3.0 PROPOSED ACTION AND ALTERNATIVES

3.1 INTRODUCTION

DOE analyzed two cleanup and closure alternatives and the No Action Alternative, in accordance with the Council on Environmental Quality regulations implementing NEPA (40 CFR Parts 1500-1508) and DOE’s NEPA implementing regulations (10 CFR Part 1021).

Under **Alternative 1**, DOE would clean up the ETEC site using the DOE cleanup standard for decontamination of radiological facilities and surrounding soils. Using this standard, DOE would ensure that any remaining radiological contamination would result in an additional theoretical lifetime cancer risk of no more than 3×10^{-4} to the maximally exposed individual (assumed to be an individual living on the site for 40 years). This additional lifetime cancer risk would result from exposure to no more than an additional 15-millirem radiation dose (above background) annually to the maximally exposed individual. DOE would also decommission and demolish the remaining sodium facility and decommission and demolish all of the remaining uncontaminated support buildings for which it is responsible. The SSFL RCRA corrective program (including the ongoing groundwater treatment) would continue. Alternative 1 is DOE’s preferred alternative. This alternative is described fully in Section 3.2.

Under **Alternative 2**, DOE would clean up the ETEC site using a 1×10^{-6} standard such that any remaining radiological contamination would result in an additional theoretical lifetime cancer risk of no more than 1×10^{-6} to the maximally exposed individual. This additional lifetime cancer risk would result from exposure to no more than an additional 0.05-millirem radiation dose (above background) annually to the maximally exposed individual. As under the preferred alternative, DOE would also decommission and demolish the remaining sodium facility and decommission and demolish all of the remaining uncontaminated support buildings for which it is responsible. The SSFL RCRA corrective program, (including the ongoing groundwater treatment) would continue. This alternative is described fully in Section 3.3.

Understanding Scientific Notation

Scientific notation is based on the use of positive and negative powers of 10. A number written in scientific notation is expressed as the product of a number between 1 and 10 and a positive or negative power of 10.

Examples:
5,000 would be written as 5×10^{3}
0.005 would be written as 5×10^{-3}

In this EA, scientific notation is used to express any number lower than 10^{-2} (0.01).

Under the **No Action Alternative**, DOE would conduct no further cleanup of radiological facilities, soil, or the remaining sodium and other support facilities for which it is responsible. Rather, Rocketdyne, as the owner of the site, would prohibit or control access to contaminated facilities, soil, groundwater, or surface water and would continue groundwater treatment. This alternative is described fully in Section 3.4.

DOE also considered other alternatives that were later found to be unreasonable. These include (1) cleanup of the entire SSFL, (2) the disposal of all radiological facilities as radioactive waste regardless of contamination levels, (3) cleanup of the site to industrial levels, and (4) cleanup of the site to background levels. These alternatives and the reasons why DOE considers them to be unreasonable are described in Section 3.5.

Section 3.6 summarizes the impacts that could occur under each of the alternatives analyzed.

3.2 ALTERNATIVE 1: CLEANUP AND CLOSURE UNDER DOE STANDARD (PREFERRED ALTERNATIVE)

Implementation of Alternative 1 would last approximately 5 years. Activities performed under Alternative 1 would involve:

- Decontamination and demolition of the three remaining radiological facilities;
- Soil remediation such that residual radioactive contamination would result in an additional theoretical lifetime cancer risk of no more than 3×10^{-4} to the maximally exposed individual (which relates to a 15-millirem dose to the maximally exposed individual annually);
- Sodium removal and demolition of the SPTF;
- Demolition of all remaining uncontaminated DOE support facilities; and
- A final, independent survey of Area IV to verify that the site has been cleaned up to the remediation goal. The California Department of Health Services will participate in this survey.

Implementation of Alternative 1 would result in the generation of radioactive, hazardous, and nonhazardous debris waste volumes, as indicated in Table 3-1.

Table 3-1. Waste Volumes Generated Under Alternative 1

Waste Type	Waste Volume (cubic meters)[a]
Low-Level Radioactive Waste	**7,500**
Building Decontamination	2,000
Soil Remediation (3×10^{-4} Standard)	5,500
• RMHF	5,500 cubic meters
• Building 4059	None expected
• Building 4024	None expected
• Remainder of Area IV	0
Mixed Low-Level Radioactive Waste	**20**
Hazardous Waste	**5**
Nonhazardous Debris Waste (Uncontaminated)	**25,300**

a. To convert cubic meters to cubic feet, multiply by 35.3.

The volume of soil that would need to be remediated in the implementation of Alternative 1 was derived using a 1995 Area IV radiological survey, the most recent characterization of all 1.2 square kilometers (290) acres of Area IV, plus additional soil samples taken in 2000 at the RMHF. The 149 soil samples taken were assumed to be characteristic of surface soil on Area IV. These soil samples provide a distribution of cesium-137, the primary contaminant of concern (as explained more fully in Chapter 4). Conservatively assuming that these predominantly surface samples are representative of all Area IV soil down to bedrock, DOE estimated the volume of soil that would need to be excavated to meet the 3×10^{-4} additional lifetime cancer risk (15-millirem annual dose) standard. Based on this dataset, DOE calculated that some soil remediation would be required for the RMHF, but no soil remediation would be required for Buildings 4024 and 4059 or for the remainder of Area IV because all soil in those areas is already below the 3×10^{-4} goal. For purposes of analysis, DOE assumed that all excavated soil would be managed as LLW and shipped offsite.

3.2.1 Decontamination and Demolition of the Remaining Radiological Facilities and Soil Remediation

As discussed in Section 2.3, the ETEC site has three radiological facilities, consisting of 13 separate radiological buildings. These are the RMHF complex (consisting of nine buildings and a rainwater runoff catch basin), the Space Nuclear Auxiliary Power Ground Prototype Test Facility (Buildings 4059 and 4459), and the Space Nuclear Auxiliary Power Environmental Test Facility (Building 4024). Building decontamination and decommissioning is conducted in accordance with DOE Order 5400.5.

3.2.1.1 Radioactive Materials Handling Facility Complex

The RMHF is a RCRA-permitted facility used for waste management activities. Under Alternative 1, DOE would continue to operate the facility until all radioactive waste was shipped offsite. DOE would then survey the buildings that comprise the RMHF complex, decontaminate them as necessary, resurvey the buildings (with verification by the Oak Ridge Institute for Science and Education and the California Department of Health Services), and demolish them. DOE would package any radioactively contaminated RMHF debris and ship it offsite for disposal at a DOE approved site. Contaminated material in the drainage channel and holding pond would also be removed, packaged, and shipped offsite. Soil remediation would begin after the building debris was removed from the area.

Decontamination and Demolition

Decontamination of the RMHF complex is expected to involve the following:

- Conduct Initial Radiation Surveys – Radiation and dose levels of equipment, piping, and structural elements would be surveyed. Samples would be collected for preliminary hazardous waste identification purposes and other analyses.
- Perform Pre-Decontamination Activities – Airlocks, tenting, temporary shielding, and temporary ventilation systems would be installed.
- Vacuum Surfaces – Contaminated materials and equipment would be removed and the floors would be vacuumed.
- Decontaminate External Surfaces – Surface contamination would be removed using pneumatic scabble equipment or other methods as needed.
- Detect Presence of Liquids – Ultrasound sonic devices would be used to detect the presence of liquid in piping and equipment.
- Wipe Down Surfaces – All floor, wall, ceiling, and equipment surfaces would be wiped to remove loose contamination.
- Remove Major Equipment – Tanks, vessels, pumps, and other major equipment would be removed.
- Remove Valves – Valves would be cut from pipes with a torch, or mechanical means, and loaded into shipping containers.
- Remove Piping – Piping would be removed, size-reduced, and loaded into shipping containers.

- Strip Out Mechanical and Electrical Devices – Small pieces of mechanical and electrical equipment would be removed and loaded into shipping containers.

- Conduct Final Survey – Surface contamination and dose levels of equipment, piping, and structural elements would be surveyed. Samples may be collected for hazardous waste characterization and other analyses.

- Verification Surveys – Verification surveys would be conducted by independent sources such as EPA, the Oak Ridge Institute for Science and Education, and the California Department of Health Services.

- Package Waste for Shipment – Wastes generated and packaged during decontamination would be further prepared for offsite shipment.

LLW and very small amounts of MLLW would be generated as a result of these activities. In addition to radiological contamination, the RMHF complex may contain hazardous materials such as lead-based paint, asbestos insulation, polychlorinated biphenyl (PCB) light fixture ballasts, solvents, oils, and greases. These would be removed and disposed of as hazardous waste.

After radiological contamination was removed, DOE would remove other components, segregate materials, and dispose of the materials. These components would include such support systems as wiring, electrical components, and remaining auxiliary systems components. The facilities would be demolished. Uncontaminated debris would be disposed of in a local municipal sanitary landfill.

Soil Remediation

Following the decontamination and demolition of the RMHF complex, soil surveys would be conducted to determine the level and extent of any radioactive soil contamination in the area. Those areas with contamination above the cleanup goal for this alternative would be excavated, with the resulting material packaged as LLW. Approximately 5,500 cubic meters (194,230 cubic feet) of soil would be excavated from around the RMHF and disposed of as LLW at a DOE disposal site (*see* Table 3-1). After a verification survey confirmed that the remediation goal had been met, the area would be backfilled with clean soil from an onsite borrow pit and resurfaced or revegetated to match the surrounding area.[3]

Under Alternative 1, the remediation goal for Area IV of the SSFL would be an additional theoretical lifetime risk of a latent cancer fatality to the maximally exposed individual of no greater than 3×10^{-4} as a result of exposure to the radiological contamination remaining on the site.[4] Using this standard, the maximally exposed individual would receive no more than an additional 15-millirem radiation dose each year (above background) due to exposure to residual radiological contamination at ETEC. For perspective, it is estimated that the average individual in the United States receives a dose of about 300 millirem each year from natural sources of radiation. Of this, between 30 and 50 millirem are due to

[3] The onsite borrow area is located in a small meadow in the southwest corner of Area IV. A total of 50,460 cubic meters (1.8 million cubic feet) are available from this onsite borrow area for all SSFL environmental projects. Grading Permit Modification, Former Sodium Disposal Facility Interim Action, Rocketdyne-Santa Susana, CUP 248: Permit No. 8664 (July 2, 1999).

[4] In accordance with its 3×10^{-4} cleanup standard, DOE has remediated the soil around all former ETEC radiological facilities to below this level. Thus, after cleanup of the RMHF to this standard, all of Area IV would meet this level of protection, or better. The California Department of Health Services has concurred with this release limit.

> **As Low As Reasonably Achievable**
>
> DOE regulations define ALARA as "the approach to radiation protection to manage and control exposures (both individual and collective) to the work force and to the general public to as low as is reasonable, taking into account social, technical, economic, practical, and public policy considerations" (10 CFR 835.2(a)). ALARA is not a dose limit but a process which has the objective of attaining doses as far below applicable limits as is reasonably achievable. All DOE activities are subject to the ALARA principle (10 CFR 835.101(c)). The ALARA principle is incorporated into DOE Order 5400.5, *Radiation Protection of the Public and the Environment*.

exposure to naturally occurring radionuclides in clean soil. This exposure to radionuclides in clean soil results in an annual theoretical fatal cancer risk of 6×10^{-4} to 1×10^{-3}.

In addition, DOE is required to act such that radiation doses from its activities, including cleanup activities, are kept "as low as reasonably achievable" (ALARA), taking into account economic and other factors (*see* 10 CFR 835.101(c)). Application of the ALARA principle means that radiation doses for both workers and the public are typically kept lower than their regulatory limits (for example, below 15 millirem per year). Although DOE believes that the lifetime risk of a latent cancer fatality from residual contamination at ETEC would be well below 3×10^{-4} after completion of soil remediation and application of the ALARA principle, DOE is taking no credit for the expected reduction in risk in its analysis of the alternatives.[5]

3.2.1.2 Building 4059

This building was used for development testing of Space Nuclear Auxiliary Power reactors. It has two concrete-shielded vaults in the basement, only one of which housed a reactor. The reactor vault was made radioactive by neutron activation during Space Nuclear Auxiliary Power reactor tests. The above-grade portion of Building 4059 and portions of the basement were decontaminated and final surveys (including verification surveys of the above-grade structure and sampling by the Department of Health Services, EPA and the Oak Ridge Institute for Science and Education) completed in 1999.

Decontamination and Demolition

All equipment, piping, and tanks in Building 4059 have been removed and surface decontamination has been completed. The building may contain hazardous materials such as lead-based paint, asbestos insulation, light fixture ballasts containing PCBs, solvents, oils, and greases. These would be removed and recycled or disposed of as hazardous waste.

The entire building (and Building 4459, located within the fenceline of Building 4059) would be surveyed and demolished in two phases. In the first phase, DOE would remove all clean portions of the building and would dispose of it in a local municipal sanitary landfill. In the second phase, DOE would remove the activated concrete in the pipe chase room, vacuum equipment room, and the north and south test vaults. DOE would package this material as LLW and ship it to DOE approved sites for disposal. The building would be demolished and the resulting nonhazardous debris would be removed for disposal.

Soil Remediation

After demolition of the building and removal of the debris, the remaining soil would be sampled. If any soil exceeded the 3×10^{-4} standard, it would be excavated and disposed of as LLW at an appropriate off-site disposal facility. However, based on initial surface soil sampling data, DOE does not expect that soil

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5 Prior remediation surveys at ETEC have demonstrated a residual risk in the 1×10^{-4} to 1×10^{-6} range.

remediation would be required for the area around Building 4059 to achieve the remediation goal for Area IV of the SSFL under Alternative 1. Following verification sampling by the Department of Health Services and the Oak Ridge Institute for Science and Education, the area would be backfilled with clean soil from an onsite borrow pit and resurfaced or revegetated to match the surrounding area.

3.2.1.3 Building 4024

This facility consists of two concrete-shielded underground vaults that housed the test reactors, an above-grade high bay support area, a control room, and engineering and administrative support offices. As in Building 4059, the reactor vaults were made radioactive by neutron activation during Space Nuclear Auxiliary Power reactor tests. The shielding concrete in the vaults contains low levels of activation products. Nine equipment storage vaults in the test cell corridor were used to store various pieces of contaminated equipment. A paved yard surrounds the facility where radioactive solid, liquid, and gas storage tanks were once buried but have since been removed.

Decontamination and Demolition

Similar to Building 4059, all equipment, piping and tanks in Building 4024 have been removed and surface decontamination has been completed. The building may contain hazardous materials such as lead-based paint, asbestos insulation, light fixture ballasts containing PCBs, solvents, oils, and greases. These would be removed and recycled or disposed of as hazardous waste.

The entire building would be surveyed and demolished in two phases. The first phase would remove all uncontaminated debris and dispose of it in a local municipal sanitary landfill. In the second phase, DOE would remove the contaminated portions of the vaults, package the waste as LLW, and ship it to DOE sites for disposal. The building would be demolished and the resulting nonhazardous debris would be removed for disposal.

Soil Remediation

After demolition of the building and removal of the debris, the remaining soil would be sampled. If any soil exceeded the 3×10^{-4} standard, it would be excavated and shipped as LLW to an appropriate offsite disposal facility. However, based on limited surface soil sampling data, DOE does not believe that soil remediation would be required for the area around Building 4024 to achieve the remediation goal for Area IV of the SSFL under Alternative 1. Following verification sampling by the Department of Health Services and the Oak Ridge Institute for Science and Education, the area would be backfilled with clean soil from an onsite borrow pit and resurfaced or revegetated to match the surrounding area.

3.2.2 Closure and Demolition of the Sodium Pump Test Facility

With DOE authorization, Rocketdyne had been using this facility under a commercial contract to perform electromagnetic pump testing of sodium. This project was completed in late 2001. No radioactive materials were ever used at this facility.

Closure of the SPTF would begin by removing approximately 197,000 liters (52,000 gallons) of bulk sodium from the facility. As with the closure of other sodium buildings, the entire SPTF sodium system and all residual material contained within that system would be classified as "excluded recyclable material" under the California Health and Safety Code. As such, at least 75 percent of the sodium would need to be reused each year. To accomplish this, the sodium would be transferred to a new owner, who would provide transport vessels (receiving tanks) to receive and transport the sodium offsite. DOE would build a system to transfer the sodium from the existing facility sodium drain tanks to the new owner's vessels. This system would be similar to the one designed, built, and operated for the transfer of sodium from the Sodium Component Test Installation. The sodium would be allowed to cool by means of heat loss through the vessel's insulation to the surrounding atmosphere and would become solid. The new owner would then transport the solid sodium offsite for reuse.

After the bulk sodium was removed, a sodium heel and a thin film of sodium would remain in the sodium pump tank. Sodium would also remain within the pipe system components. Because this remaining sodium cannot be easily removed and reused (as sodium metal), it would be converted into sodium hydroxide and reused. As with the decontamination of the Sodium Component Test Installation, DOE would use a variation of a water-vapor-nitrogen technique to convert the sodium into sodium hydroxide. In this process, subsaturated water vapor carried within a nitrogen steam would be introduced to the sodium. The water would react with the sodium in a controlled manner and produce sodium hydroxide that would be reused offsite.

All of the sodium components and piping would be cleaned to remove the residual sodium. The components would be either (1) size-reduced and cleaned in batches in a reaction chamber; (2) modified, sealed, and moved to the cleaning facility and cleaned as a unit; or (3) prepared and set up for cleaning and cleaned in place. DOE would then perform tests or examine the cleaned piping to verify the removal of the sodium. The remaining metal of the cleaned component would be collected and sent to scrap dealers for recycling.

The SPTF may also contain hazardous materials such as lead-based paint, asbestos insulation, light fixture ballasts containing PCBs, solvents, oils, and greases. These would be removed and recycled or disposed of as hazardous waste. After demolition of the building and removal of the debris, the area would be backfilled with clean soil from an onsite borrow pit and resurfaced or revegetated to match the surrounding area. Since the SPTF is not a radiological facility, no radiological release activities would occur.

3.2.3 Demolition of All Remaining Uncontaminated DOE Support Facilities

Approximately 50 other buildings on the ETEC site are uncontaminated support facilities. These facilities include sodium facilities from which the sodium has already been removed and three former radiological facilities that have been released, or are pending release, by DOE (with the concurrence of the California Department of Health Services) but not yet demolished. For purposes of analysis, DOE assumed that all of these buildings would be demolished. However, DOE may abandon a few of these buildings and turn them over to Rocketdyne for reuse.

After removal of any hazardous material such as lead-based paint, asbestos insulation, light fixture ballasts containing PCBs, solvents, oils, and greases, DOE would remove other components, segregate materials, and either recycle or dispose of the materials in a local municipal sanitary landfill. Following the demolition of the buildings and removal of the debris, the areas around the buildings would be backfilled with clean soil from an onsite borrow pit and resurfaced or revegetated to match the surrounding area.

3.2.4 Transportation

Implementation of Alternative 1 would involve the offsite truck transportation of LLW, MLLW, hazardous waste, and nonhazardous debris waste generated as a result of decontamination and demolition activities. TRU waste currently stored onsite would also be shipped offsite. Sodium would be shipped offsite for reuse.

LLW would be shipped to Nevada Test Site; MLLW would be shipped to Envirocare; hazardous waste would be shipped to a licensed hazardous waste disposal site, and nonhazardous debris waste would be shipped to a local municipal sanitary landfill. TRU waste would be shipped to WIPP for disposal. Table 3-2 shows the waste shipments that would be required under Alternative 1.

Table 3-2. Offsite Shipments Under Alternative 1

Waste Type	Number of Truck Shipments
LLW	553[a]
MLLW	20
TRU Waste	5
Hazardous Waste	5
Nonhazardous Debris Waste	1,860[a]
Sodium	11[b]

a. The number of truck shipments was calculated by dividing the total volume to be shipped by 13.6, the volume assumed that could be loaded onto one truck.

b. Approximately 18,900 liters (5,000 gallons) of sodium can be transported in one truck shipment. Shipment of 197,000 liters (52,000 gallons) would require 11 shipments.

In addition, there would be approximately 400 truck shipments of clean soil from the onsite borrow area to the RMHF.

3.3 ALTERNATIVE 2: CLEANUP AND CLOSURE USING A 1 X 10^{-6} RISK STANDARD

Implementation of Alternative 2 would involve the same actions described under Alternative 1. However, under Alternative 2, the soil remediation goal for Area IV would be an additional theoretical lifetime risk of a latent cancer fatality to the maximally exposed individual of no greater than 1 x 10^{-6} as a result of exposure to the radiological contamination remaining on the site. Using this standard, the maximally exposed individual would receive no more than a 0.05-millirem radiation dose each year due to exposure to residual radiological contamination at ETEC. For perspective, it is estimated that the average individual in the United States receives a dose of about 300 millirem each year from natural sources of radiation.

Implementation of Alternative 2 would require more soil remediation at the RMHF than would be required under Alternative 1. Unlike Alternative 1, Alternative 2 would also require soil remediation at Building 4024. Because DOE has remediated soils around former ETEC radiological facilities to a 3 x 10^{-4} additional lifetime risk level, implementation of Alternative 2 would also require additional soil remediation at the former ETEC radiological facilities at Area IV. The additional soil remediation (excavation) required under Alternative 2 would take an additional 3 years to complete, as compared to Alternative 1, assuming the same level of effort.

Under Alternative 2, approximately 404,850 cubic meters (14.3 million cubic feet) of soil would need to be excavated in order to meet the remediation goal of an additional 1 x 10^{-6} theoretical lifetime cancer risk as a result of radiological contamination remaining on Area IV as a whole. Table 3-3 indicates the total volumes of radioactive, hazardous, and nonhazardous debris waste that would be generated under Alternative 2. Only the volume of LLW differs between Alternatives 1 and 2.

Table 3-3. Waste Volumes Generated Under Alternative 2

Waste Type	Waste Volume (cubic meters)[a]
Low-Level Radioactive Waste	**406,850**
Building Decontamination	2,000
Soil Remediation (1 x 10^{-6} Standard)	404,850
• RMHF	27,500
• Building 4059	None expected
• Building 4024	9,350
• Remainder of Area IV	368,000
Mixed Low-level Radioactive Waste	**20**
Hazardous Waste	**5**
Nonhazardous Debris Waste (Uncontaminated)	**25,300**

a. To convert cubic meters to cubic feet, multiply by 35.3.

Similar to Alternative 1, the volume of soil that would need to be remediated in the implementation of Alternative 2 was derived using a 1995 Area IV radiological survey, the most recent characterization of all 290 acres of Area IV and soil samples taken at RMHF during 2000. The 149 soil samples taken were assumed to be characteristic of surface soil on Area IV. These soil samples provide a distribution of cesium-137, the primary contaminant of concern (as explained more fully in Chapter 4). Conservatively assuming that these predominantly surface samples are representative of all Area IV soil down to bedrock, DOE estimated the volume of soil that would need to be excavated to meet the 1 x 10^{-6} additional lifetime cancer risk (0.05-millirem annual dose) standard. Based on this dataset, DOE calculated that soil remediation would be required for the RMHF, Building 4024, and the remainder of Area IV. For the remainder of Area IV, DOE assumed that 817,600 square meters (200 acres) of Area IV are soil-covered and habitable and that the average soil depth is 3 meters (10 feet). Because the 1995 data show that approximately 15 percent of Area IV may contain radiological contamination in excess of the 1 x 10^{-6} goal, approximately 368,000 cubic meters (13 million cubic feet) of soil would need to be excavated. All excavated soil would be managed as LLW.

After a verification survey confirmed that the remediation goal was met, the area would be backfilled with clean soil and resurfaced or revegetated to match the surrounding area.

Implementation of Alternative 2 would involve the same type of offsite truck transportation of radioactive, hazardous, and nonhazardous debris waste for disposal and sodium for reuse. With the exception of LLW, the number of shipments required would be the same under Alternatives 1 and 2. Table 3-4 shows the truck shipments that would be required under Alternative 2.

Because there would not be sufficient clean soil available from the onsite borrow area[6], most of the clean soil would be trucked in from an offsite borrow area. Thus, implementation of this alternative would also require the shipment of approximately 26,000 truckloads of 354,390 cubic meters (12.5 million cubic feet) of clean soil to the site.

[6] As noted above, only 50,460 cubic meters (1.8 million cubic feet) of clean soil are available from the onsite borrow area for all SSFL environmental projects. Because 404,850 cubic meters (14.3 million cubic feet) of clean soil would be needed, at least 354,390 (12.5 million cubic feet) would need to be brought in from offsite.

Table 3-4. Offsite Shipments Under Alternative 2

Waste Type	Number of Truck Shipments
LLW	30,000[a]
MLLW	20
TRU Waste	5
Hazardous Waste	5
Nonhazardous Debris Waste	1,860[a]
Sodium	11[b]

a. The number of truck shipments was calculated by dividing the total volume to be shipped by 13.6, the volume assumed that could be loaded onto one truck.

b. Approximately 18,900 liters (5,000 gallons) of sodium can be transported in one truck shipment. Shipment of 197,000 liters (52,000 gallons) would require 11 shipments.

3.4 NO ACTION ALTERNATIVE: NO FURTHER CLEANUP AND SECURE THE SITE

Under the No Action Alternative, DOE would conduct no further cleanup of ETEC facilities or soil. DOE would implement the following institutional controls to protect the public:

- Facility surveillance and maintenance programs would be designed to ensure structural stability, prevent releases of contamination, and safely store any remaining radioactive or hazardous materials.

- Access to groundwater or surface water contamination would be prohibited for the public and controlled for industrial workers. Access to facilities and soil would be prohibited for the public and controlled for industrial workers to reduce exposure and risk.

- Groundwater pump-and-treat activities would continue at the current level of effort, or other mitigation actions, approved by the California Department of Toxic Substances Control, would be taken until there is evidence, verified by the Department, that offsite migration of contaminants in groundwater was no longer possible.

- Maintenance of sediment controls to prevent migration of chemical contaminants in surface water would continue until there was evidence, verified by the Regional Water Quality Control Board, that offsite migration of chemical contaminants in surface water was no longer possible.

All contaminated and uncontaminated structures would remain in place. None of the radiological or hazardous contamination remaining in or near the facilities would be removed from the facilities or the site. No radiologically contaminated soil would be removed from Area IV.

The No Action Alternative is presented as a baseline against which the potential impacts of Alternatives 1 and 2 can be compared (*see* 40 CFR 1502.14(d)). This alternative is intended to present the minimum requirements that would protect human health and the environment in the event that more extensive remediation cannot be performed (for example, if adequate funding for remedial actions is not approved by the U.S. Congress or by DOE). However, as noted in Chapter 1, DOE recognizes its responsibility for the remaining radioactive and chemical contamination at ETEC and is proposing to clean up the site prior to closure. DOE will use this EA, and other appropriate information, to decide the most appropriate cleanup and closure procedure for the radiological contamination and hazardous materials remaining at ETEC, such as sodium.

3.5 ALTERNATIVES CONSIDERED BUT NOT ANALYZED

The following alternatives were considered but were eliminated from further study because of technical or jurisdictional considerations.

3.5.1 Clean Up SSFL

During the public scoping process, a commentor suggested that DOE should consider cleaning up the entire SSFL site, rather than limiting its activities to ETEC facilities. DOE did not analyze this alternative because DOE does not have jurisdiction over the SSFL and is not responsible for contamination other than that which occurred as a result of DOE activities. Therefore, evaluation of ongoing cleanup outside of ETEC and Area IV is beyond the scope of this EA. Cleanup of contamination resulting from DOE-sponsored activities that has migrated outside of the ETEC facility area is within the scope and is addressed in this EA. It should be noted, however, that cleanup of the other areas of SSFL is being performed pursuant to applicable laws and regulations in coordination with appropriate regulatory agencies.

3.5.2 Dispose of All Waste as LLW

An EPA comment on the scoping for this EA (*see* Appendix A) suggested that DOE consider an alternative under which all of the radiologically contaminated buildings would be disposed of as radioactive waste, “rather than surveying, sampling, decontaminating, and repeating.”

DOE did not evaluate this alternative for the following reasons. Even if all generated waste were assumed to be radiologically contaminated, waste streams sent to an LLW or MLLW facility would still have to be sampled and analyzed to ensure that the facility’s waste acceptance criteria were met. Therefore, there would be no cost savings for reduced characterization requirements. Once sampling and analysis was complete, the additional cost to segregate waste streams would be minimal. Segregating the waste also provides opportunities for reuse or recycling some of the uncontaminated building materials subject to DOE approval. In addition, the capacity in existing LLW and MLLW disposal facilities is limited; disposing of large volumes of clean material along with the contaminated portions of building debris would unnecessarily reduce the remaining capacity of these facilities. This could possibly create the need for siting and constructing a new LLW or MLLW landfill. Finally, this alternative would not be consistent with existing policies regarding waste minimization. For these reasons, this alternative was eliminated from further study.

3.5.3 Clean Up to Industrial Standards

The site is currently an industrial site and is expected to remain so for the immediate future. It would be reasonable to consider an alternative that uses an industrial worker scenario to evaluate exposure pathways and durations. Compared to residential exposure, industrial worker exposure is typically for fewer hours per day, fewer days per year, and fewer years at the site. Exposure pathways such as inhalation of volatile contaminants while showering using a contaminated groundwater source are eliminated. Exposure of children is eliminated. For these reasons, an industrial worker can be exposed to much higher contaminant concentrations than a residential receptor before the calculated risk becomes unacceptable.

Most of the site has already been cleaned up to residential levels. Cleanup of remaining contamination to residential levels would ensure that industrial receptors would also be protected. For these reasons, this alternative was eliminated from further study.

3.5.4 Clean Up to Background Levels

DOE considered whether it would be technologically and economically practicable to remove any trace of detectable contamination resulting from operations at ETEC. However, because background levels of radiological and chemical constituents in soil vary widely locally, regionally, nationally, and worldwide, there are technical questions regarding determination of background levels. In addition, due to the detection limits of current field survey, sampling, and analysis technology, it is difficult or impossible to detect a small fractional increment of contamination above background levels.

The only way to ensure that cleanup to background levels was accomplished would be to remove all soil on the site down to bedrock and replace it with clean backfill. The removed soil would have to be transported to an appropriate disposal site, which could result in transportation accidents and fatalities. On the other hand, the reduction in expected latent cancer fatalities compared to residential cleanup levels would be almost imperceptible. Because remediation to background levels would be impracticable and the additional reduction in risk compared to the alternatives considered would be negligible, this alternative was eliminated from further study. DOE did analyze an alternative that would reduce the additional lifetime cancer risk of the maximally exposed individual to 1×10^{-6}, which is very close to background.

3.6 SUMMARY OF IMPACTS

Under both Alternative 1 and Alternative 2, DOE would decontaminate, decommission, and demolish radiological facilities and soil surrounding these facilities. Under Alternative 1, DOE would conduct soil remediation activities until a risk level of 3×10^{-4} was attained. Under Alternative 2, DOE would conduct soil remediation activities until a risk level of 1×10^{-6} was attained.

DOE would also decommission and demolish the remaining sodium facility, after removing the sodium for reuse. Radioactive and hazardous waste would be shipped offsite for disposal; the sodium would be transported offsite for reuse.

The only difference between Alternative 1 (DOE's preferred alternative) and Alternative 2 is the volume of soil that would need to be excavated and shipped offsite. Approximately 70 times more soil would be excavated under Alternative 2 as compared to Alternative 1.

Because soil remediation activities (excavation) require heavy physical labor and use of power equipment, this work can result in industrial hazards such as trips and falls, equipment accidents, tool mishandling, and dropped loads. The incidence of these hazards increases as the number of worker hours increases and can be calculated using standard industrial accident rates (fatalities per worker year).

In addition, decontamination and decommissioning activities require the shipment of materials over public highways, which can result in traffic accidents and fatalities. As with industrial hazards, fatalities due to transportation accidents can be calculated using standard traffic accident rates (fatalities per kilometer traveled). The incidence of traffic accidents, and the potential for fatalities due to traffic accidents, increases as the number of shipments and distances traveled increases.

The implementation of Alternative 2 would require substantially more soil remediation (excavation of approximately 404,850 cubic meters of soil as compared to 5,550 cubic meters of soil under Alternative 1) and transportation (approximately 30,000 shipments of contaminated soil offsite and 26,000 shipments of clean soil to the site for revegetation compared to 553 shipments under Alternative 1) than would Alternative 1. This additional soil remediation and resulting transportation is likely to result in increased worker and public fatalities, as compared to Alternative 1.

Against this projection of fatalities due to industrial hazards and transportation accidents must be balanced the reduction in risk due to the reduction in radiation exposure. Under Alternative 1, the expected latent cancer fatalities in a population of 500 people living on the ETEC site following remediation to the 3×10^{-4} theoretical lifetime cancer risk standard (not taking ALARA into account) would be 0.15 as a result of residual radiological contamination. Under Alternative 2, the expected latent cancer fatalities in a population of 500 people living on the ETEC site following remediation to the 1×10^{-6} theoretical lifetime cancer risk standard would be 5×10^{-4} as a result of residual contamination. The individual lifetime risk of incurring any cancer from all causes is approximately 0.23 (*Cancer Journal for Clinicians,* Cancer Statistics, 2001) (1998 data). Thus, the cumulative individual risk of incurring cancer from all causes plus the individual risk of incurring cancer as a result of exposure to residual radiological contamination on Area IV would be 0.2303 for Alternative 1, 0.230001 for Alternative 2, and 0.2317 for the No Action Alternative.

A summary of the impacts that could occur for the alternatives analyzed is contained in Table 3-5.

Table 3-5. Summary of Impacts

Resource	Unit of Measure	Alternative 1 (5 years) *Preferred Alternative*	Alternative 2 (8 years)	No Action Alternative (Perpetuity)
LAND USE (see Section 4.1)		Residential use	Residential use	Industrial use
GEOLOGY AND SOILS (see Section 4.2)	Residual contamination (40-year exposure)	3×10^{-4} additional lifetime cancer risk	1×10^{-6} additional lifetime cancer risk	1.7×10^{-3} additional lifetime cancer risk
AIR QUALITY (see Section 4.3)				
Criteria air pollutants		No exceedances expected	No exceedances expected	No exceedances expected
WATER QUALITY AND WATER RESOURCES (see Section 4.4)				
Groundwater		No impact expected	No impact expected	No impact expected
Surface water		No impact expected	No impact expected	No impact expected
Wetlands		No impact expected	No impact expected	No impact expected
Floodplains		No impact expected	No impact expected	No impact expected
RADIOLOGICAL DOSE (see Section 4.5)				
Public				
Maximally exposed individual - annual	Millirem	2.8×10^{-3}	2.8×10^{-3}	7.7×10^{-7}
Maximally exposed individual - total	Millirem	1.4×10^{-2}	2.2×10^{-2}	Not applicable
Population – annual	Person-rem	0.11	0.11	2.2×10^{-4}
Population – total	Person-rem	0.56	0.9	Not applicable
Worker				
Average - annual	Millirem	470	470	7
Average - total	Millirem	2,345	3,760	Not applicable
Population – annual	Person-rem	10.3	10.3	0.92
Population – total	Person-rem	52	82	Not applicable

Table 3-5. Summary of Impacts (cont)

Resource	Unit of Measure	Alternative 1 (5 years) *Preferred Alternative*	Alternative 2 (8 years)	No Action Alternative (Perpetuity)
HUMAN HEALTH (see Section 4.5)				
Public				
Maximally exposed individual - annual	Probability of latent cancer fatality	1.4×10^{-9}	1.4×10^{-9}	3.9×10^{-13}
Maximally exposed individual - total	Probability of latent cancer fatality	7.0×10^{-9}	1.1×10^{-8}	Not applicable
Population – annual	Latent cancer fatality	5.6×10^{-5}	5.6×10^{-5}	1.1×10^{-7}
Population – total	Latent cancer fatality	2.8×10^{-4}	4.5×10^{-4}	Not applicable
Residual risk following remediation				
Individual living onsite for 40 years	Probability of latent cancer fatality	3×10^{-4}	1×10^{-6}	1.7×10^{-3}
Population (500 people living onsite for 40 years)	Latent cancer fatality	0.15	5×10^{-4}	0.85
Total cancer risk (all causes)[a]	Probability of latent cancer fatality	0.230300	0.230001	0.2317
Worker				
Average - annual	Probability of latent cancer fatality	1.9×10^{-4}	1.9×10^{-4}	2.8×10^{-6}
Average - total	Probability of latent cancer fatality	9.4×10^{-4}	1.5×10^{-3}	Not applicable
Population – annual	Latent cancer fatality	4.1×10^{-3}	4.1×10^{-3}	3.7×10^{-4}
Population – total	Latent cancer fatality	2.1×10^{-2}	3.3×10^{-2}	Not applicable

Table 3-5. Summary of Impacts (cont)

Resource	Unit of Measure	Alternative 1 (5 years) *Preferred Alternative*	Alternative 2 (8 years)	No Action Alternative (Perpetuity)
Facility Accidents				
Industrial (workers)	Fatalities per year	5.2×10^{-3}	6.5×10^{-3}	1.8×10^{-3} (1st year) 1.3×10^{-3} (subsequent years)
Radiological				
Public – maximally exposed individual	Probability of latent cancer fatality	3.5×10^{-6}	3.5×10^{-6}	0
Public - population	Probability of latent cancer fatality	0.5	0.5	0
Worker (100 meters away)	Probability of latent cancer fatality	7.0×10^{-4}	7.0×10^{-4}	0
Sodium		Injury and death could occur in worker population	Injury and death could occur in worker population	None
BIOLOGICAL RESOURCES (see Section 4.6)				
Threatened/endangered/sensitive species		No impact expected	Potential impact	No impact expected
Other plants and animals		No impact expected	No impact expected	No impact expected
CULTURAL RESOURCES (see Section 4.7)		No impact expected	Potential impact	No impact expected
NOISE AND AESTHETICS (see Section 4.8)		No impact expected	Potential impact	No impact expected
SOCIOECONOMICS (see Section 4.9)		No impact expected	No impact expected	No impact expected
WASTE MANAGEMENT (see Section 4.10)				
LLW generated	Cubic meters	7,500	406,850	0
MLLW generated	Cubic meters	20	20	0
TRU waste generated	Cubic meters	0	0	0
Hazardous waste generated	Cubic meters	5	5	0
Nonhazardous debris waste generated	Cubic meters	25,300	25,300	0

Table 3-5. Summary of Impacts (cont)

Resource	Unit of Measure	Alternative 1 (5 years) *Preferred Alternative*	Alternative 2 (8 years)	No Action Alternative (Perpetuity)
TRANSPORTATION (see Section 4.11)				
LLW shipments	Number of truck shipments	553	30,000	0
MLLW shipments	Number of truck shipments	20	20	0
TRU waste shipments	Number of truck shipments	5	5	0
Hazardous waste shipments	Number of truck shipments	5	5	0
Nonhazardous debris waste shipments	Number of truck shipments	1,860	1,860	0
Sodium shipments	Number of truck shipments	11	11	0
Clean backfill shipments	Number of truck shipments	0	26,000	0
Transportation accidents (nonradiological)				
LLW shipments	Fatalities	2.5×10^{-2}	1.4	0
Nonhazardous debris shipments	Fatalities	5.7×10^{-3}	5.7×10^{-3}	0
Emission exhaust (all shipments)	Fatalities	6.0×10^{-3}	0.23	0
ENVIRONMENTAL JUSTICE (see Section 4.12)		No impact expected	No impact expected	No impact expected

a. The lifetime cancer risk of incurring any cancer from all causes is approximately 0.23 (*Cancer Journal for Clinicians*, Cancer Statistics, 2001) (1998 data). This represents the cumulative risk of incurring cancer from all causes plus the risk of incurring cancer as a result of exposure to residual radiological contamination on Area IV.