are not anticipated.

EPA's guidance for conducting remedial investigation and feasibility studies under CERCLA, Chapter 3 (Site Characterization),[6] contains the following statement: "…agencies will have to decide on a site-specific basis which of the activities described in this chapter must be conducted to adequately characterize the problem…." Scope for OU 7-13/14 was established and modified several times under CERCLA and the FFA/CO. The Agencies modified scope primarily to collect more information to characterize the site. Characterization tasks included laboratory studies, waste sample analysis, geophysics, surveys, probing, monitoring, and much more. However, the SDA is a landfill. As such, its contents are highly variable. Ultimately, disposal records are the most reliable source of site characteristics. Fortunately, records for most of the SDA have been preserved. The Agencies agree that available information provides a sufficient basis for remedial decision-making.

During development of the Feasibility Study, the Agencies determined that assessing 2- and 4-acre targeted waste retrievals was appropriate to facilitate scaling to higher acreages, if required. The Agencies have evaluated larger areas using this approach, as shown in response to GC-4.

**(continued)** The Tribal Air Quality department further believes that, for those areas of lesser contamination where they can be immobilized, in situ soil stabilization may work. However, DOE has not yet completed the tests necessary to determine the success of such an option, especially when the organic chemical fraction of the waste has not yet been characterized. For example, DOE has not adequately demonstrated if they can keep the technetium-99 from mobilizing, nor designed a grout to successfully immobilize it. The evapotranspiration cap design is unproven for such a long-termed application, and so the Tribal Air Quality department has significant concerns regarding this option. To be on the safe side, then, the Tribal Air Quality department must recommend the retrieval and treatment. DOE has not adequately estimated the worst case scenario for the success of the evapotranspiration cap. Nor has DOE provided adequate documentation that monitoring under the various options is adequate. If the surface cap option, for example, is selected by DOE, there was not adequate documentation of monitoring techniques to be employed to determine if contaminants are becoming mobile in the soil column. And what if some of the contaminants become mobilized? DOE has not presented in the document contingency actions necessary to stop the mobilization and correct this. The document needs to be rewritten with clear monitoring methods including contingency options. DOE should revise the monitoring section to address this issue.

**Response:** Numerous preremedial design studies have been performed to confirm technical applicability and field implementability of in situ stabilization for known waste forms within the SDA.[16,17]

Two demonstrations of surface barrier performance at the INL Site suggest a monolithic evapotranspiration barrier constructed of native soil would meet all performance requirements, including maintainability and long-term performance. The Engineered Barrier Test Facility, constructed immediately adjacent to the SDA, tested the performance of thick (i.e., monolithic) soil and capillary break barrier designs.[26] Test regimens included evaluation of performance under extreme rainfall (e.g., flooding event) and without vegetation (e.g., analogous to a post-fire event). Barrier performance rapidly recovered after intentional breakthrough events. The Protective Cap/Biobarrier Experiment was constructed immediately north of the Idaho Nuclear Technology Engineering Center by the Environmental Surveillance, Education and Research Program. The experiment assessed performance of monolithic evapotranspiration barrier designs over a 7-year period.[27] The experiment also evaluated the effectiveness of capillary break biobarriers placed shallow and deep within the evapotranspiration barrier. All designs tested in the experiment easily met performance criteria equivalent to those required for RCRA barriers. Experimental results from both projects were used to develop a preliminary design for an engineered surface barrier at the SDA[28] consistent with the EPA recommendations for alternative covers for landfills and waste repositories (see http://epa.gov/ord/NRMRL/news/news072007.html[57]).

Monitoring plans for the vadose zone and aquifer are already in place. These plans are modified, as needed, to accommodate changing conditions and priorities. Modifications will be required based on implementing the Selected Remedy. These changes will be specified during remedial design. Contingencies, if they arise in the future, will be addressed during 5-year reviews.

**(continued)** In summary, the Air Quality department supports targeted retrieval and treatment, with waste removed from the INL Site. Any low-level radionuclide-contaminated areas remaining should be capped and stabilized with a long-term monitoring plan that can assess any mobilization of contaminants in the soil column—before they reach the saturated zones. Then a contingency option should be employed to ensure the contaminants are prevented from ever reaching the saturated layers. Unfortunately, the removal and treatment option proposed by DOE presents an acreage of 35 acres that was not assessed properly under CERCLA and does not indicate the degree of segregated contamination hot-spot areas that may be successfully extracted and treated. DOE needs to rewrite the document with a better researched option for acreages between 35 and 4 acres.

**Response:** During development of the Feasibility Study, the Agencies determined that assessing 2- and 4-acre targeted waste retrieval was appropriate to facilitate scaling to higher acreages, if required. The Agencies have evaluated larger areas using this approach, as shown in the response to GC-3.

**(continued)** The Tribal Air Quality department supports Alternative 5, but with a reworked assessment of the acreage estimates for better cost-effective targeted retrieval, treatment, and disposal.

**Response:** See response to GC-4.

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