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March 1996

EPA Superfund Record of Decision:

USDOE Idaho National Engineering Laboratory, (O.U. 5-05, 6-01, & 10 No Action Sites), ID 12/1/1995

Declaration of the Record of Decision

Site Name and Location

Stationary Low-Power Reactor-1 Burial Ground,
Boiling Water Reactor Experiment-I Burial Ground, and
10 No Action Sites Within the
Auxiliary Reactor Area and the Power Burst Facility

Idaho National Engineering Laboratory
Idaho Falls, Idaho

Statement of Basis and Purpose

This document presents the selected remedial action for the Stationary Low-Power Reactor-1 (SL-1) burial ground, the Boiling Water Reactor Experiment-I (BORAX-I) burial ground, and 10 no action sites in Waste Area Group 5. The remedial actions were selected in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA) (hereafter referred to collectively as "CERCLA"), and is consistent, to the extent practicable, with the National Oil and Hazardous Substances Pollution Contingency Plan. Information supporting the selection of the remedies for the burial grounds is contained in the Administrative Record for the SL-1 and BORAX-I burial grounds (Operable Units 5-05 and 6-01). The Administrative Record for Track 1 sites in Waste Area Group 5 contains information regarding the 10 no action sites (Operable Units 5-01, 5-03, 5-04, and 5-11).

The U.S. Department of Energy (DOE) is the lead agency for this decision. The U.S. Environmental Protection Agency (EPA) and the Idaho Department of Health and Welfare (IDHW) have participated in the evaluation of the final action alternatives. The EPA and IDHW both concur with the selection of the preferred remedy for the SL-1 and BORAX-I burial grounds and with the no action determinations for the 10 Track 1 sites.

Assessment of the Sites

Actual or threatened releases of hazardous substances from the SL-1 and BORAX-I burial grounds, if not addressed by implementing the response action selected in this Record of Decision, may present a current or potential threat to public health, welfare, or the environment.

The 10 no action sites do not present a threat to human health or the environment.

Description of the Selected Remedy

The Idaho National Engineering Laboratory (INEL) has been subdivided into 10 waste area groups for investigation pursuant to the Federal Facility Agreement and Consent Order between the DOE, EPA, and IDHW. The SL-1 burial ground is designated Operable Unit 5-05, one of 13 operable units in Waste Area Group 5; the BORAX-I burial ground is Operable Unit 6-01, one of five operable units in Waste Area Group 6. The major components of the selected remedy for both sites are:

- Containment by capping with an engineered barrier constructed primarily of native materials
- For BORAX-I implementation will include consolidation of surrounding contaminated surface soils for containment under the engineered cover
- Contouring and grading of surrounding terrain to direct surface water runoff away from the caps
- Periodic above-ground radiological surveys following completion of the caps to assess the effectiveness of the remedial action
- Periodic inspection and maintenance following completion of the caps to ensure cap integrity and surface drainage away from the barriers
- Access restrictions consisting of fences, posted signs, and permanent markers
- Restrictions limiting land use to industrial applications for at least 100 years following completion of the caps
- Review of the remedy no less often than every five years until determined by the regulatory agencies to be unnecessary.

The selected remedy addresses the principal threats posed by the burial grounds by providing shielding from ionizing radiation, a barrier to inhibit ecological and human intrusion, and a long-lasting cover to diminish the effects of wind and water erosion.

Statutory Determination

The selected remedies are protective of human health and the environment, comply with federal and state requirements that are legally applicable or relevant and appropriate requirements (ARARs) to the remedial actions, and are cost effective. These remedies utilize permanent solutions and alternative treatment technologies to the maximum extent practicable. However, because treatment of the principal threats of the two burial grounds was not found to be practicable, this remedy does not satisfy the statutory preference for treatment as a principal element of the remedy. The EPA's preference for sites that pose relatively low long-term threats or where treatment is impracticable is engineering controls, such as containment. The radioactivity at each burial ground precludes a remedy in which contaminants could be readily excavated and treated without unacceptable exposures to workers. The primary contributor to risk is a short half-lived radionuclide more effectively managed by providing engineered containment while allowing the radionuclide to decay naturally.

Because these remedies will result in radionuclide-contaminated substances remaining on site at the burial grounds in excess of health-based levels, reviews will be conducted within five years after commencement of the remedial actions. Subsequent reviews will be conducted no less often than every five years thereafter to ensure that the remedies continue to provide adequate protection of human health and the environment. The periodic reviews will be discontinued when the regulatory agencies determine the sites no longer pose an unacceptable risk to human health or the environment.

Signature sheet for the foregoing Stationary Low-Power Reactor-1 Burial Ground, the Boiling Water Reactor Experiment-I Burial Ground, and 10 no further action sites in Waste Area Group 5 at the Idaho National Engineering Laboratory Record of Decision between the U.S. Department of Energy and the U.S. Environmental Protection Agency, with concurrence by the Idaho Department of Health and Welfare.

John M. Wilcynski
Manager
U.S. Department of Energy, Idaho Operations Office

12/12/95
Date

Signature sheet for the foregoing Stationary Low-Power Reactor-1 Burial Ground, the Boiling Water Reactor Experiment I Burial Ground, and 10 no further action sites in Waste Area Group 5 at the Idaho National Engineering Laboratory Record of Decision between the U.S. Department of Energy and the U.S. Environmental Protection Agency, with concurrence by the Idaho Department of Health and Welfare.

for Charles Findley

Chuck Clarke
Regional Administrator, Region 10
U. S. Environmental Protection Agency

12-1-95
Date

Signature sheet for the foregoing Stationary Low-Power Reactor-1 Burial Ground, the Boiling Water Reactor Experiment I Burial Ground, and 10 no further action sites in Waste Area Group 5 at the Idaho National Engineering Laboratory Record of Decision between the U.S. Department of Energy and the U.S. Environmental Protection Agency, with concurrence by the Idaho Department of Health and Welfare.

Wallace N. Cory
Administrator
Division of Environmental Quality
Idaho Department of Health and Welfare

1/9/96
Date

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Acronyms and Abbreviations

ARA	Auxiliary Reactor Area
ARAR	applicable or relevant and appropriate requirements
BORAX-I	Boiling Water Reactor Experiment-I
°C	degree(s) Celsius
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cm	centimeter(s)
DOE	U.S. Department of Energy
DOE-ID	U.S. Department of Energy, Idaho Operations Office
EPA	U.S. Environmental Protection Agency
°F	degrees Fahrenheit
g	gram(s)
IDAPA	Idaho Administrative Procedures Act
IDHW	Idaho Department of Health and Welfare
INEL	Idaho National Engineering Laboratory
km	kilometer(s)
m	meter(s)
m^2	square meter(s)
mg	milligram(s)
mR	milliroentgen
µrem/hr	microroentgen equivalent man per hour
nCi	nanocurie(s)
PBF	Power Burst Facility
pCi	picocurie(s)
RI/FS	Remedial Investigation/Feasibility Study
SARA	Superfund Amendments and Reauthorization Act
sec	second
SL-1	Stationary Low-Power Reactor-1
TBC	To-Be-Considered
WAG	Waste Area Group
yr	year

Decision Summary

1. Site Name, Location, and Description

The Idaho National Engineering Laboratory (INEL) is a government facility managed by the U.S. Department of Energy (DOE). The main security gate in the southern portion of the site is located 44 miles (71 km) west of Idaho Falls, Idaho. The INEL occupies 890 square miles (2,305 km^2) of the northeastern portion of the Eastern Snake River Plain. The Stationary Low-Power Reactor-1 (SL-1) and Boiling Water Reactor Experiment-I (BORAX-I) burial grounds are approximately 38 and 52 miles (61 and 84 km) west of Idaho Falls (Figure 1).

The SL-1 site is located about 1,600 feet (488 m) northeast of the Auxiliary Reactor Area II and includes the surface-soil area surrounding a 600- by 300-foot (182.9- by 91.4-m) fenced burial ground (Figure 2). Approximately 99,000 cubic feet (2,800 m^3) of radionuclide-contaminated debris, soil, and gravel are disposed of in the burial ground. An estimated 2 feet (0.6 m) of soil with a thick grass cover lies over the waste.

The BORAX-I burial ground is located about 2,730 feet (832 m) northwest of the Experimental Breeder Reactor-1, a national monument. The BORAX-I site includes a 200- by 420-foot (61- by 128-m) surface-soil contamination area surrounding the 100- by 100-foot (30- by 30-m) fenced burial ground (Figure 3). The volume of buried radionuclide-contaminated soil and debris is approximately 6,336 cubic feet (180 m^3). The 84,000-square foot (7,800-m^2) area was covered with 6 inches of gravel in 1954, but grass, sagebrush, and other plants have reseeded the area since then.

The INEL was originally established as the National Reactor Testing Station by the U.S. Atomic Energy Commission in 1949. The National Reactor Testing Station's mission was to build, test, and operate nuclear reactors, fuel processing plants, and support facilities. The INEL's current mission, as directed by the DOE, is the integration of engineering, applied science, and operations in an environmentally conscious, safe, and cost-effective manner.

The SL-1 and BORAX-I burial grounds are historical disposal areas and do not host any current programs. Current activities are limited to periodic observations for maintenance of the fences and grounds and monitoring for radioactivity.

Of the approximately 11,700 people employed at the INEL, none work full time at either burial ground. There are no residential communities within the INEL boundaries. The nearest residential community is Atomic City, located approximately 1 mile (1.6 km) south of the INEL boundary, with a population of 25. Larger communities near the INEL include Idaho Falls, located approximately 44 miles (71 km) to the east of the main gate, with a population of 43,973; Blackfoot, located approximately 37 miles (60 km) to the southeast, with a population of 9,646; and Arco, located approximately 19 miles (31 km) to the west, with a population of 1,016.

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ARA	Auxiliary Reactor Area
ANL-W	Argonne National Laboratory–West
BORAX-I	Boiling Water Reactor Experiment I
CFA	Central Facilities Area
EBR-I	Experimental Breeder Reactor I
EBR-II	Experimental Breeder Reactor II
ICPP	Idaho Chemical Processing Plant
IET	Initial Engine Test
LOFT	Loss-of-Fluid Test (facility)
NRF	Naval Reactor Facility
PBF	Power Burst Facility
RWMC	Radioactive Waste Management Complex
SL-1	Stationary Low-Power Reactor No. 1
TAN	Test Area North
TRA	Test Reactor Area
TSF	Technical Support Facility
WRRTF	Water Reactor Research Test Facility

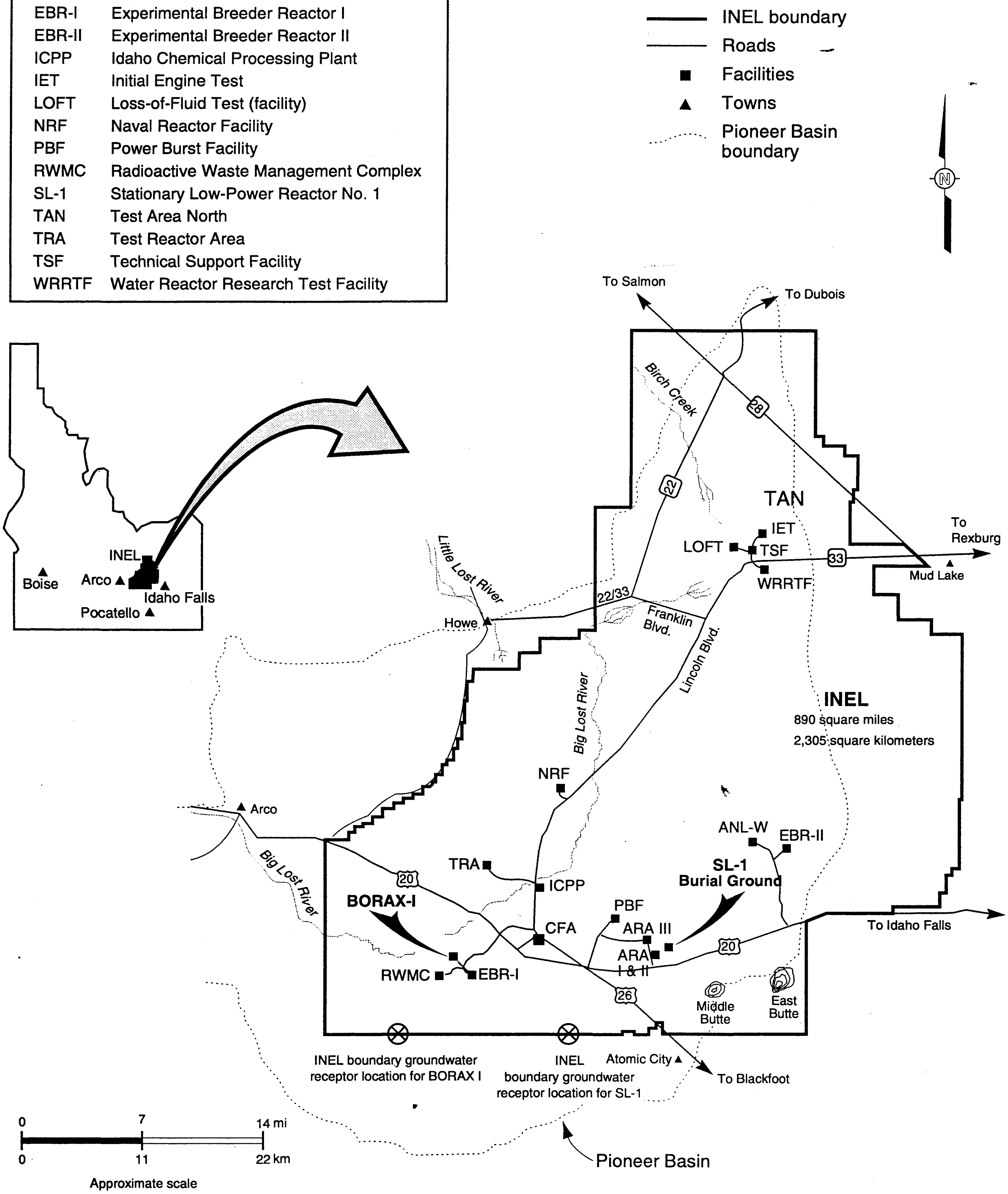


Figure 1. Location of the SL-1 and BORAX-I burial grounds at the INEL.

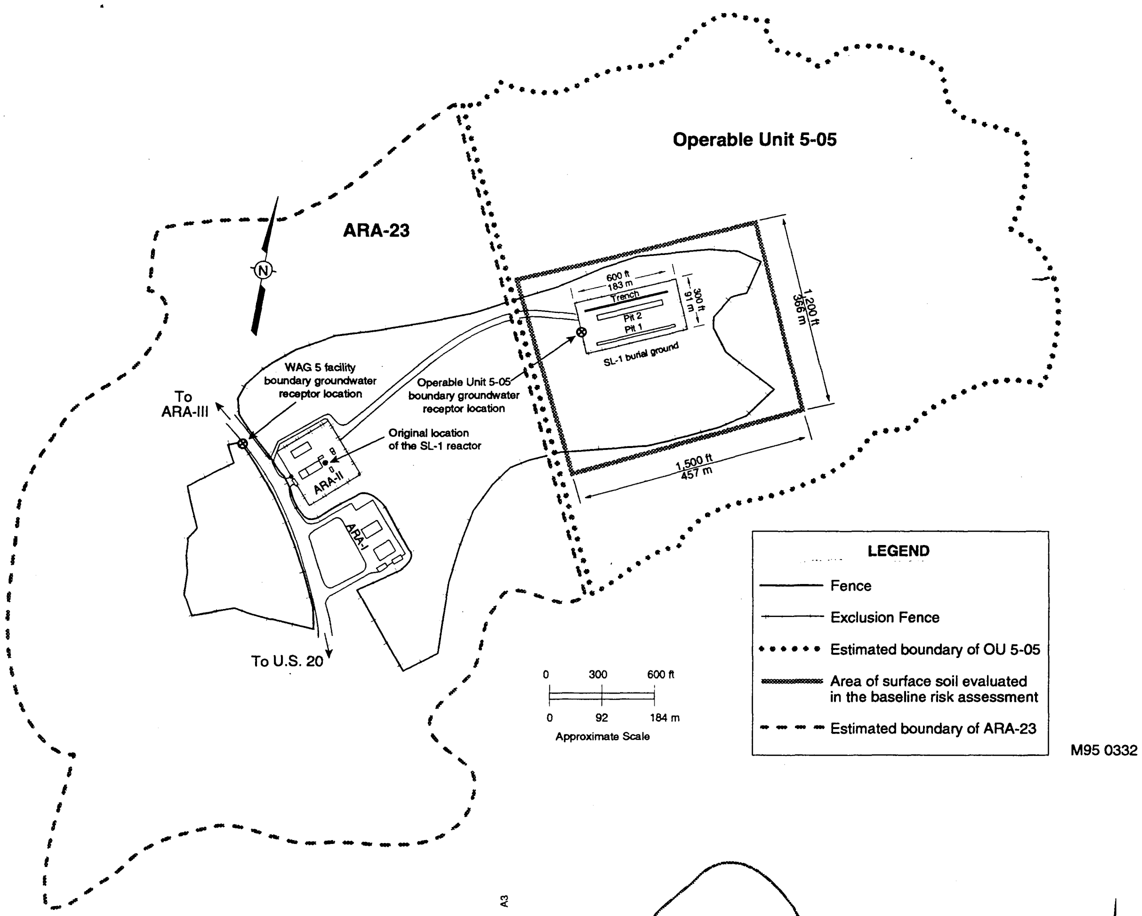


Figure 2. SL-1 burial ground site map.

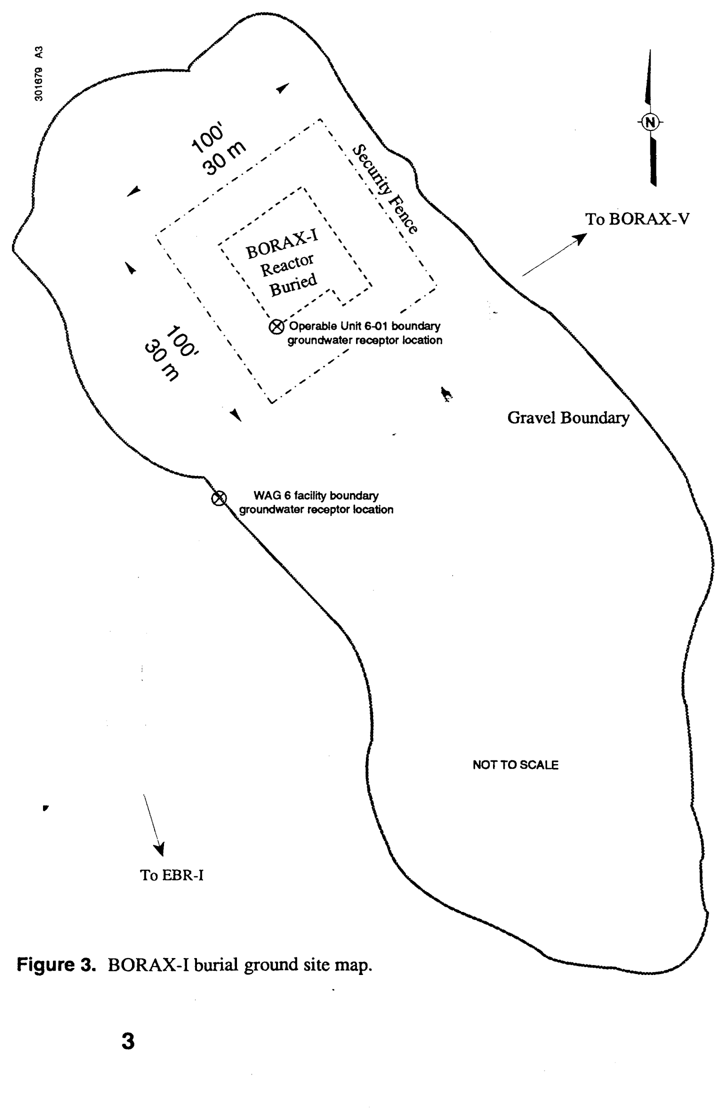


Figure 3. BORAX-I burial ground site map.

Most of the area surrounding the INEL is either unimproved rangeland or farmland, and approximately 330,000 acres (1,300 km^2) of the INEL are open to grazing by permit. However, grazing is prohibited within 2 miles (3 km) of any nuclear facility, and no dairy cows are allowed. Approximately 95% of the INEL site has been withdrawn from the public domain by land transfer from the U.S. Bureau of Land Management to the DOE.

The climate of the region is arid to semiarid. Average annual precipitation is 8.71 inches (22 cm), wind is generally from the southwest with average speeds of 5 to 9 miles per hour (8 to 15 km/hour), and average air temperatures are 64.6°F (18.1°C) in the summer and 18.8°F (-7.3°C) in the winter.

The INEL lies in the Pioneer Basin, a closed topographic depression located on the Eastern Snake River Plain. Elevations range from approximately 4,800 to 5,400 feet (1,463 to 1,646 m) with a total relief of about 600 feet (183 m). The area receives surface water from rainfall, snowmelt, and streamflow. The streamflow sources are the Big Lost River, the Little Lost River, and Birch Creek. Streamflow that reaches the INEL goes to the Big Lost River playa or the Birch Creek playa and is lost to evaporation and infiltration. Consequently, there is little available surface water within the INEL site boundaries and none available at the SL-1 and BORAX-I sites.

The Eastern Snake River Plain is a broad, flat plain composed of thick basaltic flows covering rhyolitic calderas. The flows occur as layers of lava, ranging from a few inches to a few feet thick, interspersed with cinders, breccia, and unconsolidated sediments. Much of the INEL's land surface consists of basalt flows. The western and central portions of the INEL lie within the floodplain of the Big Lost River, which extends across the site from the southwest to the northeast. Alluvial deposits from the Big Lost River grade into lacustrine (lake) deposits in the northern portion of the INEL where the Big Lost River enters a series of playa lakes. Loess deposits (wind-deposited silts) can be found covering the basalt bedrock over much of the rest of the INEL to thicknesses up to 20 feet (6 m). The loess deposits are the source of the soil typically found in the southern portion of the INEL. This soil is generally shallow, poorly developed, and has a sandy-loam or loamy texture.

The Snake River Plain Aquifer, the largest potable water aquifer in Idaho, underlies the Eastern Snake River Plain and the INEL. The aquifer is approximately 200 miles (322 km) long, 20 to 60 miles (32.2 to 96.5 km) wide, and covers an area of approximately 9,600 square miles (24,853 km^2). The depth to the Snake River Plain Aquifer varies from approximately 200 feet (61 m) in the northeastern corner of the INEL to approximately 900 feet (274 m) in the southeastern corner, a distance of 42 miles (67.6 km). Depth to groundwater is approximately 667 feet (203 m) in the vicinity of the SL-1 burial ground and approximately 596 feet (181 m) near BORAX-I.

The INEL is a flat, semiarid sagebrush desert with plants typical of such ecologies. Important shrubs include big sagebrush, rabbitbrush, winterfat, shadscale saltbush, nuttall saltbush, and gray horsebrush. The most abundant vegetation types are big sagebrush, green rabbitbrush, bluebunch wheatgrass, thickspike wheatgrass, horsebrush, dwarf sagebrush, saltbush, and crested wheatgrass.

The variety of habitats on the INEL support numerous species of reptiles, birds, and mammals. Ten reptiles, including the short-horned lizard, the gopher snake, the sagebrush lizard, and the western rattlesnake, and one amphibian species, the Great Basin spadefoot toad, have been observed on the site. A total of 164 species of birds inhabit the INEL, including sparrows, raptors, waterfowl, swallows, American kestrels, killdeers, American robins, sage thrashers, sage sparrows, western meadowlarks, house sparrows, and mallards during the breeding season and sage grouse, rock doves, horned larks, and black-billed magpies year-round. The 37 species of mammals found on the site include 18 species of rodents, four species of leporids, and six species of carnivores. The most common rodents are the Townsend's ground squirrel, the least chipmunk, the Great Basin pocket mouse, and Ord's kangaroo rat; the dominant leporid is the rabbit; common carnivores are the coyote and the long-tailed weasel. Pronghorn antelope and mule deer are frequently observed.

Only two species have been identified at the INEL that are classified as endangered or threatened: the bald eagle and the American peregrine falcon. The bald eagle has been seen in the winter months at or around the INEL, and the peregrine falcon has been observed in the northern portion of the INEL on rare occasions.

2. Site History and Enforcement Activities

The SL-1 and BORAX-I burial grounds were constructed to dispose of contaminated debris, soils, and gravel generated by the destruction of a small nuclear reactor at each location. The BORAX-I burial ground was established in 1954; the SL-1 burial ground was established in 1961. Both sites were identified in the Consent Order and Compliance Agreement which was signed by the EPA and the DOE and promulgated in 1987 pursuant to the Resource Conservation and Recovery Act Section 3008(h). Under this agreement, the DOE initially assessed and screened the identified sites and established a procedure for conducting corrective actions. Both burial grounds were identified as solid waste management units. The INEL was proposed for listing on the National Priorities List in July 1989. The listing was proposed by the EPA under authorities granted by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980. This act is also referenced by the acronym "CERCLA" or as the "Superfund." The act was amended by the Superfund Amendments and Reauthorization Act of 1986. References to CERCLA include the amendments of 1986. The National Priorities List identifies the highest risk sites, as determined by a screening and ranking process, which are to be remediated via the CERCLA process. The INEL was officially placed on the National Priorities List in November 1989.

Subsequent to the CERCLA listing, the DOE, the EPA, and the IDHW (collectively referred to as the agencies) negotiated a Federal Facility Agreement and Consent Order and an Action Plan for remediation of the INEL. The documents were signed in December 1991. Both burial grounds were classified as Track 2 operable units, described in the Action Plan as operable units that may require field data collection before a remedial decision could be reached. A Track 2 investigation would determine if no further action, an interim action, or a remedial investigation/feasibility study was warranted.

Results of the 1993 Track 2 preliminary scoping for the SL-1 burial ground led the agencies to conclude that the evaluation of the site should be elevated to a remedial investigation/feasibility study. The scope of the investigation was limited to existing data, considered sufficient by the agencies to determine a remedial action for the site, and a feasibility study focused on examining remedial alternatives selected in other Records of Decision for similar sites. In addition, because of the similarities of the BORAX-I burial ground to the SL-1 burial ground, the agencies determined that both sites would be assessed in the same remedial investigation/feasibility study.

This Record of Decision documents the remedy selected based on the results of the remedial investigation/feasibility study and additional information contained in the Administrative Record for Operable Units 5-05 and 6-01. Additional details concerning the history of each of the two burial grounds follow in the next two subsections.

2.1 SL-1

The SL-1 was a small nuclear power plant designed for the military to generate electric power and heat for remote arctic installations. The reactor was operated from August 1958 until January 3, 1961, as a test, demonstration, and training facility. On the evening of January 3, 1961, the SL-1 reactor accidentally achieved a prompt critical nuclear reaction, which caused a steam explosion that destroyed the reactor and resulted in the deaths of the three operators on duty. The reactor vessel and building were severely damaged and highly contaminated, and a massive cleanup operation ensued to dismantle and dispose of the reactor and building.

A burial ground was constructed approximately 1,600 feet (488 m) northeast of the original site of the reactor. This was done to minimize radiation exposure to the public and site workers that would have resulted from transport of contaminated debris from SL-1 to the Radioactive Waste Management Complex over 16 miles (26 km) of public highway. Original cleanup of the site took about 18 months. The entire reactor building, contaminated materials from nearby buildings, and soil and gravel contaminated during cleanup operations were disposed of in the burial ground. The majority of buried materials consists of soils and gravel.

Recovered portions of the reactor core, including the fuel and all other parts of the reactor that were important to the accident investigation, were taken to the INEL's Test Area North for study. After the accident investigation was complete, the reactor fuel was sent to the Idaho Chemical Processing Plant for reprocessing. The reactor core minus the fuel, along with the other components sent to Test Area North for study, was eventually disposed of at the Radioactive Waste Management Complex.

The SL-1 burial ground consists of three excavations, in which a total volume of 99,000 cubic feet (2,800 m^3) of contaminated material was deposited. The excavations were dug as close to basalt as the equipment used would allow and ranged from 8 to 14 feet (2.4 to 4.3 m) in depth. At least 2 feet (0.6 m) of clean backfill was placed over each excavation. Shallow mounds of soil over the excavations were added at the completion of cleanup activities in September 1962. Operable Unit 5-05 is defined as the surface and subsurface soils and debris within the 600- by 300-foot (183- by 91-m) SL-1 burial ground exclusion fence and the surface area surrounding the burial ground (see Figure 2). Other residual surface contamination from the SL-1 accident is being investigated in Waste Area Group 5 under Operable Unit 5-12, site code Auxiliary Reactor Area (ARA)-23, which is southwest of and adjacent to Operable Unit 5-05 (see Figure 2). ARA-23 includes the original location of the SL-1 reactor.

Numerous radiation surveys and cleanup of the surface of the burial ground and surrounding area have been performed in the years since the SL-1 accident. Aerial surveys were performed by EG&G Las Vegas in 1974, 1982, 1990, and 1993. The Radiological and Environmental Sciences Laboratory conducted gamma radiation surveys every 3 to 4 years between 1973 and 1987 and every year between 1987 and 1994. Particle-picking at the site was performed in 1985 and 1993. Results from the surveys indicate that cesium-137 and its progeny (decay product) are the primary surface-soil contaminants. During a survey of surface soil in June 1994, "hot spots," areas of higher radioactivity, were found within the burial ground with activities ranging from 0.1 to 50 milliroentgen (mR)/hour. On November 17, 1994, the highest radiation reading measured at 2.5 feet (0.75 m) above the surface at the SL-1 burial ground was 0.5 mR/hour; local background radiation was 0.2 mR/hour. A dose equivalent rate survey was conducted in 1995; all locations surveyed within Operable Unit 5-05 yielded readings at or below the background value of 20 μrem/hr.

Today the SL-1 burial ground is defined by a three-strand, barbed-wire exclusion fence posted with radiological control signs. Inside the burial ground the ends of the excavations are identified by concrete markers. The surface of the burial ground is covered with various grass species. The two mounds and several minor depressions due to subsidence are visible within the fenced area. A second radiological-control fence encompasses the burial ground, a larger contaminated surface soil area, and the Auxiliary Reactor Area I and II facilities. The fences, posted with radiological-control signs, and restricted access protect INEL workers and the public from exposure.

2.2 BORAX-I

The BORAX-I reactor was a small experimental reactor used in the summer months of 1953 and 1954 for testing boiling-water reactor technology. In 1954, the design mission of BORAX-I was completed, and the decision was made to make one final test, which resulted in the intentional destruction of the reactor. The destruction of the reactor contaminated approximately 84,000 square feet of the surrounding terrain. Immediately following the final test of the BORAX-I reactor, much of the radioactive debris, including some fuel residue, was collected and buried on site in the reactor shield tank. Recovered fuel fragments and fuel residue were sent to the Idaho Chemical Processing Plant and Oak Ridge National Laboratory in Tennessee. Reusable equipment associated with the reactor was successfully decontaminated and used in the construction of BORAX-II. However, the cleanup did not sufficiently reduce the radioactivity at the site; therefore, the 84,000-square foot (7,800-m^2) contaminated area was covered with approximately 6 inches (15 cm) of gravel to reduce radiation levels at the ground surface.

Buried materials at the site consist of unrecovered uranium fuel residue, irradiated metal scrap, and contaminated soil and debris. Part of the waste was buried in the bottom half of the shield tank; the top half of the tank was collapsed into the bottom and the void space was filled with debris. The burial ground is contained within the foundation of the BORAX-I installation, the dimensions of which are 18 by 32 by 11 feet (5.5 by 9.8 by 3.4 m). A mounded gravel and dirt cover approximately 5 feet (1.5 m) high and 30 feet (9 m) in diameter is centered over the buried shield tank. Operable Unit 6-01 includes the buried debris, as well as the 84,000-square feet (7,800-m^2) of contaminated surface soil.

Field radiation surveys conducted in 1978 and 1980 detected radiation at about three times the background levels in the central portion of the gravel-covered 84,000-square foot (7,800-m^2) area south-southeast of the buried reactor. Radiation in adjacent areas was at background levels. Surface and subsurface soil sampling of the 84,000-square foot (7,800-m^2) gravel-covered area in 1978 and 1980 indicated that radioactive contamination exists and is highest at a depth of approximately 6 inches (15 cm) at the interface of the gravel cover and the original ground surface. Ongoing monitoring of the site through the use of radiation dosimeters shows that radiation levels are slightly above background levels. On November 18, 1994, the radiological field measured at 2.5 feet (0.75 m) above the surface of the BORAX-I burial ground was 0.1 mR/hour; local background radiation was also 0.1 mR/hour.

Today, the ground surface at the site looks very much like the surrounding terrain. Abundant native vegetation has grown over the mound and surrounding area. A large stake about 5 feet (1.5 m) tall marks the reactor location. A 6-foot (1.8-m)-high chain-link fence surrounds the burial ground, forming an enclosed area approximately 100 feet (30 m) on each side. The contaminated surface soil area outside of the chain-link fence is bounded by a two-wire exclusion fence. The fences, posted with radiological-control signs, and restricted access protect INEL workers and the public from unacceptable exposures.

3. Highlights of Community Participation

In accordance with the CERCLA §113(k)(2)(B)(i-v) and §117, a series of opportunities for public information and participation in the remedial investigation and decision process for the SL-1 and BORAX-I burial grounds was provided to the public from September 1994 through May 1995. For the public, notifications included fact sheets that briefly discussed the investigation to date, *INEL Reporter* articles and updates, a proposed plan, telephone briefings, and public meetings. The *INEL Reporter* is a periodic, public information publication of the INEL's Environmental Restoration Program.

In September 1994, a fact sheet concerning the SL-1 and BORAX-I remedial investigation/feasibility study was sent to about 6,700 individuals of the general public and to 650 INEL employees on the INEL Community Relations Plan mailing list.

The project was discussed at informal semiannual briefings in Twin Falls (October 11, 1994), Pocatello (October 13, 1994), Moscow (October 18, 1994), Boise (October 19, 1994), and Idaho Falls (October 20, 1994). During these briefings, representatives from the DOE and the INEL discussed the project, answered questions, and listened to public comments.

Regular reports concerning the status of the project were included in the *INEL Reporter* and were mailed to those who were on the mailing list. Reports also appeared in two issues of *Citizens' Guide* (a supplement to the *INEL Reporter*).

In April 1995, another fact sheet concerning the project was sent to about 6,700 individuals of the general public and to 650 INEL employees on the INEL Community Relations Plan mailing list. On April 11, 1995, the DOE issued a news release to more than 100 contacts concerning the beginning of a 30-day public comment period, which began May 3, 1995, and ended June 3, 1995, pertaining to the SL-1 and BORAX-I proposed plan. Many of the news releases resulted in a short note in community calendar sections of newspapers and in public service announcements on radio stations. Both the fact sheet and news release gave notice to the public that SL-1 and BORAX-I documents would be available before the beginning of the comment period in the Administrative Record section of the INEL Information Repositories located in the INEL Technical Library of Idaho Falls, in the INEL Boise Office, and in public libraries in Idaho Falls, Fort Hall, Pocatello, Twin Falls, Boise, and Moscow. Also, table top displays were set up at the Grand Teton Mall in Idaho Falls (May 15-20), Burley Public Library (April 24-May 5), Twin Falls Public Library (May 5-26), Boise Towne Square Mall (April 29), and the Pocatello City Building (April 24-May 15).

Opportunities for public involvement in the decision process for the SL-1 and BORAX-I project began in May 1995. For the public, the activities included receiving the proposed plan, receiving telephone calls, attending the availability sessions at public meetings to informally discuss the issues, and submitting verbal and written comments to the agencies during the 30-day public comment period.

Copies of the proposed plan for SL-1 and BORAX-I were mailed to about 6,700 members of the public and to 650 INEL employees on the INEL Community Relations Plan mailing list on April 28, 1995, urging citizens to comment on the proposed plan and to attend public meetings. Display advertisements announcing the same information and the locations of public meetings on May 16, 17, and 18, 1995, in Idaho Falls, Boise, and Moscow, respectively, appeared in seven major Idaho newspapers. Large advertisements appeared in the following newspapers on April 26: the Post Register (Idaho Falls); the Idaho State Journal (Pocatello); the South Idaho Press (Burley); the Times News (Twin Falls); the Idaho Statesman (Boise); the Lewiston Morning Tribune (Lewiston); and the Daily News (Moscow).

Post cards were mailed on May 10, 1995, to about 6,700 members of the public and to 650 INEL employees on the INEL Community Relations Plan mailing list to encourage them to attend the public meetings and to provide verbal or written comments. News releases and newspaper advertisements gave public notice of public involvement activities. Offerings for briefings and the 30-day public comment period that was to begin May 3 and run through June 3, 1995 were also announced. Personal calls were made to stakeholders in Idaho Falls, Pocatello, Twin Falls, Boise, and Moscow the weeks of May 8 and 15 to remind individuals about the meetings.

Written comment forms, including a postage-paid business-reply form, were made available to those attending the public meetings. The forms were used to submit written comments either at a meeting or by mail. The reverse side of the meeting agenda contained a form for the public to evaluate the effectiveness of the meetings. A court reporter was present at each meeting to keep transcripts of discussions and public comments. The meeting transcripts were placed in the Administrative Record sections for SL-1 and BORAX-I, Operable Units 5-05 and 6-01, in five INEL Information Repositories. For those who could not attend the public meetings but wanted to make formal written comments, a postage-paid written comment form was attached to the proposed plan.

A Responsiveness Summary has been prepared as part of the Record of Decision. All formal verbal comments, as given at the public meetings, and all written comments, as submitted, are included in Appendix A and in the Administrative Record for the Record of Decision. Those comments are annotated to indicate which response in the Responsiveness Summary addresses each comment.

A total of about 10 people not associated with the project attended the SL-1/BORAX-I public meetings. Overall, 10 provided formal comment; of these10 people, three provided oral comments, and seven provided written comments. All comments received on the proposed plan were considered during the development of this Record of Decision. The decision for this action is based on the information in the Administrative Record for these operable units.

On August 2, 1995, the project manager from the Idaho Department of Health and Welfare Division of Environmental Quality gave a brief presentation on the projects to the Environmental Management Site Specific Advisory Board — Idaho National Engineering Laboratory. The advisory board is a group of individuals representing the citizens of Idaho, making recommendations to DOE, EPA, and the state of Idaho regarding environmental restoration activities at the INEL.

4. Scopes and Roles of Operable Units and Response Actions

Under the Federal Facility Agreement and Consent Order, the INEL is divided into ten waste area groups. Each waste area group is further subdivided into operable units, each of which may contain one or more sites. The first nine waste area groups correspond to particular operating facilities on the INEL; the tenth waste area group represents the entire INEL and the Snake River Plain Aquifer. The SL-1 site is part of Waste Area Group 5, which contains 13 operable units and is the only site in Operable Unit 5-05. The BORAX-I site is in Waste Area Group 6 and is the only site in Operable Unit 6-01. A complete evaluation of all cumulative risks associated with CERCLA action in Waste Area Groups 5 and 6 will be addressed in the respective comprehensive remedial investigation/feasibility study for each waste area group. Cumulative risks for the entire INEL will be addressed in the Waste Area Group 10 risk assessment.

Existing data from past operating and disposal activities were available to expedite the evaluation of these sites. Therefore, the scope of the remedial investigation for the SL-1 and BORAX-I burial grounds did not include any sampling or acquisition of new data, and a Work Plan was not produced. A focused feasibility study, one that examined only those alternatives that had been previously selected in Records of Decision for similar sites, was performed.

The SL-1 site is defined as the buried waste in the SL-1 burial ground plus the surface soils in the surrounding area shown in Figure 2. The BORAX-I site is defined as the buried waste in the BORAX-I burial ground plus the surface soil in the surrounding 84,000-square foot (7,800-m^2) area illustrated in Figure 3. This Record of Decision addresses the contaminated surface soils and buried wastes at both burial grounds. Both of these sites pose unacceptable risk to human health and the environment, primarily because of the risks from direct exposure to ionizing radiation from the buried wastes. There is also a lesser but still unacceptable risk due to soil ingestion. The purpose of this response is to inhibit current or future exposure to the buried waste and to reduce risks from soil ingestion.

5. Site Characteristics

This section summarizes the historical data used to evaluate contamination at the SL-1 and BORAX-I burial grounds. The agencies determined that sufficient data exist to recommend a remedial action for each site, therefore, no sampling was conducted for the remedial investigation. A complete discussion of the site characteristics for the SL-1 and BORAX-I burial grounds can be found in the remedial investigation/feasibility study and the Administrative Record for Operable Units 5-05 and 6-01.

5.1 SL-1

On January 3, 1961, the SL-1 reactor was destroyed by an accidental nuclear excursion that resulted in a steam explosion. Very little contamination was released to the environment at the time of the accident due to the containment provided by the reactor building; however, demolition and cleanup activities resulted in the spread of contamination over surface soils from Auxiliary Reactor Area II to the SL-1 burial ground. Numerous radiological surveys, surficial soil sampling, and particle-picking activities have been conducted in the years since the accident. The following section summarizes the results of these activities.

5.1.1 Previous Investigations

The DOE's Radiological and Environmental Sciences Laboratory conducted gamma radiation surveys in the vicinity of Auxiliary Reactor Areas I and II and the SL-1 burial ground every 3 to 4 years between 1973 and 1991. The areas north of Auxiliary Reactor Areas I and II and northeast of the SL-1 burial ground had the highest gamma radiation intensities. Soil sampling in 1977 found that cesium-137 was the primary contaminant.

The INEL's Waste Management Group surveyed areas in the vicinity of Auxiliary Reactor Area II and outside of the SL-1 burial-ground fence in 1985. The survey identified and mapped 236 radioactive particles, of which 219 had maximum surface readings of 20 mR/hour or greater. Of these, 16 had readings greater than 200 mR/hour (the maximum reading possible for the instruments used in the survey). A total of 44 of the particles were removed. Particles with readings greater than 200 mR/hour that were located on the road between Auxiliary Reactor Area II and the burial ground or were located in the disturbed area across Fillmore Boulevard from Auxiliary Reactor Area II were removed.

The INEL's Environmental Monitoring Unit conducted annual radiological surveys of surface soils within the SL-1 burial ground fence from 1987 through 1992. One-third of the area was surveyed each year; at the end of each three-year period, the entire area had been surveyed. From 1987 to 1989, readings ranged from 0.05 to 11.0 mR/hour measured at contact. From 1990 to 1992, readings ranged from 0.04 to 4.42 mR/hour measured at contact.

In 1993, the Environmental Monitoring Unit performed a surface-soil radiological survey and particle-picking at the SL-1 burial ground. There were 874 particles identified with readings from 0.01 to 200 mR/hour at contact. Particles reading greater than 0.15 mR/hour were removed if they were located in the top 3 inches (7.6 cm) of soil. Of the 874 particles, 709 were removed for disposal at the Radioactive Waste Management Complex. Activity levels of the particles deeper than 3 inches (7.6 cm) and left in place ranged from 0.01 to 50 mR/hour.

As part of the 1993 effort, an area immediately adjacent and northeast of the burial ground was investigated. Of the 163 particles identified, 66 were removed. The remaining particles were located at a depth of greater than 3 inches (7.6 cm) and had activities ranging from 1.0 to 250 mR/hour. Three soil samples were collected from a depth of 0 to 1 foot (0 to 0.3 m).

Four soil samples were collected from the vicinity of the SL-1 burial ground in a separate, unrelated sampling effort conducted in 1993 as part of the Waste Area Group 3 and Waste Area Group 10 soils treatability study. The soil samples were analyzed for gross alpha, gross beta, and cesium-137.

A surface-soil survey in June 1994 found 217 particles within the burial-ground fence, with activities ranging from 0.1 to 50 mR/hour. There were 51 particles identified in the area just northeast of the burial ground, with activities ranging from 0.2 to 250 mR/hour. In November 1994, a survey was conducted to determine radiation levels within the burial ground at a height of 2.5 feet (0.8 m). A maximum of 0.5 mR/hour was detected at two locations; the remainder of the area was at the local background of 0.2 mR/hour.

Aerial surveys of the SL-1 burial ground were conducted in 1974, 1982, 1990, and 1993. The surveys detected gamma radiation from man-made sources in the area, with cesium-137 the primary contributor. The 1990 survey, which was used to define the site boundary, is illustrated in Figure 4. A risk assessment was completed in August 1995 on the basis of soil samples and dose equivalent rate measurements within the isopleth defined by the 1990 aerial survey (see Section 11.1).

5.1.2 Nature and Extent

5.1.2.1 Surface Contamination. Operable Unit 5-05 comprises the area illustrated in Figure 2. Based on the original source of surface contamination (aerial distribution of contaminants during demolition and cleanup of the SL-1 reactor) and the limited mobility of radionuclides in the soil at the INEL, it is believed that contamination is restricted to the upper 0.5 foot (0.15 m) of soil. For the remedial investigation, identification of the contaminants of concern associated with surface soils at SL-1 was based on comparison of analytical data with background concentrations. Concentrations of

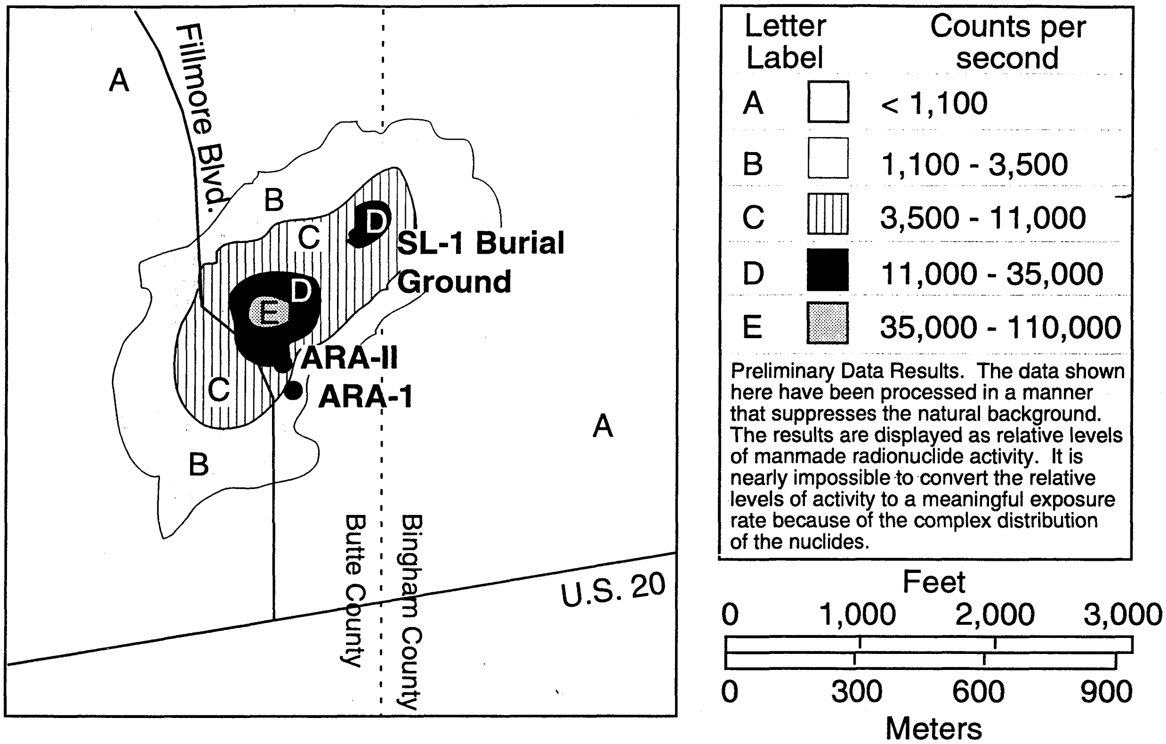


Figure 4. 1990 isoplethic map of SL-1.

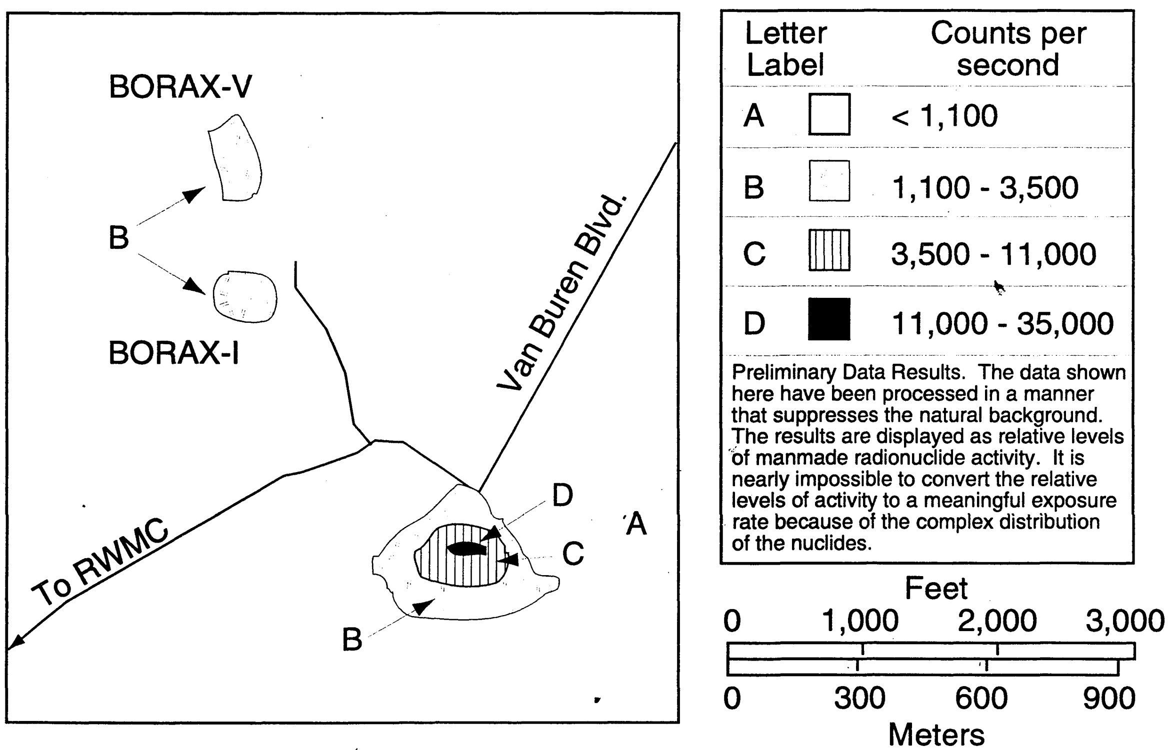


Figure 5. 1990 isoplethic map of BORAX-I.

the contaminants of concern for surface soils were based on the 95% upper confidence limit of the analytical data, and the assumption was made that each contaminant is uniformly distributed across the site. Table 1 presents the contaminants of concern for surface soils.

An assessment of the surface soils surrounding the SL-1 burial ground was concluded in August 1995 subsequent to the remedial investigation and proposed plan. Based on the results of this assessment, all dose equivalent rates within the Operable Unit are at or below the background value of 20 µrem/hr.

Table 1. Contaminants of concern and surface soil concentrations at SL-1.

Radionuclide	Concentration (pCi/g) 95% upper confidence limit	Concentration (pCi/g) INEL Background[a]
Cobalt-60	0.36	No data available
Cesium-137	904	1.28
Europium-154	2.68	No data available
Strontium-90	1,370	0.76
Thorium-228	1.6	2.1[b]
Thorium-230 and/or uranium-234	2.7	1.88, 1.95
Thorium-232	1.4	2.1[b]

a. 95%/95% upper tolerance limit, grab sample background concentrations from *Background Dose Equivalent Rates and Surficial Soil Metal and Radionuclide Concentrations for the Idaho National Engineering Laboratory*, INEL-94/0250, S. M. Rood, G. A. Harris, G. J. White, February 1995.

b. Thorium-228 and -232 were retained for evaluation based on background data that were available when the remedial investigation was prepared; the above-referenced background document was released after the remedial investigation was finalized.

5.1.2.2 Subsurface Contamination. Subsurface contamination at the SL-1 burial ground is restricted to the excavations that received contaminated building debris, equipment, and gravel and soil from the demolition and cleanup following the SL-1 reactor accident. The estimated volume of buried contaminated material is 99,000 cubic feet (2,800 m^3).

The inventory and activities of radionuclides in the subsurface of the SL-1 burial ground were estimated using the computer model ORIGEN2. Because 93% of the uranium-235 fuel was recovered during the accident investigation and cleanup, it was assumed that only 7% of the original quantity of fuel was disposed of in the SL-1 burial ground. Inventories of radionuclide activities were generated for 1961, 1994, 2024, and 2094 and were utilized in the baseline risk assessment to calculate risks for current, 30-year future, and 100-year future scenarios. Inventories were calculated for specific times to account for the decay (decrease through time) of parent radionuclides and the ingrowth (an increase through time) of radioactive progenies. The concentration of each contaminant of concern for each time evaluated was estimated using the assumption that 7% of the model-generated activity for each contaminant of concern was uniformly distributed throughout the source volume. Table 2 presents contaminants of concern for the subsurface and estimated concentrations.

Table 2. Potential contaminants of concern and estimated subsurface concentrations at SL-1 for non-groundwater pathways.

Radionuclide	Concentration (pCi/g)		
	July 1994	July 2024	July 2094
Cesium-137	2.29E+04	1.14E+04	2.27E+03
Strontium-90	2.15E+04	1.05E+04	1.99E+03
Krypton-85	6.91E+02	9.94E+01	1.08E+00
Samarium-151	5.20E+02	4.13E+02	2.41E+02
Promethium-147	2.62E+01	9.46E-03	8.78E-11
Plutonium-241	1.96E+01	4.62E+00	1.59E-01
Europium-154	1.84E+01	1.64E+00	5.80E-03
Europium-155	1.24E+01	1.87E-01	1.05E-05
Plutonium-239	1.04E+01	1.04E+01	1.04E+01
Technetium-99	6.85E+00	6.85E+00	6.85E+00
Plutonium-238	6.72E+00	5.30E+00	3.05E+00
Americium-241	2.57E+00	2.93E+00	2.76E+00
Plutonium-240	1.56E+00	1.56E+00	1.55E+00
Zirconium-93	1.04E+00	1.04E+00	1.04E+00
Niobium-93m	8.09E-01	9.46E-01	9.83E-01
Antimony-125	7.30E-01	4.01E-04	9.89E-12
Europium-152	7.11E-01	1.54E-01	4.35E-03
Uranium-235	4.60E-01	4.60E-01	4.60E-01
Cesium-135	4.34E-01	4.34E-01	4.34E-01
Uranium-236	2.32E-01	2.32E-01	2.32E-01
Tellurium-125m	1.78E-01	9.78E-05	2.41E-12
Antimony-126m	1.78E-01	1.78E-01	1.78E-01
Tin-126	1.78E-01	1.78E-01	1.78E-01
Cesium-134	9.12E-02	3.81E-06	2.30E-16
Tin-121m	2.70E-02	1.78E-02	6.76E-03
Antimony-126	2.49E-02	2.49E-02	2.49E-02
Neptunium-237	2.14E-02	2.14E-02	2.15E-02
Iodine-129	1.12E-02	1.12E-02	1.12E-02
Palladium-107	7.38E-03	7.38E-03	7.38E-03
Uranium-234	6.28E-03	6.79E-03	7.60E-03
Uranium-238	5.64E-03	5.64E-03	5.64E-03
Protactinium-231	3.34E-04	6.26E-04	1.31E-03
Americium-242m	2.40E-04	2.09E-04	1.52E-04
Actinium-227	1.31E-04	3.60E-04	1.00E-03
Americium-243	3.55E-05	3.54E-05	3.52E-05
Protactinium-234	7.33E-06	7.33E-06	7.33E-06
Curium-243	6.83E-06	3.29E-06	6.00E-07
Francium-223	1.81E-06	4.96E-06	1.39E-05

5.1.3 Fate and Transport

Potential pathways for contaminant migration at the SL-1 burial ground are limited by site conditions. The SL-1 site is fairly isolated, is gently sloped, is in a desert climate, and has a great depth to groundwater [approximately 667 feet (203 m)]. Although there is surface contamination at the site, the majority of contamination is subsurface. In general, the potential pathways for contaminant migration include atmospheric transport and transport via surface water and groundwater.

There is a potential for windblown migration of radionuclides present in the surface soil at the SL-1 burial ground, although the presence of a thick grass cover minimizes mobilization of dust and its dispersion by wind.

No surface-water migration pathway exists at the site, and there are no surface-water features. The SL-1 burial ground is in a topographic low, minimizing the chance for significant erosion due to surface water but increasing infiltration from precipitation. Flooding of the Big Lost River is not a concern at SL-1 because of topography, distance from the river, and the INEL's flood diversion system.

No groundwater sampling data are available for the SL-1 burial ground, therefore the groundwater pathway was evaluated using the GWSCREEN (version 2.02) computer model. Concentrations in the groundwater were modeled for three hypothetical locations: the edge of the burial grounds, the downgradient boundary of the waste area group (Figure 2), and the nearest downgradient INEL site-boundary (Figure 1). Groundwater flow is generally from northeast to southwest. The groundwater modeling performed in support of the remedial investigation indicates that vertical migration of contaminants from the SL-1 burial ground is limited. The tendency of the contaminants to chemically react with naturally occurring minerals in the soil and low annual precipitation result in long transit times within the vadose zone (typically hundreds of years or more). It is assumed that no lateral migration of contaminants has occurred within the subsurface because there is no mechanism or driving force to move contaminants horizontally. Infiltration of precipitation is primarily vertical within the vadose zone and therefore would not contribute significantly to the horizontal migration of radionuclides.

5.2 BORAX-I

In 1954, the design mission of the BORAX-I reactor was completed and the decision was made to conduct one final experiment that would result in the destruction of the reactor. The excursion contaminated approximately 84,000 square feet (7,800-m^2) of ground, in a strip approximately 200 feet (61 m) wide and 420 feet (128 m) long, extending south-southeast from the reactor. Following cleanup, the contaminated area of approximately 84,000 square feet (7,800-m^2) was covered with gravel to a depth of 6 inches (15 cm). Soil sampling of the 84,000-square foot (7,800-m^2) area of surface contamination was conducted in 1978 and 1980. Results of these activities are summarized in the following section.

5.2.1 Previous Investigations

In 1978, the Radiological and Environmental Sciences Laboratory performed a multiphase study to assess the distribution of radioactivity at the BORAX-I reactor burial ground. Exposure rates at 3 feet (1 m) above the ground were determined.

A portable gamma-ray spectroscopy system was used to identify gamma-emitting radionuclides. In situ gamma-ray spectrums were obtained from nine locations. Surface-soil samples were also collected at nine locations outside of the graveled area in order to assess the extent of contamination. The collection locations were chosen to include samples down range of the major debris and surface deposition zones. Soil samples were collected from five locations within the gravel-covered area and were analyzed by gamma ray spectroscopy in order to assess the deposition and migration activity. Analyses of the soil samples showed that cesium-137 and uranium-235 were the only detectable gamma-emitting radionuclides present. Samples collected from the gravel covering showed that 98% of the radioactive contamination was located within 2 inches (5 cm) of the gravel/soil interface.

An investigation of the BORAX-I reactor area was conducted in June and November 1980. The investigation consisted of a gridded radiation survey of the BORAX-I site, including high-resolution gamma spectrometer measurements of the surface soil, soil samples from trenches, and sodium-iodide gamma spectrometer profiles of selected boreholes. The purpose of the radiological characterization was to identify the radionuclides present within the area and to specify their concentrations and distributions. Cesium-137 was the only man-made gamma emitter detected during the radiological surveys. Soil-sample analyses detected cesium-137, strontium-90, uranium-235, and plutonium-239. Results indicate that surface contamination was limited to relatively small areas, mainly along a south-southeast line from the reactor location.

Aerial surveys of the BORAX-I burial ground were conducted in 1974, 1982, 1990, and 1993. The surveys detected gamma radiation from man-made sources in the area, with cesium-137 being the primary contributor. Figure 5 illustrates the results of the 1990 survey.

5.2.2 Nature and Extent

5.2.2.1 Surface Contamination. Operable Unit 6-01 comprises an area approximately 200 by 420 feet (61 by 128 m). Based on the original source of surface contamination (aerial distribution of contaminants resulting from the final experiment of the BORAX-I reactor) and the limited mobility of radionuclides in the soil at the INEL, it is believed that contamination is restricted to the upper 1 foot (0.3 m) including 0.5 foot (0.15 m) of contaminated soil and 0.5 foot (0.15 m) of gravel cover.

Identification of the contaminants of concern associated with surface soils at BORAX-I was based on comparison of analytical data with background concentrations. Concentrations of the contaminants of concern for surface soils were based on the 95% upper confidence limit of the analytical data, and the assumption was made that each contaminant is uniformly distributed throughout the 200- by 420-foot (61- by 128-m) area. Table 3 presents the contaminants of concern for surface soils.

Table 3. Contaminants of concern and surface soil concentrations at BORAX-I.

Radionuclide	Concentration (pCi/g) 95% upper confidence limit	INEL Background[a]
Cesium-137	1,817	1.28
Strontium-90	2.0	0.76
Uranium-235	68.6	0.055 - 0.059[b]

a. 95%/95% upper tolerance limit, grab sample background concentrations for cesium-137 and strontium-90 from *Background Dose Equivalent Rates and Surficial Soil Metal and Radionuclide Concentrations for the Idaho National Engineering Laboratory*, INEL-94/0250, S. M. Rood, G. A. Harris, G. J. White, February 1995.

b. Range of background for uranium-235 from the remedial investigation/feasibility study, Attachment 1 of Appendix B.

5.2.2.2 Subsurface Contamination. Subsurface contamination at the BORAX-I burial ground is restricted to the contaminated soil and materials deposited in the concrete foundation of the reactor structure. The estimated volume of contaminated material in the subsurface is 6,336 cubic feet (180 m^3).

The BORAX-I inventory and activities of buried radionuclides were estimated using the computer model RSAC-5. Decontamination documents prepared after the cleanup of the BORAX-I facility in 1954 reported that 12% of the uranium-235 fuel had been recovered. Based on this figure, it was assumed that 88% of each of the associated radionuclides remained unrecovered and was disposed of in the burial ground. Inventories of radionuclides were generated for 1954, 1994, 2024, and 2094 and were used in the baseline risk assessment to calculate risks for current, 30-year future, and 100-year future scenarios. Inventories were calculated for specific times to account for the decay (a decrease through time) of parent radionuclides and for ingrowth (an increase through time) of radioactive progenies. The concentration of each contaminant of concern for each time evaluated was estimated using the assumption that 88% of the model-generated activity for each contaminant of concern was uniformly distributed throughout the source volume. Table 4 presents the contaminants of concern for the subsurface.

Table 4. Potential contaminants of concern and estimated subsurface concentrations at BORAX-I for non-groundwater pathways.

Radionuclide	Concentration (pCi/g)		
	July 1994	July 2024	July 2094
Cesium-137	1.20E+03	6.02E+02	1.19E+02
Strontium-90	1.10E+03	5.39E+02	1.01E+02
Uranium-234	9.29E+02	9.29E+02	9.29E+02
Samarium-151	5.05E+01	4.01E+01	2.34E+01
Uranium-235	2.94E+01	2.94E+01	2.94E+01
Krypton-85	1.90E+01	2.73E+00	2.95E-02
Technetium-99	4.27E-01	4.27E-01	4.27E-01
Thorium-230	3.34E-01	5.83E-01	1.17E+00
Promethium-147	2.77E-01	1.00E-04	9.25E-13
Uranium-238	1.91E-01	1.91E-01	1.91E-01
Zirconium-93	6.35E-02	6.35E-02	6.35E-02
Niobium-93m	5.57E-02	6.21E-02	6.35E-02
Protactinium-231	2.18E-02	3.83E-02	7.65E-02
Tin-126	1.10E-02	1.10E-02	1.10E-02
Actinium-227	9.51E-03	2.29E-02	5.95E-02
Cesium-135	8.29E-03	8.29E-03	8.29E-03
Antimony-125	8.14E-03	4.46E-06	1.10E-13
Radium-226	2.88E-03	8.77E-03	3.48E-02
Lead-210	8.99E-04	4.01E-03	2.25E-02
Iodine-129	6.02E-04	6.02E-04	6.02E-04
Protactinium-234	2.48E-04	2.48E-04	2.48E-04
Europium-154	1.12E-04	9.96E-06	3.53E-08
Niobium-94	6.35E-07	6.32E-07	6.32E-07

5.2.3 Fate and Transport

Potential pathways for contaminant migration at the BORAX-I burial ground are limited by conditions at the site. The site is fairly isolated, is gently sloped, is in a desert climate, and has a great depth to groundwater [approximately 596 feet (181 m)]. Although there is surface contamination at the site, the majority of contamination is in the subsurface. In general, the potential pathways for contaminant migration include atmospheric transport and transport by surface water and groundwater.

There is a potential for windblown migration of radionuclides present in the surface soil at the BORAX-I burial ground, although the existing vegetative cover minimizes the mobilization of dust and its dispersion by wind.

No surface-water migration pathway exists at the site and there are no surface-water features. Although the BORAX-I burial ground is located on a slight rise, the slope of the ground immediately adjacent to the site is fairly gentle, minimizing the likelihood of erosion. Flooding of the Big Lost River is not a concern at BORAX-I because of topography, distance from the river, and the INEL's flood diversion system.

No groundwater sampling data are available for the BORAX-I burial ground, therefore the groundwater pathway was evaluated using the GWSCREEN (version 2.02) computer model. Concentrations in the groundwater were modeled for three hypothetical locations: the edge of the burial grounds, the downgradient boundary of the waste area group (Figure 3), and the nearest downgradient INEL site-boundary (Figure 1). Regional groundwater flow is generally from northeast to southwest. Results of the modeling indicate that vertical migration of contaminants from the BORAX-I burial ground is limited. The tendency of the contaminants to chemically react with naturally occurring minerals in the soil and low annual precipitation result in long transit times within the vadose zone (typically hundreds of years or more). It is assumed that no lateral migration of contaminants has occurred within the subsurface because there is no mechanism or driving force to move contaminants horizontally. Infiltration of precipitation is primarily vertical within the vadose zone and therefore would not contribute significantly to the horizontal migration of radionuclides.

6. Summary of Site Risks

A baseline risk assessment was conducted to evaluate current and future potential risks to human health. The risk assessments were conducted in accordance with the EPA *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual* and other EPA guidance. Risk scenarios and default parameters used in the risk assessment were selected with the concurrence of the agencies.

Radionuclides are the only contaminants of concern at the SL-1 and BORAX-I burial grounds. Although nonradioactive contaminants may be present at either site, it was determined that, if present, they probably represent an insignificant contribution to the total risk. Radionuclides present in surface soils at BORAX-I and subsurface soils at both sites pose potential carcinogenic (cancer causing) risks to occupational workers and future residents. Carcinogenic risks are generally a much greater concern than noncarcinogenic risks from radionuclides. Therefore, the baseline risk assessment focused on a quantitative assessment of carcinogenic risks. Noncarcinogenic risks were subjected to a qualitative evaluation and were eliminated from further assessment. The assessment considered the carcinogenic health effects that could result from exposure to the contaminants under current occupational and future occupational and residential land use scenarios. The health effects differ depending on whether the sites are used for light industry or residential development. Effects could result from direct exposure to radiation, from inhalation of contaminated dust, or from ingestion of contaminated soil or groundwater. Section 6.1 summarizes the results of the baseline risk assessment.

The baseline risk assessment for Operable Unit 5-05 evaluated potentially contaminated surface soils in an area 1,200 by 1,500 feet (366 by 457 m). Subsequent to finalization of the remedial investigation/feasibility study report and the proposed plan, an evaluation of new data in conjunction with historical sampling and survey data determined that surface soils within Operable Unit 5-05 do not pose an unacceptable risk to human health or the environment (see Section 11.1). Support documentation for this determination can be found in the Administrative Record for Operable Units 5-05 and 6-01.

A qualitative ecological risk assessment was performed to evaluate potential risks to the environment due to contamination at the SL-1 and BORAX-1 burial grounds. Section 6.2 summarizes results of the ecological risk assessment.

6.1 Human Health Risks

A baseline risk assessment was performed to evaluate the risks associated with taking no further action at a site. Thus, it was assumed in the assessment, as instructed in EPA guidance, that no remediation will take place. Potential risks for specified land use scenarios were assessed.

The risk assessment consisted of contaminant identification, exposure assessment, toxicity assessment, and human health risk characterization. The contaminants identified at the SL-1 and BORAX-I burial grounds were based on historical soil-sampling data and radionuclide inventories calculated using computer models. The exposure assessment identified the potential exposure pathways for current workers and for future workers and residents. The toxicity assessment evaluated the potential health effects to an individual as a result of exposure to contaminants. Exposure scenarios were chosen to reflect a range of potential future land uses. Industrial land use is assured for the next 100 years, after which residential use is considered possible. Specifically, scenarios included the current use of the SL-1 and BORAX-I burial grounds (current occupational land use) and potential future land use scenarios (occupational and residential land use) in which the onset of exposures are delayed for 30 and 100 years.

The baseline risk assessment was presented in two parts: (1) an evaluation of deterministic risk based on standard EPA methodology and (2) an evaluation of the uncertainty associated with the mean risk using probabilistic risk assessment. The first quantity (deterministic risk) is a point estimate that represents a quantified upper bound of risk. Deterministic risks are used by decisionmakers to define the estimated excess risk that must be addressed in remedial decisions. Probabilistic methods are used in the second evaluation to quantify the uncertainty associated with the deterministic risk. These methods provide a more complete understanding of the excess risk potential at a site by examining the likelihood of over- or under-estimation of risk.

6.1.1 Contaminant Identification

Historical soil sampling analytical data were used to identify radionuclides present in surface soils at both sites. The lists of radionuclides were screened based on comparison with background concentrations determined for the INEL. The range of sample concentrations was compared to the range of background concentrations. If the maximum sample concentration exceeded the maximum background concentration, the radionuclide was retained and assessed in the risk assessment (Tables 1 and 3).

Computer models were used to generate lists of radionuclides with estimated activities for the subsurface at each site. The radionuclides were screened based on availability of toxicological data and potential for posing a significant risk. Radionuclides evaluated in the risk assessment for the subsurface are presented in Tables 2 and 4.

6.1.2 Exposure Assessment

The objective of the exposure assessment was to estimate the magnitude of exposure to contaminants of concern at SL-1 and BORAX-I. The magnitude of exposure was determined by measuring or estimating the quantities of the contaminants available for contact at an exposure point during a specified time period. The results of the exposure assessment were then combined with contaminant-specific toxicity information to characterize potential risks.

6.1.2.1 Exposure Scenarios. Only those exposure pathways where a plausible route of exposure can be demonstrated from the site to an individual were quantitatively evaluated in the risk assessment. The populations at risk due to exposure from wastes at the SL-1 and BORAX-I burial grounds were identified by considering both current and future land use scenarios. For each of the two sites, 10 potential exposure scenarios (five residential scenarios and five occupational scenarios) were examined in the baseline risk assessment.

The residential scenarios model a person living on the site 350 days a year for 30 years, beginning in 2024 and 2094 (30 and 100 years from 1994). The intrusive scenarios reflect conditions if the buried waste is exposed. The nonintrusive scenarios model the risk to an individual who lives on the surface above the wastes in 2024 and 2094 and to a subsistence farmer on the site beginning in 2094.

The five occupational scenarios model nonintrusive daily industrial use without restrictions in 1994, two 1994 site-specific evaluations reflecting occupational activities over the last few years, and daily industrial use 30 and 100 years in the future in the years 2024 and 2094. Section 6.1.2.3 lists exposure parameters for each scenario.

6.1.2.2 Media Concentrations. Limited sampling and analytical data were available regarding contaminants present in the surface and subsurface soil at the SL-1 and BORAX-I sites. Surface-soil samples from the burial grounds and adjacent areas were used to evaluate the risk for soil ingestion, inhalation of dust, and ingestion of crops, meat, and milk for the nonintrusion scenarios. Surface-sample data were also used to evaluate the external exposure pathway for the subsistence farmer scenarios. Subsurface contamination was evaluated based on radionuclide inventories and activities estimated using computer models. All pathways for the intrusion scenarios and the groundwater and external exposure pathways for the nonintrusion scenarios were evaluated using the computer-generated radionuclide inventories and activities. The radionuclides and concentrations evaluated in the baseline risk assessment are listed in Tables 1 through 4.

To provide an understanding of the external exposure risk present at the surface at the two sites, risk attributable to the radiological field measurements taken within the fence at each burial grounds was also evaluated. A radiological field survey conducted in November 1994 found levels of 0.5 mR/hour at the SL-1 burial ground and 0.1 mR/hour at the BORAX-I burial ground. Measurements were taken at 2.5 feet (0.8 m) above the ground surface. Local backgrounds were 0.2 mR/hour for SL-1 and 0.1 mR/hour at BORAX-I. However, dose equivalent rates measurements taken in 1995 in the area around SL-1 yielded readings at or below the background value of 20 μrem/hr.

6.1.2.3 Quantification of Exposure. The following exposure pathways were considered applicable to the evaluation of human exposure to contaminants at the sites: ingestion of soil; inhalation of fugitive dust; ingestion of groundwater (residential scenarios only); ingestion of crops, meat, and milk (subsistence farmer scenario only); and external exposure from radionuclides. The future residential setting included a hypothetical well, which could provide contaminated groundwater for use as drinking water. For the subsistence farmer scenario, the resident was also assumed to consume homegrown produce, meat, and milk produced on site.

Adult exposures were evaluated for all scenarios and pathways (external exposure; inhalation of dust; and ingestion of soil, groundwater, and foods); child exposures (0 to 6 years old) were considered separately only for the soil ingestion pathway in the residential scenarios. Children were included because children ingest more soil than adults, significantly increasing their exposure rate.

The exposure parameters used in the risk assessment were obtained from EPA and DOE guidance. The exposure parameter default values used in the risk assessment are designed to estimate the reasonable maximum exposure at a site. The EPA defines reasonable maximum exposure as the highest exposure at a site. Use of this approach makes under-estimation of the actual cancer risk highly unlikely. Concentrations of the radionuclides evaluated in the baseline risk assessment are listed in Tables 1 through 4. The exposure parameters used in the risk assessment were:

- All pathways
  - Exposure frequency, residential: 350 days/year
  - Exposure frequency, occupational, current: 250 days/year
  - Exposure frequency, occupational, site-specific #1: 30 days/year
  - Exposure frequency, occupational, site-specific #2: 5 days/year
  - Exposure duration, occupational, current: 25 years
  - Exposure duration, occupational, site-specific #1 and #2: 3 years
- External exposure pathway
  - Exposure time, residential: 24 hour/day
  - Exposure time, occupational: 8 hour/day
  - Exposure duration, residential: 30 years

- Soil ingestion pathway

- Soil ingestion rate, residential, adult:	100 mg/day
- Soil ingestion rate, residential, child:	200 mg/day
- Soil ingestion rate, occupational:	50 mg/day
- Exposure duration, residential, adult:	24 years
- Exposure duration residential, child:	6 years

- Dust inhalation pathway

- Inhalation rate:	20 m^3 of air/day
- Exposure duration, residential:	30 years

- Groundwater ingestion pathway

- Groundwater ingestion rate, residential:	2 liters/day
- Exposure duration, residential:	30 years.

The parameters and distributions used in the probabilistic risk assessment are presented in Tables 6-9 through 6-11 of the *Remedial Investigation/Feasibility Study Report for Operable Units 5-05 and 6-01 (SL-1 and BORAX-I Burial Grounds), INEL-95/0027* (K. J. Holdren, R. G. Filemyr, D. W. Vetter, Idaho National Engineering Laboratory, March 1995), which is included in the Administrative Record for Operable Units 5-05 and 6-01.

6.1.3 Toxicity Assessment

A toxicity assessment was conducted to identify potential adverse effects to humans from contaminants at SL-1 and BORAX-I. A toxicity value is the numerical expression of the substance dose-response relationship used in the risk assessment. Carcinogenic values (slope factors) for the sites were obtained from EPA's *Health Effects Assessment Summary Tables: Annual FY-93*, ECAO-CIN-909, 1993. The slope factors selected for the soil ingestion, inhalation of dust, and external exposure pathways include progenies when available. Slope factors used to evaluate the groundwater pathway do not always include daughters because the groundwater model GWSCREEN specifically accounts for up to five daughters.

Slope factors have been developed by the EPA for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. Slope factors for radionuclides are expressed in units of risk/pCi for ingestion and inhalation and risk/year per pCi/gram for external exposure. Slope factors are multiplied by the estimated intake of a potential carcinogen, in pCi (pCi-year/gram for external exposure), to provide an upper-bound estimate of the excess lifetime cancer risk associated with the exposure at that intake level. Slope factors are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied.

6.1.4 Human Health Risk Characterization

Excess lifetime cancer risks are estimated by multiplying the intake level, developed using the exposure assumptions, by the slope factor (see Section 6.1.3). These risks are probabilities that are generally expressed in either scientific notation ($1x10^{-6}$) or exponential notation (1E-06). An excess lifetime cancer risk of 1E-06 indicates that, as a plausible upper bound, an individual has a one in one million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions at a site. Excess cancer risks estimated below 1E-06 typically indicate that no further action is appropriate. Risks estimated in the range of 1E-04 to 1E-06 (1 in 10,000 to 1 in 1,000,000) indicate that further investigation or remediation may be needed, and risks estimated above 1E-04 typically indicate that further action is appropriate. However, the upper boundary of the risk range is not a discrete line at 1E-04, although EPA generally uses 1E-04 in making risk management decisions. A specific risk estimate around 1E-04 may be considered acceptable if justified based on site-specific conditions.

6.1.4.1 Deterministic and Probabilistic Risk Summary. The results of the deterministic and probabilistic risk calculations are summarized in Table 5 for SL-1 and in Table 6 for BORAX-I and presented graphically in Figures 6 and 7. For the probabilistic simulations, the risk summary tables and figures present the 50th percentile, representing the average individual risk, and the 95th percentile, representing the reasonable maximum exposure individual risk.

The probablistic risk assessment showed that the greatest contributors to uncertainty in the overall risk for the site (that is, the risk due to external exposure) are associated with the exposure duration, concentration of cesium-137, and the external exposure slope factor for cesium-137. A number of scenarios and pathways utilized source terms estimated from computer models. Because of the lack of a sample population from which to estimate statistical parameters for use in the probablistic simulations, it was necessary to assume specific values for the parameters. Increases in the amount of actual data used for input into the probablistic assessment would result in increased value and usefulness of the results.

At both sites, the primary contributor to risk is cesium-137 (plus progeny) in the external exposure pathway. Cesium-137 has a half-life of about 30 years. The decreasing concentration through time results in decreased risk through time. External exposure risk will remain above 1E-04 for approximately the next 400 years at the SL-1 burial ground and will decrease to 2E-04 after approximately 320 years at the BORAX-I burial ground. Due to the long half-life of uranium-235 (7E+08 years), the external exposure risk at BORAX-I will essentially never decrease below 2E-04.

For SL-1, the only radionuclides predicted to reach the aquifer in concentrations of potential concern were tritium and technetium-99, with associated risks of 2E-07 and 6E-07, respectively. Summed with the risks from the remaining radionuclides, the total risk due to groundwater ingestion associated with the SL-1 burial ground is 1E-06. For BORAX-I, uranium-234 and its progenies were the only radionuclides predicted to reach the aquifer in concentrations of potential concern, with a risk sum of

2E-06. Summed with the risks from the remaining radionuclides, the total risk due to groundwater ingestion associated with BORAX-I is 3E-06.

For SL-1, an evaluation of risks due to surface soils defined by the 1990 aerial survey isopleth was performed. It was determined that there are no unacceptable risks via the soil ingestion, inhalation of dust, groundwater ingestion, or external exposure pathways within Operable Unit 5-05. Section 11.1 contains specific references contained in the Administrative Record in support of this assessment.

6.1.4.2 Radiological Field Risk. Surface radiological field measurements taken within the fences at the burial grounds provide exposure levels that account for shielding of radiation provided by the soil cover. Based on the reported maximum, single point radiological field measurements of 0.5 mR/hour at SL-1 and 0.1 mR/hour for BORAX-I, the 30-year residential risk at the surface was estimated at 9E-02 for SL-1 and 2E-02 for BORAX-I. The risk associated with local background is 3E-02 at SL-1 and 2E-02 at BORAX-I. The risk associated with the average background radiological field at the INEL is 3E-03 (0.02 mR/hour). The 30-year residential risk from national average natural background radiation ranges from 2E-03 (0.011 mR/hour) to 6E-03 (0.034 mR/hour). Risks based on radiological field measurements taken within the fences are shown graphically in Figure 8.

A more comprehensive data set for SL-1 was acquired in 1995 and an assessment of the surface soils within Operable Unit 5-05 was completed in August 1995. Dose equivalent rate measurements, all below the background value of 20 μrem/hr, indicate no unacceptable external exposure risks due to surface soils within Operable Unit 5-05.

Table 5. Summary of risks for the potential exposure scenarios and pathways at SL-1.

Scenario Pathway	Deterministic risk	Probabilistic 50th percentile risk	Probabilistic 95th percentile risk
Residential (30-year, intrusive)			
External exposure	5E-01	1E-01	6E-01
Ingestion of soil	9E-04	4E-05	1E-04
Inhalation of dust	8E-07	2E-07	9E-07
Ingestion of groundwater	1E-06	NC[b]	NC[b]
Total scenario risk	**5E-01[a]**	**1E-01**	**6E-01**
Residential (30-year, nonintrusive)			
External exposure	5E-01	1E-01	6E-01
Ingestion of soil	5E-05	3E-07	8E-07
Inhalation of dust	4E-07	7E-08	2E-07
Ingestion of groundwater	1E-06	NC[b]	NC[b]
Total scenario risk	**5E-01[a]**	**1E-01**	**6E-01**
Residential (100-year, intrusive)			
External exposure	1E-01	3E-02	2E-01
Ingestion of soil	2E-04	8E-06	2E-05
Inhalation of dust	4E-07	1E-07	5E-07
Ingestion of groundwater	1E-06	NC[b]	NC[b]
Total scenario risk	**1E-01[a]**	**3E-02**	**2E-01**
Residential (100-year, nonintrusive)			
External exposure	1E-01	3E-02	2E-01
Ingestion of soil	9E-06	6E-08	2E-07
Inhalation of dust	3E-07	7E-08	2E-07
Ingestion of groundwater	1E-06	NC[b]	NC[b]
Total scenario risk	**1E-01[a]**	**3E-02**	**2E-01**
Subsistence farmer (100-year) (water independent pathways)			
External exposure	1E-03	NC[c]	NC[c]
Ingestion of soil	4E-07	NC[c]	NC[c]
Inhalation of dust	2E-06	NC[c]	NC[c]
Ingestion of plants	1E-05	NC[c]	NC[c]
Ingestion of meat	4E-05	NC[c]	NC[c]
Ingestion of milk	1E-05	NC[c]	NC[c]
Total scenario risk	**1E-03[a]**	**NC[c]**	**NC[c]**
Occupational (current)			
External exposure	2E-01	8E-02	4E-01
Ingestion of soil	2E-05	8E-08	4E-07
Inhalation of dust	4E-07	9E-08	3E-07
Total scenario risk	**2E-01[a]**	**6E-02**	**3E-01**

Refer to footnotes at end of table.

Table 5. (continued)

Scenario Pathway	Deterministic risk	Probabilistic 50th percentile risk	Probabilistic 95th percentile risk
Occupational (site-specific #1)			
External exposure	4E-03	2E-03	1E-02
Ingestion of soil	3E-07	2E-09	5E-09
Inhalation of dust	6E-09	NC[d]	NC[d]
Total scenario risk	**4E-03[a]**	**2E-03**	**1E-02**
Occupational (site-specific #2)			
External exposure	6E-04	3E-04	2E-03
Ingestion of soil	6E-08	3E-10	9E-10
Inhalation of dust	9E-10	NC[d]	NC[d]
Total scenario risk	**6E-04[a]**	**3E-04**	**2E-03**
Occupational (future – 30 years)			
External exposure	1E-01	4E-02	3E-01
Ingestion of soil	1E-05	4E-08	2E-07
Inhalation of dust	2E-07	5E-08	2E-07
Total scenario risk	**1E-01[a]**	**4E-02**	**3E-01**
Occupational (future – 100 years)			
External exposure	3E-02	9E-03	6E-02
Ingestion of soil	2E-06	8E-09	3E-08
Inhalation of dust	2E-07	5E-08	2E-07
Total scenario risk	**3E-02[a]**	**9E-03**	**6E-02**

a. Cesium-137 (plus barium-137m) is the primary contributing radionuclide.

b. A probabilistic risk assessment was not performed for the groundwater pathway due to its small contribution to total risk and to the absence of published probability distribution functions for input parameters.

c. A probabilistic risk assessment was not performed for the subsistence farmer scenario due to the absence of published probability distribution functions for input parameters.

d. A probabilistic risk assessment was not performed due to its small contribution to total risk.

NC = Not calculated.

Table 6. Summary of risks for the potential exposure scenarios and pathways at BORAX-I.

Scenario / Pathway	Deterministic risk	Probabilistic 50th percentile risk	Probabilistic 95th percentile risk
Residential (30-year, intrusive)			
External exposure	3E-02	7E-03	5E-02
Ingestion of soil	7E-05	3E-06	8E-06
Inhalation of dust	9E-07	2E-07	1E-06
Ingestion of groundwater	3E-06	NC[b]	NC[b]
Total scenario risk	**3E-02**[a]	**7E-03**	**5E-02**
Residential (30-year, nonintrusive)			
External exposure	3E-02	7E-03	5E-02
Ingestion of soil	3E-05	4E-09	1E-08
Inhalation of dust	8E-07	5E-09	5E-08
Ingestion of groundwater	3E-06	NC[b]	NC[b]
Total scenario risk	**3E-02**[a]	**7E-03**	**5E-02**
Residential (100-year, intrusive)			
External exposure	7E-03	1E-03	1E-02
Ingestion of soil	3E-05	1E-06	4E-06
Inhalation of dust	9E-07	2E-07	1E-06
Ingestion of groundwater	3E-06	NC[b]	NC[b]
Total scenario risk	**7E-03**[a]	**1E-03**	**1E-02**
Residential (100-year, nonintrusive)			
External exposure	7E-03	1E-03	1E-02
Ingestion of soil	8E-06	2E-09	1E-08
Inhalation of dust	8E-07	5E-09	5E-08
Ingestion of groundwater	3E-06	NC[b]	NC[b]
Total scenario risk	**7E-03**[a]	**1E-03**	**1E-02**
Subsistence farmer (100-years) (water independent pathways)			
External exposure	5E-03	NC[c]	NC[c]
Ingestion of soil	2E-06	NC[c]	NC[c]
Inhalation of dust	4E-06	NC[c]	NC[c]
Ingestion of plants	1E-04	NC[c]	NC[c]
Ingestion of meat	1E-04	NC[c]	NC[c]
Ingestion of milk	4E-05	NC[c]	NC[c]
Total scenario risk	**6E-03**[a]	**NC**[c]	**NC**[c]
Occupational (current)			
External exposure	1E-02	4E-03	3E-02
Ingestion of soil	2E-05	1E-09	4E-09
Inhalation of dust	5E-07	4E-09	3E-08
Total scenario risk	**1E-02**[a]	**4E-03**	**3E-02**

Refer to footnotes at end of table.

Table 6. (continued)

Scenario / Pathway	Deterministic risk	Probabilistic 50th percentile risk	Probabilistic 95th percentile risk
Occupational (site-specific #1)			
External exposure	2E-04	9E-05	5E-04
Ingestion of soil	2E-07	1E-11	4E-11
Inhalation of dust	7E-09	NC[d]	NC[d]
Total scenario risk	**2E-04[a]**	**9E-05**	**5E-04**
Occupational (site-specific #2)			
External exposure	3E-05	2E-05	8E-05
Ingestion of soil	4E-08	2E-12	6E-12
Inhalation of dust	1E-09	NC[d]	NC[d]
Total scenario risk	**3E-05[a]**	**2E-05**	**8E-05**
Occupational (future – 30 years)			
External exposure	7E-03	2E-03	2E-02
Ingestion of soil	8E-06	6E-10	3E-09
Inhalation of dust	5E-07	4E-09	4E-08
Total scenario risk	**7E-03[a]**	**2E-03**	**2E-02**
Occupational (future – 100 years)			
External exposure	1E-03	5E-04	3E-03
Ingestion of soil	2E-06	3E-10	2E-09
Inhalation of dust	5E-07	4E-09	4E-08
Total scenario risk	**1E-03[a]**	**5E-04**	**3E-03**

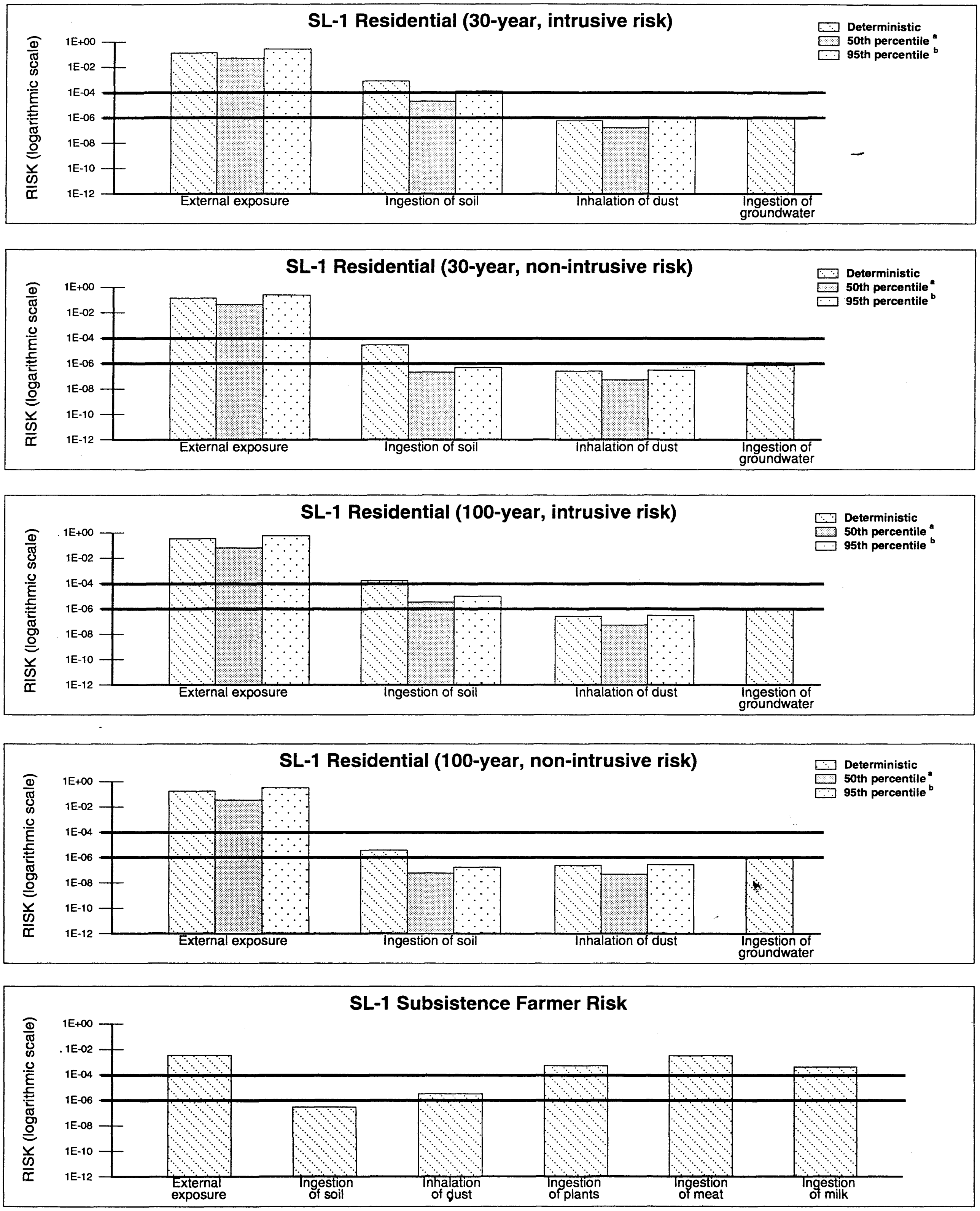
a. Cesium-137 (plus barium-137m) is the primary contributing radionuclide.

b. A probabilistic risk assessment was not performed for the groundwater pathway due to its small contribution to total risk and to the absence of published probability distribution functions for input parameters.

c. A probabilistic risk assessment was not performed for the subsistence farmer scenario due to the absence of published probability distribution functions for input parameters.

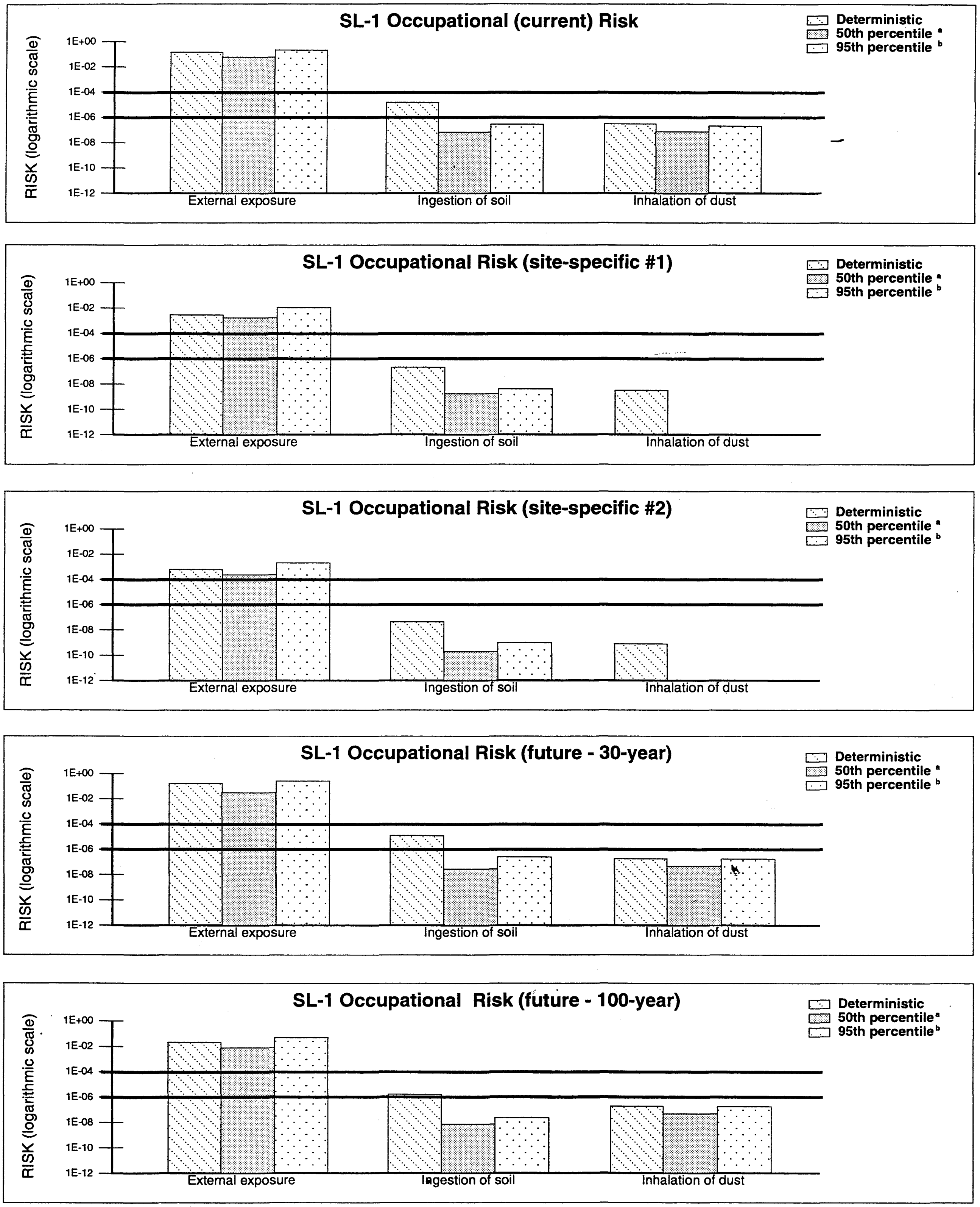
d. A probabilistic risk assessment was not performed due to its small contribution to total risk.

NC = Not calculated.



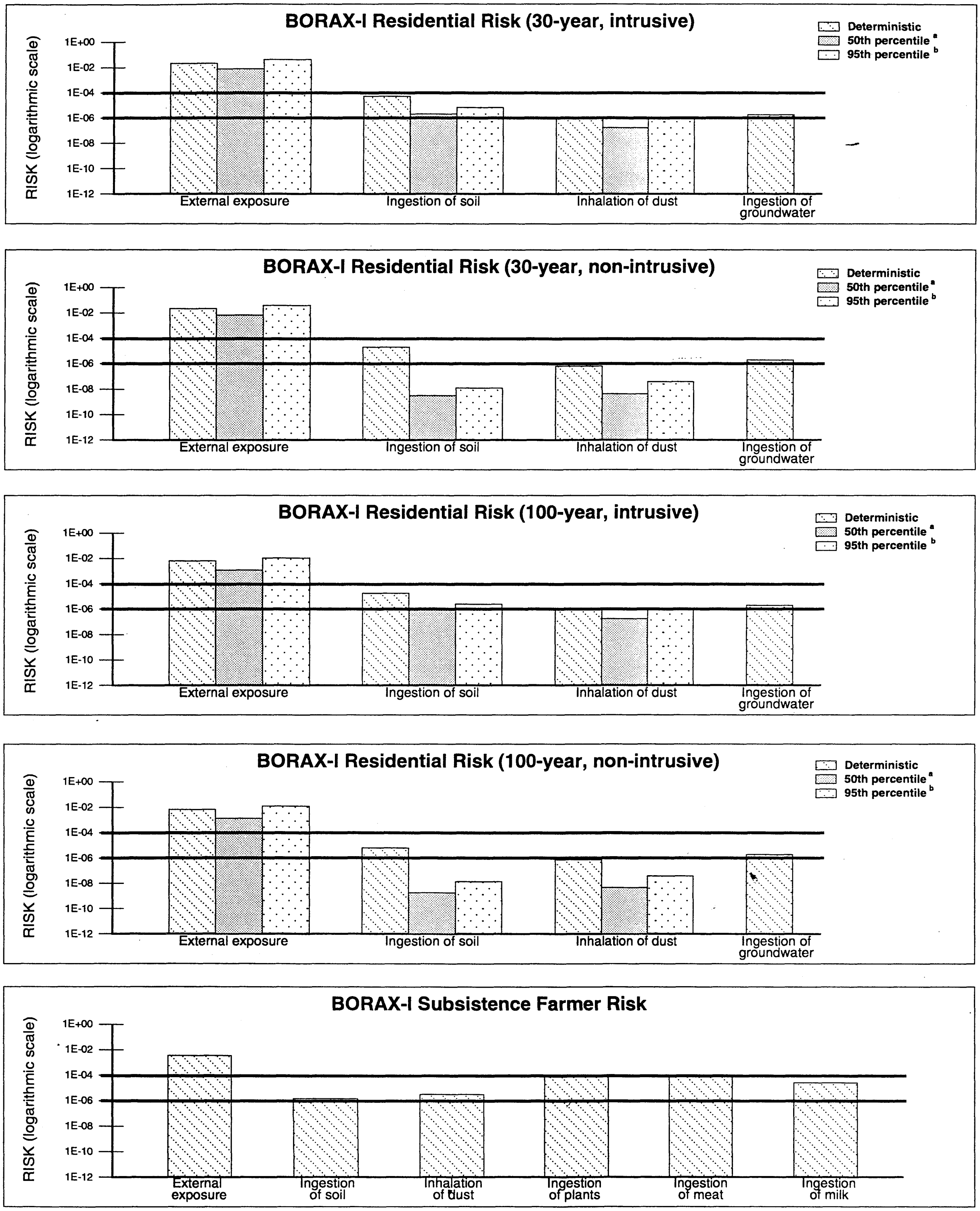
Refer to notes at end of figure

Figure 6. Graphical summary of risk for SL-1.



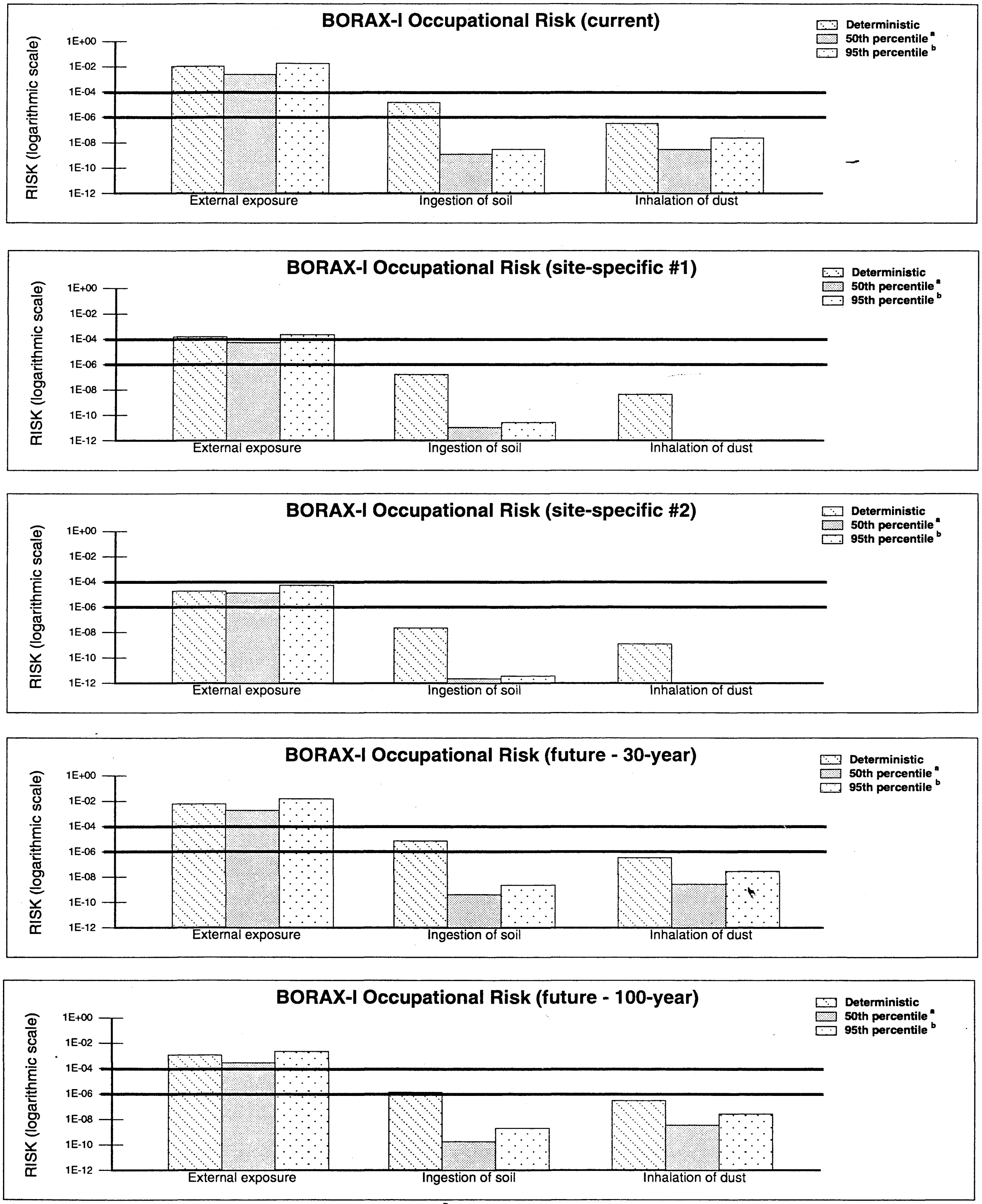
a. The 50th percentile is the average individual risk.
b. The 95th percentile is the reasonable maximum exposure individual risk.

Figure 6. (continued)



Refer to notes at end of figure

Figure 7. Graphical summary of risk for BORAX-I.



a. The 50th percentile is the average individual risk.

b. The 95th percentile is the reasonable maximum exposure individual risk.

Figure 7. (continued)

Residential (current)

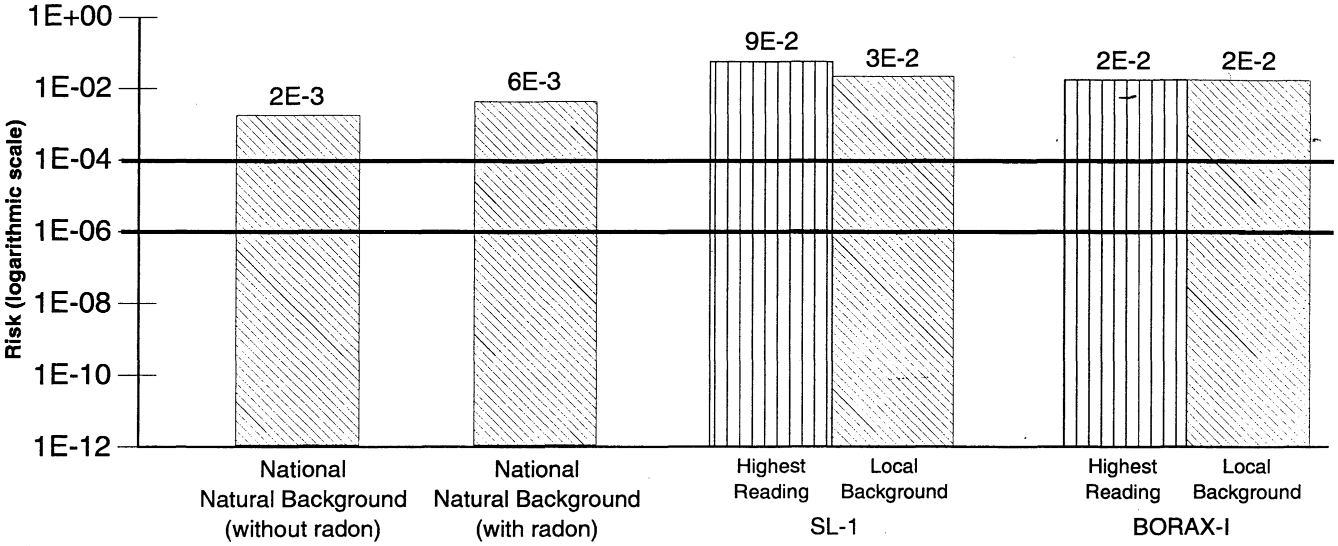


Figure 8. Graphical summary of external exposure risk based on measured radiological fields and natural background, SL-1, and BORAX-I.

The residential risk (30-year duration) estimated from radiological field measurements at the SL-1 burial ground, 9E-02, is only slightly higher than the risk due to the local background of 3E-02. At BORAX-I, the risk based on radiological field measurements is equal to local background (2E-02) and is only slightly higher than the national average natural background, which ranges from 2E-03 to 6E-03.

6.1.5 Uncertainty

Risk assessments are subject to uncertainty from assumptions about inventory estimates, fate and transport estimation, exposure estimation, and radiotoxicity data. Uncertainty was addressed by using health-protective assumptions that systematically overstate the magnitude of health risks. This process bounds the plausible upper limits of risk and facilitates an informed risk management decision. Table 7 is a summary of risk assessment assumptions and associated uncertainties.

In addition to uncertainty directly associated with the baseline risk assessment, two other issues were considered. The first was estimation of risk associated with the radiological field actually measured at the sites to evaluate the effectiveness of the soil shielding currently on the sites (the baseline risk assessment requires exposure of the receptor directly to the waste). The second issue was explored as a result of public comment received on the proposed plan and involved estimating the soil concentration of uranium-235 based on the quantity of unrecovered fuel.

Table 7. Summary of risk assessment assumptions and associated uncertainties.

Assumption	Description of uncertainty	Effect of uncertainty on risk estimates
Soil sample analytical results are representative of surface contamination.	Many samples at both sites were collected from hot spots, as opposed to a strictly random sampling strategy. Concentrations based on the 95% upper confidence limit of these biased results were assumed uniformly distributed throughout surface soil.	Results in higher estimated concentrations in surface soils and thus increased risk. (Note that Operable Unit 5-05 surface soils were found to not present an unacceptable risk subsequent to the baseline risk assessment in the remedial investigation.)
Computer-modeled radionuclide inventories (curies) converted to subsurface concentrations of radionuclides (pCi/g) are representative of subsurface contamination.	Radionuclide inventories were assumed uniformly distributed throughout the reported volumes at a material density of 1.5 g/cm^3.	The actual nature and density of buried materials is not homogeneous. Areas of both higher and lower concentrations (and thus risk) within the waste are expected.
Modeled inventories reduced by percent of uranium-235 recovered are representative of actual concentrations.	The reduced quantities are upper-bound estimates of inventories originally deposited on each site.	Results in higher estimated concentrations in the sub surface and thus increased risk.
No migration of contaminants has occurred.	Maximizes concentrations (no dilution) and minimizes volume.	Results in higher estimated concentrations in the subsurface and thus increased risk.
Significant quantities of nonradioactive contaminants are not present at either site.	If any nonradioactive contaminants are present, they would represent an insignificant contribution to the total risk at each site.	May underestimate risk slightly.
Modeled receptor is in direct contact with the surface or subsurface contamination for time periods specified in the remedial investigation report	Shielding provided by existing soil cover is excluded from consideration; the EPA-default time and duration of exposure values are formulated for sensitive individuals.	Results in substantially higher exposure values for all receptors, and thus higher risks.
Groundwater modeling parameters and assumptions generic to the INEL are adequate to model groundwater impacts.	Parameters and assumptions were selected to maximize concentrations of contaminants in the groundwater.	Results in overestimation of concentrations in aquifer and minimizes vadose zone travel times, resulting in higher estimated risk.

The uncertainties related to the measurement of radiological data in the field can lead to an under- or over-estimation of risk. Field measurements are accurate at the time and location the reading is taken. However, factors such as detection limits, correlation of field measurements to specific radionuclide concentrations, and perturbations resulting from radioactive fragments or particles add significant uncertainty to these risk estimates.

To address remarks received during the public comment period, hypothetical soil concentrations of uranium-235 were estimated for the surface soil at BORAX-I using the assumption that the entire 3.7 kg of uranium-235 unrecovered at the site was uniformly distributed through two soil volumes. The first, 84,000 cubic feet (2,400 m^3) was based on the extent of gravel-covered area and a depth of one foot. A second volume, 14,700 cubic feet (416 m^3) by one foot deep, was based on the portion of the gravel-covered area which had a radiological field greater than 0.02 mR/hour during a survey conducted in 1980. Concentrations resulting from these calculations were 2.2 pCi/g (1 mg uranium-235/kg soil) and 13 pCi/g (6 mg uranium-235/kg soil). Although, these estimates were developed under the assumption that the entire 3.7 kg of uranium-235 was distributed in the surface soil, historical documentation indicates that some of the fuel remaining at the site was buried in the reactor structure foundation. In the risk assessment, the 95% upper confidence limit for uranium-235 (68.6 pCi/g), based on analytical results of biased samples, was used to represent surface soil concentrations. This concentration is much higher than either 2.2 or 13 pCi/g, demonstrating that use of the 95% upper confidence limit of biased sampling can result in over-estimation of actual soil concentrations, and therefore over-estimation of the risk.

6.1.6 Conclusions

An inspection of the risk values shows several important facets of the investigation:

- At the SL-1 burial ground, scenario total risks range from 6E-04 to 5E-01. At BORAX-I the scenario risks range from 3E-05 to 3E-02. The risks are dominated by cesium-137 plus its daughter barium-137m in the external exposure pathway for both sites.
- The risks due to external exposures estimated by deterministic or probabilistic methods are all greater than 1E-06, and in nearly all scenarios, greater than 1E-04; the only exception was the occupational site-specific #2 scenario for BORAX-I. Values greater than 1E-04 are considered indicative of conditions that may pose a threat to human health and the environment if not addressed by a response action.
- The risks attributable to soil ingestion for all radionuclides are generally one or more orders of magnitude lower than the risks from external exposure and considered a secondary concern; however, for the residential intrusion scenarios at SL-1, the risk from the soil ingestion pathway exceeds 1E-04.
- The risks of soil inhalation and groundwater ingestion for all scenarios are less than 1E-05 and generally less than 1E-06, and thus negligible.
- Decay of cesium-137 (plus its progeny) will result in a decrease of risk through time at both sites. After about 400 years, the risk will reach 1E-04 at SL-1; after 320 years, the risk at

BORAX-I will be dominated by the long-lived uranium-235 in the external exposure pathway, and the risk will not drop below 2E-04.

- The external radiation exposure risks estimated using deterministic and probabilistic methods dominate the total risk. Although this calculated upper limit of the risk notably exceeds the 1E-04 risk value, the external exposure risks estimated from radiological field measurements were not much greater than the risk due to background radiation. The primary difference is that the baseline risk assessment was based on the assumption that the individual is exposed directly to the waste; that is, the dose that the individual receives is not adjusted to account for the shielding provided by the soil cover. The risk estimated from the field measurements was based on the actual measured dose that an individual at the surface receives.
- Although Operable Unit 5-05 surface soils were evaluated in the baseline risk assessment presented in the remedial investigation/feasibility study report and summarized in this section, a subsequent determination found the surface soils do not present an unacceptable risk to human health or the environment (see Section 11.1).

The main contributor to the deterministic and probabilistic risk is from external exposure to cesium-137 plus its daughter barium-137m. All other contributions to the total risk are very small, usually two, three, or more orders of magnitude below the risk due to external exposure to ionizing radiation and generally below the acceptable risk level of 1E-04.

6.2 Ecological Concerns

The ecological assessment of the SL-1 and BORAX-I burial grounds is a qualitative evaluation of the potential effects of the sites on plants and animals other than people and domesticated species. A quantitative ecological assessment is planned in conjunction with the INEL-wide comprehensive remedial investigation/feasibility study tentatively scheduled for 1998. There are no critical or sensitive habitats on or nearby the burial grounds, and no endangered species or habitats of endangered species are known to exist on either site. Based on the present contaminant and ecological information and the qualitative eco-evaluation performed for this Record of Decision, the preferred alternative remedial action presented herein will serve to further reduce the ecological risks posed by these sites. It is unlikely the 1998 INEL-wide comprehensive remedial investigation/feasibility study quantitative ecological assessment will result in the need for any additional actions at these sites.

6.2.1 Species of Concern

The only federally listed endangered species known to frequent the INEL is the peregrine falcon. The status of the bald eagle in the lower 48 United States was changed from endangered to threatened in July 1995. Several other species observed on the INEL are the focus of varying levels of concern by either federal or state agencies. Animal and avian species include the ferruginous hawk, the northern goshawk, the sharp-tailed grouse, the loggerhead shrike, the Townsend's big-eared bat, the pygmy rabbit, the gyrfalcon, the boreal owl, the flammulated owl, the Swainson's hawk, the merlin, and the burrowing owl. Plant species classified as sensitive include Lemhi milkvetch, plains milkvetch, wing-seed evening primrose, nipple cactus, and oxytheca.

6.2.2 Exposure Assessment

Three potential routes of exposure were identified for terrestrial and avian species: ingestion of soil, vegetation, or prey; inhalation of fugitive dust; and external exposure to radiation. Ingestion of contaminated water was not considered because there are no surface-water features on either burial ground and because groundwater is not accessible to ecological receptors. For plants, the uptake of contaminants through roots systems was considered.

The amount of exposure is directly related to the amount of time spent and the fraction of diet taken on the sites. Therefore exposures are greatest for permanent ecological residents, particularly plants and small burrowing animals. The small size of the burial grounds minimizes the exposures received by migratory species, which include most avian and large mammal species that inhabit the INEL.

6.2.3 Risk Characterization

The contaminants of concern at the burial grounds consist of radionuclide-contaminated soil and debris, most of which is buried beneath a minimum of 2 feet (0.6 m) of soil. Both sites are relatively small. Some amounts of contamination may be brought to the surface through plant uptake and burrowing animals and insects, be ingested by herbivores and animals who take prey from the sites, and enter the food web. Individuals representing a small portion of the total population of burrowing and ground-dwelling animals may also receive direct exposures. However, risks due to these exposures would be limited to a small number of individual ecological receptors and would have little impact on total populations. As a result, the potential for risk to ecological receptors is very small. In addition, the inaccessibility of contamination supports the conclusion that the sites do not present a significant risk to plant and animal life.

The small areas of the sites will not support sizeable populations relative to the area and populations of the entire INEL. The potential for cumulative effects throughout each waste area group and INEL-wide are of much greater concern than the effects from the individual burial grounds. These issues will be addressed in the comprehensive remedial investigation/feasibility studies for each waste area group and for the entire INEL.

6.3 Basis for Response

Actual or threatened releases of contaminants from these burial grounds, if not addressed by implementing the response action selected in this Record of Decision, present a potential threat to public health, welfare, or the environment.

The results of the baseline risk assessment indicate that unacceptable risk exists at both burial grounds. The primary risk at both sites is from external exposure to cesium-137 and its daughter barium-137m. Decay of cesium-137 (plus its daughter) will result in a decrease of risk to acceptable levels after about 400 years at SL-1, and after 320 years at BORAX-I. Risk at both sites results from direct exposure to the contaminants. The shielding and control of intrusion can be accomplished through construction of a long-term engineered cap at each site designed to contain the radionuclides as they decay with time.

The risk to ecological receptors at both sites is associated with intrusion into the wastes. This risk will decrease through time as the radionuclides decay. Long-term engineered caps can inhibit intrusion by plant roots, insects, and burrowing animals.

7. Description of Alternatives

7.1 Remedial Action Objectives and Applicable or Relevant and Appropriate Requirements

The description of alternatives includes discussion of how remediation goals are satisfied by the actions undertaken. Similarly, the descriptions explain how compliance with federal and state environmental laws is achieved. The remedial action objectives and environmental laws associated with the alternatives considered in the remedial investigation/feasibility study for the SL-1 and BORAX-I burial grounds are summarized below to support the description of alternatives.

7.1.1 Remedial Action Objectives

As part of the remedial investigation/feasibility study process, remedial action objectives were developed in accordance with the National Contingency Plan and EPA guidance. The intent of the remedial action objectives is to set goals for protecting human health and the environment. The goals are designed specifically to mitigate the potential adverse effects associated with the burial grounds.

Results of the remedial investigation and baseline risk assessment indicate that exposure to penetrating radiation from contaminated soils and materials within the burial grounds presents the most significant future risk to human health. Therefore, the primary remedial action objectives and the focus of the remedial action alternative development are to inhibit exposure to radioactive materials. Remedial action objectives established for protection of human health are:

- Inhibit exposure to radioactive materials that would result in a total excess cancer risk (for all contaminants) of greater than 1 in 10,000 to 1 in 1,000,000 (1E-04 to 1E-06)
- Inhibit ingestion of radioactive materials that would result in a total excess cancer risk (for all contaminants) of greater than 1 in 10,000 to 1 in 1,000,000 (1E-04 to 1E-06)
- Inhibit inhalation of suspended radioactive materials that would result in a total excess cancer risk (for all contaminants) of greater than 1 in 10,000 to 1 in 1,000,000 (1E-04 to 1E-06)
- Inhibit degradation of the burial grounds that could result in exposure of buried wastes or migration of contaminants to the surface that would pose a total excess cancer risk (for all contaminants) of greater than 1 in 10,000 to 1 in 1,000,000 (1E-04 to 1E-06).

The remedial action objective for protection of the environment focuses on preservation of the local ecology by inhibiting the potential for contaminant migration. The remedial action objective established for protection of the environment is:

- Inhibit adverse effects to resident species from exposure to contaminants at the burial grounds.

7.1.2 Applicable or Relevant and Appropriate Requirements

CERCLA requires that remedial actions comply with federal and state laws that are applicable to the action being taken. Remedial actions must also comply with the requirements of laws and regulations that are not directly applicable but are relevant and appropriate; in other words, the requirements pertain to situations sufficiently similar to those encountered at a CERCLA site so that their use is well-suited to the site. Combined, these are referred to as applicable or relevant and appropriate requirements (ARARs). State ARARs are limited to those requirements that are (a) promulgated, (b) uniformly applied, and (c) are more stringent than federal requirements. Compliance with ARARs requires evaluation of the remedial alternatives for compliance with chemical-, location-, and action-specific ARARs or justification for a waiver.

During the remedial investigation/feasibility study for SL-1 and BORAX-I, ARARs were specified for the remedial action alternatives under consideration. Potential ARARs initially identified were screened on the basis of review by the DOE-ID, the EPA, and the IDHW. Table 8 provides a summary of the ARARs for the three alternatives considered. These regulations focus on protection of the public from radiation and control of emissions that may result from any remediation activities. As ARARs, these regulations govern potential radionuclide emissions and dust-generating activities (such as excavation, earth-moving, and heavy-equipment operation). Although DOE orders are not ARARs, established DOE orders would be considered to ensure radiation protection for the environment and the public. Such DOE orders are identified as "To-Be-Considered" (TBC) criteria. Currently no EPA or State of Idaho regulations exist that establish cleanup levels for radionuclide contaminants in soil. Based on the contaminants of concern at SL-1 and BORAX-I, the location of the burial grounds, and the remedial actions evaluated, no other ARARs were identified.

Table 8. Summary of ARARs and criteria to be considered for alternatives.

Statute	Regulations	Alternative 1 No Action	Alternative 2 Containment	Alternative 3 Removal
NESHAP	National Emission Standards for Radionuclide Emissions Other than Radon from DOE Facilities (40 CFR §61.90)	NA	NA	A
IDAPA	Idaho Rules for Control of Fugitive Dust (IDAPA 16.01.01.650 and .651)	NA	A	A
IDAPA	Idaho Rules for Toxic Air Pollutants (IDAPA 16.01.01.585 and .586)	NA	NA	A
	DOE Order 5400.5, "Radiation Protection of the Public and Environment"	TBC	TBC	TBC
	DOE Order 5820.2A, "Radioactive Waste Management"	TBC	TBC	TBC

A = Applicable; NA = Not applicable or relevant and appropriate; R = Relevant and appropriate; TBC = To be considered

7.2 Summary of Alternatives

The three types of alternatives submitted to detailed analysis include:

Alternative 1: No action

Alternative 2: Containment by capping with an engineered long-term barrier comprised primarily of natural materials

Alternative 3: Removal by conventional excavation with disposal at the Radioactive Waste Management Complex.

The no action alternative and the two alternatives that passed the screening criteria are described below. Remedial action at BORAX-I is expected to include management of contaminated surface soils. Surface soils presenting a potential human health excess risk of over 1 in 10,000 will be included in the remedial action. Action levels for the radionuclides of concern in BORAX-I soils are based on the Remedial Investigation/Feasibility Study for Operable Unit 10-06 (Radionuclide-Contaminated Soils at the INEL) and are identified as 16.7 pCi/g for cesium-137, 10.8 pCi/g for strontium-90, and 13.2 pCi/g for uranium-235. These activity concentrations correspond to a 1 in 10,000 risk level based on the external exposure and ingestion pathways and a residential scenario beginning in 100-years. Costs presented for remedial actions at BORAX-I are based on the assumption that all potentially contaminated surface soils will be included in the remedial action. A surface area as large as 84,000 square feet (7,800 m^2) would require management as part of the remedial action at BORAX-I. As presented in the proposed plan, remedial action at the SL-1 operable unit may have also required management of potentially contaminated surface soils. An assessment of those soils has since been completed that supports a no action decision for the surface soils within Operable Unit 5-05 outside of the exclusion fence. Section 11 contains more details regarding this assessment.

7.2.1 No Action

Under Alternative 1, no attempt would be made to contain, treat in place, or remove contaminated materials. Instead, environmental monitoring would be performed to assess contaminant migration from the burial grounds. Environmental monitoring would consist of those methods used to identify contaminant migration within environmental media (air, groundwater, and soil) and to identify the exposure resulting from those contaminated media. Monitoring results would be used to determine the need for any future remedial actions necessary to protect human health and the environment. Environmental monitoring would be conducted until future reviews of the remedial action determine such activities are no longer necessary. There were no ARARs identified for the no action alternative.

The estimated cost for implementing environmental monitoring for 30 years under this alternative is \$188,000 at SL-1 and \$180,000 at BORAX-I. Environmental monitoring may be required beyond 30 years, however CERCLA guidance specifies costing such activities for only 30 years.

To the extent practicable, environmental monitoring activities would be performed under WAG-wide and INEL-wide comprehensive monitoring programs. Radiological surveys would be performed at both SL-1 and BORAX-I as part of this remedial action until WAG-wide comprehensive environmental monitoring programs are in place. Groundwater monitoring needs would be identified in the WAG 5 Comprehensive RI/FS and the WAG 10 Comprehensive RI/FS (which encompasses WAG 6). Air monitoring at both sites would be conducted as part of the INEL-wide air monitoring program.

7.2.2 Containment

Alternative 2 is a containment action that consists of installing a long-term engineered barrier (cap) over a burial site to provide shielding from penetrating radiation, to inhibit contaminant migration, and to limit intrusion. Barrier technology is currently in use at several waste sites to provide long-term isolation of radioactive wastes that are disposed of in place, as is the case for both burial grounds. The cap can be designed for longevity and would be of sufficient thickness to provide a shield from penetrating radiation, inhibit intrusion by burrowing animals and insects into the waste, and discourage human intrusion. Contaminant migration would be inhibited by reducing erosion by wind and water.

The barrier would be designed to provide shielding from penetrating radiation for at least 400 years at SL-1 and 320 years at BORAX-I. A multiple-layer cap comprised primarily of natural materials would be designed during the remedial design phase of the remedial action. Cap layers would likely consist of a combination of sand, gravel, silt, basalt, cobbles, or native soil. Construction details for the engineered barrier would be identified during the remedial design phase. The barrier design would be based on site-specific characteristics and conditions at the INEL such that maintenance requirements are minimized. Site-specific considerations, such as annual precipitation, frost depth, and anticipated soil erosion, would be used to design the optimum barrier configuration for application at the SL-1 and BORAX-I burial grounds during the remedial action phase. Each cap system would also include surface-water diversion controls to direct runoff away from the burial grounds.

The capping system would be combined with institutional controls consisting of access and land use restrictions to prevent intrusion into the SL-1 and BORAX-I burial grounds. The DOE would be responsible for establishing and maintaining land use and access restrictions for at least 100 years. Access restrictions in the form of fences, warning signs, and permanent markers would be used to determine unauthorized entry into the burial grounds. Institutional controls would include placing written notification of the remedial action in the facility land use master plan; the notification would prohibit any activities that would interfere with the remedial activity. A copy of the notification would be given to the Bureau of Land Management, together with a request that a similar notification be placed in the Bureau of Land Management property management records. The DOE would provide EPA and IDHW with written verification that notification, including Bureau of Land Management notification, have been fully implemented.

Cap integrity monitoring and radiological survey programs would be established to verify the continued functionality of the containment systems and provide early detection of potential contaminant migration. Cap integrity monitoring for cracks, erosion, and other observable degradation would be conducted to identify maintenance requirements. Institutional controls and monitoring requirements would be the responsibility of the DOE and would be evaluated for adequacy, effectiveness, and necessity during each five-year review of the remedial actions.

The area requiring containment at SL-1 is the region extending from the trench to pit 1 in Figure 2. The area requiring containment at BORAX-I is based on the assumption that consolidation of all contaminated surface soil is necessary. The minimum area requiring containment at BORAX-I is the 100- by 100-foot (30- by 30-m) fenced area of the burial ground, or 10,000 square feet (929 m^2). The maximum area of containment required at BORAX-I is based on the assumption that the entire 84,000 square foot (7,800 m^2) area of contaminated surface soil would require containment. Although protective covers over this entire area are feasible, consolidation of contaminated surface soil to a location near the existing buried wastes is proposed. Consolidation of contaminated surface soil would ensure that the size of a protective cover is limited to the area containing the majority of contamination (e.g., the reactor foundation).

The ARAR identified for this alternative is the Idaho Rules for Control of Fugitive Dust (IDAPA 16.01.01.650 and .651). This ARAR would be met during soil consolidation activities at BORAX-I and construction of a barrier at either site by application of appropriate engineering controls to minimize generation of airborne contamination and dust.

The estimated cost of Alternative 2 is \$1.9 million at SL-1 and \$1.5 million at BORAX-I. These costs are based on refinements to the estimates presented in the proposed plan for Alternative 2. The primary refinements include a cap design specific to the INEL and elimination of groundwater monitoring requirements. The cap design is based on research performed at the INEL by the Environmental Science and Research Foundation. Environmental monitoring has been specified by the agencies to consist of radiological surveys. Groundwater monitoring costs have not been included because groundwater monitoring needs will be determined by the WAG 5 Comprehensive RI/FS for WAG 5 as a whole and the WAG 10 Comprehensive RI/FS for WAG 6. Responsibility for radiological surveys at SL-1 will be assumed by the WAG 5 Comprehensive RI/FS once the comprehensive program is in place. Similarly, responsibility for radiological surveys at BORAX-I will be assumed by the WAG 10-04 Comprehensive RI/FS once the comprehensive program is in place. The cost estimates include 30 years of radiological surveys at SL-1 and BORAX-I. (Air monitoring at both sites would be conducted as part of the INEL-wide air monitoring program to eliminate that cost component from this remedial action.)

Direct costs for equipment and construction are approximately \$0.90 million at SL-1 and \$0.61 million at BORAX-I (including soil consolidation). Indirect costs for engineering design and management, construction management, and contractor overhead and profit are approximately \$0.47 million at SL-1 and \$0.45 million at BORAX-I. A contingency cost to account for the conceptual level of design for Alternative 2 is approximately \$0.27 million at SL-1 and \$0.18 million at BORAX-I. Net present value cost to perform post-closure monitoring and maintenance activities for 30 years are approximately

$0.33 million at SL-1 and $0.21 million at BORAX-I. Monitoring and maintenance may be required beyond 30 years, however CERCLA guidance specifies costing such activities for no more than 30 years.

7.2.3 Removal and Disposal

Alternative 3 is the complete removal of all contaminated materials from the burial grounds using conventional excavation techniques, with cleanup levels established on the basis of excess risk at the INEL. Conventional excavation techniques utilize commercially available earth-moving equipment.

The volume of contaminated media at the SL-1 is approximately 265,182 cubic feet (7,509 m^3). The total volume of contaminated media at the BORAX-I is approximately 93,421 cubic feet (2,645 m^3). These estimates are based on the volumes of buried waste, backfill, and potentially contaminated surface soils at BORAX-I. Once removed, contaminated materials would be packaged and transported to the Radioactive Waste Management Complex for disposal.

Following the removal of contaminated soil and solid waste, the excavated area would be backfilled with clean fill material and compacted to prevent future subsidence or settling. A layer of topsoil would be placed over the compacted backfill, contoured to match the surrounding landscape, and seeded with an appropriate mixture of native grasses and shrubs to facilitate revegetation.

The ARARs identified for this alternative include the National Emissions Standards for Radionuclide Emissions Other than Radon from DOE Facilities (40 CFR §61.90), Idaho Rules for Toxic Air Pollutants (IDAPA 16.01.01.585 and .586), and Idaho Rules for Control of Fugitive Dust (IDAPA 16.01.01.650 and .651). All three ARARs would be met by conducting excavation activities within an enclosed structure fitted with a filtered ventilation system and by implementing dust-suppression measures.

The estimated costs of Alternative 3 are approximately $68.9 million at SL-1 and $20.5 million at BORAX-I. The estimated cost for SL-1 is based on the no action decision for soils outside of the 600- by 300-foot (182.9- by 91.4-m) exclusion fence but inside the boundary of Operable Unit 5-05. The lower end of the cost range presented in the proposed plan for Alternative 3 at SL-1 reflects this situation. The estimated cost for BORAX-I is based on the anticipated need to include up to 84,000 square feet (7,800 m^2) of contaminated surface soil in the remedial action. The upper end of the cost range presented in the proposed plan for Alternative 3 at BORAX-I is representative of this scenario.

The estimates include an assumption that no additional costs are incurred once the contaminated materials are removed from the sites and disposed at the Radioactive Waste Management Complex. Therefore, post-closure activities such as monitoring are not required. Direct costs for equipment, construction, and disposal at the Radioactive Waste Management Complex are approximately $34.0 million at SL-1 and $10.1 million at BORAX-I. Indirect costs for engineering design and management, construction management, and contractor overhead and profit are approximately $24.7 million at SL-1 and $7.4 million at BORAX-I. The contingency cost to account for the conceptual level of design for Alternative 3 is approximately $10.2 million at SL-1 and $3.0 million at BORAX-I.

8. Summary of Comparative Analysis of Alternatives

Each of the three alternatives subjected to the detailed analysis were evaluated against the nine evaluation criteria identified under CERCLA. The criteria are subdivided into three categories: (a) threshold criteria that mandate overall protection of human health and the environment and compliance with ARARs; (b) primary balancing criteria that include long- and short-term effectiveness, implementability, reduction in toxicity, mobility or volume through treatment, and cost; and (c) modifying criteria that measure the acceptability of alternatives to state agencies and the community. The following sections summarize the evaluations of the three alternatives against the nine evaluation criteria.

8.1 Threshold Criteria

The remedial alternatives were evaluated in relation to the two threshold criteria: overall protection of human health and the environment, and compliance with ARARs. The selected remedial action must meet the threshold criteria. Although the no action alternative does not meet the threshold criteria, this alternative was used in the detailed analysis as a baseline against which the other alternatives were compared, as directed by EPA guidance.

8.1.1 Overall Protection of Human Health and the Environment

This criterion addresses whether a remedy provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

Results of the baseline risk assessment indicate that upper limit of exposure risk will decrease to below 1 in 10,000 after approximately 400 years at SL-1. This upper limit will further decrease to 3 in 1,000,000 after approximately 650 years and remain constant thereafter. The upper limit of exposure risk at BORAX-I will decrease to approximately 2 in 10,000 after 320 years, then remain essentially unchanged far into the future.

Alternative 1 (no action) would not satisfy the criterion of overall protection of human health and the environment because access to the site and contact with the waste is not prevented. The containment alternative, Alternative 2, would provide overall protection of human health and the environment. A protective cover would provide shielding from penetrating radiation, limit contaminant migration, and inhibit inadvertent intrusion into the wastes by humans, insects, and animals. Consolidated surface soil at BORAX-I would also be contained beneath the protective cover. Long-term protection would be ensured by incorporating design features engineered to last a minimum of 400 years at SL-1 and 320 years at BORAX-I. Alternative 3 (removal by conventional excavation with disposal at the Radioactive Waste Management Complex) would provide effective long-term protection of human health and the environment but could result in potentially significant short-term exposures for workers removing the radionuclide-contaminated wastes during the remedial action.

Both of the action alternatives would result in a reduction of excess lifetime cancer risk. Alternative 2 would result in an excess lifetime cancer risk of less than 1 in 1,000,000 for as long as the cap remains functional. A cap minimizes potential risks by shielding, limiting migration of contamination, and inhibiting intrusion into the waste. Alternative 3, the removal action, would reduce risk by managing contaminated materials removed from the burial grounds within an operating radioactive waste disposal facility.

8.1.2 Compliance with Applicable or Relevant and Appropriate Requirements

There are no ARARs identified for the no action alternative. The two action alternatives meet the identified ARARs through engineering controls and operating procedures. Section 7.2, Summary of Alternatives, discusses the primary ARARs considered in this study. These ARARs focus on controlling exposures to the public and air emissions that may result from remediation activities at the SL-1 and BORAX-I operable units.

8.2 Balancing Criteria

Once an alternative satisfies the threshold criteria, five balancing criteria are used to evaluate other aspects of the remedial alternatives and weigh major trade-offs among alternatives. The balancing criteria are used in refining the selection of the candidate alternatives for the site. The five balancing criteria are: (1) long-term effectiveness and permanence; (2) reduction in toxicity, mobility or volume through treatment; (3) short-term effectiveness; (4) implementability; and (5) cost.

8.2.1 Long-Term Effectiveness and Permanence

This criterion evaluates the long-term effectiveness of alternatives in maintaining protection of human health and the environment after remedial action objectives have been met.

Alternative 1 (no action) provides the least possible level of long-term effectiveness and permanence because unacceptable risks would remain at both burial grounds. The long-term effectiveness and permanence of containment, Alternative 2, depends on the design-life of each protective cover. As described previously, the cover can be designed to last for the period of time required to allow radionuclide decay to decrease exposure risks to acceptable levels. Risks at SL-1 will fall below the 1 in 10,000 risk range in about 400 years. Risks at BORAX-I will decrease to about 2 in 10,000 in approximately 320 years and will remain constant, essentially forever, due to the presence of long-lived uranium-235. The Alternative 3 removal action provides the highest degree of long-term effectiveness and permanence because contaminated materials would be completely removed. However, removing and transporting contaminated materials from one place to another within the INEL (from SL-1 or BORAX-I to the Radioactive Waste Management Complex) simply transfers the risk from one place to another.

8.2.2 Reduction of Toxicity, Mobility, or Volume through Treatment

This criterion addresses the statutory preference for selecting remedial actions that employ treatment technologies that permanently reduce toxicity, mobility, or volume of the hazardous substances as their principal element. Treatment to reduce the toxicity of radionuclides is presently not feasible; therefore none of the remedial alternatives developed for the burial grounds involve the use of treatment to reduce the toxicity, mobility, or volume of contaminated materials.

8.2.3 Short-Term Effectiveness

Short-term effectiveness addresses the period of time needed to implement remediation methods to reduce any adverse impacts on human health and the environment that may be posed during the construction and implementation period until cleanup goals are achieved.

The short-term effectiveness for any remedial action taken at the burial grounds would be enhanced to the maximum extent practicable through adherence to strict health and safety protocols for worker protection and use of engineering controls to prevent potential contaminant migration. However, the alternative that requires the least amount of disturbance of contaminated materials ranks the highest in terms of short-term effectiveness. As such, Alternative 1 (no action) provides the highest degree of short-term effectiveness because no additional on-site activities are required. Implementation of Alternative 2 (containment) would require disturbance to the surface of the burial grounds, however, no contact with buried waste would be involved. Alternative 2 does require contaminated surface soil at BORAX-I to be consolidated near the location of the reactor foundation. Assuming no protective measures were in place, workers installing the Alternative 2 cap would receive external exposure to penetrating radiation until sufficient construction material (such as soil, sand, and gravel) was placed over the burial ground to provide adequate shielding. Based on modeling and field measurements, approximately 3 inches (0.1 m) of additional soil placed over the SL-1 burial ground and 9 inches (0.2 m) of additional soil placed over the BORAX-I burial ground would reduce external exposures to background radiation levels. Consequently, the soil required to form the foundation for a protective cover is likely to reduce external exposures to background levels. Alternative 3 (conventional excavation) offers the least short-term effectiveness due to direct contact with contaminated materials during excavation of the burial grounds and transport to the Radioactive Waste Management Complex. Short-term effectiveness for Alternatives 2 and 3 would be equally diminished if surface-soil consolidation is required at BORAX-I.

8.2.4 Implementability

The implementability criterion has the following three factors requiring evaluation: (a) technical feasibility, (b) administrative feasibility, and (c) the availability of services and materials. Technical feasibility requires an evaluation of the ability to construct and operate the technology, the reliability of the technology, the ease of undertaking additional remedial action (if necessary), and monitoring considerations. The ability to coordinate actions with other agencies is one factor for evaluating administrative feasibility, and the agencies have demonstrated this ability throughout the project to date. Other administrative activities that would be readily implementable include planning, use of administrative controls, and personnel training. In terms of services and materials, an evaluation of the following availability factors is required: necessary equipment and personnel, prospective technologies, and cover materials.

Alternative 1 (no action) is the simplest remedial action to implement from a technical perspective because environmental monitoring is all that is required. Monitoring would be required until future reviews of the remedial action indicate such activities are no longer necessary. Environmental monitoring services and equipment are readily available. However, Alternative 1 is administratively unacceptable due to the potential risks to human health and the environment posed by SL-1 and BORAX-I.

The containment option of Alternative 2 is technically implementable. Consolidation of contaminated surface soils at BORAX-I would involve standard earth moving equipment to perform excavation activities and water spray vehicles for dust suppression. Construction capabilities for engineered barriers are commercially available, and such barriers have been used at many similar sites in both private industry and at government facilities. Specialized construction equipment and materials would not be required. The engineering required to design and construct a cap meeting the requirements necessary to ensure protection of human health and the environment at SL-1 and BORAX-I would be specified during the remedial design phase. The general performance requirements of the cap are established in this Record of Decision.

Alternative 3 (excavation and removal) would be the most difficult remedial option to implement because of the complexity of the remediation process. Containment of contamination during excavation and handling contaminated materials removed from the burial grounds would be required. Conventional excavation techniques to perform removal operations are commercially available and commonly used for earth moving applications. Administratively this alternative would require significant time and resources to perform environmental assessments, safety analyses, designs, and demonstrations prior to initiating any removal activity.

8.2.5 Cost

In evaluating project costs, an estimation of the direct and indirect costs in present-worth dollars is required. Direct costs include the estimated dollars for equipment, construction, and operation activities to conduct a remedial action. Indirect costs include the estimated dollars for activities that support the remedial action (such as construction management, project management, and management reserve). In accordance with remedial investigation/feasibility study guidance, the costs presented are estimates (-30% to +50%). Actual costs will vary based on the final design and detailed cost itemization.

Table 9 for SL-1 and Table 10 for BORAX-I summarize the estimated costs for each remedial action alternative. The costs presented are based on a specific set of assumptions and as those assumptions change so will the cost estimates. For example, CERCLA guidance specifies monitoring and maintenance costs to be estimated for 30 years. However, these activities may be required beyond 30 years and as a result may cost significantly more than estimated.

The cost estimates presented for Alternative 3 (excavation and removal) are based on the proposed plan and the remedial investigation/feasibility study prepared for SL-1 and BORAX-I. As indicated in Section 7.2.1, the estimated cost for no action (Alternative 1) differs from the proposed plan because monitoring requirements for the sites have been refined.

The cost estimates presented for Alternative 2 (containment) have been revised since the proposed plan. As part of the CERCLA process, estimated costs for the selected remedy have been refined based on further developments in the level of design detail for Alternative 2. Estimated costs for Alternative 2 have been revised based on a cap design specific to the conditions at the INEL and identification of specific environmental monitoring requirements at both sites. The cap design is based on research performed at the INEL by the Environmental Science and Research Foundation. Environmental monitoring has been specified by the agencies to consist of radiological surveys. Groundwater monitoring costs have not been included because groundwater monitoring needs will be determined by the WAG 5 Comprehensive RI/FS for WAG 5 as a whole and the WAG 10 Comprehensive RI/FS for WAG 6. Responsibility for radiological surveys at SL-1 will be assumed by the WAG 5 Comprehensive RI/FS once the comprehensive program is in place. Similarly, responsibility for radiological surveys at BORAX-I will be assumed by the WAG 10-06 Comprehensive RI/FS once the comprehensive program is in place. The cost estimates included 30 years of radiological surveys at both sites. (Air monitoring at both sites will be conducted as part of the INEL-wide air monitoring program. Therefore air monitoring costs are not included in the estimates.) The estimated costs presented for Alternative 2 reflect these refinements.

Table 9. SL-1 alternative cost estimates.[a]

Cost Elements	Alternative 1 No Action	Alternative 2 Containment	Alternative 3 Removal
Construction and construction operations[b]	NA	$1,368,000	$58,724,000
Post-closure maintenance[c]	NA	115,000	NA
Post-closure monitoring[d]	150,000	150,000	NA
Contingency	38,000	337,000	10,149,000
Total[e]	$188,000	$1,970,000	$68,870,000

a. Costs are for 1995 for Alternatives 1 and 2 and 1994 for Alternative 3.

b. Includes operating costs (net present value) during remedial action.

c. Net present value assuming 5% interest (net of inflation) for 30 years.

d. Changed from proposed plan to include soil monitoring only. See Section 11.

e. Rounded to ten thousands.

NA = Not applicable (item is not included in the scope for the alternative).

Table 10. BORAX-I alternative cost estimates.[a]

Cost Elements	Alternative 1 No Action	Alternative 2 Containment	Alternative 3 Removal
Construction and construction operations[b]	NA	$1,058,000	$17,518,000
Post-closure maintenance[c]	NA	27,000	NA
Post-closure monitoring[d]	144,000	144,000	NA
Contingency	36,000	225,000	3,020,000
Total[e]	$180,000	$1,450,000	$20,540,000

a. Costs are for 1995 for Alternatives 1 and 2 and 1994 for Alternative 3.

b. Includes operating costs (net present value) during remedial action.

c. Net present value assuming 5% interest (net of inflation) for 30 years.

d. Changed from proposed plan to include soil monitoring only. See Section 11.

e. Rounded to ten thousands.

NA = Not applicable (item is not included in the scope for the alternative).

8.3 Modifying Criteria

Two modifying criteria are used in the final evaluation of remedial alternatives: state acceptance and community acceptance. For both of these criteria, the factors that are considered include the elements of the alternatives that are supported, the elements of the alternatives that are not supported, and the elements of the alternatives that have strong opposition.

8.3.1 State Acceptance

The IDHW concurs with the selected remedial alternative, containment with an engineered cover comprised primarily of native materials. The IDHW has been involved in the development and review of the remedial investigation/feasibility study, the proposed plan, and this Record of Decision. Comments received from IDHW were incorporated into these documents, which have been issued with IDHW concurrence.

8.3.2 Community Acceptance

This assessment evaluates the general community response to the proposed alternatives presented in the proposed plan. Specific comments are addressed in the Responsiveness Summary portion of Appendix A in this document.

Nine individuals provided comments on the proposed plan during the public comment period. One additional comment was received after the comment period. A total of nineteen comments were received. Public opinion on the preferred alternative, in no particular order, included, but was not limited to (a) Alternative 3, Removal, should have been selected; (b) Alternative 2, Containment, was the best choice; (c) models for groundwater fate and transport should be benchmarked and validated before proceeding; (d) maximum doses should be compared to maximum dose limits; (e) how were the laws addressing disposal of spent fuel, transuranic wastes, greater-than-Class-C wastes, and low-level wastes accounted for; (f) trials regarding partial cleanup, including ground scraping and removal, should be conducted and considered; (g) future land uses should be considered; (h) results of other capping studies should be used in this evaluation; (i) no further out-of-state shipments of radioactive wastes should be allowed to be deposited there; and (j) publications and the expenditures directed toward low-risk projects are a total waste of taxpayers' dollars.

In summary, three commentors favored the preferred alternative, two preferred Alternative 3, and the others either requested additional or clarifying information or provided comments not specifically associated with the two sites in question. The additional information requested appears in the Responsiveness Summary in Appendix A.

9. Selected Remedy

Based upon consideration of the requirements of CERCLA, on detailed analysis, and on public comments, the DOE-ID, the EPA, and the IDHW have selected Alternative 2, Containment, as the most appropriate remedy for both the SL-1 and BORAX-I burial grounds. The agencies believe that this alternative represents the best balance of trade-offs with respect to the evaluation criteria. Alternative 2 provides overall protection of human health and the environment, complies with ARARs, provides long- and short-term effectiveness, is readily implementable, and is cost-effective. An engineered barrier can effectively isolate contaminated materials from the accessible environment. Isolation both inhibits migration of contaminants from the burial grounds and allows time for radioactive decay of the primary contributor, cesium-137 and progeny, to the overall risk. Engineered barriers can also inhibit biotic and inadvertent human intrusion into the burial grounds. The agencies believe that an engineered cover system can maintain isolation of contaminated materials while the overall risks decrease. Engineered barriers have been used extensively for remedial actions involving radionuclide-contaminated wastes.

Results of the baseline risk assessment indicate that the direct exposure pathway dominates the overall risk for both burial grounds. The primary contributor to this risk at both sites is cesium-137 and its progeny. Based on the time required for radionuclide decay to reduce the direct exposure risk to 1 in 10,000 at SL-1 and 2 in 10,000 at BORAX-I, a protective cover must be effective for approximately 400 years at SL-1 and for approximately 320 years at BORAX-I.

9.1 Description of Selected Remedy

The selected remedial action for both burial grounds is Alternative 2, containment by capping with an engineered long-term barrier comprised primarily of natural materials. The cover will be designed to maintain effective long-term isolation of contaminants. The number and thicknesses of layers designed in the cover depend on local climatic and geographic conditions, including precipitation rate, freeze depth, indigenous plant and animal species, and local topography. A 25-foot (7.5-meter) buffer zone will be established around the perimeter of the containment structures at each site. Additional design considerations will include the engineered lifetime of each cap, a minimum of 400 years at SL-1 and a minimum of 320 years at BORAX-I, to allow decay of cesium-137 and to reduce exposure risks. Surface-water diversion measures, including contouring and grading, will be used as necessary to direct runoff away from the burial grounds and into nearby, naturally occurring drainage formations. The specific cover design for each burial ground will be defined during final remedial design.

The cover system design will provide:

- Shielding from penetrating radiation
- A barrier to inhibit biotic and inadvertent human intrusion
- Longevity through the predominant use of naturally occurring materials
- Resistance to erosion that could expose buried waste and contribute to contaminant migration
- Containment of contaminated surface soils which pose an excess risk greater than 1 in 10,000 at BORAX-I
- Low maintenance requirements.

The capping system will be combined with instititional controls consisting of access and land use restrictions to discourage intrusion into the SL-1 and BORAX-I burial grounds. The DOE would be responsible for establishing and maintaining land use and access restrictions for at least 100 years. Access restrictions in the form of fences, warning signs, and permanent markers would be used to deter unauthorized entry into the burial grounds. Institutional controls would include placing written notification of the remedial action in the facility land use master plan; the notification will prohibit any activities that would interfere with the remedial activity. A copy of the notification will be given to the

Bureau of Land Managment, together with a request that a similar notification be placed in the Bureau of Land Management property management records. The DOE will provide EPA and IDHW with written verification that notification, including Bureau of Land Managment notification, have been fully implemented.

Cap integrity monitoring and radiological survey programs will be established to ensure the functionality of the containment systems and provide early detection of potential contaminant migration. These programs will be implemented annually for the first five years following completion of the caps. The necessity for continued monitoring will then be reevaluated and defined as determined appropriate by the agencies during subsequent five-year reviews. Groundwater monitoring needs at WAG 5 will be determined by the WAG 5 Comprehensive RI/FS. Radiological surveys at SL-1 will be conducted as part of this Record of Decision until such time the surveys can be included as part of the environmental monitoring program established for the WAG 5 Comprehensive RI/FS. Similarly, groundwater monitoring needs at WAG 6 will be determined during the WAG 10 Comprehensive RI/FS. Radiological surveys at BORAX-I will be conducted as part of this Record of Decision until such time the surveys can be included as part of the environmental monitoring program established for the WAG 10 Comprehensive RI/FS. Air monitoring will be conducted as part of the INEL-wide air monitoring program. Cap integrity monitoring for cracks, erosion, and any observable degradation will be conducted to identify maintenance requirements. Institutional controls and monitoring requirements will be the responsibility of the DOE and will be evaluated for adequacy, effectiveness, and necessity during each five-year review of the remedial actions.

During implementation dust suppression measures such as water sprays will be used to minimize dust generation and thereby ensure compliance with ARARs (IDAPA 16.01.01.650 and .651). Health and safety plans will be established to identify training requirements, specify personal protection equipment requirements, and define general safe work practices. The remedial design will include measures to ensure mitigation of potential contaminant migration during implementation.

Implementation of the selected remedy at BORAX-I includes consolidation of contaminated surface soils which pose an excess risk greater than 1 in 10,000 to a location near the reactor foundation. Any surface soils consolidated will then be isolated beneath the engineered barrier. Action levels for the radionuclides of concern in BORAX-I surface soils are identified as 16.7 pCi/g for cesium-137, 10.8 pCi/g for strontium-90, and 13.2 pCi/g for uranium-235.

Because this remedy will result in wastes remaining on site, five-year reviews of this Record of Decision and reviews of monitoring data will be conducted. Evaluation will be performed within five years of the Record of Decision signature and will be conducted at least every five years thereafter until such evaluations are determined by the agencies to be no longer necessary. The purpose of these reviews is to ensure that the remedy achieves the remedial action objectives set forth in this Record of Decision and continues to provide adequate protection of human health and the environment.

9.2 Remediation Goals

The purpose of this response action is to inhibit potential exposure for human and environmental receptors and to minimize the spread of contamination. This will be accomplished by constructing long-term covers (caps) and restricting access to the sites.

Performance standards will be implemented to ensure that the cover system provides protection against direct exposure to the wastes at the two sites. The performance standards identified for the containment alternative include:

- Installation of caps that are designed to remain in existence for at least 400 years at SL-1 and 320 years at BORAX-I to discourage any individual from inadvertently intruding into the buried waste or from contacting the waste at any time after active institutional controls over the disposal sites are removed up to the design life of the cap.
- Application of maintenance and surface monitoring programs for the containment systems capable of providing early warning of releases of radionuclides from the disposal site before they leave the site boundary.
- Institution of restrictions limiting land use to industrial applications for at least 100 years.
- Implementation of surface water controls to direct surface water away from the disposed wastes.
- Elimination, to the extent practicable, of the need for ongoing active maintenance of the disposal sites following closure so that only surveillance, monitoring, or minor custodial care are required.
- Placement of adequate cover to inhibit erosion by natural processes for the specified design lives of the caps.
- Incorporation of features to inhibit biotic intrusion into the waste disposal pits and trench at the SL-1 burial ground.

The inspection and maintenance of the cover system will be conducted concurrent with the radiological survey program. Implementation of the maintenance and survey programs will ensure protection of human health and the environment from any unacceptable risks. These programs will be implemented annually for the first five years following completion of the caps. The necessity for continued monitoring will then be reevaluated and defined as determined appropriate by the agencies during subsequent five-year reviews.

9.3 Estimated Cost Details for the Selected Remedy

A summary of the costs for each of the remedial action alternatives evaluated was presented in Tables 9 and 10. As noted in Section 8.2.5, additional design details for the engineered barrier and environmental monitoring requirements have enabled subsequent refinements in the original cost estimates for Alternative 2 (containment). Tables 11 and 12 provide detailed breakdowns of the estimated costs for the selected remedy, based on refinements in the costs presented previously in the proposed plan. Post-closure costs for maintenance and monitoring of the sites are net present value dollars for 1994. These costs are calculated based on a 5 percent interest rate (net of inflation).

Table 11. SL-1 selected remedy detailed cost estimate.[a]

Cost Elements	Estimated Cost
Construction	
Mobilize/demobilize cap subcontractor	$ 95,000
Construction of cap	543,000
Subsidence prevention	22,000
Surface water control	51,000
Air monitoring	50,000
Miscellaneous	141,000
Construction management	234,000
Engineering design and inspection	111,000
Contractor overhead and profit	121,000
Contingency	271,000
Construction subtotal[b]	**$1,639,000**
Post-closure costs	
Cap monitoring and maintenance	$ 108,000
Fence maintenance	7,000
Environmental monitoring	150,000
Post-closure contingency	66,000
Post-closure costs subtotal[c]	**$331,000**
Total[d]	**$1,970,000**

a. Costs are for 1995.

b. Includes net present value operating costs during remedial action.

c. Net present value assuming 5% interest (net of inflation) over 30 years.

d. Rounded to ten thousands.

Table 12. BORAX-I selected remedy detailed cost estimate.[a]

Cost Elements	Estimated Cost
Construction	
Mobilize/demobilize cap subcontractor	$ 95,000
Construction of cap	274,000
Surface soil consolidation[b]	—
Subsidence prevention	5,000
Surface water control	20,000
Air monitoring	50,000
Miscellaneous	162,000
Construction management	233,000
Engineering design and inspection	79,000
Contractor overhead and profit	140,000
Contingency	182,000
Construction subtotal[c]	**$1,240,000**
Post-closure costs	
Cap monitoring and maintenance	$ 24,000
Fence maintenance	3,000
Environmental monitoring	144,000
Post-closure contingency	43,000
Post-closure costs subtotal[d]	**$214,000**
Total[e]	**$1,450,000**

a. Costs are for 1995.

b. Costs for soil consolidation are covered by the other cost elements.

c. Includes net present value operating costs during remedial action.

d. Net present value assuming 5% interest (net of inflation) over 30 years.

e. Rounded to ten thousands.

10. Statutory Determinations

Remedy selection is based on CERCLA and the regulations contained in the National Oil and Hazardous Substances Pollution Contingency Plan. All remedies must meet the two threshold criteria (see Section 8.1) established in the National Oil and Hazardous Substances Pollution Contingency Plan: protection of human health and the environment, and compliance with ARARs. In addition, CERCLA requires that the remedy uses permanent solutions and alternative treatment technologies to the maximum extent practicable, and that the implemented action is cost-effective. Finally, the statute includes a preference for remedies that employ treatment that permanently and significantly reduce the volume, toxicity, or mobility of hazardous wastes as their principal element. The following sections discuss how the selected remedy addresses these statutory requirements.

10.1 Protection of Human Health and the Environment

As described in Section 9, the selected remedy for both SL-1 and BORAX-I satisfies the criterion of overall protection of human health and the environment by isolating contaminated materials from the accessible environment. The remedy will maintain isolation for a sufficient period of time to allow short-lived radionuclides to decay, thereby decreasing direct exposure risks. Decay of short-lived radionuclides (primarily cesium-137 and its progeny) will reduce direct exposure risks to 1 in 10,000 at SL-1 after approximately 400 years and to 2 in 10,000 at BORAX-I after approximately 320 years. The risk level at SL-1 will continue to decrease to a lower limit of 3 in 1,000,000 after approximately 650 years, where it will remain due to the presence of long-lived uranium-235. The risk level at BORAX-I will decrease to 2 in 10,000 in about 320 years and will stabilize due to long-lived uranium-235.

Although the National Oil and Hazardous Substances Pollution Contingency Plan established the acceptability of risk to be within a range of 1 in 10,000 to 1 in 1,000,000, the estimated long-term risk levels cited above for SL-1 and BORAX-I are considered acceptable for several reasons. First, the Office of Solid Waste and Emergency Response Directive 9255.0-30, dated April of 1991, states that the upper boundary of this risk range is not a discrete line at 1 in 10,000 and that a specific risk estimate around 1 in 10,000 may be considered acceptable if justified based on site-specific conditions. On this basis, risk levels around 1 in 10,000 have been determined to be acceptable for remedial actions implemented at other INEL operable units. Second, there are no practical, safe, and cost-effective methods of removing the uranium-235 and its progenies from the contaminated materials associated with the burial grounds. Any uranium-235 and its progenies removed would still require long-term isolation because there are no technologies for accelerating radionuclide decay. Finally, the methodology used in the baseline risk assessment to determine potential risks at SL-1 and BORAX-I resulted in upper bound estimates; uncertainty analysis indicates that risk is likely over-estimated, not under-estimated. Therefore it is probable that the long-term risks at BORAX-I, estimated at 2 in 10,000, may actually be within the 1 in 10,000 to 1 in 1,000,000 range.

Several assumptions, as discussed in Section 6.1.4, were incorporated into the methodology of the baseline risk assessment to ensure an upper-bound estimate would be computed. The assessment of residential scenarios was based on the assumption that direct contact with buried waste would be maintained for 24 hours a day, 350 days per year, for 30 years. Similarly, occupational scenarios included the assumption that direct contact with buried waste would be maintained for 8 hours a day, 250 days per year, for 25 years. For surface exposures, the assessments also included an assumption of homogeneous contamination within soils, based on the highest radionuclide concentrations detected during sampling activities. The result of these assumptions is most likely an over-estimation of the potential risks associated with the SL-1 and BORAX-I burial grounds.

The remedy selected for both SL-1 and BORAX-I is containment by capping, with engineered barriers comprised primarily of natural materials. The selected remedy will include consolidation of contaminated surface soils at BORAX-I for isolation beneath the engineered barrier. The engineered barriers will shield against penetrating radiation, discourage human and biotic intrusion, resist erosion, require low maintenance, and provide long-term performance and durability. Until determined by the agencies to be no longer necessary, radiological surveys will be performed to ensure effective isolation of contamination at both sites. Monitoring of the engineered barriers will be performed until determined by the agencies to be no longer necessary to ensure the integrity of the caps is not compromised by erosion or other deteriorating mechanisms. Additionally, institutional controls consisting of access restrictions (e.g., fencing, warning signs, and permanent markers) and runoff controls (e.g., contouring and grading as determined necessary) will be implemented to enhance isolation of the burial grounds. Land use will be restricted to industrial applications for the duration of DOE operations at the INEL. The DOE will request that the U.S. Department of Interior, Bureau of Land Management imposes similar restrictions.

Because this remedy will result in wastes remaining on site at both SL-1 and BORAX-I, reviews of this Record of Decision and monitoring data will be conducted. The initial review will be performed within five years of this Record of Decision signature with subsequent reviews conducted at least every five years thereafter until determined by the agencies to be no longer necessary. The purpose of these five-year reviews is to ensure the remedy provides adequate protection of human health and the environment.

10.2 Compliance with ARARs

The engineered caps for SL-1 and BORAX-I will be designed to meet all state and federal ARARs. The ARARs that will be satisfied by the selected remedy are explained below.

10.2.1 ARARs

No chemical- or location-specific ARARs were identified for the remedial action at either SL-1 or BORAX-I. A single action-specific ARAR was identified for the selected remedy at both SL-1 and BORAX-I (see Section 7.1.2, Table 8). The requirements of the rules for Control of Fugitive Dust

(IDAPA 16.01.01.650 and .651) will be satisfied at both SL-1 and BORAX-I by application of appropriate engineering controls to minimize generation of airborne contamination and dust during installation of the engineered barriers and consolidation of surface soil at BORAX-I.

10.2.2 To-Be-Considered Guidance

In implementing the selected remedy, the agencies have agreed to consider a number of procedures and guidance documents that are not legally binding. The following list of DOE orders are to be considered as guidance documents:

- DOE 5400.5, "Radiation Protection of the Public and Environment"
- DOE 5820.2A, "Radioactive Waste Management."

These DOE orders provide guidance to ensure radiation protection for the environment and the public. DOE Order 5400.5 provides radiation protection standards to protect the general public from activities conducted at DOE sites. DOE Order 5820.2A addresses future control of sites; the DOE intends to maintain active institutional control of low-level radioactive waste disposal sites for 100 years following closure.

10.3 Cost Effectiveness

The selected remedy is cost-effective based on the overall protection to human health and the environment relative to the costs incurred. Due to the persistent toxicity associated with radionuclides, removing waste from SL-1 and BORAX-I simply results in the transfer of risk from one location to another with a significant increase in cost and short-term risk. Therefore, compared to other potential remedial actions, the selected remedy provides the best balance between cost and effectiveness in protecting human health and the environment.

10.4 Use of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The selected remedy utilizes permanent solutions to the maximum extent practicable for the SL-1 and BORAX-I burial grounds. The National Oil and Hazardous Substances Pollution Contingency Plan prefers a permanent solution whenever possible. However, guidance established in the National Oil and Hazardous Substances Pollution Contingency Plan to assist in the selection and implementation of appropriate remedial actions states that EPA encourages the use of containment for waste that poses a relatively low long-term threat or where treatment is impracticable. Therefore, the selected remedy focuses on long-term containment, radiological monitoring, and institutional control of the burial grounds, due to the persistent radiotoxicity associated with radionuclides. The selected remedy provides protection by isolating contaminated materials from the accessible environment for a sufficient period of time to reduce potential exposure risks to acceptable levels. Based on analysis of the CERCLA remedial alternative evaluation criteria and in particular the five balancing criteria (see Section 8.2), containment provides the best remedy for both the SL-1 and BORAX-I burial grounds in terms of long- and short-term effectiveness, cost, implementability, and reduction of toxicity, mobility, and volume. The following discussion highlights the tradeoffs among the alternatives considered for SL-1 and BORAX-I relative to the five balancing criteria.

Long-term effectiveness is equally achieved by either containment or removal and disposal, because both remedial actions involve isolation from the accessible environment to ensure long-term protection of human health and the environment. However, removal actions would involve significantly increased worker exposures during the short-term period of implementation. No action would not be effective in the short- or long-term.

The toxicity of radionuclides associated with the burial grounds can only be reduced by natural decay; there are currently no technologies available to accelerate the decay process. Therefore, evaluation of the remedial actions considered with respect to reduction in toxicity is not applicable. In addition, the alternatives evaluated do not affect the volume of contaminated material existing at the burial grounds. However, both the selected remedy and the removal and disposal alternative would result in significantly reduced mobility based on long-term isolation from the accessible environment. No action would not have an impact on toxicity, volume, or mobility of contaminants at SL-1 or BORAX-I.

Implementability and cost are directly related to the complexity of the remedial actions considered. Removal and disposal is the most complex alternative due to health and safety concerns associated with handling the contaminated materials buried at SL-1 and BORAX-I. As a result, removal and disposal is the most difficult to implement and the most expensive alternative. Although no action would be unacceptable to the agencies, this alternative is technically easy to implement and the least expensive. The selected remedy is not complex and therefore is not difficult to implement and is much less expensive than removal and disposal.

Relative to the five balancing criteria, short-term effectiveness, implementability, and cost were the decisive factors in selecting the containment alternative. The containment alternative does not require intrusion into the burial grounds and therefore does not require worker exposure to the contaminated waste buried at SL-1 and BORAX-I. Furthermore, the containment alternative is not difficult to implement and does not involve significant cost when compared to the removal and disposal alternative. No action was not considered a viable option.

State and community acceptance were also included in the decision-making process for remedy selection. The IDHW participated in the development and review of all required CERCLA documentation, including the remedial investigation/feasibility study, the proposed plan, and this Record of Decision, and supports the selected alternative. The Environmental Management Site Specific Advisory Board for the INEL concurred with the selection of the containment alternative at both burial grounds and recommended that construction and monitoring costs be reduced to the extent possible to reflect the costs for similar actions performed within the private sector. In addition, public meetings were held at various locations throughout the state, and publications were made available to inform, educate, and encourage participation of the community regarding remedial activities associated with the SL-1 and BORAX-I burial grounds.

10.5 Preference for Treatment as a Principal Element

Treatment was not considered in the formulation of potential alternatives for SL-1 and BORAX-I based on review of remedial actions previously selected for similar CERCLA sites. In addition, the nonhomogeneous characteristics associated with the wastes buried at SL-1 and BORAX-I rendered standard treatment techniques inappropriate. Contaminated materials buried at these sites include construction debris, with physical properties ranging in size, shape, and material. Furthermore, based on the inability of treatment to reduce the toxicity of radionuclides, the remedy selected did not consider treatment as a principal element.

11. Documentation of Significant Change

Several refinements have been identified for the selected remedial action at the SL-1 and BORAX-I burial grounds. These refinements are related to surface soil consolidation, monitoring, cost refinements, the boundaries of Operable Unit 5-05, and other changes to the proposed plan and are described in the following subsections.

11.1 Surface Soil Consolidation

The information in the proposed plan indicated that the surface soils around the burial grounds could require consolidation due to the presence of wind-dispersed contamination. Costs in the proposed plan were developed as ranges to accommodate the potential for consolidation of surface soils and the types of caps under consideration. Refined cost estimates were prepared for this Record of Decision based on no surface soil consolidation at SL-1, and consolidation of the entire 84,000-square foot (7,800-square meter) area at BORAX-I.

Subsequent to finalization of the proposed plan an evaluation of new data in conjunction with historical sampling and survey data determined that surface soils surrounding the SL-1 burial ground do not pose an unacceptable risk to human health or the environment. Soil ingestion, dust inhalation, groundwater ingestion, and external exposure were evaluated for current occupational and 30-year future residential scenarios. Surface soil concentrations of identified contaminants of concern outside of the exclusion fence are at or below background values within Operable Unit 5-05. Dose equivalent rate measurements of the Operable Unit 5-05 surface soils indicate radiological field levels at or below the average INEL level of 20 μrem/hr. The agencies have reviewed this information and concur that no further action is appropriate for the surface soils outside of the exclusion fence within Operable Unit 5-05. Documentation in support of the decision can be found in the Administrative Record for Operable Units 5-05 and 6-01 specifically in an engineering design file titled "ARA Windblown Area

Risk Evaluation" and an associated letter report titled "Assessment of Surface Soils Surrounding the SL-1 Burial Ground".

It is expected that surface soil consolidation will be necessary at BORAX-I to appropriately manage soil contamination and minimize the potential for human or environmental exposure to unacceptable risks. Therefore the refined cost estimate for capping the BORAX-I site incorporates the consolidation of surface soil option discussed in the proposed plan.

11.2 Monitoring

Long-term monitoring to confirm isolation of the buried contaminants for the accessible environment and groundwater was described in the proposed plan. Environmental monitoring of air, soil, and groundwater, and cap integrity monitoring to assess erosion, cracking, or other observable deterioration were included. In the effort to refine costs the monitoring component was critically examined. It was determined that large components of the environmental monitoring could be incorporated into larger programs on the INEL at significant cost savings. Monitoring costs for the no action alternative were revised to be consistent with monitoring estimated for the selected Alternative 2. Therefore the no action alternative includes only soil monitoring. Alternative 3 did not include monitoring, and estimates have not changed.

11.2.1 Groundwater Monitoring

The results of the baseline risk assessment indicate risks via ingestion of groundwater of 1E-06 at the SL-1 burial ground and 3E-06 for the BORAX-I burial ground. These estimates, very low in the acceptable risk range, are upper bounds on risk because parameters for the groundwater modeling were selected to maximize the potential risk estimates. These estimates also represent the summation of risks due to all contaminants, regardless of modeled peak concentration time in the aquifer.

Uncertainty analyses support the conclusion that there is no risk to groundwater from either burial ground; therefore, costs for groundwater monitoring have been eliminated. Installation of groundwater monitoring wells specific to these sites, at an approximate cost of $200,000 per well, is not necessary. Therefore, groundwater monitoring needs will be determined under the Waste Area Group 5 Comprehensive Remedial Investigation/Feasibility Study for WAG 5 and the Waste Area Group 10 Comprehensive Remedial Investigation/Feasibility Study for WAG 6. This approach will be more cost efficient because groundwater monitoring plans can be designed to cover much larger areas. Five-year reviews of monitoring data will be defined for the comprehensive remedial investigation/feasibility studies. In the unlikely event that either burial ground is suspected of contributing to groundwater contamination, additional site-specific monitoring wells or other means of contaminant migration detection can be installed in the future.

11.2.2 Air Monitoring

Costs for long-term monitoring of air have been eliminated for both burial grounds for Alternatives 1 and 2. An INEL-wide program is in place that would make additional monitoring specific to either site redundant. In compliance with the identified ARARs, site-specific air monitoring will be performed during the construction of the caps; after the remedial action is complete, responsibility for air monitoring at each site will be assumed by the site-wide program.

11.2.3 Soil Monitoring

Under Alternative 2, surface soils will be monitored by radiological surveys. For SL-1, cost estimates include radiological monitoring until the Waste Area Group 5 Comprehensive Remedial Investigation/Feasibility Study monitoring program is in place. At that time, long-term responsibility for these surveys will be placed under the Waste Area Group 5 program. Monitoring results and the need for continued monitoring will be evaluated during subsequent five-year reviews by the agencies.

Because there will be no long term monitoring plan for Waste Area Group 6, estimates in this Record of Decision include costs for radiological monitoring of the BORAX-I site. The need for continued monitoring will be assessed periodically in the five-year reviews conducted by the agencies.

Estimates for monitoring under the No Action Alternative 1 were revised to be consistent with the approach formulated for Alternative 2.

11.3 Cost Refinements

The estimated costs for the selected remedy were presented in the proposed plan as ranges; $3,684,000 to $8,775,000 for SL-1, and $2,340,000 to $4,690,000 for BORAX-I. The refined cost estimates presented in this Record of Decision are $1,970,000 for SL-1 and $1,450,000 for BORAX-I. The cost refinements result from the soil consolidation issues discussed in Section 11.1, monitoring discussed in Section 11.2, and refinements in general design parameters applied to the extent possible without specific engineering designs. Further refinements of costs will be achieved when the remedial design is finalized and well-defined.

Removing costs for goundwater and air monitoring (see Section 11.2) results in estimates for the No Action Alternative 1 of $188,000 for SL-1 and $180,000 for BORAX-I.

11.4 Operable Unit 5-05 Boundary

In the proposed plan the boundary of OU 5-05 was defined as the 1,200- by 1,500-foot (366- by 477-m) area around the SL-1 burial ground. The investigation of the surface soils and the external exposure pathway discussed above in Section 11.1 was not limited to this region, but encompassed the entire area defined by the isopleth illustrated in Figures 2 and 4. Rather than assess a region in the middle of one end of this isopleth, the agencies have agreed to expand the boundary of Operable Unit 5-05 to include the northeast portion, about 40% of the entire area defined by the aerial isopleth. This approach avoids the necessity for future reassessment and expenditure of additional funds for the administration of the additional evaluation. Based on recently acquired dose equivalent rates, there are no unacceptable external exposure risks due to surface soil outside the exclusion fence but inside the revised Operable Unit 5-05 boundary. There are no other pathways of concern for the surface soils in the defined area. Therefore no remedial actions will be necessary. Expanding Operable Unit 5-05 to include the surrounding surface soils efficiently addresses the region and saves significant time and funds. The remaining 60% of the area defined by the aerial isopleth will be addressed in the WAG 5 comprehensive RI/FS as site ARA-23.

11.5 Other Changes to the Proposed Plan

Several other minor changes have been made due to refinement of elements presented in the proposed plan.

- Institutional control: Institutional control will be maintained by DOE for at least 100 years to limit land use to industrial applications. Institutional controls will include placing written notification of the remedial action in the facility land use master plan; the notification will prohibit any activities that would interfere with the remedial activity. A copy of the notification will be given to the Bureau of Land Management, together with a request that a similar notification be placed in the Bureau of Land Management property management records. The DOE will provide EPA and IDHW with written verification that notification, including Bureau of Land Management notification, have been fully implemented.
- Remedial action objectives: The word "prevent" has been replaced with the word "inhibit" to more realistically describe each of the remedial action objectives.
- Biotic intrusion at BORAX-I: In the development of preliminary cap design, the agencies have reviewed the available data and concluded that a biotic barrier is not necessary for protection of human health and the environment at BORAX-I.
- Biotic intrusion at SL-1: In the development of preliminary cap design, the agencies have reviewed the available data and concluded that a biotic barrier is not necessary over the entire SL-1 burial ground. Layers to inhibit biotic intrusion will be placed only directly over the disposal pits and trench.

12. Decision Summary for No Action Sites

This Record of Decision includes determinations for 10 Track 1 sites. The agencies have evaluated each site and support decisions for no further action. Much of the information discussed in previous sections, particularly Sections 1 through 5, also applies to these 10 sites. Additional information specific to these sites is discussed in the remainder of this section, with individual descriptions of the 10 sites in Section 12.6. Further details can be found in the Administrative Record for Waste Area Group 5.

12.1 Site Name, Location, and Description

Waste Area Group 5 contains two groups of facilities: the Auxiliary Reactor Area and the Power Burst Facility (see Figure 9). The Auxiliary Reactor Area is comprised of four inactive facilities located along Fillmore Boulevard north of Highway 20. The Power Burst Facility is just north of the Auxiliary Reactor Area and consists of a total of five facilities spread radially around the Power Burst Facility Control Area at the end of Jefferson Boulevard. Section 1 describes the topography, meteorology, surface-water hydrology, geology, ecology, demography, and land use for both areas. The general description of groundwater hydrology is also the same, with site-specific depths to groundwater of approximately 667 feet (203 m) at the Auxiliary Reactor Area and 483 feet (147 m) at the Power Burst Facility.

12.2 Site History and Enforcement Activities

The Auxiliary Reactor Area was originally constructed in 1957 for U.S. Army research and development of a compact power reactor. The area consisted of four facilities called Auxiliary Reactor Areas I through IV. In 1965 the Army program was discontinued. Technical support services, not including reactor operations, were continued until 1985, when the facilities were shut down. Three Track 1 sites, two at Auxiliary Reactor Area I and one at Auxiliary Reactor Area III, are included in this Record of Decision.

The Power Burst Facility was originally called the Special Power Excursion Reactor Test area. Built in the late 1950s for reactor behavior and safety experiments, the facility consisted of five areas, the Control Area and Special Power Excursion Reactor Test Areas I through IV. After this series of experiments terminated, all of the reactors were removed, and the individual facilities within the area were converted to other uses. With the construction of a new reactor in 1970, the area was renamed the Power Burst Facility. The Special Power Excursion Reactor Test Control Area became the Power Burst Facility Control Area; Special Power Excursion Reactor Test Areas I through IV became, respectively, the Power Burst Facility Reactor Area, the Waste Engineering Development Facility, the Waste Experimental Reduction Facility, and the Radioactive Mixed Waste Storage Facility. Seven Track 1 sites located at the Power Burst Facility are included in this Record of Decision.

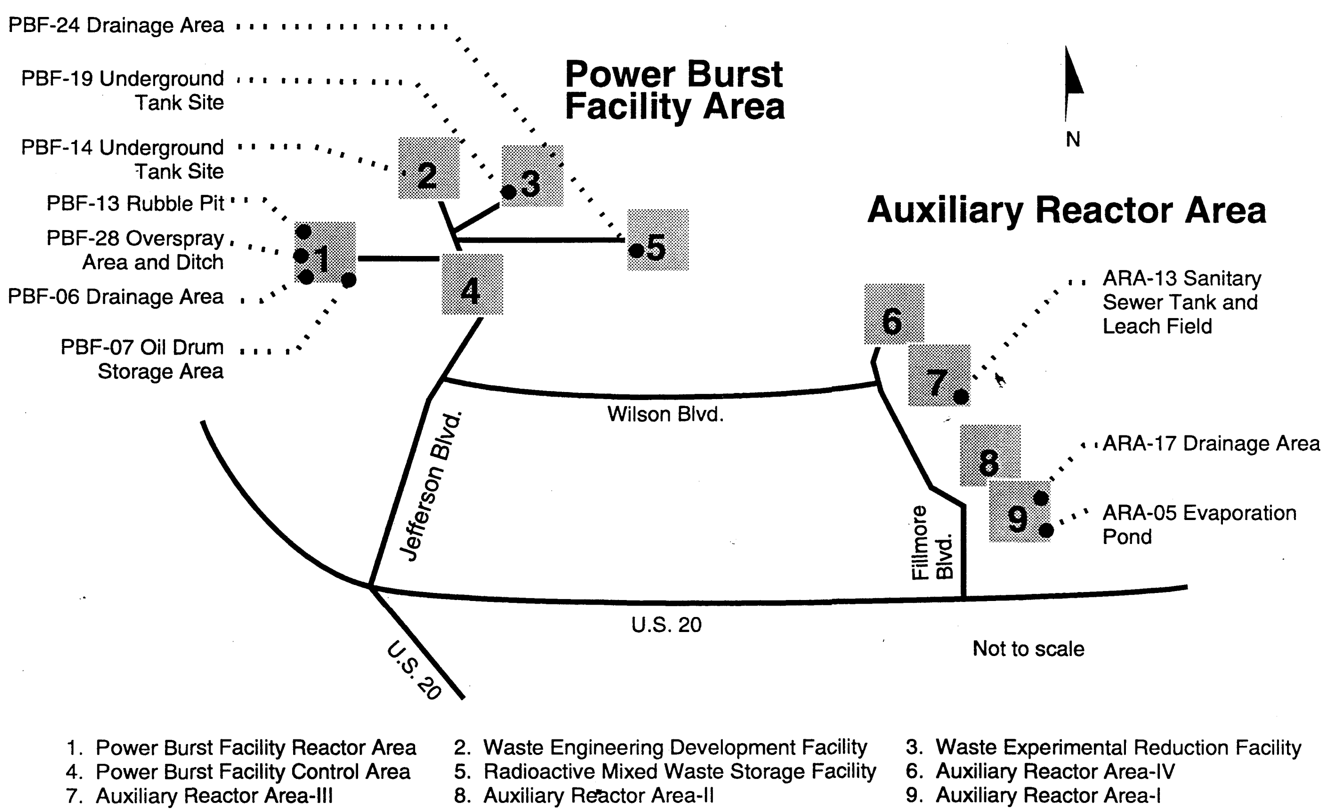


Figure 9. Waste Area Group 5 facilities and no further action sites.

12.3 Highlights of Community Participation

All 10 Track 1 sites were included in the proposed plan for the SL-1 and BORAX-I burial grounds. Public comments were solicited at the same meetings and in the same comment periods discussed previously. No comments were received.

12.4 Scope and Role of Operable Unit or Response Action

Ten sites in Waste Area Group 5 are presented in this Record of Decision with no further action determinations. As illustrated in Figure 9, three are located in the Auxiliary Reactor Area, and seven are within the Power Burst Facility. Of the twelve operable units in Waste Area Group 5, four have one or more individual Track 1 sites presented here for no further action.

All 10 sites were identified in the Federal Facility Agreement and Consent Order and evaluated according to INEL-specific guidance for Track 1 sites. Qualitative Track 1 risk assessments evaluate all available existing information and data, including site operating, waste, and disposal histories, engineering drawings, and anecdotal evidence. These assessments examine only potential hazards to human health, utilizing the assumption that actions taken to protect human health will also be protective of the environment. The information was evaluated by representatives of the DOE, the IDHW, and the EPA, who agreed that the sites did not warrant remediation or further study.

As previously described, cumulative risks from each operable unit will be further evaluated in the comprehensive remedial investigation/feasibility study for Waste Area Group 5. Final evaluation of site-wide impacts will be performed in the Waste Area Group 10 assessment.

12.4.1 Auxiliary Reactor Area Sites

Operable Unit 5-01, located at the Auxiliary Reactor Area I, contains six sites; two of the six, ARA-05 and ARA-17, are included in this Record of Decision. Also addressed is site ARA-13, the only site in Operable Unit 5-11. This Operable Unit is located at the ARA-III.

12.4.2 Power Burst Facility Sites

All of the five sites in Operable Unit 5-03 (PBF-06, PBF-07, PBF-13, PBF-24) and PBF-28, are included in this Record of Decision. Of these five sites, four are located at the Power Burst Facility Reactor Area and the fifth, PBF-24, is at the Radioactive Mixed Waste Storage Facility. The other two Power Burst Facility sites are two of the three sites in Operable Unit 5-04, site codes PBF-14 and PBF-19. PBF-14 is located at the Waste Engineering Development Facility. PBF-19 is adjacent to the Waste Experimental Reduction Facility.

12.5 Site Characteristics

The complete Track 1 Decision Documentation Packages and other information supporting the evaluations for these sites can be found in the Administrative Record. Standard exposure pathways and scenarios were evaluated according to the INEL-specific guidance for assessing Track 1 sites. Potential exposure routes considered were external exposure to ionizing radiation, soil ingestion, inhalation of dust, inhalation of volatiles, and groundwater ingestion. Both current occupational and future residential scenarios were qualitatively evaluated. The following section summarizes the contaminants considered for each site and the results of the qualitative risk assessments.

12.6 Summary of Site Risks

The 10 sites were categorized for discussion and summary into three different types: wastewater disposal sites, soil contamination sites, and underground storage tanks.

12.6.1 Wastewater Disposal Sites

The six sites discussed in the following subsections were associated with liquid waste discharges. During the initial site identifications, several of these sites were only suspected of receiving hazardous or radioactive wastes. Subsequent evaluation determined that no disposal activities had occurred. Other sites were identified as recipients of contaminated wastes, but evaluation determined that discharges were neutralized, biodegraded, or in quantities too small to pose an unacceptable risk.

12.6.1.1 ARA-05. ARA-05 in Operable Unit 5-01 was originally described in the initial site identification as an evaporation pond northeast of ARA-I. The area is a shallow natural depression in the ground that may have received some runoff from an adjacent small parking lot. There are no records of waste generation or disposal processes associated with this site, nor are there any records indicating that the site was ever the intended destination of any waste stream. Historical monitoring surveys detected the presence of random radioactive particles in both the pond area and the general vicinity around ARAs I and II. These hot particles were probably a result of the SL-1 accident and cleanup efforts. This site was prepared in 1993 for removal of radioactive particles, but the survey indicated that the area was free of radioactivity above the ambient background.

12.6.1.2 ARA-17. ARA-17 in Operable Unit 5-01 is a nearly flat drainage area south of ARA-I that received drainage from two sources: the boiler room blow-down from the Hot Cells building and the raw-water storage tank and pump house at the southwestern corner of the facility. Surface dimensions are approximately 150 by 150 feet (46 by 46 m). There are no known concentrations of radiological contamination above background levels at this site, as confirmed by radiological surveys, and no evidence of nonradiological constituents. Historical documents and process information pertinent to ARA-I do not indicate that this site was the intended destination of any waste stream except uncontaminated water.

12.6.1.3 PBF-28. PBF-28 in Operable Unit 5-03 consists of an overspray area of surface soils north of the drainage ditch that is south and west of the Power Burst Facility Reactor Area cooling tower. The reactor cooling tower began service in 1976 and received reactor secondary cooling water until 1985. The drainage ditch was constructed in the early 1970s and is approximately 600 feet (183 m) in length. This drainage ditch was used for surface runoff drainage from the reactor area. It also received water from the boiler blow-down tank and discharge or overflow of secondary cooling water from the cooling towers. Soil samples were collected along the entire length of the drainage ditch and the cooling tower area and analyzed for chromium, the primary contaminant of concern. Results indicated a 100- by 100-foot (30- by 30-m) area was contaminated by aerosol overspray from the cooling tower. However, the concentrations of chromium found at this site are substantially below risk-based contaminant levels and surveys indicate no radiological activity above background levels for the cooling tower area or the drainage ditch.

12.6.1.4 PBF-06. PBF-06 in Operable Unit 5-03 is a ditch located west of the Power Burst Facility reactor building. A pipe running from the oil-fired boiler has emptied approximately 30 gallons (114-liters) per day of blow-down water into the pit since 1970. Although the reactor was placed in a standby status in 1985, the boiler is still being used to support ongoing activities at the facility, which require continued release of the boiler blow-down water. The blow-down water contains some chemicals that are used to inhibit corrosion in the boiler. However, the corrosion inhibitors used contain no hazardous chemicals, are nontoxic, and are used in very small quantities. A radiological survey conducted in 1991 found no radiological contamination above background levels at this site.

12.6.1.5 PBF-24. PBF-24 in Operable Unit 5-03 is a boiler blow-down pit that was used for drainage of the reactor building boiler waters from 1960 to 1971. The 2- by 2- by 6-foot (0.6- by 0.6- by 1.8-m) pit, located 30 feet (9 m) north of the reactor building, is a subsurface reinforced concrete structure and has an open gravel base for drainage. A pipe running from the oil-fired boiler emptied approximately 30 gallons (114 liters) per day of blow-down water into the pit. The blow-down water contained some chemicals that were used to inhibit corrosion in the boiler. However, the corrosion inhibitors used contained no hazardous chemicals, were relatively nontoxic, and were used in very small quantities. Radiological surveys show no radiological contamination above background levels at this site.

12.6.1.6 ARA-13. ARA-13 in Operable Unit 5-11 consists of a septic tank, a distribution box, and a drain field at Auxiliary Reactor Area III. Sanitary wastes were disposed into the system from 1969 to 1980. Between 1980 and 1983, in addition to sanitary wastes, small quantities of hazardous laboratory wastes were diverted to this system. Sampling and analysis yielded low-level concentrations of arsenic, barium, beryllium, mercury, nickel, selenium, and thallium in four samples taken from the leach field. The metals were detected at depths from 1 to 6 feet (0.3 to 1.8 m). However, concentrations were lower than background metal concentrations found in soils at other operable units at the INEL. The contents of the system were sampled and analysis showed concentrations were below levels that would present an unacceptable risk.

12.6.2 Soil-Contamination Sites

The following two Track 1 sites were classified as potential soil-contamination sites. One site was suspected of having received hazardous waste and possible oil spillage, but subsequent site evaluation determined that no such disposal activities had occurred. The other site was a dump for a variety of materials, including piping with asbestos insulation and some heavy metals. The asbestos has been removed, and subsequent evaluation of the site indicated that remaining contaminant concentrations do not pose an unacceptable risk to human health or the environment.

12.6.2.1 PBF-07. PBF-07 in Operable Unit 5-03 is the location of an oil drum storage area at the Power Burst Facility Reactor Area. The site consists of a wholly enclosed 4- by 8-foot (1.2- by 2.4-m) concrete pad, which is used to temporarily store two or three 55-gallon (208-liter) drums of used oil and lubricant until pick up for recycling. The site initially only had a steel roof covering the oil drums, but in 1990, the pad was enclosed with metal corrugated siding, and a drip pan was installed. There have been no recorded oil spills and the site shows no physical evidence of spillage. No hazardous substances have been stored on the site, and a radiological survey conducted in 1991 detected no radiological activity above background.

12.6.2.2 PBF-13. PBF-13 in Operable Unit 5-03 is a rubble pit located north of the Power Burst Facility Reactor Area cooling tower. The rubble pit was first used to dispose of soil and basalt pieces excavated during facility construction in the late 1960s and was later used as a dump for a variety of construction materials until approximately the mid-1970s. Fence posts mark the location of the 75- by 45- by 10-foot (23- by 14- by 3-m) dumping area. The dump received lumber, rusting empty barrels and cans, cable, concrete, and piping with asbestos insulation. All visible materials containing asbestos were removed from the pit in 1993. Any small quantity that remains was covered when the pit was backfilled with 3 to 12 feet (0.9 to 3.7 m) of clean soil and basalt rubble. Soil samples indicated the presence of cadmium, chromium, lead, nickel, and zinc in small amounts consistent with background levels. Volatile organic compounds detected at very low concentrations were acetone and toluene.

12.6.3 Underground Storage Tanks

The following two Track 1 sites were associated with underground storage tanks. One of the tanks, its contents, associated piping, and contaminated soil have been removed. This site is now paved and used for storage. The other tank was filled with sand, disconnected from the associated piping, and abandoned in place. Risk evaluations determined that possible residual soil contamination would not pose an unacceptable risk.

12.6.3.1 PBF-14. PBF-14 in Operable Unit 5-04 is the site of a buried 500-gallon (1,893-liter) gasoline tank once used to power an emergency generator. The tank was in service from 1960 to 1964, when the Special Power Excursion Reactor Test II reactor was functional. The tank was filled with sand and abandoned in place with the fuel line disconnected. Two posts prevent parking on the tank site. The top of the tank is about 2 feet (0.6 m) below the surface. During the Track 1 investigation, soils were excavated down to the top of the tank to a depth of 2 to 2.5 feet (0.6 to 0.8 m). No stained soils were visible, volatile organic compounds were not detected and there were no holes observed in either the tank or associated piping.

12.6.3.2 PBF-19. PBF-19 in Operable Unit 5-04 was a 3,000-gallon (11,355-liter) underground fuel oil storage tank associated with the furnace in the reactor building at the Special Power Excursion Test Reactor III. Documentation from 1986 indicates that the tank and any contaminated soil associated with the tank were scheduled for removal, but post-removal records were not found. Although evidence that the tank was removed versus abandoned in place is not confirmed, it is likely that the tank and any associated contaminated soil were removed in 1986. The area has since been paved and is now used for outside storage.

12.7 Description of the No Action Alternative

Based on the information summarized above from the supporting documents placed in the Administrative Record, the 10 Track 1 sites described do not pose an unacceptable risk to either human health or the environment. No further action is warranted. Although no additional efforts will be expended to remediate or assess these sites individually, each will be considered again for cumulative effects in the comprehensive remedial investigation/feasibility study for Waste Area Group 5 and the site-wide assessment for Waste Area Group 10.

Appendix A

Responsiveness Summary

Appendix A

Responsiveness Summary

A.1 Overview

Operable Unit 5-05 is within Waste Area Group 5 of the Power Burst Facility/Auxiliary Reactor Area at the INEL. The unit comprises the SL-1 burial ground and surrounding area. Operable Unit 6-01 is within Waste Area Group 6 of the Experimental Breeder Reactor-I/Boiling Water Reactor Experiment at the INEL and comprises the BORAX-I burial ground and surrounding area. Both of these operable units are described in the Record of Decision to which this Responsiveness Summary is attached. Due to the similarities of the two operable units, they were investigated together. A proposed plan was released April 28, 1995, with a public comment period from May 3 to June 3, 1995. The preferred alternative recommended in the proposed plan is containment by capping with an engineered long-term barrier comprised primarily of natural materials. This Responsiveness Summary recaps and responds to the comments received during the comment period. Generally, the comments reflect a broad range of views, from strong support for the selected alternative to opposition and support for Alternative 3, Removal and Disposal.

A.2 Background on Community Involvement

In accordance with CERCLA §113(k)(2)(B)(i-v) and 117, a series of opportunities for public information and participation in the remedial investigation and decision process for the SL-1 and BORAX-I burial grounds were provided to the public from September 1994 through May 1995. For the public, the activities included receiving fact sheets that briefly discussed the investigation to date, *INEL Reporter* articles and updates, a proposed plan, an availability session and public meetings. A few members of the public received telephone briefings

In September 1994, a kickoff fact sheet concerning the SL-1 and BORAX-I remedial investigation/feasibility study was sent to about 6,700 individuals of the general public and to 650 INEL employees on the INEL Community Relations Plan mailing list. The fact sheet contained a postage-paid comment form to solicit early public input on the investigations.

The investigations were discussed at informal semiannual briefings in Twin Falls (October 11, 1994), Pocatello (October 13, 1994), Moscow, (October 18, 1994), Boise (October 19, 1994), and Idaho Falls (October 20, 1994). During these briefings, representatives from the DOE and INEL discussed the projects with members of the community, answered questions, and listened to public comments.

Regular reports concerning the status of the project were included in the *INEL Reporter* and mailed to those who were on the mailing list. Reports also appeared in two Citizens' Guides.

In April 1995, a fact sheet concerning the project was sent to about 6,700 individuals of the general public and 650 INEL employees on the INEL Community Relations Plan mailing list. On April 11, 1995, the DOE issued a news release to more than 100 news media contacts concerning the beginning of a 30-day public comment period, which began May 3, 1995 and ended June 3, 1995, pertaining to the proposed plan for SL-1 and BORAX-I. Many of the news releases resulted in a short note in community calendar sections of newspapers and as public service announcements on radio stations. Both the fact sheet and news release gave notice to the public that documents for SL-1 and BORAX-I would be available before the beginning of the comment period in the Administrative Record section of the INEL Information Repositories located in the INEL Technical Library of Idaho Falls, the INEL Boise Office, as well as in public libraries in Idaho Falls, Fort Hall, Pocatello, Twin Falls, Boise, and the University of Idaho Library in Moscow. Also, table top displays were set up at the Grand Teton Mall in Idaho Falls (May 15-20), Burley Public Library (April 24-May 5), Twin Falls Public Library (May 5-26), Boise Towne Square Mall (April 29), and the Pocatello City Building (April 24-May 15).

Opportunities for public involvement in the decision process for SL-1 and BORAX-I were provided beginning in May 1995. For the public, the activities ranged from receiving the proposed plan, conducting one teleconference call, and attending open houses and public meetings to informally discussing the issues and offering verbal and written comments to the agencies during the 30-day public comment period.

Copies of the proposed plan for the burial grounds were mailed to about 6,700 members of the public and 650 INEL employees on the INEL Community Relations Plan mailing list on April 28, 1995, urging citizens to comment on the proposed plan and to attend public meetings. Display advertisements announcing the same information and the location of public meetings on May 16, 17, and 18, 1995, in Idaho Falls, Boise, and Moscow, respectively, appeared in seven major Idaho newspapers. All of the public meetings were held on the scheduled days. Large advertisements appeared in the following Idaho newspapers on April 26: Post Register (Idaho Falls); Idaho State Journal (Pocatello); South Idaho Press (Burley); Times News (Twin Falls); Idaho Statesman (Boise); Lewiston Morning Tribune (Lewiston); and The Daily News (Moscow).

Personal calls were made to stakeholders in Idaho Falls, Pocatello, Twin Falls, Boise, and Moscow the week of May 8 and 15 to remind individuals about the meetings. A post card was mailed on May 10, 1995, to about 6,700 members of the public and 650 INEL employees on the INEL Community Relations Plan mailing list to encourage them to attend the public meetings and provide verbal or written comments. Both media, the news release and newspaper advertisements, gave public notice of public involvement activities and offerings for briefings, and the beginning of a 30-day public comment period that was to begin May 3 and run through June 3, 1995.

Written comment forms, including a postage-paid business-reply form, were made available to those attending the public meetings. The forms were used to turn in written comments at the meeting, and by some, to mail in comments later. The reverse side of the meeting agenda contained a form for the public to evaluate the effectiveness of the meetings. A court reporter was present at each meeting to record transcripts of discussions and public comments. Transcripts from the three public meetings were placed in the Administrative Record section for the SL-1 and BORAX-I burial grounds, Operable Units 5-05 and 6-01, in five INEL Information Repositories. A total of about 10 people attended the public meetings. Overall, eight provided formal comment; of these eight people, three provided oral comments and five provided written comments. For those who did not attend the public meetings but wanted to make formal written comments, a postage-paid comment form was attached to the proposed plan. All comments received on the proposed plan were considered during the development of this Record of Decision.

This Responsiveness Summary has been prepared as part of the Record of Decision. All formal verbal comments, as given at the public meetings, and all written comments, as submitted, are included in the Administrative Record for the Record of Decision. Those comments are annotated to indicate which response in the Responsiveness Summary addresses each comment. The Record of Decision presents the preferred alternative for the project, selected in accordance with CERCLA, as amended by the Superfund Amendments and Reauthorization Act and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan. The decision for this operable unit is based on information contained in the Administrative Record.

A.3 Summary of Comments with Responses

Comments and questions raised during the public comment period on the SL-1 and BORAX-I burial grounds proposed plan are summarized below. The public meetings were divided into an informal question-and-answer session and a formal public comment session. The meeting format was described in published announcements and meeting attendees were reminded of the format at the beginning of each meeting. The informal question-and-answer session was designed to provide immediate responses to the public's questions and concerns. Several questions were answered during the informal question-and-answer period during the public meetings on the proposed plan. This Responsiveness Summary does not attempt to summarize or respond to issues and concerns raised during that part of the public meeting. However, the Administrative Record contains complete transcripts of these meetings, which include the agencies' responses to these informal questions.

Comments received during the formal comment session of the meeting were addressed by the agencies in this Responsiveness Summary. The public was requested to provide their comments in writing, verbally during the public meetings, or by recording a message by calling the INEL's toll-free number. Seven written comments were received and 12 verbal comments were offered during the public meetings. This Responsiveness Summary responds to those comments.

1. **Comment:** One commenter asked what the maximum doses are regardless of time, at least to 10,000 years, and how these compare to the maximum dose limits of Nuclear Regulatory Commission and the DOE for an unrecognized abandoned radiation waste disposal facility.

   Response: The annual dose was estimated for the SL-1 and BORAX-I burial grounds based on the residential intrusion scenario beginning 30 years in the future. This scenario was selected because it represents the "maximum dose" at the time of earliest possible public access to either site. Selection of this exposure scenario from the 10 scenarios modeled in the baseline risk assessment represents the highest risk to the public and is also consistent with the proposed plan.

   Risk spreadsheets generated for the baseline risk assessment provided the starting point for the estimation of dose. Radionuclides posing a risk less than 1 in 10,000,000 for a given pathway were screened from this evaluation as insignificant contributors to the total dose. The methodology, including formulae, source terms, and dose conversion factors used to estimate annual dose rates, is presented in the technical memorandum titled *Dose Conversions for the SL-1 and BORAX-I Burial Grounds*, and can be found in the Administrative Record for Operable Units 5 and 6.

   Results of the calculations for the 30-year residential intrusion scenarios are summarized below. A limit of 25 mrem/yr for members of the public has been established by the Nuclear Regulatory Commission and by the DOE.

Table A-1. Estimates of dose for the 30-year residential intrusion scenario.

Site	Pathway	Estimated Annual Dose Rate (mrem/yr)
SL-1	External exposure	34,000
	Soil ingestion	69
	Dust inhalation	0.31
	Groundwater ingestion	0.043
	Total (2 significant digits)	**34,000**
BORAX-I	External exposure	1,800
	Soil ingestion	7.0
	Dust inhalation	0.14
	Groundwater ingestion	0.64
	Total (2 significant digits)	**1,800**

2. **Comment:** Two commenters feel that models used for groundwater fate and transport must be benchmarked and validated before we can proceed with action or no action.

   Response: GWSCREEN was the groundwater modeling code used to estimate groundwater concentrations and potential risks due to groundwater ingestion. This code was designed to EPA and IDHW specifications to address conditions and uncertainties pertinent to the INEL. Worst case upper bounds of concentrations and risks were generated by using EPA and IDHW approved default input parameters defined for evaluating Track 2 sites (sites about which little is known, and low risk is expected). The code has been validated by benchmarking against the PORFLOW and GRDFLX codes, both of which are well known and accepted codes in groundwater modeling. GWSCREEN results were within 5% of both PORFLOW and GRDFLX results. Further information regarding the development, validation, and benchmarking of GWSCREEN can be found in the following documents which are available in the Administrative Record for Operable Units 5-05 and 6-01.

Rood, A. S. and R. C. Arnett, J. T. Barraclough. Contaminant Transport in the Snake River Plain Aquifer: Phase I, Part 1: Simple Analytical Model of Individual Plumes" EGG-ER-8623, May 1989.

Matthews, S. D., "Software Configuration Management Plan for Controlled Code Support System", EGG-CATT-10196, April 1992.

Rood, A. S., "Software Verification and Validation Plan for the GWSCREEN Code", EGG-GEO-10798, May 1993.

Smith, C. S, and C. A. Whitaker, "Independent Verification and Limited Benchmark Testing of the GWSCREEN Computer Code, Version 2.0", GEE-GEO-10799, June 1993.

Rood, A. S., "GWSCREEN: A Semi-Analytical Model for Assessment of the Groundwater Pathway from Surface or Buried Contamination Theory and User's Manual Version 2.0", EGG-GEO-10797, June 1994, Revision 2.

Rood, A. S, "GWSCREEN: A Semi-Analytical Model for Assessment of the Groundwater Pathway from Surface or Buried Contamination: Theory and User's Manual", EGG-GEO-10158, March 1992.

DOE, Track 2 Sites: Guidance for Assessing Low Probability Hazard Sites at the INEL, DOE/ID-10389, January 1994, Revision 6.

3. **Comment:** One commenter requested information regarding the water transport time from the surface to the aquifer, and flow rate in the aquifer used in the groundwater modeling. The commenter also inquired about the extremes examined in the uncertainty analysis, what kind of uncertainty analyses were done, and the resultant extremes of dosage imposed by the more significant radionuclides in the aquifer plumes from SL-1 and BORAX-I.

   Response: Vadose zone water travel times used in the evaluation were 18 years for SL-1 and 66.3 years for BORAX-I. The GWSCREEN model (see comment #2) uses water travel times estimated using only sediment thicknesses in the vadose zone. Water travel time through the basalts was neglected because describing water movement through the basalts in the vadose zone is not scientifically well-defined. Neglecting the travel time through basalt results in conservative estimates. The average linear water velocity in the aquifer was specified as 570 m/yr for both facilities.

A parametric sensitivity/uncertainty analysis was performed for both SL-1 and BORAX-I for those parameters that were thought to most significantly affect the results. Sensitivity calculations were done only for the radionuclides with the highest estimated groundwater risk at each facility boundary using base case parameters. The radionuclides were technetium-99 for SL-1 and U-234 for BORAX-I. Parameters varied in the analysis were: infiltration rate, vadose zone sediment thickness, sediment moisture content, distribution coefficient, aquifer porosity, aquifer dispersivity, and well-screen thickness. Each parameter was varied over a range and only one parameter was varied at a time, except infiltration rate and moisture content which were related through the moisture characteristic curve for the sediment.

Vadose zone water travel times for base case calculations as well as minimum and maximum values investigated as part of the sensitivity/uncertainty analysis are shown in Table A-2. The minimum and maximum vadose zone water travel times were a result of varying the vadose zone thickness or infiltration rate.

Table A-2. Minimum and maximum vadose zone water travel times (years) considered in the sensitivity/uncertainty analysis.

Facility/Location	Base Case Value	Minimum Value	Maximum Value
SL-1	18	10.2[a]	54.4[b]
BORAX-I	66.3	42.5[a]	156[c]

a. Using minimum value of vadose zone sediment thickness and base case infiltration.

b. Using maximum value of vadose zone sediment thickness and base case infiltration.

c. Using minimum value of infiltration rate and base case vadose zone sediment thickness.

The average linear groundwater velocity was not varied as part of the sensitivity/uncertainty analysis because the burial ground boundary receptor is so close to the source that the concentration and corresponding risk values are relatively insensitive to changes in this parameter. The term average linear groundwater velocity is the average speed traveled by water in the aquifer, and is often referred to as aquifer pore velocity.

The results of the sensitivity/uncertainty analysis were presented as a percent change from the base case peak groundwater concentration. This comparison can be extended to risk because the relationship between concentration and risk is linear. For SL-1, the changes in concentration ranged from a minimum of 19% (of base case concentration) using the maximum well screen thickness (vertical mixing zone) to a maximum of 301% (of base case concentration) using the minimum aquifer dispersivities. For BORAX-I, the changes ranged from a minimum of 8% to a maximum of 970%. Both of these are the result of using the minimum and maximum distribution coefficients. A more complete discussion of the sensitivity/uncertainty analysis as well as a discussion of the effect of each parameter and assumption can be found in Appendix C, Section C-5, of the remedial investigation/feasibility study report.

Because annual dose due to groundwater ingestion is insignificant (see Comment #1), sensitivity analyses to generate the extremes of dose by radionuclide, as requested by this commenter, were not generated.

4. **Comment:** One commenter requested more information regarding potential contaminant plumes and stated that cumulative impacts from various facilities must be considered to at least 10,000 years in the future, not contributions from individual sites for only 100 or 1,000 years. Specific questions included "Will the SL-1 contaminant plume in the aquifer overlap the plume from BORAX-I?", and "Will these plumes overlap the plume from the previously evaluated RWMC Pad A?"

   Response: It is unlikely that potential groundwater plumes from SL-1 and BORAX-I will overlap and cause significant concentrations. Figure 1 in the Record of Decision shows the locations of the INEL site boundary receptors for SL-1 and BORAX-I. These locations were determined based on the regional groundwater flow direction which is to the southwest. Radionuclide concentrations from both SL-1 and BORAX-I were predicted to decrease several orders of magnitude by the time they reached the INEL site boundary receptors. It is doubtful that the plumes would overlap on the INEL unless there were an uncharacteristically large degree of spreading. Any plume overlap would likely occur off the INEL site. At that point, the additive concentrations of any plume overlap would be much less than those predicted at the burial ground boundary, facility boundary, and probably the INEL site boundary. Nevertheless, overlap of plumes will be considered in the sitewide groundwater assessment in conjunction with the Waste Area Group 10 remedial investigation/feasibility study.

   The possibility of potential groundwater plumes from other facilities was not evaluated It is likely however, that a plume from BORAX-I would overlap a plume from Pad A given the relatively close proximity of the two sites. Any impact of overlaps will be evaluated in Waste Area Group 10.

   The peak radionuclide groundwater concentrations were calculated irrespective of any time frame. Several radionuclides were predicted to take more than 10,000 years to reach the aquifer. For conservatism, the peak groundwater concentrations of each radionuclide were assumed to occur at the same time for each receptor.

5. **Comment:** One commenter wanted to know how the requirements of 40 CFR 193, particularly 10,000 year disposal requirements, and the Low-Level Waste Policy Act of 1985 are being met for these two sites, described by the commenter as "inactive disposal sites for spent fuel, transuranic waste, greater than Class C waste, and low-level waste."

   Response: The preproposal draft of 40 CFR 193 states explicitly that "The management and storage standards are not intended to apply to remedial actions at LLW facilities which were closed prior to the effective date of 40 CFR part 193...". The draft acknowledges that it may be years before 40 CFR 193 is finalized. 40 CFR 193 does not qualify as an ARAR until it becomes law.

Capping of the two burial grounds does, however, satisfy the intent of the preproposal draft. The draft states that "The only practical method of reducing the radiation hazard from LLW is to isolate it from people and the environment until the radioactivity has decayed," and the proposed standards should consider "...the protection provided by the engineered and natural barriers of a disposal system." The caps will be designed to prevent human or environmental exposure to the wastes for 400 years at SL-1 (when the external exposure risk will reach 1E-04) and 320 years at BORAX-I (when the long-lived uranium-235 becomes the primary risk contributor at 2E-04).

In terms of possible intrusion into the waste, the draft states that "the standards have not been devised to protect individuals who purposefully or inadvertently farm on the superjacent land or penetrate into the waste. They do apply outside the area delineated by permanent markers and in records of government ownership." It is anticipated that these restrictions will be specified in the remedial design phase which follows the signing of this Record of Decision.

The EPA proposes a standard of 15 mrem committed effective dose per year (equivalent to a fatal cancer risk of 5E-04) to the public, outside of the area delineated by permanent markers and recorded government ownership. Shielding provided by the caps will be adequate to keep exposures below 15 mrem/yr above background.

The commenter referred to disposal requirements for spent fuel, transuranic waste, and greater-than-Class C waste. The wastes buried at both SL-1 and BORAX-I do not meet the definition of these waste types. All wastes associated with the SL-1 and BORAX-I burial grounds are considered low-level waste. The following paragraphs clarify this point.

Spent nuclear fuel is defined in DOE Order 5820.2A (Radioactive Waste Management), Attachment 2, as "Fuel that has been withdrawn from a nuclear reactor following irradiation, but that has not been reprocessed to remove its constituent elements." Neither the SL-1 or BORAX-I reactor operated for long enough to achieve burn-up to the design core lifetime prior to destruction of the facilities. Thus, the fuel never became "spent".

Transuranic waste is defined in DOE Order 5820.2A, Attachment 2, as "Without regard to source or form, waste that is contaminated with alpha emitting transuranium radionuclides with half-lives greater than 20 years and concentrations greater than 100 nCi/g at the time of assay." The concentrations of transuranium radionuclides at SL-1 are estimated to be in the pCi/g range and no transuranium radionuclides were identified as contaminants of concern at BORAX-I. Thus, no transuranic wastes exist at either burial ground.

A comparison of the radionuclide concentrations associated with the SL-1 and BORAX-I burial grounds with Class C waste determination criteria revealed that no waste containing concentrations in excess of Class C levels exists at either site. This determination is based on the assumption of uniform distribution of contaminants throughout the estimated volume. Therefore, it is possible that localized areas of higher concentrations could exceed Class C criteria. However, based on the comparison performed, contaminant concentrations are below the lower end of the Class B criteria range.

All the waste associated with both burial grounds does meet the definition of low-level waste, as defined in DOE Order 5820.2A, Attachment 2:

> "Waste that contains radioactivity and is not classified as high-level waste, transuranic waste, or spent nuclear fuel or 11(e) byproduct material as defined by this Order. Test specimens of fissionable material irradiated for research and development only, and not for the production of power or plutonium, may be classified as low-level waste, provided the concentration of transuranic is less that 100 nCi/g."

Therefore, only low-level radioactive waste management and disposal requirements are considered relevant to the SL-1 and BORAX-I burial grounds.

The commenter also referenced disposal requirements specified in the Low-Level Waste Policy Act of 1985. The act specifically excludes low-level waste owned or generated by the DOE. DOE Order 5820.2A specifies requirements for managing and disposing DOE owned and generated low-level waste. This DOE Order specifies that inactive sites such as SL-1 and BORAX-I be managed in conformance with CERCLA, which is the process currently being undertaken. The Order does not specify retrofitting such inactive sites to meet the requirements that would apply for new or operating disposal facilities.

6. **Comment:** One commenter calls the reports "excellent and interesting" but thinks cost estimates are too high, especially for construction management and contractor overhead and profit. The commenter states that competitive bidding on a fixed price design that is simple and clear should reduce estimated costs by 25 to 50%.

   Response: Cost estimates for the alternatives analyzed were developed for comparison purposes only, and will not likely reflect the actual cost of implementing the selected alternative. The cost estimates were developed on the basis of a preliminary conceptual design, and therefore have omitted many specific details of the alternatives that were not well defined. These specific details are accounted for within a contingency cost element included in each estimate. However, the commenter judged the estimates as being excessive by 25 to 50 percent. This evaluation by the commenter is consistent with CERCLA guidance for preparing such cost estimates, which calls for accuracy within the range of -30 to +50 percent.

   The commenter specifically identified Construction Management and Contractor Overhead & Profit costs as being "very high". These cost elements are computed on a percentage basis. The percentage rate used was developed from INEL-specific construction cost history.

Costs were refined in preparation for public meetings with the EM Site-Specific Advisory Board–INEL. These refined estimates include additional specific items, such as foundation preparation and acquisition and transportation of materials, thus reducing the contingency factor percentage. These refinements result in estimates of $1.97 million for SL-1 and $1.45 million for BORAX-I. Although these estimates are better than those that appeared in the proposed plan, they are still fairly rough. Anticipated actual costs can not be presented until remedial design is complete.

7. **Comment:** Three commenters expressed opinions that Alternative 2 is the best choice.

   Response: The agencies agree that Alternative 2, containment by capping with an engineered barrier comprised primarily of natural materials, is the preferred alternative based on effectiveness, cost, and the other evaluation criteria discussed in the proposed plan and Record of Decision. Consequently, this alternative appears in the Record of Decision as the selected remedial action for both the SL-1 and the BORAX-I burial grounds.

8. **Comment:** Two commenters favor Alternative 3. One commenter felt that Alternative 2 would leave us vulnerable to natural disasters, vandalism, or cutbacks in monitoring. The other commenter was worried that the INEL, being situated above the Snake River Plain Aquifer and in an earthquake sensitive area, is "a disaster awaiting its own fulfillment."

   Response: The excavation and removal discussed in Alternative 3 does return the sites to natural conditions; however, this remedy essentially moves the problem from one location to another within the INEL with significant risks to workers and the public and at very high cost. This action would only forestall a timely decision regarding the final disposition of the wastes and would not alleviate the commenters' concerns. The prediction regarding "a disaster awaiting its own fulfillment", refers to events such as earthquakes and other natural disasters. A very small probability exists that such events could occur; therefore design features such as slope minimization will be evaluated and incorporated into the engineered covers as determined appropriate during the Remedial Design phase.

9. **Comment:** One commenter stated that the Special Power Excursion Reactor Test I reactor program was also concluded with a destructive test similar to the BORAX-I experiment. The commenter concludes that this experiment must also have resulted in contaminated debris and soil, and wanted to know why it is not included in any proposed clean-up plan.

   Response: The Special Power Excursion Reactor Test I facility was decommissioned in 1964. The reactor pit was demolished in 1985 and the site returned to its original state. No known contaminated debris remains at the site. The Power Burst Facility reactor was built just north of the Special Power Excursion Reactor Test I location, and the facility is now known as the Power Burst Facility Reactor Area. The only two remediation sites identified within this facility are a seepage pit (site code PBF-11) and a leach pond (site code PBF-12). Both have received no further action recommendations.

10. **Comment:** One commenter expressed the opinion that taxpayers money is being wasted by producing publications and expending funds on "low risk projects."

Response: The SL-1 and BORAX-I burial grounds can not be considered low risk projects in view of the risks estimated in the baseline risk assessment and summarized in the proposed plan. In response to Superfund guidance and the *INEL Community Relations Plan*, the agencies have directed that program funds be used to communicate information concerning the investigations to the public. The preparation of the *INEL Reporter*, fact sheets, and proposed plans are traditional methods of updating citizens on project specifics. The object of these publications is to describe how the agencies are approaching the work outlined in the Federal Facility Agreement and what new information is learned about the sites. The invitation for citizens to interact with the agencies concerning this process is an important part of finding out what citizens think of the agencies' recommendations. The result of interaction between the public and the agencies is the formulation of a decision that considers the issues raised by citizens through a fair and reasonable process.

11. **Comment:** One commenter stated that trials should be conducted to determine if scraping surface soils and extracting the uranium-235 results in recovery of significant amounts of uranium. If successful, the method should be applied more extensively at the sites because recovery of the uranium would return it to secure storage and reduce the long-term impacts from these sites.

Response: The commenter referred to the use of technologies which could be used to extract uranium-235 from surface soils if soils were scraped from the areas surrounding the burial grounds. The technology being referred to is called "soil washing". This technology has been demonstrated for the removal of uranium from soil, but was not considered for application at either SL-1 or BORAX-I. As described in Section 11, the surface soil associated with the SL-1 burial ground will not require remedial action. In addition, uranium was not identified as a contaminant of concern in SL-1 surface soils. This technique for BORAX-I is described below.

The effectiveness of soil washing is dependent on site-specific soil characteristics and the chemical behavior of contaminants in the environment. Soil washing studies performed at the Hanford site indicated that uranium would typically be concentrated in the smaller soil size fractions (silts and clays). Therefore, removal of uranium from BORAX-I soils would initially require separation into specific soil size fractions such as gravel, sand, silt, and clay. The larger soil size fractions, gravel and sand, would then be analyzed and either returned to the site or treated, depending on the results of the analysis. If necessary, mechanical agitation or scrubbing would be used to physically remove uranium from the surfaces of the larger size soil fractions. The smaller soil size fractions, most likely to contain the majority of uranium,.would then be leached by a chemical extractant such as sulfuric acid. Studies have shown such leaching processes can reduce uranium concentrations in the smaller soil size fractions to levels between approximately 20 and 70 parts per million. The chemical extractant and wash water would require additional treatment to remove uranium extracted from the soils.

Separating uranium from the soil surrounding BORAX-I is not considered feasible based on the extremely low concentrations anticipated in the surface soils, and the small mass of uranium actually contained in the soil. Scraping contaminated surface soils would result in considerable mixing of the existing gravel cover and the clean soil immediately beneath the contaminated soil. Assuming the entire mass of unrecovered uranium at BORAX-I, about eight pounds (3.7 kilograms), is uniformly distributed throughout the 84,000 square feet of potentially contaminated soil area, removal of the top foot of soil and gravel from this area would result in a maximum uranium concentration of one part per million. For the sake of argument, assuming the smaller soil size fraction represented 20 percent of this volume and was effectively separated by the initial soil washing stage, then a maximum of only five parts per million could be obtained. Assuming the entire eight pounds (3.7 kilograms) were distributed in a much smaller area, perhaps one-sixth the entire 84,000 square feet, the uranium concentration would be approximately six parts per million. If the smaller soil size fraction represented 20 percent of this volume and were effectively separated by the initial soil washing, then a maximum of 30 parts per million could be obtained. Such low concentrations would not be amenable to effective leaching in the final stage of the soil washing process.

Soil washing could be effective for removing larger particles if the majority of uranium were not in the form of uniformly distributed fine particles. However, historical documentation indicates the fuel fragments (larger particles) were collected from the surface soils and the majority of remaining contamination interred in the reactor foundation. Therefore the actual mass of uranium in the BORAX-I surface soils is probably significantly less than the unrecovered eight pounds (3.7 kilograms).

The focused remedial investigation/feasibility study performed for SL-1 and BORAX-I was based on remedial actions identified in previous CERCLA Records of Decision, and although soil washing technology exists and is currently in use under the EPA Superfund Innovative Technology Evaluation Program, the technology has not been specified for use in previous CERCLA Records of Decision involving radionuclide contaminated soils.

12. **Comment:** One commenter suggested that selection of an alternative should be deferred until the methods and costs associated with the Pit 9 action are available. The commenter felt the cost estimates for SL-1 and BORAX-I and the decision for these two sites could change if some of the waste could be processed through the Pit 9 treatment facilities.

Response: The situation at Pit 9 is sufficiently different from that at the SL-1 and BORAX-I burial grounds to eliminate the possibility of similar treatment. The limited production tests at Pit 9 are directed at transuranic wastes in concentrations greater than 10 nanocuries per gram; wastes at the SL-1 and BORAX-I burial grounds are described in terms of picocuries, three orders of magnitude smaller. In addition, Pit 9 wastes include hazardous substances and some mixed waste, unlike the SL-1 and BORAX-I burial grounds where radionuclides are the only contaminants of concern. Preliminary information regarding cost and effectiveness of the limited production tests being performed for the Pit 9 treatments will not be available before January, 1997. The agencies do not anticipate that delaying this remedial action until the Pit 9 cost and effectiveness data are available will alter their preference for capping the sites as described in Alternative 2 of the proposed plan.

13. **Comment:** One commenter stated that partial cleanup including ground scraping and removal of contamination in excess of 10 CFR 61 Class A limits should be considered as an additional alternative.

    Response: Removal of contaminated surface soil is a potential aspect of the final remedial design phase. Three potential options for disposition of contaminated surface soils surrounding the burial grounds were identified in the remedial investigation/feasibility study. These options include:

    - No action or restricted access
    - Removal followed by disposal at Radioactive Waste Management Complex
    - Consolidation near the location of buried waste for inclusion beneath the protective cover.

    10 CFR 61 defines the criteria under which the Nuclear Regulatory Commission issues licenses for land disposal of radioactive waste. The disposal at the SL-1 and BORAX-I burial grounds took place prior to the effective date of 10 CFR 61, so the licensing requirements do not apply.

14. **Comment:** Two commenters indicated that future land use scenarios should be established before decisions are made so that exposure scenarios could be determined on the basis of realistic projected land use.

    Response: The INEL is in the process of establishing land use scenarios for areas surrounding Site facilities. Certain areas may be designated for future industrial land use; these scenarios will be used to form the basis of risk calculations in the future. In the meantime, the agencies have decided to take the cautious approach to protect workers, the public, and the environment by applying the most protective land use scenarios in current risk assessments.

15. **Comment:** One commenter expressed the opinion that results of capping studies from the old dairy farm and other studies should be used in this evaluation.

    Response: INEL-specific research involving capping design has been included in the preliminary conceptual designs of the caps evaluated for SL-1 and BORAX-I. The Environmental Science and Research Foundation is currently conducting cap design experiments at the INEL. These experiments, called the Protective Cap/Biobarrier Experiments, focus on "low-cost, natural systems to effectively isolate municipal, industrial, and low-level radioactive wastes and contaminated soil surfaces from the environment, for centuries." The results obtained thus far in the experiments were incorporated in the Uranium Mill Tailings Remedial Action type cap design presented in the remedial investigation/feasibility study report. This included a 5-foot (1.6-m) soil layer for water balance, a 1.5-foot (45-cm) rock/cobble layer in combination with a 1-foot (30-cm) gravel layer for biotic control. During the remedial design phase, such INEL-specific information will be included in the final cap design.

16. **Comment:** One commenter demands that Alternative 3 be selected for SL-1 and BORAX-I and that no further out-of-state shipments of radioactive waste be "allowed to be deposited there".

    Response: Alternative 3 is the removal of wastes from the burial ground with disposal at the INEL's Radioactive Waste Management Complex. Removal and disposal only relocates the contamination within the INEL at a high cost and potentially high risk to workers and the public; it does not eliminate the problem. Alternative 2, covering and controlling the contamination through time while radioactive decay decreases the risk, is a safer and more cost-effective approach. The SL-1 and BORAX-I sites have never received waste shipped into the state from other sources. To receive information or ask questions concerning possible transportation of waste to the INEL from out-of-state, citizens can call the INEL's toll-free number, 1-800-708-2680, to request additional details and assistance.

17. **Comment:** One commenter suggested that "debris treatment" should be utilized to reduce volumes of mixed waste.

    Response: Mixed wastes have not been identified at either burial ground. Also see responses 11, 12, and 13.

18. **Comment:** One commenter asked what considerations to reduce volumes of contaminated soils were being exercised.

    Response: Under the preferred alternative, capping with an engineered barrier, contaminated surface soils will be consolidated at BORAX-I based on field screening and sample data acquired during the remedial design phase of the remedial action. No other applicable minimization efforts have been identified.

A.4 Comment and Response Index

Because comments are summarized in the Responsiveness Summary for response, an index is included to assist in identifying responses to specific comments. All oral comments, as received at the public meetings, and all written comments are included verbatim. Each comment is coded with a W, meaning a written comment, or a T for an oral comment transcribed during the public meetings. Seven people submitted written comments and three rendered oral comments during the meeting. A total of 19 comments were received.

To locate a response to a specific comment, identify the comment on the index, note the associated response number and page number, and turn to that response in the Summary of Comments and Responses in Section A.3.

Table A-3. Index of comments.

Code	Response Number	Comment	Page Number
W-1	7	Alternative 2 is adequate.	A-11
W-2	6, 7	Excellent & interesting reports. Cost estimates seem high! I agree with the preferred alternatives. Estimated costs for capping landfills seem very high; if design is simple and clear, I think competitive bidding (fixed price) should reduce estimated costs shown here in by (25 to 50) %. In particular, const. mg't & contractor ov'h'd & profit seem very high compared to the direct "Construction of Cap" costs. Possibly this is due to high liability insurance costs, or other job risk costs that I am not familiar with. At any rate, I recommend "working" the cost reduction possibilities very hard.	A-10
W-3	9	The SPERT I reactor program was also concluded with a destruct test which occurred in the early to mid 1960s, similar to the BORAX-I destruct test. The SPERT I destruct test must have resulted in contaminated debris and soil. Why is SPERT I not included in any proposed clean-up plan?	A-11
W-4	10	Why do you continue to waste taxpayers $. Your publications plus the expenditures directed towards low risk projects are a total waste. You guys are out-of-control.	A-12
W-5	8	I favor Alternative 3 as the only permanent solution for decontamination of the SL-1 and BORAX-I sites. I fear that Alternative 2 would leave us vulnerable to natural disasters, vandalism, or cutbacks in monitoring in the long run.	A-11
W-6	8, 16	The INEL, being situated above the Snake River Aquifer and in an earthquake sensitive area, is a disaster awaiting its own fulfillment. I demand that Alternative 3 be instated and that no further out-of-state shipments of radioactive waste be allowed to be deposited there.	A-11 A-15
W-7	14, 17, 18	• Utilize "debris treatment" for reducing vol. of mixed waste • Closure goals must be established considering future "land use" criteria • DOE must establish "land use" criteria for the INEL • What considerations are being exercised to minimize volume of contaminated soils to be disposed.	A-14 A-15
T-1	2	There's been a lot of discussion on these plumes, and what might reach the groundwater. Of course, that's one of the major things that the citizens of the State of Idaho are concerned about. I heard tonight that it was going to be 10,000 years before the heavy metals, U-235 would reach the groundwater by modeling by a code named GWSCREEN. My understanding is there's been very little benchmarking of these codes done. Last summer there was what was called the aquifer stress test to try and do some benchmarking. There's been considerable work to validate codes - we've heard about the NRC - to validate computer codes to make sure that they predict what's right. The codes that are being used at the INEL are not benchmarked. They are not validated. And I think we're getting the cart before the horse on this and going out and taking actions before we really know what we've got as far as contaminants. Let's get some good computer codes. Let's get some good modeling. I see fate and transport modeling in here. And again, it's the old adage of "garbage in, garbage out." And I think that's what we've got here. We don't know the ion exchange of these metals between the soil. Conservative values most largely are being used, but there's a lot of unknowns, and there needs to be some overall benchmarking of those computer codes that are being used similar to what the NRC has done with the RELAP models, the Skadat (sic) (TRAC?) models. We talk about us spending huge sums of money on reactor safety, and we're talking about risk here supposedly, according to the EPA of 5 in 10,000. This is much greater than what the NRC is saying you're going to have from some of these spare reactor accidents. So let's get some codes validated and benchmarked, and then let's proceed with what we have - either a No Action or Alternative Actions.	A-6
T-2	2	I heartily agree with what's just been said when it comes to the need for the improvements that he's (Robert Wadkins, comment T-1). There's certainly a real need there.	A-6
T-3	11	According to DOE's reports regarding remediation of these sites, considerable uranium-235 remains unrecovered - about two pounds at the SL-1 site and about eight pounds at the BORAX-I site. Because of U-235's very long half-life, as a practical matter it will never decay away, and there is enough there to make one or more nuclear weapons. With today's improved equipment, scraping an inch or two of topsoil from the ground surface and passing the scrapings and any other appropriate excavated soil through soil decontamination equipment and a heavy metal particle separation device could probably recover a considerable amount of the uranium and other radionuclides for disposition elsewhere. And before replacing more cover material, it appears that this should be tried on a limited scale and used more extensively if the trials prove successful. Removal of uranium-235 will not only restore this uranium to secure storage, it will also decrease these sites' long-term impacts that will not be reduced appreciably during the limited lifetime of an engineering barrier.	A-12
T-4	3	What water transport time (from the surface to the aquifer) and what flow rate in the aquifer were used in the evaluation? Since these are uncertain, what extremes were considered in the uncertainty analyses? What kind of uncertainty analyses were done, and what were the resultant extremes of dosage imposed by the more significant radionuclides in the aquifer plumes from SL-1 and BORAX-I?	A-7

Table A-3. (continued)

Code	Response Number	Comment	Page Number
T-5	4	Will the SL-1 contaminant plume in the aquifer overlap the plume from BORAX-I? Will these plumes overlap the plume from the previously evaluated RWMC Pad A? (Pad A is downstream from BORAX-I and SL-1. And for Pad A, DOE previously concluded that a cap will be installed over about 18,000 55-gallon drums and 2,000 4x4x7 foot boxes of alpha-contaminated Rocky Flats waste that is to be left buried there.) My concern is the combined impact of these on a future member of the public since it is the combined impact on the maximally exposed individual that counts. And this combined impact is what should be considered in deciding what to do about the waste at each disposal site. In addition, the following locations emit plumes that may overlap the plumes from SL-1 and BORAX-I and Pad A: waste buried from 1984 through the end of RWMC waste disposal operation, the Test Reactor Area, the Idaho Chemical Processing Plant, and the portion of the RWMC that was used for rad waste disposal from 1952 to 1984. The impact of all of the plumes that overlap should be considered in reaching a conclusion regarding the appropriate remediation action for waste at any one of the locations. Moreover, the extent of time in the future that should be addressed should not be restricted to a relatively short time period like 100 years or 1,000 years but should extend much further to at least 10,000.	A-9
T-6	5	These sites are essentially inactive disposal sites for spent fuel, transuranic waste, greater than Class C waste, and low level waste. There are laws against disposal of such waste - that is, 40 CFR 193 and the Low Level Waste Policy Act of 1985 - unless the waste can be shown to be adequately confined for at least 10,000 years. How are these requirements accounted for?	A-9
T-7	1	Considering the Nuclear Regulatory Commission scenarios regarding a future inadvertent intruder onto an in-future abandoned waste disposal site - that is, the well drilling scenario, basement excavation and home construction, farming and excavation and discovery of buried articles - what would be the maximum dosage to such and intruder at the times of maximum dosage regardless of how far these are in the future? Or at least to 10,000 years? How do these dosages compare with DOE and NRC dosage limits for a future inadvertent intruder onto an unrecognized abandoned rad waste facility?	A-6
T-8	12	The planned cleanup of Pit 9 could provide experience-derived information on which to base cost estimates for cleaning up the SL-1 and BORAX-I sites. And changes to their cost estimates could influence the decision regarding which remediation alternative to pursue. Consideration should be given to deferring the final decision regarding these issues until Pit 9 cleanup has progressed sufficiently to permit better assessment of the methods and costs that should be involved in their cleanup. Also possibly some of the waste generated in these cleanups could best be prepared for disposal by processing them through the Pit 9 treatment facilities.	A-14
T-9	13	The Site Disposition Alternatives considered apparently only one involving waste removal - removal of all contaminated materials, the most expensive of all. Partial cleanup involving the above mentioned ground scraping plus removal of materials contaminated beyond 10 CFR 61 Class A limits deserves consideration as an alternative. Such a partial cleanup could substantially reduce the very long half-lived portion of these sites' radioactivity plumes in the aquifer and their impacts on future inadvertent intruders, and the cost should be substantially less than that of total cleanup.	A-14
T-10	14	I still have a question on the land use and the industrial scenario, and I think that any further action or closing out or accepting of any alternatives be delayed until we get a land use plan for the INEL so we know where we're going and what we're going to do with it. The one in ten scenario - again I believe on the industrial, the risk scenario, I believe there's a direct exposure driving that, and it's a direct exposure to an individual with no capping, no asphalt, or something like that. I believe it needs to be a realistic scenario on the industrial scenario, and that factors again into this land use. I think that we're just sitting here spinning our wheels and perhaps spending a lot of money along with the wheel spinning if we proceed with some of these alternatives before we've got a land use plan in place for these areas that we're considering tonight, and perhaps even the total INEL. The soil consolidation variables that were mentioned, I think that if you're picking up any contamination out there under the EPA criteria, if you're going to say that it's going to be exposed and there's no cover on it, you're going to have to consolidate the soil. I don't think you've got any choice with the cesium-137 out there.	A-14
T-11	15	The other question I have, is there's a number of studies going on various capping things on what was called the old dairy farm out there. I don't know what those studies are called, but they've done a number of studies and looking at animals burrowing into the soil and things like that. I think those should be factored in. Here there's a lot of research going on out there, and I keep seeing these things and none of it factored in here. Here we're proposing some things, that of capping and that - let's use what work we've done and what research we've done out there.	A-15
T-12	7	Looking at and having read this and having a pretty good grasp about the natural sciences, having degrees in it, I think the Containment Number 2 would be in my opinion the Preferred Alternative in this situation. I think that No Action is - I think that we created this mess in our lifetime, we need to clean up this mess in our lifetime. I don't think we need to leave it for future generations. Plus I think that there is a good possibility that we could have airborne particulate activity with this thing as far as with wind erosion, and that is really what I'm mostly concerned about in this situation, in all of these sites, really, is the possibility of having wind erosion take place. I think that in any of these sites I would prefer that nothing that is contaminated is ever touched again and everything is left in place. I you're going to mound on top of it sufficient weight where the shaking of the earthquake - I mean, there is a fault line that is running through this area - you wouldn't worry about it sloughing off and creating even a larger problem than is already there. I think it'll indicate to whoever happens upon it in the future generations, it will indicate to them that this wouldn't be a proper place to put a foundation for a home or put a garden in. Whether we are able to communicate to those future generations or not, in 400 years Lord knows where we'll be as far as the human race, we all know that, so that's about all I have to say about that.	A-11

Appendix B

Administrative Record File Index

Idaho National Engineering Laboratory
Administrative Record File Index for the Track 2 Scoping of the ARA-II SL-1 Burial Ground OU 5-05 and 6-01
6/26/95

File Number

AR1.1 Background

- Document #: EGG-GEO-10068
  Title: A Modeling Study of Water Flow in the Vadose Zone beneath the RWMC
  Author: Baca, R.G.
  Recipient: N/A
  Date: 01/01/92

*Note: This Document is filed in the Pad A Administrative Record Binder
Operable Unit 7-12 Volume I

- Document #: EGG-BG-9175
  Title: Independent Verification and Benchmark Testing of the Porflo-3 Computer Code, Version 1.0
  Author: Baca, R.G.
  Recipient: N/A
  Date: 08/01/90

- Document #: KJH-09-94
  Title: Interviews with Darrell Hanni Regarding the SL-1 Burial Ground
  Author: Holdren, K.J.
  Recipient: Halford, V.E.
  Date: 07/06/94

- Document #: 10022
  Title: Record of Meeting with Roger G. Jensen, U.S.G.S., Regarding Depth to Aquifer near BORAX-I/SL-1
  Author: VanDerpoel, G.
  Recipient: N/A
  Date: 02/17/94

- Document #: 10023
  Title: Record of Meeting with Dick Meservey, EG&G Idaho, Regarding BORAX-I
  Author: Tucker, J.
  Recipient: N/A
  Date: 02/17/94

File Number

AR1.1 Background (continued)

- Document #: 10024
  Title: Record of Meeting with Roger Wilhelmson, EG&G Idaho, Regarding Pipes in SL-1 Burial Ground
  Author: Meadows, G.
  Recipient: N/A
  Date: 04/15/94

- Document #: 10025
  Title: Record of Meeting with Eddy Chew, DOE-Idaho Regarding SL-1 Burial Ground Pipes
  Author: Meadows, D.
  Recipient: N/A
  Date: 04/14/94

- Document #: 10026
  Title: Record of Meeting with Glenn Briscoe, Regarding SL-1 Burial Ground
  Author: Meadows, D.
  Recipient: N/A
  Date: 01/25/94

- Document #: 10027
  Title: Record of Meeting with Craig Kwamme, LITCO, Regarding Basis for RWMC Disposal Costs
  Author: Vetter, D.
  Recipient: N/A
  Date: 12/02/94

- Document #: 10028
  Title: Memo of Conversation with Richard Green, Regarding Pipes in the SL-1 Burial Ground
  Author: Holdren, K.J.
  Recipient: N/A
  Date: 04/14/94

- Document #: 10133
  Title: Support Documentation: Estimation of Uranium-235 Surface Soil Concentrations Based on Mass Unrecovered at the BORAX-I Burial Ground
  Author: R. Filemyr
  Recipient: J. Holdren
  Date: 08/30/95

- Document #: 10134
  Title: Errata for the Remedial Investigation/Feasibility Study Report for Operable Units 5-05 and 6-01 (SL-1 and BORAX-I Burial Grounds)
  Author: R. Filemyr
  Recipient: N/A
  Date: 08/30/95

- Document #: 10135
  Title: Support Documentation: Annual Dose Calculation for Selected Scenarios at the SL-1 and BORAX-I Burial Grounds
  Author: R. Filemyr
  Recipient: J. Holdren
  Date: 08/30/95

- Document #: 10136
  Title: SL-1/BORAX-I Class C Waste Equivalency Determination
  Author: R. Filemyr
  Recipient: J. Holdren
  Date: 08/30/95

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File Number

AR1.7 Initial Assessments

- Document #: 2984
  Title: ARA-06, ARA II SL-1 Burial Ground
  Author: N/A.
  Recipient: N/A
  Date: 09/15/86

- Document #: 2629
  Title: BORAX-02, BORAX-I Burial Site
  Author: N/A
  Recipient: N/A
  Date: 10/03/86

AR3.8 Risk Assessment

- Document #: MISC-94001
  Title: Preliminary Baseline Risk Assessment for the OU-5-05 and 6-01, SL-1 and BORAX-I Burial Grounds RI/FS
  Author: N/A
  Recipient: N/A
  Date: 10/01/93

- Document #: 5662
  Title: Overview of Exposure Scenarios for the Baseline Risk Assessment for the OU 5-05 and 6-01, SL-1 and BORAX-I Burial Grounds RI
  Author: N/A
  Recipient: N/A
  Date: 10/01/93

- Document #: INEL-95/103 Rev 2
  Title: ARA Windblown Area Risk Evaluation
  Author: D. Jorgensen
  Recipient: N/A
  Date: 09/07/95

- Document #: 10137
  Title: Assessment of Surface Soils Surrounding the SL-1 Burial Grounds
  Author: K. J. Holdren
  Recipient: N/A
  Date: October, 1995

ARA-II SL-1 Burial Ground OU 5-05 and 6-01
6/26/95

File Number

AR3.10 Scope of Work

- Document #: EGG-ER-10998
  Title: Scope of Work for Operable Units 5-05 and 6-01 (SL-1 and BORAX-I Burial Grounds) Remedial Investigation Feasibility Study (RI/FS)
  Author: Halford, V.E.
  Recipient: N/A
  Date: 03/01/94

AR3.12 Remedial Investigation/Feasibility Study

- Document #: OPE-ER-157-94
  Title: Transmittal of the Draft Remedial Investigation/Feasibility Study Report for Operable Units 5-05 and 6-01 (SL-1 and BORAX-I Burial Grounds RI/FS); Volume 1 of 2
  Author: Lyle, J.L.
  Recipient: Pierre, W.; Nygard, D.
  Date: 06/15/94

- Document #: INEL-95/0027
  Title: Remedial Investigation/Feasibility Study Report for Operable Units 5-05 and 6-01 (SL-1 and BORAX Burial Grounds)
  Author: Holdren, K.J.; Filemyr, R.G.; Vetter D.W.
  Recipient: N/A
  Date: 03/01/95

AR4.3 Proposed Plan

- Document #: 10011
  Title: Proposed plan for Operable Units 5-05 and 6-01 Stationary Low-Power Reactor-1 and the Boiling Water Experiment-I Burial Grounds
  Author: DOE, EPA, IDHW
  Recipient: N/A
  Date: 05/01/95