DOE/EA-1345

ENVIRONMENTAL ASSESSMENT FOR CLEANUP AND CLOSURE OF THE ENERGY TECHNOLOGY ENGINEERING CENTER

FINAL

March 2003

U.S. Department of Energy
NNSA Service Center
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LIST OF ACRONYMS

ALARA	as low as reasonably achievable
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DHS	Department of Health Services (State of California)
DOE	U.S. Department of Energy
EA	environmental assessment
EPA	U.S. Environmental Protection Agency
ETEC	Energy Technology Engineering Center
HWMF	Hazardous Waste Management Facility
LLW	low-level radioactive waste
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MLLW	mixed low-level waste
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
ORISE	Oak Ridge Institute for Science and Education
PCB	polychlorinated biphenyl
RCRA	Resource Conservation and Recovery Act
RMHF	Radioactive Materials Handling Facility
SEIS-II	*Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement*
SNAP	Space Nuclear Auxiliary Power
SPTF	Sodium Pump Test Facility
SSFL	Santa Susana Field Laboratory
TCE	trichloroethylene
TRU	transuranic
WIPP	Waste Isolation Pilot Plant
U.S.C.	United States Code

GLOSSARY

Additional theoretical lifetime cancer risk

The potential risk to an individual of developing cancer that could result from that individual's exposure to radiological contaminants over and above the existing risk from dying of cancer. The lifetime risk of death from cancer from all causes is 0.23, according to the U.S. National Center for Health Statistics (1998).

Background radiation

Radiation from naturally occurring radioactive materials as they exist in nature (such as radon) and cosmic rays from space filtered through the Earth's atmosphere. Other sources of background radiation include medical procedures (x-rays), air travel, consumer and industrial products, and fallout from prior nuclear weapons testing. Background radiation in the United States averages 300 millirem per year.

Berm

A sloped wall or embankment (typically constructed of earth, hay bales, or timber framing) used to prevent inflow or outflow of material into/from an area.

Contamination

The deposition of unwanted radioactive or hazardous material on the surfaces of structures, areas, objects, or people.

Decommissioning

The process of removing from service a facility that is no longer needed for its original purpose. For facilities in which nuclear materials were handled, it usually involves decontaminating the facility so that it may be dismantled or dedicated to other purposes.

Decontamination

The actions taken to reduce or remove substances that pose a substantial present or potential hazard to human health or the environment, such as radioactive contamination from facilities, soil, or equipment by washing, chemical action, mechanical cleaning, or other techniques.

Fast breeder reactor

A nuclear reactor with fertile material loaded around the core, to be converted into fissile material through neutron capture, which generates more fissile material than is consumed.

Latent cancer fatality

A fatality resulting from a cancer that was originally induced by radiation but which may occur years after the exposure. Small doses of radiation may result in fractional latent cancer fatalities, or only a probability that a latent cancer fatality may be incurred. The lower the fractional latent cancer fatality, the lower the probability that a latent cancer fatality will be incurred. For example, 1×10^{-4} probability of a latent cancer fatality means 1 chance in 10,000 of incurring a latent cancer fatality; 1×10^{-6} probability of a latent cancer fatality means 1 chance in 1 million of incurring a latent cancer fatality.

Maximally exposed individual

A hypothetical individual whose location and habits result in the highest possible total radiological or chemical exposure (and thus dose) from a particular source for all exposure routes (for example, inhalation, ingestion, direct exposure). For purposes of analyzing the offsite impacts of decontamination, decommissioning, and demolition activities at ETEC, the maximally exposed individual was assumed to be an individual living off the site in a residence 2,867 meters (9,406 feet) northwest of the Radioactive Materials Handling Facility. For purposes of analyzing the risk of residual contamination on the site following remediation, the maximally exposed individual was assumed to be an individual living on the site for 40 years. This is equivalent to the "average member of the critical group" used in 10 CFR 20.1402.

National Environmental Policy Act of 1969 (NEPA)

A federal act designed to promote inclusion of environmental concerns in federal decision-making. The Act is implemented by procedures issued by the Council on Environmental Quality and DOE.

Millirem

One-thousandth of a rem (0.001 rem); *see* "Rem."

Rem (Roentgen Equivalent in Man)

The unit of a dose equivalent from ionizing radiation to the human body that is used to measure the amount of radiation to which a person has been exposed.

Remediation

Action taken to permanently remedy a release or a threatened release of a hazardous substance to the environment, instead of or in addition to a removal action.

Scientific notation

A system of expressing very large or very small numbers 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}

Scoping

An early and open process for determining the range of issues to be addressed in an environmental impact statement or environmental assessment (EA) and for identifying the significant issues related to a proposed action.

Waste characterization

The identification of waste composition and properties by reviewing process knowledge, nondestructive examination, nondestructive assay, or sampling and analysis. Characterization provides the basis for determining appropriate storage, treatment, handling, transportation, and disposal requirements.

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1.0 INTRODUCTION

The U.S. Department of Energy (DOE) Oakland Operations Office is responsible for the operation of the Energy Technology Engineering Center (ETEC), a government-owned complex of buildings located within Area IV (approximately 1.2 square kilometers [290 acres]) of the Santa Susana Field Laboratory (SSFL) (*see* Figure 1-1). The 11-square-kilometer (2,850-acre) SSFL is located atop a range of hills between the Simi and San Fernando Valleys in southeastern Ventura County, California. ETEC is operated by Rocketdyne Propulsion & Power, a division of The Boeing Company. ETEC does not have specific site boundaries, but rather is a group of facilities owned by DOE or where DOE-sponsored operations took place.

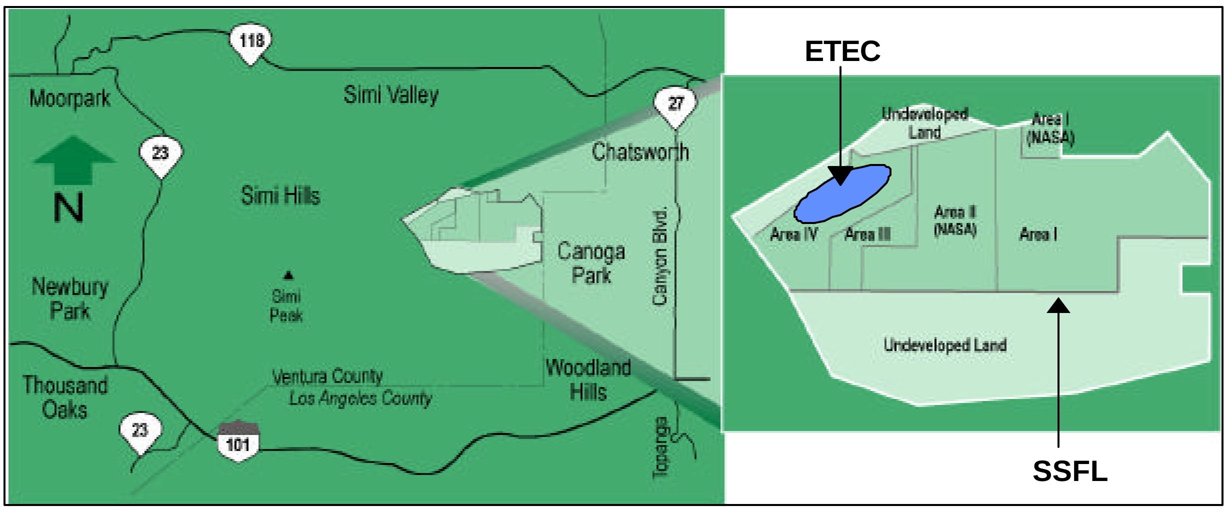

Figure 1-1. Location of SSFL, Area IV, and ETEC

From the mid-1950s until the mid-1990s, DOE and its predecessor agencies conducted nuclear research and energy development projects at ETEC. Activities in Area IV of the SSFL sponsored by DOE included nuclear operations (development, fabrication, disassembly, and examination of nuclear reactors, reactor fuel, and other radioactive materials) and large-scale liquid sodium metal experiments for testing liquid metal fast breeder reactor components. The use of radioactive materials at the SSFL was restricted to Area IV only. As a result of these and other activities, various facilities and locations on the site contain radioactive and chemical contamination. Hazardous materials such as asbestos insulation and lead-based paint may also be present in some buildings. The remainder of Area IV and the SSFL are not owned or controlled by DOE.

All nuclear research at ETEC terminated in 1988. Since then, many of the previously used nuclear facilities and associated site areas have been decontaminated and decommissioned. Decontamination and decommissioning activities at the sodium test facilities began in 1996.

As public concern over cleanup activities at ETEC increased, DOE decided to conduct an environmental assessment (EA) under the National Environmental Policy Act (NEPA) of its remaining cleanup activities. (Previous closure activities at the site were performed under NEPA through categorical exclusions). DOE has prepared this EA to evaluate the potential impacts of implementing additional cleanup and closure activities. The EA was prepared in accordance with the Council on Environmental Quality's NEPA implementing regulations (40 CFR Parts 1500-1508) and DOE's NEPA implementing regulations (10 CFR Part 1021).[1] A notice of intent was published in the *Federal Register* on September 15, 2000, announcing DOE's decision to prepare this EA and hold public scoping meetings (65 Fed. Reg. 55949 (2000)). The EA was issued in draft for public comment. The initial 30-day public comment period, during which DOE conducted a public meeting on the draft, was extended for an additional 60 days at the request of commenters.

DOE will use this EA, and other relevant information, to determine (1) if the current cleanup standard for the radiological cleanup of ETEC facilities and all Area IV land for which DOE is responsible is appropriate for the remaining activity, and (2) whether to decontaminate and decommission the remaining sodium facility and other support facilities. The chemical contamination in soil and groundwater will be addressed under the Resource Conservation and Recovery Act (RCRA) Facility Investigation process.

1.1 PURPOSE AND NEED

DOE determined in 1996 that ETEC is surplus to its current needs and is closing the site. However, DOE is responsible for the remaining radioactive and chemical contamination from its activities and is proposing to clean up the affected portion of Area IV prior to turning the area over to Rocketdyne. There are no radiological facilities outside of Area IV. DOE now needs to decide the most appropriate cleanup and closure procedure for the radiological contamination and hazardous materials remaining at ETEC.

1.2 ALTERNATIVES

DOE is proposing to clean up the remaining ETEC facilities using the existing site-specific cleanup standard of 15mrem/yr. (plus DOE's As Low As Reasonably Achievable – ALARA- principle) for decontamination of radiological facilities and surrounding soils (**Alternative 1**). An annual 15-millirem additional radiation dose to the maximally exposed individual (assumed to be an individual living in a residential setting on Area IV) from all exposure pathways (air, soil, groundwater)[2] equates to an additional theoretical lifetime cancer risk of no more than 3×10^{-4} (3 in 10,000) (*see* the text box titled "Exposure to Radiation" for an explanation of terms relating to radiation exposure).

Cancer Risk from Radiation

Background radiation is radiation from naturally occurring radioactive materials as they exist in nature (such as radon) and cosmic rays from space filtered through the Earth's atmosphere. Other sources of background radiation include medical procedures (x-rays), air travel, consumer and industrial products, and fallout from prior nuclear weapons testing. On average, individuals in the United States receive 300 millirem annually from background radiation. The probability of incurring a fatal cancer as a result of exposure to background radiation is approximately 1×10^{-2} (1 in 100) over a 70-year lifetime. Additional information is available in Appendix C.

In this EA, the term "additional theoretical lifetime fatal cancer risk" refers to the potential risk of developing a fatal cancer that could result from exposure to radiological contaminants *over and above* the existing risk of dying of cancer.

[1] Earlier decontamination, decommissioning, and demolition activities at ETEC were conducted pursuant to categorical exclusions issued in accordance with DOE's NEPA regulations (10 CFR Part 1021, Appendix B to Subpart D).

[2] DOE established the soil release criteria for ETEC in September 1996. A detailed discussion of the soil cleanup standard is found in *Approved Sitewide Release Criteria for Remediation of Radiological Facilities at the SSFL* (Rocketdyne 1999a).

However, actual exposures generally will be much lower as a result of the application of the "as low as reasonably achievable" (ALARA) principle (*see* additional information in Chapter 3 and Appendix G). Based on post-remediation verification sampling previous cleanups have resulted in a less than 2 x 10^{-5} level of residual risk. DOE would decontaminate, decommission, and demolish the remaining radiological facilities. DOE would also decommission and demolish the one remaining sodium facility and all of the remaining uncontaminated support buildings for which it is responsible. The ongoing RCRA corrective action program, including groundwater treatment (interim measures), would continue. Alternative 1 is DOE's preferred alternative.

Exposure to Radiation

As a result of past radiological activities at ETEC, Area IV contains radioactive contamination in various facilities and locations. The decontamination activities that would be undertaken under the alternatives analyzed in this EA could expose workers to radiation and contaminated material. These activities could also expose the public to very small quantities of radioactive materials from controlled releases to the atmosphere. Even after decontamination activities were completed, extremely small levels of radioactivity could remain. Radiation may cause a variety of ill health effects in people, including cancer.

To determine whether health effects could occur as a result of radiation exposure from a particular activity and to determine the extent of such effects, the radiation dose must be calculated. An individual may be exposed to radiation externally (through a radiation source outside of the body) and/or internally (from ingesting or inhaling radioactive material). The dose is a function of the exposure pathway (for example, inhalation, ingestion, or external exposure through the skin) and the type and quantity of the radionuclides involved.

The unit of radiation dose for an individual is the *rem*. A *millirem* is 1/1,000 of a rem. The unit of dose for a population is *person-rem* and is determined by summing the individual doses of an exposed population. The impacts from a small dose to a large number of people can be approximated by the use of population (that is, *collective*) dose estimates. Dose estimates are usually derived for both the *maximally exposed individual* (a member of the public located nearest to the site during decontamination, decommissioning, and demolition activities or, following remediation, a person who would live on the site for 40 years) and the *collective population* within 80 kilometers (50 miles) of the site.

After the dose is estimated, the health impact is calculated from current internationally recognized risk factors. The potential health impact is stated in terms of a *latent cancer fatality*. A latent cancer fatality is a fatality resulting from a cancer that was originally induced by radiation but which may occur years after the exposure. Small doses of radiation may result in fractional latent cancer fatalities, or only a probability that a latent cancer fatality may be incurred. The lower the fractional latent cancer fatality, the lower the probability that a latent cancer fatality will be incurred. For example, 1 x 10^{-4} probability of a latent cancer fatality means 1 chance in 10,000 of incurring a latent cancer fatality; 1 x 10^{-6} probability of a latent cancer fatality means 1 chance in 1 million of incurring a latent cancer fatality.

For this EA, DOE also analyzed an alternative that would clean up the ETEC site using a 0.05-millirem standard (**Alternative 2**). A 0.05 mrem exposure would result in an additional theoretical lifetime cancer risk of no more than 1 x 10^{-6} to the maximally exposed individual over 40 years. As under Alternative 1, DOE would also decommission and demolish the remaining sodium facilities and all of the remaining uncontaminated support buildings for which it is responsible. Ongoing groundwater treatment (interim measures) and the SSFL site-wide RCRA corrective action would continue.

Routine Radiation Exposure

Below are radiation doses associated with various activities (UNSCEAR 1993):

3 chest x-rays	18 millirem
2 round-trip cross-country airplane trips	14 millirem
Living for 1 year in a brick house	7 millirem
Living in Denver for 1 year (above sea-level exposure)	21 millirem
Total average annual exposure to background radiation	300 millirem

The Council on Environmental Quality regulations implementing NEPA require agencies to consider the no action alternative as a baseline against which the environmental impacts of the proposed action and alternatives can be measured. For this EA, DOE analyzed the potential impacts of leaving the site in its current state (**No Action Alternative**). Under the No Action Alternative, DOE would conduct no further cleanup of radiological facilities or soil or cleanup of the remaining sodium and other support facilities for which it is responsible. Rather, Rocketdyne would prohibit or control access to contaminated facilities, soil, groundwater, and surface water and continue groundwater treatment. However, the ongoing RCRA corrective action program would continue.

The specific activities that would be conducted under each of these alternatives are discussed fully in Chapter 3, Proposed Action and Alternatives. Other alternatives DOE considered but concluded were not reasonable based on initial review are also summarized in Chapter 3.

1.3 PUBLIC INVOLVEMENT

1.3.1 Scoping

The public scoping period began with the September 15, 2000, publication in the *Federal Register* of the notice of intent to prepare an EA and continued until October 30, 2000. During the scoping period, DOE conducted public scoping meetings on October 17, 2000, in Woodland Hills, California, and on October 18, 2000, in Simi Valley, California (Atkinson-Baker 2000a, 2000b). Information on the upcoming scoping meetings was published in local public notices prior to the meetings as well as in mailings to interested parties.

The public was encouraged to comment on the proposed scope of the EA, suggest other site cleanup alternatives, express any concerns regarding ETEC and proposed actions, and provide any other information or comments that DOE should consider in the course of developing the EA. The scoping process was used to help determine issues to be addressed, identify significant issues related to the proposed action, identify and eliminate issues that were not significant or were covered by another environmental review, and develop a range of alternatives for analysis. In fact, DOE added Alternative 2, the 0.05mrem cleanup standard at the request of stakeholders.

U.S. Environmental Protection Agency (EPA) Cleanup Policy

Consistent with DOE policy, cleanup activities at ETEC are being conducted consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 U.S.C. 9601 *et seq*).

The regulations issued by the EPA for CERCLA state that CERCLA cleanups need to achieve a cleanup level such that there is an upper bound lifetime cancer risk to an individual of between 1×10^{-4} to 1×10^{-6} resulting from exposure to residual contamination after the cleanup is complete (*see* 40 CFR 300.430(e)(2)(i)(A)(2)). EPA has stated that a site-specific 15-millirem annual dose cleanup standard, equating to an increased lifetime cancer risk to an individual of approximately 3×10^{-4}, "is consistent with levels generally considered protective in other governmental actions, particularly regulations and guidance developed by EPA in other radiation control programs" (EPA 1997).

More recently, EPA has adopted "very stringent public health and environmental protection standards" for the proposed high-level radioactive waste and spent nuclear fuel repository at Yucca Mountain, Nevada. Under these standards, residents closest to the repository would be exposed to no more than 15 millirem annually from all pathways (EPA 2001a). Further, EPA has stated that a 25-millirem standard used by the U.S. Nuclear Regulatory Commission (NRC) for the cleanup of the West Valley Demonstration Project in West Valley, New York, "will result in a residual risk within the [CERCLA] risk range of 10^{-4} to 10^{-6}" (EPA 2001b).

Appendix A summarizes the comments received during scoping and DOE's responses to these comments. Appendix B provides a list of agencies and persons consulted regarding the preparation of this EA.

1.3.2 Public Comments on the Draft EA

DOE issued a draft version of this EA for public comment in January 2002, and held two sessions of a public meeting on the draft document on January 24, 2002, during which 16 people presented comments. In addition, during the 90-day comment period that ended on April 26, 2002, DOE received 63 comment letters, electronic mail messages, and verbal communications on the Draft EA from individuals; groups; and federal, state, and local governmental entities. DOE has considered these comments individually and collectively and has made many changes to the Draft EA as a result of the comments. These changes are reflected in this Final EA. DOE's specific responses to the issues raised in the public comments are provided in Appendix I.

1.4 ORGANIZATION OF THE EA

The EA consists of six chapters and nine appendices. **Chapter 1** is a brief introduction to DOE's purpose and need for action, the alternatives analyzed, and the means by which the public has been and can continue to be involved with the preparation of the document and DOE's decisionmaking process.

Chapter 2 provides background information regarding the history of the site, regulatory requirements involving ETEC site cleanup, the facilities that are the subject of this EA, waste management activities on the site, and the current status of the site.

Chapter 3 describes the proposed action and alternatives analyzed in the EA. This chapter includes a table that summarizes and compares the potential environmental impacts associated with each alternative.

Chapter 4 describes the affected environment and environmental consequences that could occur under each alternative. For each resource area, the EA describes the current conditions at the site and the potential environmental impacts of implementing the alternatives. The resource areas analyzed are land use, geology and soils, air quality, water quality and water resources, human health, biological resources, cultural resources, noise and aesthetics, socioeconomics, waste management, transportation, environmental justice, and cumulative impacts.

Chapter 5 addresses unavoidable adverse environmental impacts, the relationship of short-term uses of the environment and long-term productivity, and irreversible and irretrievable commitments of resources.

Chapter 6 contains a list of the documents used in the preparation of this EA.

Appendix A summarizes scoping comments and provides DOE responses. **Appendix B** lists the individuals and agencies consulted and contacted during the preparation of this EA. **Appendix C** provides additional information on radiation and human health. **Appendix D** identifies endangered, threatened, and sensitive species that have been observed or that could occur at the SSFL. **Appendix E** provides information regarding the methodology used to collect the soil data used as the basis for the analysis in the EA. **Appendix F** discusses radionuclides of concern at Area IV. **Appendix G** provides information regarding the ALARA principle and process. **Appendix H** describes the methodology used to assess air quality impacts. **Appendix I** summarizes the public comments received on the Draft EA and DOE's responses to the issues raised in the comments.

2.0 BACKGROUND

2.1 HISTORY OF THE SITE

In the late 1940s, North American Aviation acquired land in the Simi Hills between the Simi and San Fernando Valleys. That land, now known as the SSFL, was used primarily for the testing of rocket engines. Atomics International, a division of North American Aviation, was formed in 1955, and part of Area IV was set aside and used for nuclear reactor development and testing. In 1984, Rocketdyne merged with Atomics International. The Boeing Company purchased Rocketdyne in 1996.

Activities in Area IV started in the mid-1950s; until 1964, these activities were primarily related to sodium-cooled nuclear power plant development and development of space power systems with sodium and potassium as coolants. ETEC (originally known as the Liquid Metal Engineering Center) was formed in the mid-1960s as an Atomic Energy Commission (now DOE) laboratory for the development of liquid metal heat transfer systems in support of the Liquid Metal Fast Breeder Reactor Program. Nuclear operations at ETEC included 10 nuclear research reactors, 7 critical facilities, the Hot Laboratory, the Nuclear Materials Development Facility, the Radioactive Materials Handling Facility (RMHF), and various test and nuclear material storage areas. As a result of DOE nuclear activities, several ETEC facilities became radioactively activated and/or contaminated.

All nuclear operations ended in 1988. Since that time, DOE-funded activities have focused on decontamination and decommissioning of the ETEC facilities and offsite disposal of waste. Remediation of ETEC is now in its final stages. Three facilities still contain residual radiological contamination and/or activation.

Activation

Neutrons are electrically neutral subatomic particles. In a nuclear reactor, neutrons from uranium (contained in cylindrical fuel pellets and placed in fuel assemblies) strike other uranium atoms, causing them to split into parts. This produces heat, radioactive fission products, gamma rays, and more free neutrons. The neutrons produced by the fission process sustain the nuclear reaction by striking other uranium atoms in the fuel, causing additional atoms to split. During nuclear reactor operations, some neutrons generated by the fission process leave the reactor core. These neutrons enter the concrete shielding surrounding the reactor. This interaction causes some elements in the concrete to gain neutrons and become radioactive themselves. At two ETEC facilities (Buildings 4059 and 4024), the shielding concrete contains low levels of activation products as a result of the nuclear operations that were conducted in those buildings in the past. The activation products produced in shielding and structural materials (*e.g.*, rebar) are tritium, iron-55, nickel-63, cobalt-60, and europium-152/154.

DOE also conducted large-scale heat transfer and fluid mechanics experiments, using nonradioactive sodium metal in a molten state at ETEC. While not a contaminant, sodium metal is the most significant hazardous chemical substance remaining at ETEC. Most of the sodium has been removed and shipped offsite for reuse at other industrial sites. Residual sodium remains at one facility.

Hazardous materials such as asbestos insulation and lead-based paint were also used in ETEC facilities.

In addition to DOE-sponsored activities in Area IV, the balance of the SSFL has been used by Boeing, the National Aeronautics and Space Administration (NASA), and the Department of Defense for rocket and laser testing, which have also resulted in hazardous chemical contamination. DOE is responsible only for contamination resulting from DOE-sponsored activities. Contamination on other portions of the SSFL is the responsibility of other federal agencies and private entities.

2.2 REGULATORY FRAMEWORK

Under the authority of the Atomic Energy Act (42 U.S.C. 2011 *et seq*.), DOE is responsible for establishing a comprehensive health, safety, and environmental program for managing its facilities through the promulgation of regulations and the issuance of DOE orders. DOE derives this authority from Section 161 of the Act (42 U.S.C. 2201). In general, DOE orders set forth policies, programs, and procedures for implementing policies. In addition, DOE policy is to conduct all its cleanup in a manner consistent with CERCLA.

2.2.1 Radiological Contamination

Decontamination activities are governed by DOE Order 5400.5, *Radiation Protection of the Public and the Environment* (DOE 1990). Chapters 2 and 4 of this order prescribe an extensive and detailed methodology for restoring DOE sites. DOE Order 435.1, *Radioactive Waste Managemen*t (DOE 1999), is also applicable to the management of waste generated during cleanup of the radiological facilities. It is also DOE policy to conduct decommissioning consistent with the CERCLA non-time critical removal process. Pursuant to the order and policy, DOE has prepared and issued the *ETEC Closure Program – DOE Order 435.1 Implementation Plan* (Boeing 2000a).

To verify that cleanup policies and standards are being followed, DOE has contracted with the Oak Ridge Institute for Science and Education (ORISE) to conduct and document surveys at ETEC facilities to verify cleanup activities have met their objectives for DOE independently of Rocketdyne, DOE's cleanup contractor. ORISE has established an Environmental Survey and Site Assessment Program that conducts radiological surveys and environmental assessments for government agencies such as DOE and NRC that are working to clean up facilities contaminated with hazardous or radioactive materials. The Institute verifies that the sites are free of any contamination that may be harmful to the public or the environment by using a combination of laboratory and field capabilities to control all aspects and phases of the survey process. Institute staff follow systematic procedures to collect samples for analyses in their laboratory. Should these analyses indicate that contaminants remain above acceptable levels, the Institute recommends actions to be taken. Although the ORISE has a contractual relationship with DOE, it is not under the control or influence of Rocketdyne, the DOE contractor responsible for site restoration.

As an Agreement State under the provisions of the Atomic Energy Act, the State of California also has jurisdiction over non-DOE radiological activities at ETEC. The California Department of Health Services (DHS) oversees the radioactive materials license held by Rocketdyne, radioactive facility cleanup, and environmental monitoring. DHS also conducts unannounced inspections to verify the amounts and types of radioactive materials being used onsite, evaluates radiation exposure to employees and the general public, and reviews records related to radiation usage at the site. In particular, before a former DOE radiological facility at ETEC may be released for unrestricted (non-DOE) use in accordance with state regulatory standards, DHS must concur with the DOE determination regarding the decontamination and decommissioning of the facility.

The release process is implemented to ensure that the facility will not expose future users to hazards or risks from radiation. DOE Order 5400.5 (DOE 1990) requires DOE contractors to obtain approval of the cleanup standards that will be implemented during decontamination and decommissioning activities. These cleanup standards address surface contamination limits for building surfaces, soil radio isotope concentrations, and groundwater.

Rocketdyne submitted its proposed criteria to DOE and the DHS, which approved them in 1996 (Rocketdyne 1999a). The following steps occur in the cleanup process for a particular radiation facility or facilities at ETEC:

- Characterization survey to determine the extent and type of contamination.
- Evaluation of options for decontaminating the facility and managing any generated waste.
- Decommissioning plan to describe the technical requirements, schedule, resources, and goal of the cleanup.
- Decommissioning and decontamination, during which all contamination is removed from the facility. Activities include removing fuel and equipment, cleaning contaminated surfaces, removing material with volumetric neutron activation, removing tanks, and removing contaminated soil.
- Remedial action support surveys to determine if a cleanup action has been effective and whether additional remedial action is needed to meet cleanup goals.
- Radioactive waste disposal in DOE-approved or NRC-licensed disposal sites.
- Final decontamination and decommissioning report to document the process, costs, waste volumes generated, and worker exposure incurred.
- Final radiological status survey to ensure than all contamination has been removed to below limits specified in federal and state regulations. Guidance for performing such surveys is provided in the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) (NRC/EPA 1997). For ETEC facilities, the survey is conducted by Rocketdyne and the results are sent to DOE and the DHS Radiologic Health Branch.
- Independent verification surveys performed by a third party to verify the results of the final status survey. For ETEC facilities, DOE contracts with ORISE to provide the independent verification surveys. The results of the independent survey are forwarded to the DHS, which is asked to either release the facility for unrestricted use (for Rocketdyne-owned buildings) or to concur with the release for unrestricted use (for DOE-owned buildings).
- Certification docket, which includes all key documentation (approved site release criteria, approval of the criteria, the independent verification survey, and the release concurrence letter from the DHS).
- Federal Register notification of intent to release a DOE-owned building for unrestricted use or Radioactive Materials License amendment, issued by the DHS, to remove a Rocketdyne-owned facility from the license.

In sum, the legal and regulatory process of releasing a building for unrestricted use ensures that (1) approved cleanup standards have been met, (2) no further radiological controls or regulatory oversight are imposed on the building or land, (3) the building can safely be used for any other purposes without any further radiological controls, (4) the building can be safely demolished and disposed of at sanitary landfills without any further radiological controls, and (5) any other material from the building can be safely reused or recycled without any further radiological controls.

2.2.2 Chemical Contamination

Cleanup of chemical contamination at ETEC is being regulated under the RCRA (42 U.S.C. 6901 *et seq*.). As part of Area IV of the SSFL, ETEC is subject to several ongoing RCRA actions: closure of inactive RCRA treatment, storage, or disposal units; compliance/permitting of active RCRA units; groundwater characterization and remediation; and RCRA corrective actions. These activities are under the jurisdiction of the California Environmental Protection Agency's Department of Toxic Substances Control, pursuant to delegated authority from the EPA. The Department of Toxic Substances Control is preparing an environmental impact report, in accordance with the California Environmental Quality Act, for the corrective measures to be undertaken under the RCRA Corrective Action Program for all of the SSFL, including ETEC. The environmental impact report will be based in part on information generated from the characterization of chemical releases at SSFL performed in the RCRA corrective action process.

Because the cleanup of the chemical contamination at ETEC is being undertaken in the larger context of the SSFL cleanup and under a separate regulatory process, these activities are not part of the proposed action or alternatives analyzed in this EA. DOE has analyzed the cumulative impacts of the cleanup of the ETEC facilities for which DOE is responsible and the ongoing RCRA cleanup at the SSFL (*see* Section 4.14).

Compliance with RCRA

RCRA establishes a comprehensive regulatory program for the management of hazardous waste and the cleanup of active sites where releases have occurred. RCRA requires that hazardous wastes be treated, stored, and disposed of so as to minimize present and future threats to human health and the environment. RCRA applies mainly to active facilities that generate and manage hazardous wastes.

DOE facilities that store, treat, or dispose of hazardous waste or waste containing hazardous constituents are subject to RCRA requirements and must obtain a permit from EPA or from states that have been delegated permit authority by EPA. The Federal Facilities Compliance Act, 42 U.S.C 6961, waives DOE's sovereign immunity by allowing states to impose fines and penalties for RCRA violations.

RCRA compliance programs include the following activities: permitting storage, treatment, and disposal facilities; closing inactive RCRA-permitted facilities; and undertaking corrective actions to address chemical contamination at active sites. Developing corrective actions involves the preparation of a RCRA facility assessment, facility investigation, corrective measures study, and corrective measures implementation. Facility assessments are used to identify solid waste management units (defined as any location where hazardous materials were used, stored, or handled) and areas of concern.

In 1989, a RCRA facility assessment identified solid waste management units and areas of concern at the SSFL. The SSFL corrective action process is currently at the RCRA facility investigation stage.

2.2.3 Oversight Activities

Other federal, state, and local agencies are also involved in various oversight activities at ETEC and the SSFL:

- ***EPA's Office of Radiation and Indoor Air*** is the lead agency responsible for enforcing those provisions of the National Emission Standards for Hazardous Air Pollutants (NESHAP) related to radionuclides. Although nuclear operations are no longer conducted at ETEC, these standards also apply to ongoing decontamination activities that might produce air emissions. DOE submits annual NESHAP reports to EPA that document radiological releases from the site.

- The ***Regional Water Quality Control Board (Los Angeles Region)*** is the lead agency responsible for regulating surface water discharge activities at the SSFL. Under the authority of the Clean Water Act, 33 U.S.C. 1251 *et seq*., and the National Pollutant Discharge Elimination System (NPDES), the board sets maximum limits for chemical contaminants in waters being discharged from the SSFL. These limits, along with requirements for sampling, are incorporated into the site's NPDES permit, which must be renewed every 5 years. The board also shares responsibilities with the California Department of Toxic Substances Control for monitoring discharges to the groundwater.

- The ***Ventura County Environmental Health Division*** is responsible for enforcing regulations on hazardous waste generation and storage, pursuant to an agreement with the State of California.

- The ***Ventura County Air Pollution Control District*** is the lead agency responsible for regulating nonradioactive air emissions at the SSFL. The district is responsible for establishing and enforcing local air pollution regulations that meet or exceed requirements of the federal and California State Clean Air Acts and the California Health and Safety Code. The district also issues permits that establish requirements for construction, modification, and operation of equipment and processes that may result in air emissions. The SSFL currently has five permits covering various process equipment and groundwater treatment facilities. Other responsibilities of the district include regulating asbestos removal projects, implementing the vehicle trip reduction program, and overseeing the state-mandated Air Toxics "Hot Spot" Program that requires facilities to inventory all toxic materials that could result in airborne releases.

2.3 FACILITY DESCRIPTIONS

At its mission peak, ETEC consisted of over 200 facilities. As ETEC was a test site, facilities were often remediated as necessary and demolished once their mission was achieved. Since the decision to close ETEC in 1996, many facilities have been decontaminated, decommissioned, and demolished. These activities were conducted under categorical exclusions pursuant to DOE's NEPA regulations (10 CFR Part 1021, Appendix B to Subpart D). Approximately 64 structures remain.

Three radiological facilities (comprising a total of 13 buildings) and one sodium facility are the principal focus of this EA. In addition, 50 other DOE support facilities (for example, office and storage buildings, warehouses, parking lots, electrical substations) are proposed for demolition. Figure 2-1 shows the locations of these facilities within ETEC. This section describes these facilities.

2.3.1 Radiological Facilities

The three radiological facilities remaining at ETEC are the RMHF complex, Building 4059, and Building 4024. In addition, two other former radiological ETEC facilities have already been decontaminated and released for unrestricted use by DOE, with the concurrence of the DHS. These cleanup activities met requirements for categorical exclusion from NEPA. One other facility has been decontaminated and is pending release by DOE. Because these facilities are no longer contaminated but have not been demolished, they are included in the discussion of other DOE support facilities (*see* Section 2.3.3).

2.3.1.1 Radioactive Materials Handling Facility Complex

The RMHF complex consists of nine different buildings that are used for the following purposes: decontamination and packaging (Building 4021); operations and storage vaults (Building 4022); offices (Building 4034); health physics services (Building 4044); enclosed storage (Buildings 4075, 4621, and 4665); covered storage (Building 4688); and security (Building 4658). A rainwater runoff catch basin (referred to as Building 4614) is also included within the approximately 12,000-square-meter (3-acre) RMHF. The RMHF has been in continuous operation as a storage and handling facility for radioactive materials and waste since the late 1950s. It is a RCRA-permitted facility. Operations at the RMHF include waste characterization, limited treatment, packaging, and temporary storage of radioactive and mixed waste materials, which are shipped offsite to appropriate approved disposal facilities. The facility is radiologically contaminated from past operations, including the storage of both new fuel and irradiated fuel.

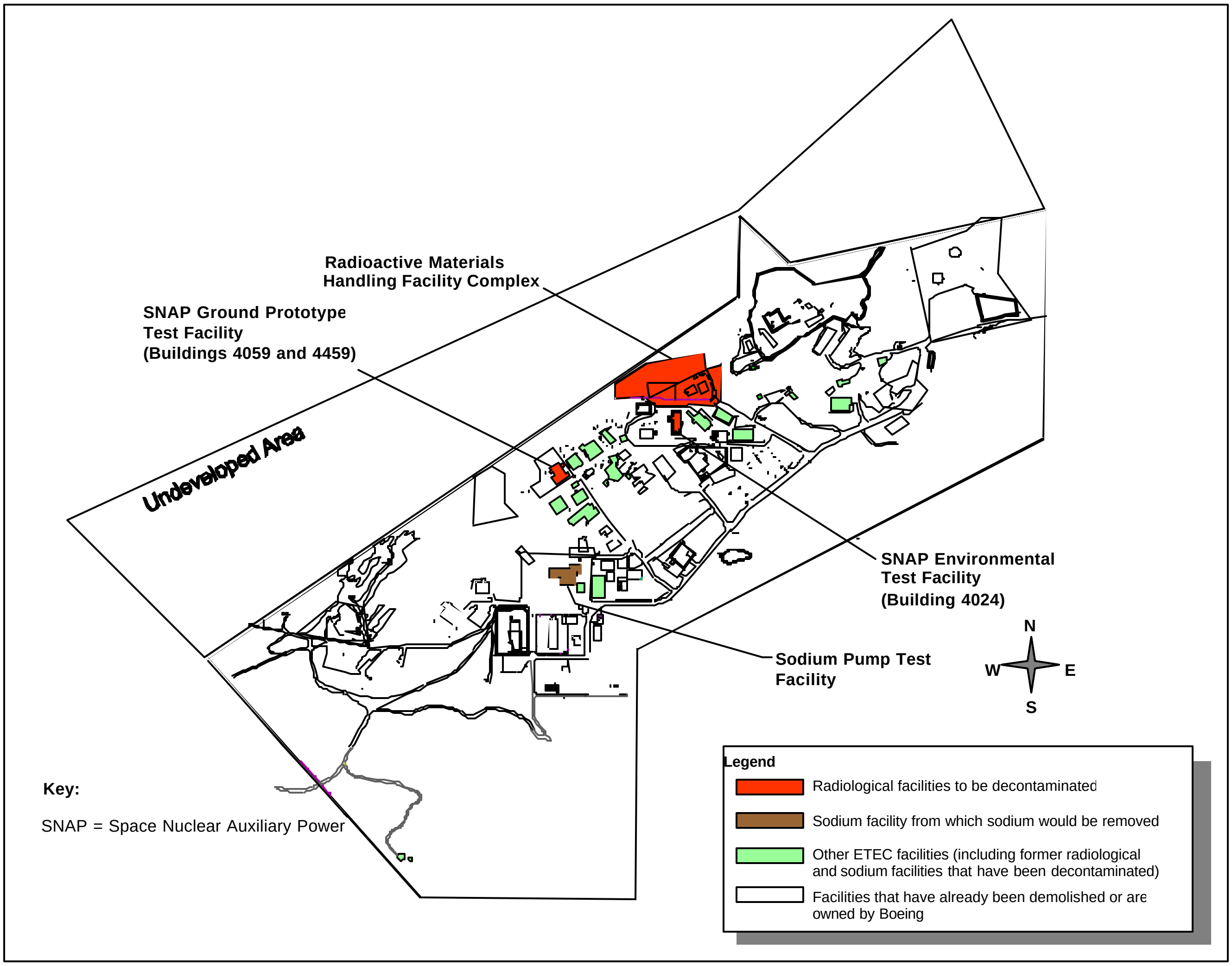

Figure 2-1. ETEC Radiological, Sodium, and Other Uncontaminated or Decontaminated Facilities

Radioactive Waste Types at ETEC

Activities at ETEC have resulted in the generation of three types of radioactive waste: low-level radioactive waste (LLW), mixed low-level waste (MLLW), and transuranic (TRU) waste. *The primary radionuclide of concern in soils is cesium*^{137}.

LLW includes all radioactive waste that is not classified as high-level radioactive waste, spent nuclear fuel, TRU waste, uranium and thorium mill tailings, or waste processed from ore. Most LLW consists of relatively large amounts of waste materials contaminated with small amounts of radionuclides, such as contaminated equipment, protective clothing, paper, rags, packing material, and soil. Most LLW contains short-lived radionuclides and generally can be handled without additional shielding or remote handling equipment.

MLLW is LLW that also contains hazardous components regulated under RCRA. MLLW results from a variety of activities, including the processing of nuclear materials used in energy research and development.

TRU waste is waste that contains alpha particle-emitting radionuclides with atomic numbers greater than uranium (92) and half-lives greater than 20 years in concentrations greater than 100 nanocuries per gram of waste. Some TRU waste also contains hazardous components regulated under RCRA, making it a mixed waste. In accordance with earlier DOE decisions, TRU waste will be disposed of at the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico. All TRU waste generated at

The RMHF is in active use. Operated safely since its initial use, the RMHF was designed and constructed to withstand naturally occurring hazards, including wind, earthquakes, landslides, and rainwater flooding. Adequate systems and controls are in place to minimize direct radiation exposure to personnel and the release of radioactive material into the environment. All potential hazards have been identified and engineering controls have been incorporated into the operation of the facility to ensure that safe operation is maintained at all times. Design safety features include security and radiation controls, evacuation routes, shielding provisions, ventilation and filtration, site water runoff control, alarm instrumentation, and fire protection. Ventilation from work areas in the RMHF is exhausted through high efficiency particulate air filters and released from a stack. Emissions from this exhaust stack are monitored and reported.

2.3.1.2 Building 4059

Building 4059, the Systems for Nuclear Auxiliary Power Ground Prototype Test Facility, was built in 1962-1963 for development testing of space nuclear auxiliary power reactors. It has one reactor vault in the basement (another vault in the basement did not house a reactor). Testing of the reactor was conducted in 1968-1969. The reactor vault was made radioactive by neutron activation during the reactor tests. At the end of the test operations, the reactor core and control system were removed, sent to an onsite examination facility for inspection, and then shipped offsite for disposal. To make a portion of the facility available for other use, decontamination was conducted according to DOE order 5400.5 surface contamination requirements (leaving a residual dose of less than one millirem per year). In 1999, the above-grade portion of the building and the underground, nonactivated portions of the basement were decontaminated and surveyed for release for unrestricted use. Building 4459 (a storage building) is within the fence line boundary of Building 4059.

2.3.1.3 Building 4024

Building 4024, the Systems for Nuclear Auxiliary Power Environmental Test Facility, contained two reactors, which were operated in two different vaults. Criticality tests were also conducted in this facility. As in Building 4059, the reactor vaults were made radioactive by neutron activation during the reactor tests. The reactors and associated equipment have all been removed and disposed of as radioactive waste. Some activated concrete shielding and reinforcing steel rods remain in the vaults.

2.3.2 Sodium Pump Test Facility (Building 4462)

The Sodium Pump Test Facility (SPTF) has two circulating sodium loops with transient capability and was used to test large sodium pumps, valves, and flow meters. It currently contains approximately 197,000 liters (52,000 gallons) of liquid sodium.[3] The residual sodium will be recycled.

> **Sodium**
>
> Metallic sodium is an excellent heat transfer medium and, for that reason, has been used as a coolant in nuclear reactors. It is not radioactive. Sodium does react vigorously with water, steam, oxygen, carbon dioxide, and several other common substances. The initial and secondary reactions may be violent. Sodium can burn spontaneously in air, releasing caustic fumes.

Activities at the SPTF have been classified as low-hazard because they present minor onsite and negligible offsite impacts to people or the environment. The facility was designed in accordance with applicable codes, and the Rocketdyne system of procedures applies to activities undertaken in the facility. These procedures include environment, safety, and health procedures, which ensure compliance with applicable federal, state, and local rules and regulations. Training of personnel and performance of operations in accordance with the procedures reduce the potential for accidents during operations.

Other sodium facilities at ETEC included the Liquid Metal Development Loops, Sodium Components Test Laboratory, Sodium Component Test Installation Complex, and Former Sodium Disposal Facility. The sodium has been removed from all of these facilities, and they have either been demolished or are proposed for demolition. Because they no longer contain any sodium, the former sodium facilities that have not been demolished but that are proposed for demolition are included in the discussion of other DOE support facilities (*see* Section 2.3.3).

2.3.3 Other DOE Support Facilities

Other facilities were constructed at ETEC to support DOE programs there. The structures include:

- Office buildings
- Electrical substations
- Storage buildings
- Emergency generator shelters

[3] At the time the analysis was originally conducted, the SPTF contained 197,000 liters (52,000 gallons) of liquid sodium. DOE, through its onsite contractor, has since removed all but 4,550 liters (1,200 gallons) as part of its ongoing cleanup activities at the site. Removal of the remaining volume of sodium would require 4 shipments, rather than the 11 shipments analyzed. Because the volume of sodium to be removed and the number of shipments required are substantially less than were analyzed, the environmental impacts that could occur as a result of removing and transporting this material would be correspondingly less than those noted in this document (see Sections 4.5 and 4.11). In addition, this document analyzes the removal and transportation of solid sodium, a chemical that is highly reactive with water. The remaining 4,550 liters (1,200 gallons) of sodium would be converted into liquid sodium hydroxide (lye), which is far less hazardous than solid sodium.

- Time card buildings
- Fuel oil storage tanks and piping systems
- Foundations
- Vaults and berms
- Former sodium facilities from which all sodium has been removed

Most of these facilities were not in radiological areas and have been demolished. Currently, approximately 50 uncontaminated support facilities are still present at the ETEC site (Table 2-1).[4] These facilities include the sodium facilities from which the sodium has already been removed and two former radiological facilities that have been released by DOE (with the concurrence of the DHS) but not yet demolished. Although these facilities do not contain radiological contamination or sodium, some do contain hazardous materials that are typical of those found in comparable commercial or industrial facilities, such as asbestos and lead-based paint.

Two of the support facilities (Buildings 4133 and 4029) make up the Hazardous Waste Management Facility (HWMF). These buildings were used for more than 20 years to convert waste metallic sodium into sodium hydroxide. Treatment and storage of waste sodium was authorized under a RCRA permit. Operations ended at the HWMF in 1998, and the facility is now in the process of closure.

Building 4029 was also used as a radiation instrument calibration facility from 1959 to 1974. In 1964, a below-grade storage tube became contaminated when a radium source was dropped into the tube. All radioactive sources were removed in 1974 and a radiation survey was performed that showed that the building was free of radiological contamination except for the interior of the radium storage well. The storage tube was removed in 1988. The building was used from 1974 to 1998 to store waste metallic sodium before treatment at Building 4133. Radioactive wastes were not treated at the HWMF.

Rocketdyne performed a radiological survey of Building 4029 in 1990 (Rocketdyne 1990). ORISE surveyed Building 4029 in 1992 (ORISE 1993), and the DHS Radiologic Health Branch surveyed the building in 1994 (DHS 1995). The building was released for unrestricted use in 1997. In 2000, EPA Region 9 performed an additional facility survey. The EPA radiological survey report has not yet been published.

The HWMF, including Building 4029, is now considered a sodium-related building relative to the closure of ETEC. The California Department of Toxic Substances Control is the lead agency for the HWMF closure. In accordance with an approved closure plan, the buildings will be demolished and a subsurface investigation initiated. Remediation will be performed as needed.

[4] Seven of the 50 support facilities were sodium facilities (Buildings 4354, 4355, 4356, 4357, 4358, 4756, and 4805) and, since the analysis was originally conducted, have been demolished as part of the ongoing cleanup activities at the site. Thus, there are now 43 support facilities that would be demolished. Because the volume of building debris is somewhat less than the volume originally analyzed, the environmental impacts that could occur as a result of transporting the debris material would be somewhat less than is noted in this document (see Section 4.11).

Table 2-1. Other Support Facilities at ETEC

Building	Building Name/Description
4012	X-Ray Facility / Storage
4013	Seismic Test Facility
4014	Storage Facility
4019	Equipment Storage and Computer Center
4027	Former Weld Shop
4029	Sodium/Hazardous Waste Storage
4032	Liquid Metal Development Loops 1 Lab
4038	ETEC Headquarters/Office Building.
4039	Office Building
4042	Liquid Metal Fast Breeder Reactor Development Testing
4057	Liquid Metal Development Loops 2 Lab
4133	Hazardous Waste Treatment Facility
4228	Power Pak
4334	Kalina Control Room
4335	Kalina Turbine Generator Bldg
4354	Control Element Test Structure
4355	Sodium Components Test Installation Complex Control Center/Offices
4356	Sodium Component Test Installation
4357	Sodium Component Test Installation Storage
4358	Sodium Component Test Installation Support Building
4457	(Foundation and Pit only)
4459	ETEC Storage
4461	SPTF Motor Generator Building
4463	Component Handling and Cleaning Facility
4473	Hydraulic Test Facility
4573	Parking Lot
4626	Warehouse
4641	Warehouse
4663	(Foundation only)
4683	Electrical Substation for Building 4143
4487	Office Building
4710	Sodium Component Test Installation Power Pak Cooling Tower
4713	Electrical Substation for Buildings 4012 & 4013
4719	Electrical Substation for Building 4019
4725	Electrical Substation for Buildings 4024 & 4025
4727	Electrical Substation for Buildings 4027, 4032, 4036
4742	Electrical Substation for Buildings 4023 & 4042
4756	Electrical Substation for Building 4355
4757	Electrical Substation for Buildings 4038 & 4057
4759	Electrical Substation for Building 4059
4760	Electrical Substation for Building 4462
4763	Electrical Substation near Building 4487
4780	Electrical Substation for Building 4463
4805	Timeclock Shack by Sodium Component Test Installation Building 4026
4863	Hydraulic Test Facility
4883	Electrical Substation at Building 4726 Substation
	Electrical Substation for Buildings 4030 and 4041
	Electrical Substation for Building 4228 Power In
	Electrical Substation for Building 4228 Power Out
	Electrical Substation near Building 4015

2.4 WASTE MANAGEMENT ACTIVITIES

Small amounts of LLW continue to be generated each year at ETEC as a result of ongoing site closure activities (approximately 50 cubic meters [1,765 cubic feet] in fiscal year 2001). MLLW is not routinely generated (5 cubic meters [176 cubic feet] of MLLW were generated in fiscal year 2001). TRU waste is no longer generated at the ETEC site.

Currently, DOE sends LLW generated at ETEC to DOE disposal sites (the Nevada Test Site near Las Vegas, Nevada, and the Hanford Site in Richland, Washington), or Envirocare, a permitted commercial radioactive disposal facility in Clive, Utah, for disposal in accordance with an earlier DOE decision made pursuant to the *Environmental Assessment of Off-Site Transportation of Low-Level Waste from Four California Sites* (LLW EA) (DOE 1997c) and associated finding of no significant impact. DOE sends most MLLW generated at ETEC to Envirocare.

Radioactive Waste Transportation Analysis

Additional volumes of LLW would be generated as a result of Alternatives 1 and 2; very small amounts of MLLW could also be generated. The shipment of LLW from ETEC to Nevada Test Site or Hanford Site was addressed in DOE's earlier LLW EA. The shipment of MLLW from ETEC to either of these sites was addressed in DOE's Waste Management Programmatic Environmental Impact Statement (DOE 1997a). The results of these analyses are incorporated by reference and the potential impacts of offsite transportation of LLW and MLLW will not be addressed in this EA.

No TRU waste is expected to be generated under any of the alternatives. The shipment of TRU waste to WIPP was analyzed in the WIPP SEIS-II (DOE 1997b) and the results of that analysis are incorporated by reference.

In 2002, DOE sent all ETEC TRU waste (approximately 11 cubic meters [388 cubic feet]) to Hanford for storage (prior to shipment, the waste was reduced in volume such that approximately 9 cubic meters was shipped to Hanford). The ETEC TRU waste will eventually be shipped from Hanford to the WIPP near Carlsbad, New Mexico for disposal, in accordance with an earlier DOE Record of Decision (63 Fed. Reg. 3624 (1998)) (DOE 1998a) made pursuant to the *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement* (WIPP SEIS-II) (DOE 1997b).

Small amounts of hazardous waste are generated (1 cubic meter [35 cubic feet] in fiscal year 2001) and disposed of in commercial, licensed hazardous waste disposal facilities in accordance with RCRA and an earlier DOE Record of Decision (63 Fed. Reg. 41810 (1998)) (DOE 1998b) made pursuant to the *Waste Management Programmatic Environmental Impact Statement* (DOE 1997a). Nonhazardous debris waste is also generated at ETEC (50 cubic meters [1,766 cubic feet] in fiscal year 2001). This type of debris includes asphalt, concrete, and building materials. Debris waste is disposed of at a local municipal landfill.

In July 2000, the Secretary of Energy suspended the unrestricted release for recycling of all metals from radiological areas within DOE facilities. This suspension remains in effect pending the outcome of an environmental impact statement on the unrestricted release of such materials from DOE sites. A notice of intent to prepare an environmental impact statement on DOE policy alternatives for the disposition of radioactively contaminated scrap metals was issued on July 12, 2001 (66 Fed. Reg. 36562 (2001)).

2.5 CURRENT STATUS OF THE SITE

The current status of ETEC is described fully in the *Site Environmental Report for Calendar Year 2000* (DOE 2001b). In general, ongoing environmental monitoring at the site demonstrates that the SSFL does not impose any significant radiological impact on the health and safety of the general public. All significant potential pathways are monitored, including airborne, direct exposure, groundwater, surface water, waste disposal, and recycling pathways. This monitoring confirms that there has been no offsite migration of chemical or radiological contamination. Results of these monitoring activities are contained in Chapter 4 of this EA and in the 2000 Site Environmental Report. The 2001 Site Environmental Report was published in September 2002 and mirrors the conclusions of the 2000 Site Environmental Report.

Currently, the risk level at the site is far below the 15-millirem per year standard, and in fact has been calculated to be 2×10^{-6} (0.09 millirem per year) for residential use. This risk assessment is based on a 1995 survey and soil sampling of previously remediated and unaffected areas of the site and was derived by taking the weighted average concentrations detected (2.4 picocuries per gram of cesium-137) and assuming that this concentration was uniform through out the site. Implementation of the ALARA process ensures that the actual cleanup is substantially below the 15-millirem per year standard. This was demonstrated by post-remedial sampling from the Former Sodium Disposal Facility and Former Hot Lab Facility where the final risk level was 0.014 millirem per year and 0.24 millirem per year, respectively.

Since 1988, DOE-funded activities have focused on decontamination and decommissioning of the ETEC facilities and offsite disposal of waste. Three facilities still contain residual radiological contamination and/or activation. Only one sodium facility remains.

The SSFL became subject to the RCRA corrective action process in 1989. EPA prepared the preliminary assessment report and conducted the visual site inspection portions of the RCRA facility assessment. The California Department of Toxic Substances Control has RCRA authorization and has become the lead agency in implementing the corrective action process for the SSFL. Currently, the SSFL RCRA corrective action program is at the RCRA Facility Investigation stage.

Soil contamination. Remediation of hazardous chemical contamination in soil at Area IV will be undertaken in accordance with RCRA. Based on an approved corrective measures study, which follows the completion of the RCRA Facility Investigation, Rocketdyne will prepare a corrective measures implementation plan that details the remediation requirements that will be necessary to address the hazardous chemical contamination in Area IV soil.

Groundwater contamination. An extensive groundwater remediation program is ongoing at the SSFL, including Area IV and ETEC. The major groundwater contaminant in Area IV is trichloroethylene (TCE). Interim measures have been implemented to pump and treat areas of known groundwater contamination. In Area IV, contaminated groundwater is pumped from a series of wells and treated using a granulated activated charcoal filtration system. Groundwater is monitored, sampled, and analyzed regularly. While the pump-and-treat activities are being performed on an interim basis, it is expected that this type of activity may continue under the RCRA corrective measures implementation plan.

Surface water contamination. Surface water is discharged regularly under a NPDES permit administered by the Regional Water Quality Control Board. The only contaminant of concern previously detected in surface water is mercury in sediment that can be mobilized during high flow. Small weirs and settling ponds are in place to prevent the transport of mercury offsite. Surface water and institutional controls to restrict access to contamination at levels of concern will remain in place until monitoring indicates that additional releases of mercury at levels greater than the NPDES permit limit are no longer possible.

All remediation of soil, groundwater, and surface water chemical contamination will be performed pursuant to the RCRA process under the jurisdiction of the California Department of Toxic Substances Control. Those activities are not the subject of this EA.

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 is proposing to clean up the remaining ETEC facilities using the existing site-specific cleanup standard of 15mrem/yr. (plus DOE's As Low As Reasonably Achievable – ALARA-principle) for decontamination of radiological facilities and surrounding soils (**Alternative 1**). An annual 15-millirem additional radiation dose to the maximally exposed individual (assumed to be an individual living in a residential setting on Area IV) from all exposure pathways (air, soil, groundwater) equates to an additional theoretical lifetime cancer risk of no more than 3×10^{-4} (3 in 10,000). 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.

However, actual exposures generally will be much lower as a result of the application of the "as low as reasonably achievable" (ALARA) principle (*see* additional information in Chapter 3 and Appendix G). Based on post-remediation verification sampling previous cleanups have generally resulted in a $2x10^{-6}$ level of residual risk. DOE would decontaminate, decommission, and demolish the remaining radiological facilities. DOE would also decommission and demolish the one remaining sodium facility and all of the remaining uncontaminated support buildings for which it is responsible. The ongoing RCRA corrective action program, including groundwater treatment (interim measures), would continue. Other environmental impacts would include 2.5×10^{-3} fatalities as a result of LLW shipments and 6.0×10^{-3} fatalities as a result of emission exhaust from all shipments. 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.

> **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 **Alternative 2**, DOE would clean up the ETEC site using a 0.05-millirem standard. A 0.05 mrem exposure would result in an additional theoretical lifetime cancer risk of no more than 1×10^{-6} to the maximally exposed individual over 40 years. Additional environmental impacts of this alternative include 1.4 traffic fatalities and increased release of particulates. As under Alternative 1, DOE would also decommission and demolish the remaining sodium facilities and all of the remaining uncontaminated support buildings for which it is responsible. Ongoing groundwater treatment (interim measures) and the SSFL site-wide RCRA corrective action would continue. The only difference between Alternative 1 and Alternative 2 is the volume of soil that would need to be excavated in order to meet the annual dose rate. 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.

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 initially considered other alternatives that were screened out because they were not considered to be reasonable. 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 chose to eliminate them from further consideration are discussed 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 THE 15 MILLIREM 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;
- Remediation of residual soil contamination using an annual 15-millirem additional radiation dose to the maximally exposed individual (assumed to be an individual living in a residential setting on Area IV) from all exposure pathways (air, soil, groundwater).
- Sodium removal from, and demolition of, the SPTF;
- Demolition of all remaining uncontaminated DOE support facilities; and
- A final independent survey, using MARSSIM protocols, of Area IV to verify that the site has been cleaned up to the remediation goal.

Implementation of Alternative 1 is expected to 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	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 (Rocketdyne 1996), 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 (internal Boeing data) (*see* Appendix E for a discussion of the soil sampling data). 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 and Appendix E). 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 15-millirem annual dose ETEC 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 15-millirem 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 Systems for Nuclear Auxiliary Power Ground Prototype Test Facility (Buildings 4059 and 4459), and the Systems for Nuclear Auxiliary Power Environmental Test Facility (Building 4024). Building decontamination and decommissioning is conducted in accordance with DOE Order 5400.5 (DOE 1990).

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 make up the RMHF complex, decontaminate them as necessary, resurvey the buildings (with verification by ORISE and the California DHS), 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 conducting initial radiation surveys, installing protective equipment (airlocks, tenting, shielding, temporary ventilation systems), removing contaminated materials and equipment, decontaminating external services, conducting final and verification surveys, and packaging waste for 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 in accordance with all applicable requirements, including the Toxic Substances Control Act and the Ventura County Air Pollution Control District's asbestos management rules (Ventura County 1992).

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.

> **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*, which is similar to the NRC policy. *See* Appendix G for additional information regarding the implementation of the ALARA process at ETEC.

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 are projected for excavation from around the RMHF with disposal 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.[5]

As discussed previously, DOE utilizes the ALARA principle (see box above) to minimize radiation doses from its activities, including cleanup activities (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 (in the case of alternative 1, below 15 millirem per year).[6] However, for the purpose of this EA, DOE did not factor in the expected reduction in exposure or risk in its analysis of the alternatives. Appendix G provides additional detail regarding how ALARA is used to achieve lower post-remediation levels below regulatory cleanup goals.

3.2.1.2 Building 4059

This building was used for development testing of Systems for 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 Systems for 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 California DHS, EPA, and the ORISE) completed in 1999 (Rocketdyne 1999c; ORISE 2000).

Decontamination and Demolition

All equipment, piping, and tanks in Building 4059 have been removed and surface decontamination, to the standards of DOE Order 5400.5 (leaving a residual dose of less than one millirem), has been completed. The building may contain hazardous materials such as lead-based paint, asbestos insulation,

[5] 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 [Rocketdyne 1999b]).

[6] Post remediation surveys at ETEC have demonstrated a residual risk of less than 2×10^{-5}. *See* Appendix G.

light fixture ballasts containing PCBs, solvents, oils, and greases. These would be removed and recycled or disposed of as hazardous waste in accordance with all applicable requirements, including the Toxic Substances Control Act and the Ventura County Air Pollution Control District's asbestos management rules (Ventura County 1992).

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 building demolition and debris removal, the remaining soil would be sampled. If any soil exceeded the 15-millirem annual exposure ETEC standard, it would be excavated using the ALARA approach, and disposed of as LLW at an appropriate offsite disposal facility. However, based on initial surface soil sampling data, DOE does not expect that soil 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 California DHS and the ORISE, the area would be backfilled with uncontaminated 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 Systems for 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

Remediation of Building 4024 is planned for the near future. 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 in accordance with all applicable requirements, including the Toxic Substances Control Act and the Ventura County Air Pollution Control District's asbestos management rules (Ventura County 1992).

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 building demolition and debris removal, the remaining soil would be sampled. If any soil exceeded the 15-millirem annual exposure 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 California DHS and the ORISE, the area would be backfilled with uncontaminated 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 (Rocketdyne 1998). As with the closure of other sodium buildings, the entire SPTF sodium system and all residual material contained within that system would be classified and managed as “excluded recyclable material” under the California Health and Safety Code.

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 (Peterson 1999). 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 in accordance with all applicable requirements, including the Toxic Substances Control Act and the Ventura County Air Pollution Control District’s asbestos management rules (Ventura County 1992). 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. Because 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 DHS) but not yet demolished (*see* Appendix E for a table showing the status of all ETEC radiological facilities). 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 in accordance with all applicable requirements, including the Toxic Substances Control Act and the Ventura County Air Pollution Control District's asbestos management rules (Ventura County 1992). 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. 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. 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
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 uncontaminated soil from the onsite borrow area to the RMHF.

3.3 ALTERNATIVE 2: CLEANUP AND CLOSURE USING A 0.05 MILLIREM STANDARD

Implementation of Alternative 2 would involve the same actions described that were previously discussed under Alternative 1. However, under Alternative 2, a 0.05-millirem cleanup standard would be used to remediate soil. A 0.05 mrem exposure would result in an additional theoretical lifetime cancer risk of no more than 1×10^{-6} to the maximally exposed individual over 40 years. Additional environmental impacts of this alternative include 1.4 traffic fatalities and increased release of particulates. 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 this alternative would require significantly more soil to be excavated, including around Building 4024, and shipped offsite than would be required under Alternative 1. Implementation of this alternative would require additional soil remediation at the former ETEC radiological facilities on Area IV that were previously that were previously remediated to the 15-millirem standard (Alternative 1).

Under this alternative, 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 a 0.05-millirem annual dose. 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 soils 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**[7]
Building Decontamination	2,000
Soil Remediation (0.05 millirem -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.

The volume of soil that would need to be remediated in the implementation of Alternative 2 was derived using the same information and assumptions used to evaluate Alternative 1. Based on this dataset, DOE calculated that soil remediation would be required not only for the RMHF, but also for Building 4024 and the remainder of Area IV, including previously remediated areas. 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 0.05-millirem annual exposure goal, approximately 368,000 cubic meters (13 million cubic feet) of soil would need to be excavated.

After a verification survey confirmed that the remediation goal was met, the area would be backfilled with uncontaminated 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 additional soil shipments, 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 uncontaminated soil available from the onsite borrow area[8], 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 uncontaminated soil to the site.

[7] Most of this soil would meet DOE, DHS, NRC, and EPA cleanup standards and thus would not meet the definition of LLW. Typically, this soil would be disposed of in a municipal solid waste landfill (Class III). To address public concerns, DOE would dispose of this material at a DOE-approved LLW disposal site.

[8] 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 an offsite location.

Table 3-4. Offsite Shipments Under Alternative 2

Waste Type	Number of Truck Shipments
LLW	30,000[a]
MLLW	20
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 on Area IV. 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). 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 SCREENED FROM DETAILED EVALUATION

The following alternatives were initially considered but were eliminated from further study because of technical or jurisdictional considerations. The alternatives analyzed and those eliminated from further study are shown in Table 3-5.

3.5.1 Dispose of All Waste as LLW

Under this alternative, DOE would dispose of all radiologically contaminated buildings as radioactive waste.

DOE screened this alternative from detailed evaluation primarily for reasons of impracticality. Even if all generated waste were assumed to be radiologically contaminated, waste streams sent to a 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 were 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 materia ls 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. Accordingly, this alternative was eliminated from further study.

3.5.2 Clean Up to Industrial Standards

The site is currently an industrial site and is expected to remain so for the immediate future. 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 an accepted level of the typical risk is exceeded. The consideration of the cleanup to industrial standards would not be appropriate where the land may be used for a non-industrial purpose at some point in the future.

Cleanup of remaining contamination to residential levels would ensure that industrial receptors would also be protected. Since the land owner has not determined future plans for the site, cleaning up the site to the industrial standards was eliminated from further study.

Table 3-5. Evaluation and Screening of Alternatives

Alternative	Major Components	Effectiveness	Implementability	Cost	Retained for Detailed Evaluation
1	No Further Action	No additional protection provided.	Straightforward. Most controls already in place. Would require final land-use change to industrial.	Low	Yes (Required as baseline)
2.	Cleanup and closure to 15 millirem plus ALARA - excavation - disposal off-site - D&D of radiological facilities	Protects long-term public health and the environment for long term. Minimizes short-term impact on environment and worker health and safety.	Technically straightforward. Implementability has been demonstrated	Medium	Yes
3	Cleanup and closure to 0.05 millirem - excavation - disposal off-site - D&D of radiological facilities	Protects long-term public health and the environment for long term. Short-term impact on environment and worker health and safety is a concern since significantly greater volumes will be excavated.	Technically complex since excavation will be to bedrock in several places. Volume is sufficiently large that existing storage and transportation capacity may be exceeded. Required transportation for off-site disposal may also exceed capacity of existing access roads.	Very High	Yes
4	Cleanup and Closure to 15 millirem plus ALARA, - Treat all wastes as LLW.	Protects long-term public health and the environment for long term. Minimizes short-term impact on environment and worker health and safety.	Technically straightforward, but inconsistent with existing regulations.	Very High	No
5	Cleanup to Industrial Standards	Minimal additional protection provided.	Straightforward. Most controls already in place. Inconsistent with previous adjacent cleanup actions. Would also require change in planned land use.	Low	No
6	Cleanup to background levels	Protects long-term public health and the environment for long term. Most significant negative impact on short-term effectiveness on environment and worker health and safety since significantly greater volumes will be excavated.	Technically complex since excavation will be to bedrock in several places. Volume is sufficiently large that existing storage and transportation capacity may be exceeded. Required transportation for off-site disposal may also exceed capacity of existing access roads.	Very High	No

3.5.3 Clean Up to Background Levels

Under this alternative, DOE would have removed any trace of detectable contamination resulting from operations at ETEC. This alternative was excluded from detailed evaluation primarily due to impracticality. 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, which itself would contain naturally occurring radionuclides. 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.

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 exposures were as low as reasonably achievable (ALARA) and not higher than a 15-millirem annual limit. Under Alternative 2, DOE would conduct soil remediation activities until exposures were not higher than a 0.05 millirem annual limit.

Under both alternatives, 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 lower cleanup level in Alternative 2 would result in approximately 70 times more soil being excavated under Alternative 2 than would be in Alternative 1 (404,850 cubic meters vs. 5,500 cubic meters respectively). The impacts associated with excavation and disposal are summarized below.

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.

When compared with Alternative 1, the implementation of Alternative 2 would require a substantially higher number of transportation shipments (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). The only difference between Alternative 1 and Alternative 2 is the volume of soil that would need to be excavated in order to meet the annual dose rate. This additional soil remediation and resulting transportation under Alternative 2 is likely to result in increased worker and public fatalities, as compared to Alternative 1. Other environmental impacts would include 1.4 fatalities as a result of shipments and 0.23 fatalities as a result of emission exhaust from all shipments. The completion of activities described in Alternative 2 is expected to produce 744 tons of additional criteria air pollutants and particulate matter over Alternate 1 (see Table 3-6).

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 for 40 years following remediation to the 15-millirem annual dose ETEC site-specific 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 for 40 years following remediation to the 0.05-millirem dose standard would be 0.0005 (5×10^{-4}) as a result of residual contamination. The individual lifetime risk of death from cancer from all causes is approximately 0.23 (1998 data) (CDC 2000). Thus, the cumulative individual risk of incurring cancer from all causes plus the maximum theoretical 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. See Appendix G for more information on risk.

Table 3-6 summarizes the impacts that could occur for the alternatives analyzed.

Table 3-6. Summary of Impacts

Resource	Unit of Measure	Alternative 1 15-millirem annual dose (5 years)[a] *Preferred Alternative*	Alternative 2 0.05-millirem annual dose (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	Tons	39.8 tons of air pollutants released as a result of soil excavation and transportation	756.4 tons of air pollutants released as a result of soil excavation and transportation	No criteria air pollutants released
Particulate matter	Tons	2.0 tons released as a result of soil excavation and transportation	29.5 tons released as a result of soil excavation and transportation	No releases
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 3-6. Summary of Impacts (cont)

Resource	Unit of Measure	Alternative 1 (5 years)[a] *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	0.0005	0.85
Total cancer risk to an individual (all causes)[b]	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 3-6. Summary of Impacts (cont)

Resource	Unit of Measure	Alternative 1 (5 years) [a] *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	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
Hazardous waste generated	Cubic meters	5	5	0
Nonhazardous debris waste generated	Cubic meters	25,300	25,300	0

Table 3-6. Summary of Impacts (cont)

Resource	Unit of Measure	Alternative 1 (5 years) [a] *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
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. Although application of the ALARA process is component of this alternative, DOE has taken no credit for the expected reduction in exposure or risk in its analysis.

b. The individual lifetime cancer risk of a fatal cancer from all causes is approximately 0.23 (1998 data) (CDC 2000). 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.

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4.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter describes the resources that would be affected by implementation of the alternatives analyzed in this EA. For each resource, the EA describes the current conditions at the site and then discusses how those resources would be affected by the alternatives. The impacts of the transportation of nonhazardous solid waste and sodium (for reuse) are also addressed; however, as noted in Chapter 2, impacts that could occur as a result of transportation of radioactive and hazardous waste from ETEC to offsite disposal sites have been addressed in prior NEPA documents and will not be addressed further here (*see* Section 2.4). DOE has included a discussion of air pollutant emissions as a result of transportation in response to public comments on the Draft EA. In addition, this chapter discusses the potential cumulative impacts of the cleanup activities proposed and analyzed in this EA and other ongoing or future site activities, including the cleanup of chemical contamination under RCRA.

4.1 LAND USE

4.1.1 Current Conditions

The ETEC complex of buildings is located on approximately 364,000 square meters (90 acres) within Area IV of the SSFL. Figure 4-1 shows the SSFL arrangement.

Undeveloped land surrounds most of the SSFL site. No significant agricultural land use, including prime or unique farmland, exists within 30 kilometers (19 miles) of the site. The location of the SSFL site in relation to nearby communities is shown in Figure 4-2. The community of Santa Susana Knolls lies 5 kilometers (3 miles) to the northeast of Area IV. The Bell Canyon area begins approximately 2.3 kilometers (1.4 miles) to the southeast, and the Brandeis-Bardin Institute is adjacent to the north. The closest residential portion of Simi Valley is 2.7 kilometers (1.7 miles) northwest of Area IV. The Santa Monica Mountains National Recreation Area, Malibu Creek State Park, and Topanga Canyon State Park are within 16 kilometers (10 miles) of the center of the SSFL, as are several state beaches; the Channel Islands National Park, Los Padres National Forest, Point Mugu State Park, Leo Carrillo State Park, Will Rogers State Historical Park, and additional state beaches are within 80 kilometers (50 miles) of the center of the SSFL. There are no wild and scenic rivers on or near the SSFL.

Although currently an industrial facility, future use of the property for residential purposes is probable. DOE has no control or authority over the future use of ETEC buildings, Area IV, or the SSFL.

4.1.2 Impacts of Alternative 1 (Cleanup and Closure With the 15 Millirem Annual Dose Standard)

Implementation of Alternative 1 would not affect current land uses at the site. Cleanup of Area IV the 15 mrem standard would allow future residential use of the site. There would be no impacts to prime or unique farmland, state or national parks, or wild and scenic rivers.

4.1.3 Impacts of Alternative 2 (Cleanup and Closure Using a 0.05-Millirem Annual Dose Standard)

Implementation of Alternative 2 would not affect current land uses at the site. Cleanup of Area IV to the 0.05-millirem standard would allow future residential use of the site. There would be no impacts to prime or unique farmland, state or national parks, or wild and scenic rivers.

Subdivisions			
Owner	**Jurisdiction**	**Acres**	**Subtotals**
Rocketdyne	Rocketdyne-Area IV	289.9	
	Rocketdyne	784.8	
	Rocketdyne (Undeveloped land)	1,324.6	2,399.3
Government	NASA (former AFP 57)	409.5	
	NASA (former AFP 64)	41.7	451.2
Total Acres			2,850.5

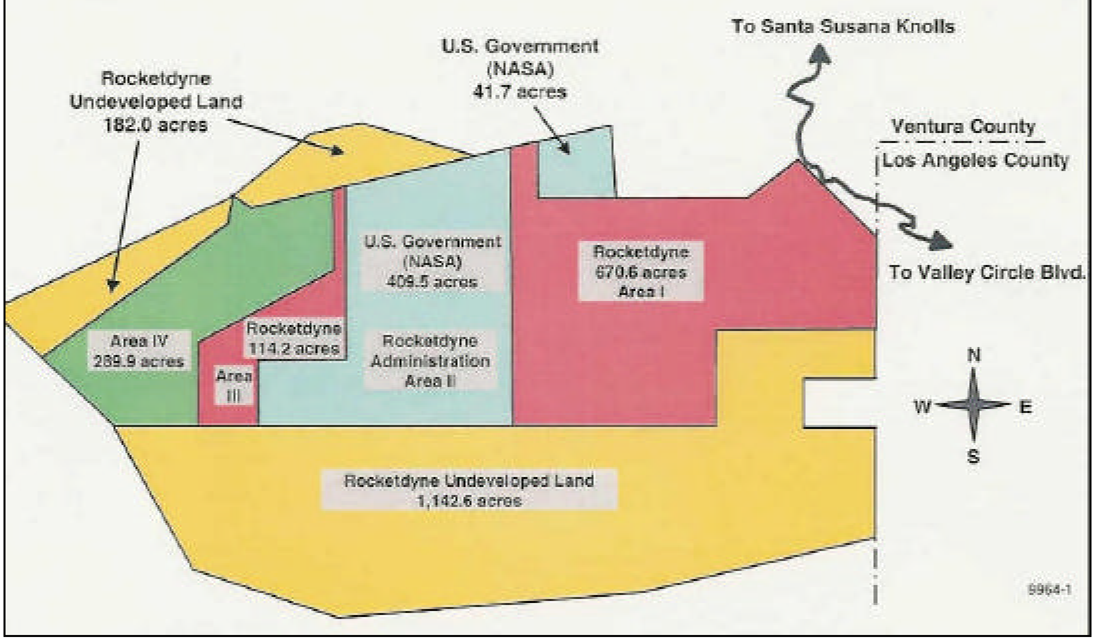

Figure 4-1. SSFL Arrangement

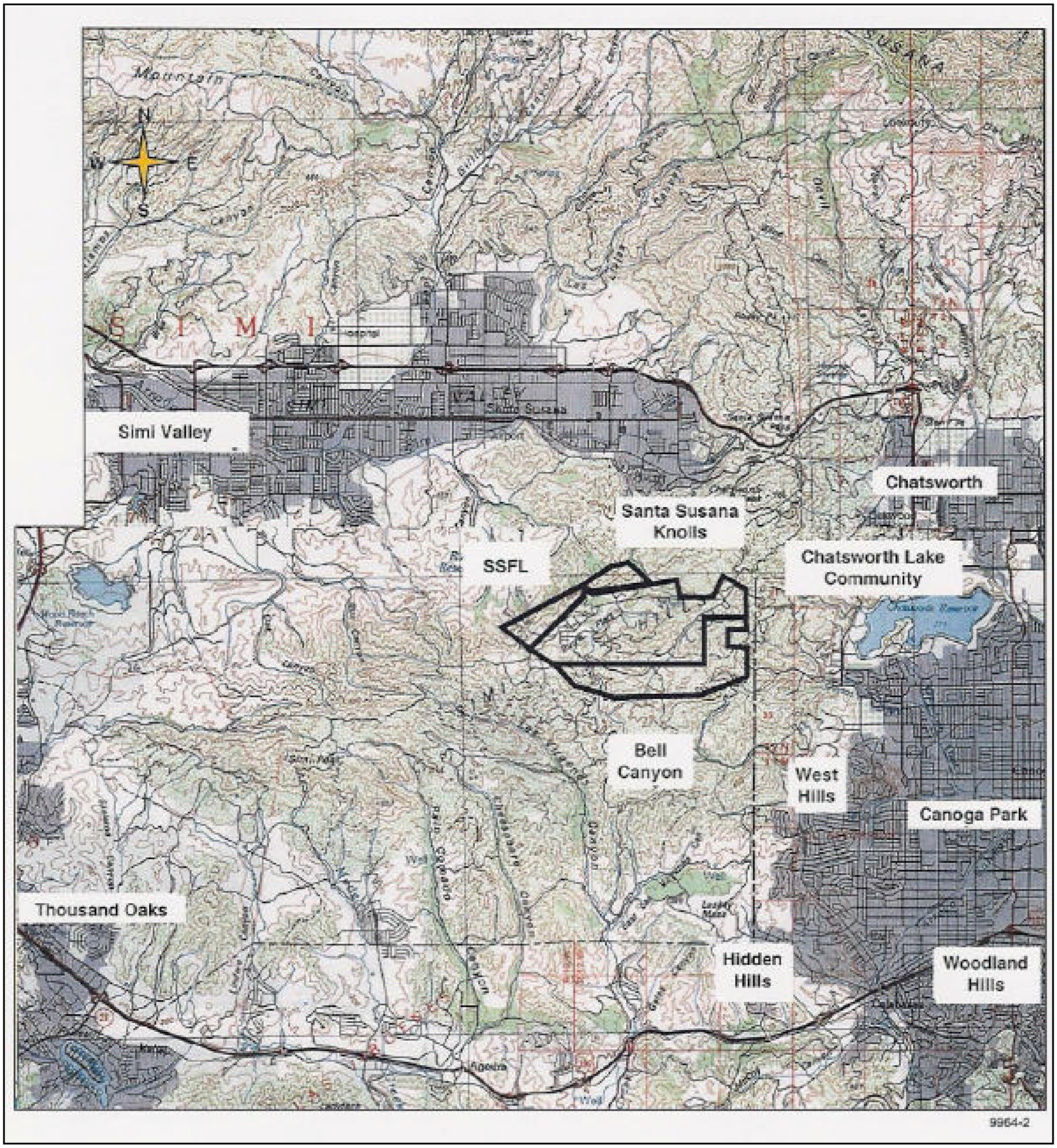

Figure 4-2. SSFL Location in Relation to Nearby Communities

4.1.4 Impacts of No Action Alternative (No Further Cleanup and Secure the Site)

Implementation of the No Action Alternative would not affect current land uses at the site. However, the site would not be available for any other purposes until such time as residual radioactive contamination fell within acceptable standards. (With the exception of the RMHF, much of the soil in Area IV is already at a theoretical risk level of zero to 1.8×10^{-6} (0.09 mrem/yr), with small regions as high as 2×10^{-5} (1 mrem/y dose). Even at the RMHF, which is yet to be remediated, soil has an average theoretical risk level of 1.5×10^{-4} (7.5 mrem/y dose) less than the 3×10^{-4} (15 mrem/y dose) standard of Alternative 1.) However, implementation of DOE's ALARA (As Low as Reasonably Achievable) principle dictates that DOE remediate the three remaining contaminated facilities.

4.2 GEOLOGY AND SOILS

4.2.1 Current Conditions

The SSFL is part of the Chatsworth Formation, which is composed of poorly to well-cemented massive sandstone with interbeds of siltstone and claystone. It is situated on rocky terrain and occupies an upland area known as Burro Flats, which sits at the crest of the Simi Hills, near their eastern end. Area IV is between 570 meters (1,880 feet) and 660 meters (2,150 feet) above sea level and is relatively flat. Its overlying soils consist of weathered bedrock and alluvium (unconsolidated sand, silt, and clay materials that have been eroded primarily from the surrounding Chatsworth and Martinez Formations). Several geologic faults traverse the site.

Potassium-40

Potassium-40 is a naturally occurring radionuclide present at the site. It is not a regulated material. Soil sampling conducted by DOE in and around ETEC has not found any significant difference between the concentration of potassium-40 in onsite and offsite samples (Boeing 2000b).

Radiological Contamination. Soil radioactivity at ETEC is due to various naturally occurring radionuclides present in the environment, radioactive fallout of dispersed nuclear weapons materials from offsite locations, and nuclear reactor and other operations in ETEC facilities. The radionuclide composition of local area surface soil has been determined to be predominantly potassium-40, natural thorium, natural uranium, and their decay progeny. Radioactivity in the soil from nuclear weapons test fallout consists primarily of strontium-90, cesium-137, and plutonium-239. In soil sampling done in 2000, only trace amounts of cesium-137 (a man-made radionuclide) were detected, in addition to naturally occurring potassium-40 and uranium and thorium decay products. The maximum observed cesium-137 concentration was 53 picocuries/gram, from one soil sample taken near the RMHF in 2000 (the highest concentration of cesium-137 in soil samples taken from other locations on Area IV in 1995 was 2.4 picocuries/gram). An individual who was exposed to the maximum observed concentration of 53 picocuries/gram level of contamination in a residential lot, to a depth of 1 meter (3.3 feet) for 40 years would experience an additional theoretical lifetime cancer risk of 1.7×10^{-3}.[10] An individual who was exposed to the maximum observed concentration of 2.4 picocuries/gram would experience an additional theoretical lifetime cancer risk of 7.2×10^{-5}. *See Appendix G for further discussion of risk from soil contamination at Area IV.*

Chemical Contamination. The RCRA Facility Investigation Program started at the SSFL in 1996 and is ongoing. The primary objectives of the program are to (1) investigate the nature and extent of chemicals in the soil and the potential threat to groundwater, and (2) evaluate the potential risk to human health and the

[10] Naturally occurring radionuclides in uncontaminated soil result in an annual exposure to individuals of between 30 and 50 millirem. This results in a lifetime theoretical fatal cancer risk of 6×10^{-4} to 1×10^{-3}.

environment and assess whether remediation is required. Soil sampling conducted for the RCRA Facility Investigation Program revealed areas on the SSFL with elevated levels of petrochemicals (diesel fuel, lubricants, oil, and grease), solvents, metals, and other chemicals. All remediation of chemical contamination on the SSFL, including ETEC, will be conducted under the RCRA process and is not analyzed in this EA.

4.2.2 Impacts of Alternative 1 (Cleanup and Closure Under 15 mrem Annual Dose Standard)

Implementation of Alternative 1 would reduce radiological contamination in the soil such that the maximally exposed individual would experience no more than an annual 15-millirem additional radiation dose from all exposure pathways (air, soil, groundwater). Alternative 1 would have no impact on the general terrain because the area would be regraded with clean soil from the onsite borrow area. Implementation of the ALARA process under Alternative 1 ensures that post-remedial doses will be much less than 15 mrem/year.

4.2.3 Impacts of Alternative 2 (Cleanup and Closure Using a 0.05-Millirem Annual Dose Standard)

Implementation of Alternative 2 would reduce radiological contamination in the soil such that the maximally exposed individual would experience no more than an annual 0.05-millirem additional radiation dose from all exposure pathways (air, soil, groundwater). Similar to Alternative 1, implementation of Alternative 2 would require excavation of soil on Area IV, but the volume of soil would be much greater. Because the area would be regraded with clean soil from off the site, implementation of Alternative 2 would have no impact on the general terrain.

4.2.4 Impacts of No Action Alternative (No Further Cleanup and Secure the Site)

Implementation of the No Action Alternative would leave existing radiological contamination in place. *See* Appendix G for a discussion of the range of theoretical risk from soil in Area IV.

4.3 AIR QUALITY

4.3.1 Current Conditions

In compliance with the Clean Air Act, 42 U.S.C. 7401 *et seq.*, the EPA has promulgated National Primary and Secondary Ambient Air Quality Standards for six air pollutants that are responsible for most air pollution (40 CFR Part 50). These are known as criteria air pollutants. They are carbon monoxide, sulfur dioxide, particulate matter, ozone, nitrogen oxide, and lead.

Air pollutant discharge limitations at the SSFL are imposed by the Ventura County Air Pollution Control District rules and regulations and a Permit to Operate, which is kept current and renewed each year by the district. ETEC does not emit lead, and all other emissions of criteria air pollutants at the SSFL are below applicable permit limits.

Further, EPA has promulgated regulations for hazardous air pollutants and has established a 10-millirem dose limit per year from airborne releases of radionuclides (40 CFR Part 61, Subpart H). The ETEC radiological monitoring program measures radioactive emissions from point sources (emission stacks). At the end of each year, the air samples for the entire year are combined and analyzed for specific radionuclides. The results are used to estimate the potential offsite dose to the maximally exposed member of the public from the air pathway. The results of the air emissions monitoring at ETEC for the last 5 years show that the annual radiation dose to the maximally exposed individual for the air pathway range from none to 0.00013 millirem. Potential health impacts from the radioactive air emissions are addressed in Section 4.5. DOE implements mitigation measures such as dust suppression, sediment controls, personnel protective equipment, monitoring, and compliance with safety and health plans to reduce radiation exposure to workers and the public through the air pathway. Table 4-1 shows the results of the air emissions monitoring at ETEC for the last 5 years. Potential health impacts from the radioactive air emissions are addressed in Section j4.5. DOE implements mitigation measures such as dust suppression, sediment controls, personnel protective equipment, monitoring, and compliance with safety and health plans to reduce radiation exposure to workers and the public through the air pathway.

Table 4-1. Results of Radioactive Air Emissions Monitoring, 1996 – 2000

Year	Annual Radiation Dose to Maximally Exposed Individual – Air Pathway (Point Sources)[a]	Annual Radiation Dose to Maximally Exposed Individual – Air Pathway (Area Sources)[b]	Average Annual Background Radiation Dose to an Individual (All Sources)	Annual Population Dose[c] – Air Pathway (Point Sources)	Annual Population Dose[c] – Air Pathway (Area Sources)	Average Annual Population Dose Resulting from Background Radiation (All Sources)
1996	4.6×10^{-6} millirem	1.3×10^{-4} millirem	300 millirem	6.4×10^{-3} person-rem	5.1×10^{-3} person-rem	3 million person-rem
1997	2.7×10^{-6} millirem	1.6×10^{-4} millirem	300 millirem	6.8×10^{-4} person-rem	6.2×10^{-3} person-rem	3 million person-rem
1998	1.3×10^{-6} millirem	2.5×10^{-3} millirem	300 millirem	2.9×10^{-4} person-rem	8.5×10^{-2} person-rem	3 million person-rem
1999	2.2×10^{-7} millirem	6.6×10^{-7} millirem	300 millirem	$4.8 \times 10\text{-}^{5}$ person-rem	4.7×10^{-5} person-rem	3 million person-rem
2000	7.7×10^{-7} millirem	None	300 millirem	2.2×10^{-4} person-rem	None	3 million person-rem

a. Point sources are monitored exhaust stacks from the Hot Laboratory (now decontaminated and demolished), Building 4024, and the RMHF. There is a 10-millirem-per-year dose limit on radionuclide air emissions from point sources. *See* 40 CFR Part 61, Subpart H.

b. Area sources at ETEC are sources of windborne resuspension of radioactively contaminated soil. These are the RMHF sump (when dry), Building 4064 Side Yard before remediation, Building 4020 yard soil before remediation, and the 17th Street Drainage Area site. The emissions from area sources cannot be measured and are estimated using conservative assumptions and a computer modeling calculation. Reporting this source is not a regulatory requirement.

c. Total dose to population within 80 kilometers (50 miles) of SSFL.

Sources: National Emission Standards for Hazardous Air Pollutants – Radionuclides Reports for 1996 through 2000 (Boeing Rocketdyne 1997-2001); 1996 Annual Site Environmental Report (DOE 1997d).

4.3.2 Impacts of Alternative 1 (Cleanup and Closure Under the 15 mrem Annual Dose Standard)

Implementation of Alternative 1 would result in increases in emissions of hydrocarbons, carbon monoxide, nitrogen oxide, and particulate matter from the operation of machinery on the site for demolition and offsite transportation of waste. These emissions would be temporary, would not exceed any permit limits for the site, and would not significantly affect air quality in the area or in the region.

Demolition and soil removal activities could also result in fugitive dust emissions. DOE would use dust suppression techniques such as spraying water to reduce fugitive dust emissions to the extent possible. In addition, land clearing, filling, grading, earth moving, or excavation activities would cease during periods of high winds to prevent excessive amounts of fugitive dust.

Table 4-2 shows the projected volume of air pollutant emissions from soil excavation and transportation of wastes and soil to authorized disposal areas under Alternative 1. The annual emissions listed in Table 4-2 are below the thresholds for all pollutants. *See* Appendix H for additional information on the air quality analysis, including a conformity review.

Table 4-2. Air Pollutant Emissions for Soil Excavation and Transportation Activities Under Alternative 1

Activity	Air Pollutants (in tons)			
	Hydrocarbons	**Carbon Monoxide**	**Nitrogen Oxide**	**Particulate Matter**
Soil Excavation				
Annual	0.38	0.78	5.4	0.38
Transportation				
Annual	0.15	0.75	0.47	0.016
Total (5 years)	0.53	1.53	5.87	0.4
Threshold Annual Emission Rates (depending on area air quality classification)	10 – 100	100	10 – 100	100

Radionuclide emissions could also increase slightly (*see* Section 4.5.2), but no higher than they have been in previous years when radiologically contaminated facilities were decontaminated and demolished. DOE would continue to implement mitigation measures such as dust suppression, sediment controls, personnel protective equipment, monitoring, and compliance with safety and health plans to reduce radiation exposure to workers and the public through the air pathway. Potential doses from the decontamination of the radiological facilities and soil under Alternative 1 are described in Section 4.5, Human Health.

4.3.3 Impacts of Alternative 2 (Cleanup and Closure Using a 0.05-Millirem Annual Dose Standard)

Implementation of Alternative 2 would also result in increases in emissions of criteria air pollutants from the operation of machinery on the site for demolition and offsite transportation of waste. These emissions would be temporary, would not exceed any permit limits for the site, and would not significantly affect air quality in the area or in the region. Emissions of criteria air pollutants from the operation of machinery would continue for 3 years longer than under Alternative 1 because of the additional soil remediation and transportation that would occur under Alternative 2. Demolition and soil removal activities could also result in fugitive dust emissions. DOE would use dust suppression techniques such as spraying water to reduce fugitive dust emissions to the extent possible. In addition, land clearing, filling, grading, earth moving, or excavation activities would cease during periods of high winds to prevent excessive amounts of fugitive dust. Because more soil would be removed under Alternative 2 than under Alternative 1, the potential for fugitive dust emissions and the level of those emissions would be greater under Alternative 2 than under Alternative 1.

Because more soil would be excavated under Alternative 2, emissions of air pollutants from the operation of machinery would be correspondingly higher. Table 4-3 shows the amount of air pollutant emissions that would occur as a result of soil excavation and transportation under Alternative 2. Compared to the completion of Alternative 1 activities, Alternative 2 will result in the production of 744.1 additional tons of priority air pollutants and particulate matter. The annual emissions listed in Table 4-3 are below the thresholds for all pollutants except for nitrogen oxide; nitrogen oxide emissions would exceed the threshold for serious (50 tons allowed per year), severe (25 tons allowed per year), and extreme (10 tons allowed per year) nonattainment areas for ozone. *See* Appendix H for additional information on the air quality analysis.

Table 4-3. Air Pollutant Emissions for Soil Excavation and Transportation Activities Under Alternative 2

Activity	Air Pollutants (in tons)			
	Hydrocarbons	**Carbon Monoxide**	**Nitrogen Oxide**	**Particulate Matter**
Soil Excavation				
Annual	2.9	7.6	52.3	3.3
Transportation				
Annual	3.5	17	11	0.37
Total (8 years)	6.4	24.6	63.3	3.67
Threshold Annual Emission Rates (depending on area air quality classification)	10 – 100	100	10 – 100	100

Alternative 2 would result in annual radionuclide emissions similar to those under Alternative 1, but the potential for emissions would continue for 3 years longer because of the additional soil remediation required. DOE would continue to implement mitigation measures such as dust suppression, sediment controls, personnel protective equipment, monitoring, and compliance with safety and health plans to reduce radiation exposure to workers and the public through the air pathway. Potential doses from the decontamination of the radiological facilities and soil under Alternative 2 are described in Section 4.5, Human Health.

4.3.4 Impacts of No Action Alternative (No Further Cleanup and Secure the Site)

Implementation of the No Action Alternative would result in continued releases of radioactive air emissions at very low levels. In 2000, the total air emissions were 7.7 x 10^{-7} millirem (*see* Table 4-1). Because no soil excavation would occur, there would be no air quality impacts as a result of the operation of machinery for this purpose.

4.4 WATER QUALITY AND WATER RESOURCES

4.4.1 Current Conditions

Water resources on the SSFL consist of (1) a shallow groundwater system that exists in the surficial alluvium at small, isolated locations, and (2) a deeper regional groundwater system in the fractured Chatsworth Formation. There are no natural surface waters on the site, although portions of the site become saturated during and immediately following the wet season in the winter months. Because of its elevation, Area IV is not within a floodplain.

Groundwater. Forty-seven wells in and around Area IV are used to monitor water levels and to monitor the condition of the groundwater (including concentrations of chemicals and/or radioactivity released by DOE operations). Past ETEC operations resulted in chemical and radiological contamination of groundwater onsite. A Groundwater Monitoring Program has been established to detect the presence of volatile organic compounds, base/neutral and acid extractable organic compounds, petroleum hydrocarbons, trace metals and common ion constituents, and radiological constituents.

The major chemical groundwater contaminant at the site is TCE. TCE is a dense liquid that does not dissolve easily in water. Though it is not very soluble, TCE can dissolve somewhat in groundwater, and even at low concentrations can be toxic if ingested over a long period of time. This solution can be transported by groundwater through the fractured Chatsworth formation sandstone.

Groundwater remediation through pumping and treating has been under way since 1994 to reduce contamination in groundwater and prevent contamination plumes from migrating beyond site boundaries. Data have also been collected to refine the understanding of groundwater movement and contaminant migration and to evaluate possible continuing releases from historically contaminated soil and sediment.

Radioactivity concentrations in groundwater at SSFL are below drinking water standards. Laboratory analyses were performed for tritium in 43 water samples from 26 groundwater-monitoring wells. Of the 43 analyses performed, seven samples from four onsite wells had tritium concentrations higher than the detection limits. The maximum value among all the results was far below the EPA and California drinking water limit. No offsite wells show the presence of tritium. The occurrence of tritium in groundwater appears to have resulted from formation of tritium in the reactor shielding in Building 4010, which has been decontaminated, released for unrestricted use, and subsequently demolished. Prior to removal, tritiated water migrated from the concrete into the surrounding soil and subsequently into the groundwater.

Surface Water. Most of Area IV slopes toward the southeast. Rainfall runoff is collected by a series of drainage channels and accumulates in an onsite retention pond beyond the Area IV boundary. Influent to the retention pond includes tertiary treated domestic sewage, cooling water from various testing operations, and treated groundwater and stormwater runoff. Water from the pond is eventually released to Bell Creek (a tributary of the Los Angeles River) under an NPDES permit issued pursuant to the Clean Water Act, 33 U.S.C. 1251 *et seq*.

Some of Area IV slopes to the northwest, and a small amount of rainfall drains toward the northwest ravines, which lead into Meier Canyon. To permit sampling of this runoff, five catch basins were installed in 1989 near the site boundary to accumulate Area IV runoff from the northwest portion of the site.

DOE routinely monitors all water outfalls. Since 1989, this monitoring has found no indication of any radiological contamination of surface water discharges, and all monitoring results have been below the drinking water supplier limits established in the NPDES permit. Mercury, antimony, copper, and cadmium have been found at levels above acceptable guidelines. DOE has taken measures such as installing sediment control structures, replacing equipment, and cleaning an outside storage area to bring the levels of these chemicals to within permitted levels. Ultimately, the releases will be controlled by the restoration of the areas that are the source of the contamination.

Wetlands. Pursuant to Section 404 of the Clean Water Act, 33 U.S.C. 1344, the U.S. Army Corps of Engineers regulates the "discharge of dredged or fill material" into "waters of the United States," which includes tidal waters, interstate waters, and all other waters that are part of a tributary system to interstate waters or to navigable "waters of the United States." In addition, the California Department of Fish and Game regulates activities within wetlands under California state law (Fish and Game Code Section 1600-1607). Approximately 157,826 square meters (39 acres) of drainages on the SSFL meet the U.S. Army Corps of Engineers definition of "waters of the United States," of which approximately 60,700 square meters (15 acres) are jurisdictional wetlands (PCR 2001). Approximately 360,167 square meters (89 acres) of drainages are streambed and associated riparian habitat identified by the California Department of Fish and Game. Any impacts to jurisdictional waters on the SSFL would require authorization from the U.S. Army Corps of Engineers or the California Department of Fish and Game.

4.4.2 Impacts of Alternative 1 (Cleanup and Closure Under the 15 mrem Annual Dose Standard)

Implementation of Alternative 1 would not affect water quality or water resources. None of the activities would result in releases of radioactively contaminated liquid effluents or any impacts to jurisdictional waters, including wetlands, on the SSFL.

4.4.3 Impacts of Alternative 2 (Cleanup and Closure Using a 0.05-Millirem Annual Dose Standard)

Implementation of Alternative 2 would not affect water quality or water resources. None of the activities would result in releases of radioactively contaminated liquid effluents or any impacts to jurisdictional waters, including wetlands, on the SSFL.

4.4.4 Impacts of No Action Alternative (No Further Cleanup and Secure the Site)

Implementation of the No Action Alternative would not affect water quality or water resources. Continuous monitoring has revealed no groundwater or surface water radiological contamination (with the exception of localized tritium onsite at levels below drinking water standards) that resulted from nuclear operations at ETEC and Area IV. Because institutional controls would be maintained onsite, no radiological releases to groundwater or surface water would be expected.

4.5 HUMAN HEALTH

4.5.1 Current Conditions

Radioactive and chemical contamination in the soil, radioactive air emissions, and radioactive and chemical contamination in water resources (as described in Sections 4.2.1, 4.3.1, and 4.4.1, above) have resulted in public and worker exposure to very low levels of radiation and hazardous chemicals. As documented in the *Site Environmental Report for Calendar Year 2000* (DOE 2001b) issued for DOE operations at ETEC, exposure of the maximally exposed member of the public to radiation from all pathways (internal and external) was estimated to be 7.7×10^{-7} millirem per year. Based on current internationally recognized risk factors, this dose results in 3.9×10^{-13} latent cancer fatality risk annually. For the population within 80 kilometers (50 miles) of the site, ETEC activities in 2000 resulted in a release of 2.2×10^{-4} person-rem. This dose results in 1.1×10^{-7} latent cancer fatalities annually in a population of approximately 10 million.

Radionuclides of Concern

The radionuclides of concern at ETEC are uranium-238, thorium-232, strontium-90, cobalt-60, cesium-137, and tritium. Other radionuclides present in soil samples taken in and around ETEC are either from naturally occurring sources or global fallout. Of the five radionuclides of concern, only cesium-137 has a maximum observed concentration exceeding 10 percent of the 15 mrem/yr. soil release criteria. If the maximum observed concentration of a radionuclide is below 10 percent of the release criteria, it is highly unlikely that this radionuclide would pose any risk to the public or the environment. For this reason, the public and worker exposure estimates are based on exposures to cesium-137, which is considered to be the primary radiological risk driver at ETEC. *See* Appendix F for additional information.

For workers, the average measured radiation exposure that an individual worker received at ETEC in 2000 was 7 millirem. This is 0.35 percent of the annual 2,000-millirem administrative control limit for radiation workers at ETEC. It also represents a probability of a latent cancer fatality to a worker of about 3 in 1 million.

Approximately 197,000 liters (52,000 gallons) of nonradioactive metallic sodium are present onsite in the SPTF. Although a hazardous material, the sodium is not a contaminant and is currently in safe storage awaiting reuse.

Human Health Effects Methodology

To estimate the *public* doses and potential human health effects resulting from the implementation of Alternatives 1 and 2, DOE averaged site air emissions data from 1996-1998 when DOE decontaminated and demolished the Hot Laboratory and remediated the radioactively contaminated soil surrounding the building. This laboratory was built in 1959 and operated until 1988. It was a 1,500-square-meter (16,000-square-foot) facility and had four large hot cells with remote manipulators and cranes. It was used to handle and examine highly radioactive items such as used reactor fuel assemblies and other test specimens. It was also used to manufacture sealed radioactive sources, do leak checks on sources, and do cutting and machining operations on radioactive cobalt-60.

DOE assumed that public exposure resulting from the decontamination, demolition, and soil remediation for the Hot Laboratory that occurred in 1996-1998 would be similar to the expected exposure for the RMHF, Building 4059, and Building 4024. To be conservative (that is, to overestimate the potential environmental impacts), DOE assumed that all three buildings would be decontaminated and demolished at the same time and that exposure to radiation from each of these facilities would be the same as for the Hot Laboratory. Therefore, DOE multiplied the average dose resulting from the decontamination, demolition, and soil remediation of the Hot Laboratory by three to conservatively estimate the impacts of decontamination, demolition, and soil remediation at the RMHF and Buildings 4059 and 4024.

To estimate *worker* doses and potential health effects, DOE averaged site worker exposure data from 1991 and 1992. These doses were the highest reported over the last 10 years.

To estimate the potential health effects of the No Action Alternative for the public and workers, DOE used the site air emissions data for 2000.

Exposure data were derived from ETEC Annual Site Environmental Reports (DOE 1997d; 2000b; 2001b); National Emission Standards for Hazardous Air Pollutants Annual Reports (Boeing Rocketdyne 1997-2001), and DOE's Radiation Exposure Monitoring System (DOE 2001c). For more information on radiation and human health, *see* Appendix C.

The major chemical groundwater contaminant at the site, TCE, can be toxic even at low concentrations. Other chemical groundwater contaminants are petrochemicals (diesel fuel, lubricants, oil, and grease), copper, and lead. Mercury, antimony, copper, and cadmium have also been found in surface water at levels slightly above permitted guidelines. The potential health risks of the chemical contamination and all remediation of chemical contamination on the SSFL are being addressed under the RCRA process.

4.5.2 Impacts of Alternative 1 (Cleanup and Closure Under the 15 mrem Annual Dose Standard)

Radiological Impacts to the Public. Implementation of Alternative 1 would result in an annual 2.8×10^{-3} millirem dose to the maximally exposed member of the public through the air pathway (no exposure would be expected through any other pathway). This exposure would result in 1.4×10^{-9} latent cancer fatality risk. The total dose to this individual over the 5-year duration of the alternative would be 1.4×10^{-2} millirem, which would result in 7.0×10^{-9} latent cancer fatality risk.

The maximum additional annual dose to the public within 80 kilometers (50 miles) of the site would be 0.11 person-rem. This would result in 5.6×10^{-5} latent cancer fatalities within this population of approximately 10 million. The total dose to the public for the 5-year duration of the alternative would be 0.56 person-rem, which would result in a maximum of 2.8×10^{-4} latent cancer fatalities within the population during that time period.

Following cleanup, a person residing on the site for 40 years would be exposed to a maximum additional total of 600 millirem, which would result in 3×10^{-4} latent cancer fatality risk over that period. A site population of 500 people would receive a total of 300 person-rem over 40 years, resulting in 0.15 latent cancer fatalities within the population residing on the site for that period of time. For comparison purposes, this population would be expected to incur approximately 3 latent cancer fatalities as a result of exposure to background radiation during this time period.

Proposition 65 Applicability to the ETEC Cleanup

In November 1986, California voters approved the "Safe Drinking Water and Toxic Enforcement Act of 1986," better known as Proposition 65. Proposition 65 requires the California Governor to publish a list of chemicals that are known to cause cancer, birth defects, or other reproductive harm. Proposition 65 prohibits releases of those chemicals into sources of drinking water, and requires that responsible entities warn consumers, employees, and the public prior to exposing them to listed chemicals at levels exceeding a "no significant risk" level. Radioactive materials are included in the Proposition 65 list as "radionuclides." To date, ETEC closure activities have not resulted in the release of materials at a level sufficient to warrant warnings to the public.

Radiological Impacts to Workers. Implementation of Alternative 1 would result in an annual 470-millirem dose to the average worker. This exposure would result in 1.9×10^{-4} latent cancer fatality risk. The total dose to this individual over the 5-year duration of the alternative would be 2,345 millirem, which would result in 9.4×10^{-4} latent cancer fatality risk.

The annual dose to the worker population at ETEC would be 10.3 person-rem. This would result in 4.1×10^{-3} latent cancer fatalities within this population. The total dose to the worker population for the duration of the alternative would be 52 person-rem, which would result in 2.1×10^{-2} latent cancer fatalities within the ETEC worker population.

Sodium Removal. Based on past experience with removal of sodium from the Sodium Component Test Installation and other former sodium facilities, removal of the nonradioactive sodium from the SPTF would not result in any human health impacts under routine operations. The impacts of a potential accident during the removal process are addressed below.

Facility Accidents. Implementation of Alternative 1 could result in industrial accidents at the three radiological facilities, the one sodium facility (SPTF), or the other uncontaminated support buildings. These accidents could consist of (1) accidents that are typical of industrial settings, or (2) accidents that involve the radioactive or sodium materials in the buildings being decontaminated and demolished.

Under Alternative 1, no worker fatalities (5.2×10^{-3} fatalities) would be expected as a result of industrial accidents.

DOE also analyzed a potential accident in the RMHF to estimate radiological impacts to members of the public and workers. In the bounding accident (the accident that would have the highest consequences), which would be a fire involving radioactive materials, the maximally exposed individual member of the public would receive a 7-millirem dose, resulting in a 3.5×10^{-6} probability of incurring a latent cancer fatality. The radiation dose to the population within 80 kilometers (50 miles) of the site would be 990 person-rem, resulting in 0.5 latent cancer fatalities within a population of 10 million people. A worker located 100 meters (330 feet) from the accident would receive a 1,700-millirem dose (1.7 rem). This would result in a 7.0 x 10^{-4} probability of incurring a latent cancer fatality. An accident involving radiological materials at Buildings 4059 and 4024 would have fewer impacts because the radiological inventory at those buildings is far less than that in the RMHF. The probability that such an accident could occur at any of the radiological facilities is low, given the existence of alarms, smoke detectors, sprinkler systems, and fire extinguishers within the facilities.

Sodium is highly reactive. Thus, an accident involving the removal of sodium from the SPTF into portable transfer vessels could result in serious injuries or death to workers located near the site of the accident, but no public health effects would be expected.

4.5.3 Impacts of Alternative 2 (Cleanup and Closure Using a 0.05-Millirem Annual Dose Standard)

Radiological Impacts to the Public. Implementation of Alternative 2 would result in the same annual dose to the maximally exposed member of the public as under Alternative 1. However, because implementation of Alternative 2 would take 8 years, rather than 5 under Alternative 1, the total dose would be larger.[11] The total dose to this individual over the 8-year duration of the alternative would be 2.2 x 10^{-2} millirem, which would result in 1.1 x 10^{-8} probability of a latent cancer fatality.

The annual dose to the public within 80 kilometers (50 miles) of the site would be the same as under Alternative 1. The total dose to the public for the 8-year duration of the alternative would be 0.9 person-rem, which would result in 4.5 x 10^{-4} latent cancer fatalities within the population during that time period.

Following cleanup, a person residing on the site for 40 years would be exposed to a total of 2.0 millirem, which would result in 1 x 10^{-6} latent cancer fatality risk. A site population of 500 people would receive a total of 1.0 person-rem over 40 years, resulting in 5 x 10^{-4} latent cancer fatalities within the population residing on the site for that period of time. For comparison purposes, this population would be expected to incur approximately 3 latent cancer fatalities as a result of exposure to background radiation.

Radiological Impacts to Workers. Implementation of Alternative 2 would result in the same annual dose to the average worker as under Alternative 1. However, the total dose would be larger because of the longer duration of Alternative 2 as compared to Alternative 1. The total dose to this individual over the 8-year duration of Alternative 2 would be 3,760 millirem, which would result in 1.5 x 10^{-3} probability of a latent cancer fatality.

The annual dose to the worker population at ETEC would be the same as under Alternative 1. The total dose to the worker population for the 8-year duration of the alternative would be 82 person-rem, which would result in 3.3 x 10^{-2} latent cancer fatalities within the ETEC worker population.

Sodium Removal. Based on past experience with removal of sodium from the Sodium Component Test Facility and other former sodium facilities, removal of the liquid sodium from the SPTF would not result in any human health impacts under routine operations.

Facility Accidents. Implementation of Alternative 2 could result in the same type of accidents as could occur under Alternative 1. The consequences of a radiological or sodium accident would be the same as

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[11] Once decontamination and demolition of the radiological facilities were completed, potential doses to the public and to workers would end. However, to determine the doses to the public and workers from soil remediation alone would require complex modeling. Because the doses are already minute, and for ease of analysis, DOE simply assumed – conservatively – that the doses to the public and to workers from decontamination, demolition, and soil remediation would continue for the entire 8-year duration of Alternative 2.

described under Alternative 1. Because more soil remediation would occur under Alternative 2 than under Alternative 1, the potential for industrial accidents at the site would increase, although no fatalities (6.5 x 10^{-3} fatalities) would be expected as a result of industrial accidents.

4.5.4 Impacts of No Action Alternative (No Further Cleanup and Secure the Site)

Radiological Impacts to the Public. Based on exposures experienced in 2000, implementation of the No Action Alternative would result in an annual 7.7 x 10^{-7} millirem dose to the maximally exposed member of the public. This exposure would result in 3.9 x 10^{-13} probability of a latent cancer fatality. The annual dose to the public within 80 kilometers (50 miles) of the site would be 2.2 x 10^{-4} person-rem. This would result in 1.1 x 10^{-7} latent cancer fatalities within this population. These annual impacts would occur indefinitely.

Radiological Impacts to Workers. Implementation of the No Action Alternative would result in an annual 7-millirem dose to the average worker. This exposure would result in 2.8 x 10^{-6} probability of a latent cancer fatality. The annual dose to the worker population at ETEC would be 0.92 person-rem. This would result in 3.7 x 10^{-4} latent cancer fatalities within the worker population. These annual impacts would occur indefinitely.

Sodium Removal. Implementation of the No Action Alternative would cause the residual sodium to remain onsite. This material would be maintained in its solid state. Abandonment of the facility and the sodium would cause the sodium to be regulated as hazardous waste, and removal of the sodium would be required.

Facility Accidents. Implementation of the No Action Alternative would not be expected to result in any fatalities due to accidents because no decontamination, demolition, or soil remediation activities would be conducted and institutional controls would be maintained.

4.6 BIOLOGICAL RESOURCES

4.6.1 Current Conditions

The undeveloped areas within the SSFL site, both in open space and in the natural areas surrounding the developed site areas, consist of a large area of diverse habitats. This diversity is reflected in a wide variety of plants and animals at the site. The habitat and species diversity associated with the SSFL property, the physical attributes of the facility, and its geographic location make the area a potentially important route for effective movement of species. The open space at the site may play an important role as a habitat linkage between the Santa Susana Mountains, the Simi Hills, and possibly the Santa Monica Mountains.

Appendix D identifies the sensitive species observed or potentially occurring at the SSFL site (plants; reptiles; aquatic, amphibian, and insect species; birds; and mammals). Species are designated as sensitive because of their overall rarity, status, unique habitat requirements, and/or restricted distribution. Sensitive species include those listed by the U.S. Fish and Wildlife Service under the Endangered Species Act, 16 U.S.C. 1531 *et seq.*, or the California Department of Fish and Game under state preservation laws as threatened or endangered, protected, rare, candidate species, special animals, species of special concern, or harvest species.

Of those that could occur at the SSFL, several have been observed in surveys of the area. These are as follows:

- Santa Susana tarplant (state sensitive species)

- Southern California black walnut (candidate state sensitive species)
- Braunton's milkvetch (federal endangered and candidate state sensitive species)
- Two-striped garter snake (state special animal)
- Double-crested cormorant (state species of special concern)
- Great blue heron (state special animal)
- Southern California rufous-crowned sparrow (state species of special concern)
- Loggerhead shrike (state species of special concern)
- Sharp-skinned hawk (state species of special concern)
- Cooper's hawk (state species of special concern)
- Bobcat (state harvest species)
- Mule deer (state harvest species)
- San Diego black-tailed jackrabbit (state species of special concern)
- Los Angeles little pocket mouse (under review for federal threatened or endangered status; state species of special concern)
- Ringtail (state protected species).

In addition, Coast Live Oak trees, which are protected by Ventura County, California, are found on the site. Any work on a tree or in the ground within a protection zone surrounding the protected tree is subject to ordinance requirements. The County of Ventura is contacted before the trimming of branches or roots or grading or excavating within the root zone of a protected tree and a permit is issued as required. The services of a qualified tree trimmer may be required to oversee the activities taking place near a protected tree.

Most common species as well as sensitive species of plants and animals are not affected by exposure to low levels of radiological contamination. The territorial range of large animals limits their exposure duration at a contaminated site. The short life span of smaller animals limits the cumulative radiation dose that would be required to induce cancer.

In any event, because radiation doses to humans have been found to be very low (*see* Table 4-1), doses to plants and animals are also assumed to be very low. The impacts from those doses are unlikely to affect the population of any species.

Vegetation has been sampled throughout ETEC's operational period and DOE has continued this sampling during site cleanup activities. No evidence of any radioactive contamination in vegetation has ever been found.

No other natural resources such as timber, minerals, or rangeland are present on the site.

4.6.2 Impacts of Alternative 1 (Cleanup and Closure Under the 15 mrem Annual Dose Standard)

While implementation of Alternative 1 could have some short-term adverse effects on local plant and wildlife populations, these effects would be minimal because the actions would be limited to areas that are already highly disturbed and industrial in nature. No threatened, endangered, or sensitive species would be affected because they are not present in the areas where the work would be performed. In the long term, the remediation of Area IV would increase habitat availability, and the site may become more effective as a habitat linkage between the Santa Susana Mountains, the Simi Hills, and the Santa Monica Mountains. No other natural resources would be affected.

4.6.3 Impacts of Alternative 2 (Cleanup and Closure Using a 0.05-Millirem Annual Dose Standard)

Implementation of Alternative 2 would also have similar short-term adverse effects on local plant and wildlife populations as Alternative 1. However, these effects would be more widespread because of the additional soil remediation that would occur in Area IV. Approximately 45 acres of wildlife habitat would be disturbed under this alternative. The additional land disturbance would increase the potential for the disturbance of threatened, endangered, or sensitive plant and animal species, disturbance of migratory bird species that might roost in the area, and the introduction of non-native plant and weed species. Potential adverse impacts to threatened or endangered species would require consultation with the U.S. Fish and Wildlife Service and the preparation of a biological assessment.

4.6.4 Impacts of No Action Alternative (No Further Cleanup and Secure the Site)

Implementation of the No Action Alternative would avoid the short-term adverse effects on local plant and wildlife populations. Because the site would be maintained in its current industrial state wildlife habitat would not be improved.

> **Brush Fires**
>
> In 2000, a concern was raised about brush fires in and around contaminated sites at the SSFL. The concern centered on the potential for brush and vegetation growing on contaminated land to become contaminated. Subsequent fires could then result in airborne contamination, which could be a hazard to firefighters and the surrounding community.
>
> To address this concern, comprehensive vegetation sampling was conducted in Area IV in 2000. One composite vegetation sample (a variety of vegetation at each location) was collected at each of 28 existing and legacy radiological facilities. For comparison purposes, two offsite samples were collected to determine the natural background. The only radionuclide found in the vegetation samples was naturally occurring potassium-40. No man-made radionuclides were found in either the onsite or offsite vegetation samples. This latest finding confirms the results from earlier sampling conducted at the SSFL.

4.7 CULTURAL RESOURCES

4.7.1 Current Conditions

An intensive archeological survey was conducted for Area IV in 2001 (W&S Consultants 2001). This involved (1) background studies reviewing the prehistory, ethnography, and historical land use of the study area; (2) an archival records search to determine whether any prehistoric or historical archaeological sites had been recorded or were known to exist; and (3) an on-foot survey of the study area.

This survey of the entire Area IV study area resulted in the identification and recording of four archaeological sites. Each of these is located in rocky, undeveloped areas and is associated with a rock shelter or a cave. These sites are:

- A rock painting on the back wall of a small sandstone cave, probably Euro-American in origin
- A rock shelter exhibiting fire-blackened walls and ceiling that appears to represent a small special-use area
- A single bedrock mortar located on an open boulder adjacent to a rock shelter
- A low rock shelter that contains a midden deposit and bedrock mortar (site integrity has been lost to previous artifact looting)

None of these sites are eligible for inclusion on the National Register of Historic Places. Further, the sites are all located in rocky areas that have not been developed or used during DOE operations at ETEC.

4.7.2 Impacts of Alternative 1 (Cleanup and Closure Under the 15 mrem Annual Dose Standard)

Because no remediation would occur at or near any of the four identified archaeological sites, implementation of Alternative 1 would not affect cultural resources at Area IV. Limited remediation of soil near the RMHF would not be expected to result in the discovery of as-yet-unknown archaeological or cultural resources.

4.7.3 Impacts of Alternative 2 (Cleanup and Closure Using a 0.05-Millirem Annual Dose Standard)

Because no remediation would occur at or near any of the four identified archaeological sites, implementation of Alternative 2 would not affect known cultural resources at Area IV. However, the additional land disturbance required under Alternative 2 could increase the potential for the disturbance of as-yet-undiscovered archaeological or cultural resources. Discovery of such resources during remediation would require a cessation of activities and consultation with the State Historic Preservation Officer.

4.7.4 Impacts of No Action Alternative (No Further Cleanup and Secure the Site)

Implementation of the No Action Alternative would not affect any of the four identified archaeological sites.

4.8 NOISE AND AESTHETICS

4.8.1 Current Conditions

The SSFL and Area IV are industrial areas and have sound and aesthetic characteristics typical of such areas. However, because most operational activities at Area IV have ceased, the site is frequently quiet. Because of the remote location in a relatively remote, mountainous area, no sound from normal DOE operations travels offsite. Some ETEC facilities can be seen from offsite locations.

4.8.2 Impacts of Alternative 1 (Cleanup and Closure Under the 15 mrem Annual Dose Standard)

Implementation of Alternative 1 would result in the generation of noise at levels above the current operational level. However, this would be temporary and no noise would travel offsite because of its remote location. At the conclusion of decontamination, demolition, regrading, and revegetation, the site would be restored to its natural condition.

Transportation of waste offsite would generate noise and vibrations along truck routes, particularly in the residential neighborhoods closest to the site. Approximately two trucks per day for offsite shipments of waste would travel over local roads for the 5 years required to implement Alternative 1.

4.8.3 Impacts of Alternative 2 (Cleanup and Closure Using a 0.05-Millirem Annual Dose Standard)

Implementation of Alternative 2 would result in the generation of noise at levels above the current operational level, and for a slightly longer period of time (3 years longer) than Alternative 1. However, this would be temporary and no noise would travel offsite because of its remote location. At the conclusion of decontamination, demolition, regrading, and revegetation, the site would be restored to its natural condition.

Transportation of waste offsite would generate noise and vibrations along truck routes, particularly in the residential neighborhoods closest to the site. Approximately 27 trucks per day of offsite shipments of waste and shipments of clean soil to the site, 15 times more than Alternative 1, would travel over local roads for the 8 years required to implement Alternative 2.

4.8.4 Impacts of No Action Alternative (No Further Cleanup and Secure the Site)

Implementation of the No Action Alternative would result in no change to the current noise levels and aesthetic conditions of the site. Truck traffic in the residential neighborhoods nearest the site would not increase.

4.9 SOCIOECONOMICS

4.9.1 Current Conditions

Based on a recent demographic survey (based on census data and modified by direct observations of nearby residential areas around the SSFL site), DOE estimates that 1,403 people live within 3.2 kilometers (2 miles) of the center of the SSFL. Currently, residents live directly adjacent to the eastern and southern site boundaries, and two mobile home parks are located east of the site on Woolsey Canyon Road. According to maps and direct observation, there are no schools, nursing homes, or other facilities within 1.6 kilometers (1 mile) of the site boundary. Approximately 69,398 people live within 8 kilometers (5 miles) of the site.

The SSFL currently employs 280 people, 22 of whom are employed at ETEC.

4.9.2 Impacts of Alternative 1 (Cleanup and Closure Under the 15 mrem Annual Dose Standard)

Implementation of Alternative 1 would require approximately 40 additional workers onsite for the 5-year duration of the alternative. This slight increase in personnel would not affect socioeconomic conditions in the region.

4.9.3 Impacts of Alternative 2 (Cleanup and Closure Using a 0.05-Millirem Annual Dose Standard)

Implementation of Alternative 2 would require approximately 55 additional workers onsite for the 8-year duration of the alternative. This slight increase in personnel would not affect socioeconomic conditions in the region.

4.9.4 Impacts of No Action Alternative (No Further Cleanup and Secure the Site)

Implementation of the No Action Alternative would require no additional workers for 1 year and fewer workers (approximately 15 workers) in each subsequent year to monitor and secure the remaining ETEC buildings. This level of effort would not affect socioeconomic conditions in the region.

4.10 WASTE MANAGEMENT

4.10.1 Current Conditions

As discussed in Section 2.4, ETEC manages LLW and MLLW. LLW continues to be generated each year as a result of ongoing site closure activities. MLLW is not routinely generated.

DOE sends LLW generated at ETEC to the Nevada Test Site near Las Vegas, Nevada; the Hanford Site in Richland, Washington; or Envirocare, a commercial radioactive waste disposal facility in Clive, Utah, for disposal. DOE sends the majority of MLLW generated at ETEC to Envirocare.

Small amounts of hazardous waste are generated and disposed of in commercial, licensed hazardous waste disposal facilities in accordance with RCRA. Nonhazardous debris waste is also generated at ETEC. This type of debris includes asphalt, concrete, and building materials. Debris waste is disposed of at a local municipal sanitary landfill (Bradley Landfill).

Table 4-4 lists the waste volumes that are currently stored onsite and the volumes that were generated at ETEC in fiscal year 2001.

Table 4-4. Waste Volumes Stored and Generated

Waste Type	Volume Currently Stored Onsite (cubic meters)[a]	Volume Generated in Fiscal Year 2001 (cubic meters)
LLW	75	50
MLLW	20	5
Hazardous Waste	0	1
Nonhazardous Debris Waste	0	50

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

4.10.2 Impacts of Alternative 1 (Cleanup and Closure Under the 15 mrem Annual Dose Standard)

Implementation of Alternative 1 would result in the generation of the following quantities of waste:

- 7,500 cubic meters (264,750 cubic feet) of LLW
- 20 cubic meters (706 cubic feet) of MLLW
- 5 cubic meters (180 cubic feet) of hazardous waste
- 25,300 cubic meters (893,500 cubic feet) of nonhazardous debris waste

Disposal of Debris and Recycling

DOE has imposed a moratorium on the unrestricted release for recycling of any metals from radiation areas within a DOE facility, pending the completion of an environmental impact statement on the disposition of radioactively contaminated scrap metals (DOE 2001a).

For former radiological facilities, DOE disposes of uncontaminated building debris (including formerly contaminated material that has been decontaminated) in municipal sanitary landfills. Before such materials can be disposed of, the legal process of "releasing a building for unrestricted use" must be completed. Completion of this process means:

- Cleanup standards have been met and verified;
- The regulatory agency imposes no further radiological controls or regulatory oversight for the building;
- The regulatory agency removes the building from the existing "Radioactive Material License;"
- The building can be used safely for any other purposes without any further radiological controls;
- The building can be demolished safely and disposed of at regular landfills without any further radiological controls; and
- Any other material from the building, including metal, can be safely reused or recycled without any further radiological controls.

Moratorium in California. Through Executive Order D-62-02 (September 30, 2002), the Governor of California imposed a moratorium on the disposal of decommissioned materials into Class III landfills and unclassified waste management units, as described in Title 27, sections 20260 and 20230, of the California Code of Regulations. The moratorium affects material from former radiological facilities. It will remain in effect until the state completes its assessment of the public health and environmental safety risks associated with the disposal of decommissioned materials and the regulations setting dose standards for decommissioning.

As discussed in Section 3.2, 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 (Rocketdyne 1996), the most recent characterization of all 1.2 square kilometers (290 acres) of Area IV. Soil sample data taken from the RMHF in 2000 were also used (internal Boeing data). All excavated soil would be managed as LLW.

4.10.3 Impacts of Alternative 2 (Cleanup and Closure Using a 0.05-Millirem Annual Dose Standard)

Implementation of Alternative 2 would result in the generation of following quantities of waste:

- 406,850 cubic meters (14.4 million cubic feet) of LLW[12]
- 20 cubic meters (706 cubic feet) of MLLW
- 5 cubic meters (180 cubic feet) of hazardous waste
- 25,300 cubic meters (893,500 cubic feet) of nonhazardous debris waste

[12] Most of this soil would meet DOE, DHS, NRC, and EPA cleanup standards and thus would not meet the definition of LLW. Typically, this soil would be disposed of in a municipal solid waste landfill (Class III). To address public concerns, DOE would dispose of this material at a DOE-approved LLW disposal site.

As discussed in Section 3.3, 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 (Rocketdyne 1996). Soil sample data taken from the RMHF in 2000 were also used (internal Boeing data). All excavated soil would be managed as LLW.

4.10.4 Impacts of No Action Alternative (No Further Cleanup and Secure the Site)

Implementation of the No Action Alternative would result in the generation of minimal amounts of LLW and nonhazardous debris waste as a result of continuing monitoring and maintenance of institutional controls.

4.11 TRANSPORTATION

4.11.1 Current Conditions

As noted above, DOE ships LLW generated at ETEC to the Nevada Test Site, the Hanford Site, or Envirocare for disposal. The LLW is contained in drums or metal boxes per DOT requirements. DOE ships most MLLW generated at ETEC to Envirocare. Some MLLW is treated on site and then disposed of appropriately. Small amounts of hazardous waste are disposed of in commercial, licensed hazardous waste disposal facilities in accordance with RCRA. Nonhazardous debris waste is disposed of at local, licensed refuse disposal sites. All transportation is by truck.

Table 4-5 lists the truck shipments by waste type that occurred at ETEC in fiscal year 2001.

Table 4-5. Offsite Waste Shipments

Waste Type	Number of Truck Shipments in Fiscal Year 2001
LLW	5
MLLW	1
Hazardous Waste	0
Nonhazardous Debris Waste	20

The potential environmental impacts of transporting LLW, MLLW, and hazardous waste by truck from ETEC to authorized disposal sites has been addressed in earlier NEPA documents (*see* Section 2.4). The remainder of this section identifies the number of truck shipments of LLW, MLLW, and hazardous waste that would occur under each alternative and focuses on the potential environmental impacts of transporting nonhazardous debris waste and sodium offsite. Traffic fatalities that could occur as a result of LLW shipments and fatalities as a result of pollution from vehicle exhaust from all shipments are also reported. Air pollutant emissions that would occur as a result of the shipments are identified in Section 4.3 (*see* Appendix H for additional information on the air quality analysis).

4.11.2 Impacts of Alternative 1 (Cleanup and Closure Under the 15 mrem Annual Dose Standard)

Implementation of Alternative 1 would result in the following numbers of truck shipments:

- 553 truck shipments of LLW
- 20 truck shipments of MLLW
- 5 truck shipments of hazardous waste

- 1,860 truck shipments of nonhazardous debris waste
- 11 truck shipments of sodium (for reuse)

For LLW, hazardous waste, and nonhazardous debris waste, DOE assumed that each truckload would carry 13.6 cubic meters of waste.

LLW. The 553 truck shipments of LLW required under Alternative 1 would not be expected to result in any traffic fatalities (2.5×10^{-2} fatalities) (for purposes of analysis, DOE assumed that all LLW would be shipped to Nevada Test Site, which is the closest and currently the less expensive disposal alternative).[13] Other impacts of transporting LLW, including the impacts of an accident in which LLW is released, are addressed in the *Environmental Assessment of Off-Site Transportation of Low-Level Waste from Four California Sites* (DOE 1997c). This EA concluded that the environmental impacts (human health, traffic, air quality, noise, and environmental justice) of the transportation of LLW would be minimal.

Nonhazardous debris. The 1,860 shipments of debris waste is not expected to result in any traffic fatalities (5.7×10^{-3}) as a result of traffic accidents.

Sodium. The 197,000 liters (52, 000 gallons) of liquid sodium in the SPTF would be transferred to portable transfer vessels provided by a new owner of the sodium. DOE would build a system capable of transferring the sodium from the SPTF to the new owner's vessels. 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. Then the new owner would transport the solid sodium offsite.

Transportation of hazardous materials such as sodium must meet Department of Transportation shipping regulations. These regulations include requirements and specifications for shipping papers, packaging, marking, labeling, placarding, emergency response training, and route selection (*see* 49 CFR Parts 171, 172, and 178). The sodium would be transported as a solid. However, in the event of an accident involving a release of sodium, the rupture of a tank or fire may result if there were significant moisture in the air or water present.[14]

Exhaust emissions. The 2,443 truck shipments required for all shipments under Alternative 1 would result in exhaust emissions from the trucks. These emissions would not be expected to result in any fatalities (6.0×10^{-3} fatalities).

4.11.3 Impacts of Alternative 2 (Cleanup and Closure Using a 0.05-Millirem Annual Dose Standard)

Implementation of Alternative 2 would result in the following numbers of truck shipments:

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[13] Traffic fatalities were calculated by applying the traffic-fatality-per-kilometer-traveled rate provided in NUREG-1496 (NRC 1997).

[14] At the time the analysis was originally conducted, the SPTF contained 197,000 liters (52,000 gallons) of liquid sodium. DOE, through its onsite contractor, has since removed all but 4,550 liters (1,200 gallons) as part of its ongoing cleanup activities at the site. Removal of the remaining volume of sodium would require 4 shipments, rather than the 11 shipments analyzed. Because the volume of sodium to be removed and the number of shipments required are substantially less than were analyzed, the environmental impacts that could occur as a result of removing and transporting this material would be correspondingly less than those noted in this document. In addition, this document analyzes the removal and transportation of solid sodium, a chemical that is highly reactive with water. The remaining 4,550 liters (1,200 gallons) of sodium would be converted into liquid sodium hydroxide (lye), which is far less hazardous than solid sodium.

- 30,000 truck shipments of LLW
- 20 truck shipments of MLLW
- 5 truck shipments of hazardous waste
- 1,860 truck shipments of nonhazardous debris waste
- 11 truck shipments of sodium (for reuse)

For LLW, hazardous waste, and nonhazardous debris waste, DOE assumed that each truckload would carry 13.6 cubic meters of waste. In addition, approximately 26,000 shipments of clean soil would have to be brought to the site as backfill for revegetation.

LLW. DOE assumed that all of the soil excavated under Alternative 2 would be disposed of as LLW, although much of it could be considered to be clean soil. The 30,000 truck shipments of LLW required under Alternative 2 could result in 1.4 traffic fatalities (for purposes of analysis, DOE assumed that all LLW would be shipped to Nevada Test Site, which is the closest and currently the less expensive disposal alternative). Other impacts of transporting LLW, including the impacts of an accident in which LLW is released, are addressed in the *Environmental Assessment of Off-Site Transportation of Low-Level Waste from Four California Sites* (DOE 1997c). This EA concluded that the environmental impacts (human health, traffic, air quality, noise, and environmental justice) of the transportation of LLW would be minimal.

Nonhazardous debris waste. The consequences of an accident involving shipments of nonhazardous debris waste would be the same as those described for Alternative 1.

Sodium. The consequences of an accident involving a shipment of sodium would be the same as those described for Alternative 1.

Exhaust emissions. The 31,807 truck shipments required for all shipments under Alternative 2 would result in exhaust emissions from the trucks. These emissions would not be expected to result in any fatalities (0.23 fatalities).

4.11.4 Impacts of No Action Alternative (No Further Cleanup and Secure the Site)

Implementation of the No Action Alternative would result in fewer than five truck shipments of LLW and nonhazardous debris waste to offsite disposal sites annually. No impacts would be expected.

4.12 ENVIRONMENTAL JUSTICE

Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including a racial, ethnic, or socioeconomic group, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies.

In February 1994, the President issued Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (59 Fed. Reg. 7629 (1994)). This Order directs federal agencies to incorporate environmental justice as part of their missions. As such, federal agencies are specifically directed to identify and address as appropriate disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations.

The Council on Environmental Quality has issued guidance to federal agencies to assist them with their NEPA procedures so that environmental justice concerns are effectively identified and addressed (*Guidance for Considering Environmental Justice Under the National Environmental Policy Act* [CEQ 1997]). In this guidance, the Council encouraged federal agencies to supplement the guidance with their own specific procedures tailored to particular programs or activities of an agency. DOE has prepared a document titled *Draft Guidance on Incorporating Environmental Justice Considerations into the Department of Energy's National Environmental Policy Act Process* (DOE 2000a). DOE's draft guidance is based on Executive Order 12898 and the Council on Environmental Quality environmental justice guidance.

Among other things, the DOE draft guidance states that even for actions that are at the low end of the sliding scale with respect to the significance of environmental impacts, some consideration (which could be qualitative) is needed to show that DOE considered environmental justice concerns. DOE needs to demonstrate that it considered apparent pathways or uses of resources that are unique to a minority or low-income community before determining that, even in light of these special pathways or practices, there are no disproportionately high and adverse impacts on the minority or low-income population. The DOE draft guidance also defines "minority population" as a demographic composition of the populace where either the minority population of the affected area exceeds 50 percent or the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population.

For this EA, DOE applied the draft environmental justice guidance to determine whether there could be any disproportionately high and adverse human health or environmental impacts on minority or low-income populations surrounding ETEC as a result of the implementation of any of the alternatives analyzed. Analysis of environmental justice concerns was based on an assessment of the impacts reported in Sections 4.1 through 4.11. Although no high and adverse impacts were identified, DOE considered whether minority or low-income populations would be disproportionately affected by the alternatives.

There are no minority or low-income populations immediately adjacent to ETEC or the SSFL. The primary impact to the area around the SSFL would be a temporary increase in car and truck traffic.[15] This increase in traffic would be noticeable only in the immediate area, where no minority or low-income populations have been identified. Because no other offsite impacts are anticipated, DOE believes that no minority or low-income populations would be disproportionately affected by the alternatives.

4.13 MITIGATION

The results of the environmental analysis conducted for this EA indicate that implementation of Alternative 1 or 2 would not result in significant environmental impacts. However, DOE would use standard practices to further reduce the environmental impacts of these alternatives. These practices would include:

- Dust suppression, sediment controls, personnel protective equipment, monitoring, and compliance with safety and health plans to reduce radiation exposure to workers and the public through the air pathway
- Protection of undiscovered cultural resources by compliance with established operating procedures regarding preservation of archaeological sites (if such resources are discovered, excavation or other activities would stop until all required steps were taken to preserve the resource)

[15] The increase in traffic would occur over a period of 5 to 8 years, depending on the alternative selected. Car traffic would increase due to onsite workers commuting to ETEC. Truck traffic would increase due to offsite shipment of waste and shipment of uncontaminated soil to the site if needed for Alternative 2.

- Protection of sensitive plant species by adherence to established operating procedures, including hiring a qualified tree trimmer to oversee the activities taking place near a protected tree

- Limitations on transportation hours, trucks per hour, and trucks per day to reduce impacts to roads and neighborhoods; implementation of traffic control and loading procedures that address local traffic hazards, noise restrictions, city/county approval, manifesting, dust suppression, truck decontamination, environmental monitoring, container cover, truck inspection, and spill/release control

- Compliance with Department of Transportation shipping requirements (including proper packaging; limitations on waste quantities per shipment; and preparation of and compliance with spill prevention, control, and cleanup plans) to protect transportation workers and the public from exposure to contaminants in the waste

- Maintenance of sediment control structures and related access restrictions to prevent additional migration of mercury

- Continuation of institutional controls and pump-and-treat systems to protect the public from potential exposure to TCE through the groundwater pathway

4.14 CUMULATIVE IMPACTS

Council on Environmental Quality regulations implementing the procedural provisions of NEPA require federal agencies to consider the cumulative impacts of a proposal (40 CFR 1508.25(c)). A cumulative impact on the environment is the impact that results from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions (40 CFR 1508.7). This type of assessment is important because significant cumulative impacts can result from several smaller actions that by themselves do not have significant impacts. The relatively few truck shipments over 5 years under Alternative 1 (2,443 truck shipments or an additional 2 trucks per day for 5 years) in comparison to other radioactive waste and materials shipments and truck shipments generally would not pose cumulatively significant environmental impacts in the local area or in the southern California region. Implementation of Alternative 2, which would require 56,000 truck shipments over 8 years (or approximately 27 additional trucks per day over that period of time) for offsite transportation of waste and transport of clean soil to the site, would not impose cumulatively significant environmental impacts when considered in combination with other truck shipments in the region, although this amount of truck traffic on the roads near ETEC could impose a hardship on local residents.

ETEC is located in a remote area with no other major industrial or commercial centers surrounding it. Thus, there is no potential for cumulative impacts from other present or reasonably foreseeable future actions. However, an important consideration in whether residual contamination, from both radiological and chemical constituents, could pose a cumulative risk to future users of the site, particularly residential use where multiple pathways would exist (e.g. direct contact soils, and migration of groundwater).

Cleanup of the chemical contamination will be conducted pursuant to RCRA corrective action program. For the purpose of this analysis, DOE assumes that the cleanup of chemical contamination on the SSFL will result in a residual cancer risk, from all pathways of between 1×10^{-4} and 1×10^{-6}, as required by EPA. Because any residual radioactive contamination from the DOE's cleanup will be in areas away from the chemical contamination, and the inability for a receptor to be in direct contact with separate portions of the site at the same time, an unacceptable cumulative risk from soils would not be expected to occur.

It is also DOE's assumption that groundwater will be remediated to within the acceptable risk range, or access to that groundwater will be restricted, if it is not. Therefore, given the low radiological risk projected to remain after implementing the 15 mrem plus ALARA annual dose alternative (most of Area IV is already at or below 2×10^{-6}); or, the 0.05 mrem annual dose alternative (1×10^{-6}), the only feasible way an unacceptable cumulative risk would occur is if the chemical contamination was not properly remediated or controlled. Furthermore, Cs^{137}, the principal radiological constituent of concern has a relatively short half-life. Thus, the residual risk would continue to decline over time.

5.0 UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS, RELATIONSHIP OF SHORT-TERM USES OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY, AND IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

5.1 UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS

Under Alternative 1 or 2, there would be a very slight temporary increase in radiation doses to the public and workers as a result of decontamination, demolition, and soil remediation activities, which could result in a very slight increase in excess cancer risk (*see* Section 4.5). The highest increased total dose for the maximally exposed member of the public would be 2.2 x 10^{-2} millirem, which would result in 1.1 x 10^{-8} latent cancer fatality risk under Alternative 2. Offsite transportation of waste under Alternatives 1 and 2 and transportation of clean soil to the site under Alternative 2 could also result in slight public and worker radiation exposure and the potential for traffic accident fatalities (*see* Section 4.11).

5.2 RELATIONSHIP OF SHORT-TERM USES OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

Implementation of Alternative 1 or 2 would not create a conflict between the local, short-term uses of the environment and long-term productivity. All activities would occur on an already disturbed site or would use existing infrastructure resources such as roads. Environmental resources such as land, plants and animals, wetlands, air quality, and water quality would not be significantly affected by implementation of either of the two action alternatives. The significantly greater number of trucks transporting waste offsite, and clean soil onsite, associated with Alternative 2 would result in a substantive rise for those neighborhoods along the truck route.

5.3 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The only irreversible or irretrievable commitment of resources that would occur if Alternative 1 or 2 were implemented is the use of fossil fuels in the shipment of waste off the site and the use of land for the disposal of radioactive wastes. Truck shipments would require the consumption of diesel fuel and other fossil fuels such as gasoline and lubricants. Approximately 50 times more shipments of LLW (including contaminated soil) would be required under Alternative 2 as compared to Alternative 1 (406,850 cubic meters of LLW under Alternative 2, as compared to 7,500 cubic meters of LLW under Alternative 1).

Implementation of Alternative 1 or 2 would also involve the commitment of land for waste disposal facilities. The land-use requirements for the offsite disposal of LLW, MLLW, TRU waste and hazardous waste were addressed in the F*inal Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* (DOE 1997a) and the *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement* (DOE 1997b). Disposal of nonhazardous debris waste would be in accordance with local regulations. Approximately 50 times more LLW would be generated and would need to be disposed of under Alternative 2 than Alternative 1.

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APPENDIX A. SCOPING COMMENTS SUMMARY AND DOE RESPONSES

The following is a summary of the comments recorded in the October 17 and 18, 2000, *U.S. Department of Energy, Environmental Assessment, Energy Technology Engineering Center, Public Scoping Meetings, Transcript of Proceedings* (Atkinson-Baker 2000a, 2000b), and written comments received from the U.S. Environmental Protection Agency (EPA). Brief responses by the U.S. Department of Energy (DOE) to these comments are provided. No other comments were received during the comment period that extended from September 15–October 30, 2000.

1. **Comment on Groundwater Plumes:** The groundwater trichloroethene (TCE) plume that is being evaluated does not include the larger plumes for the entire Santa Susana Field Laboratory (SSFL) site. Are these plumes a part of the site groundwater cleanup activities? Are the three plumes connected to the larger plume at SSFL?

   Response: Cleanup of chemical contamination is being addressed in accordance with the SSFL site-wide Resource Conservation and Recovery Act (RCRA) corrective action program. With respect to the RCRA process, DOE is only responsible for the groundwater plumes that were created as a result of DOE-funded activities. All of the Energy Technology Engineering Center (ETEC) groundwater plumes are being remediated at this time. The National Aeronautics and Space Administration (NASA), the Department of Defense, and Boeing are responsible for the larger plumes at SSFL. These are separate from the ETEC plumes and are being cleaned up using separate wells and treatment systems in accordance with RCRA permit requirements.

2. **Comment on Cleanup Standards:** It is not clear what standard DOE will use in cleanup of the site. It was recommended that DOE use the EPA standards for residential use as the appropriate cleanup standards. DOE should use rural residential standards rather than residential standards.

   Response: DOE's preferred alternative is to use the cleanup standards approved by DOE for ETEC, which are consistent with EPA's Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) protectiveness requirement of ensuring risk is within the 10^{-4} to 10^{-6} range and the California Department of Health Services, Radiologic Health Branch. Under this alternative, DOE would clean up the site such that a resident on the site would be exposed to no more than an additional 15 millirem annually and would experience an additional lifetime cancer risk that would not exceed 3×10^{-4}. This alternative is equivalent to the suburban residential scenario. With implementation of the "as low as reasonably achievable" (ALARA) principle, DOE will be within the CERCLA range. DOE also analyzed an alternative under which the site would be cleaned up to a level such that a resident on the site would be exposed to no more than an additional lifetime cancer risk of 1×10^{-6}. This environmental assessment (EA) also considers the No Action Alternative of no further cleanup and securing the site.

3. **Comment on National Environmental Policy Act (NEPA) Compliance:** DOE should do an environmental impact statement rather than an EA because there is more opportunity for public involvement. Past cleanup activities at the ETEC site have been conducted without proper NEPA documentation.

   Response: DOE believes that an EA is the appropriate level of NEPA documentation for cleanup and closure of ETEC. The purpose of an EA is to determine whether the impacts of a proposal may be significant. Based on past experience, DOE concluded that there was no indication that the impacts of the proposed action or alternative would have significant environmental impacts. With respect to public involvement, DOE issued a notice of intent to prepare the EA, conducted 2 days of scoping meetings, and encouraged the submission of scoping comments. The EA is being put out for public review for a period of 30 days. Thus, the public involvement activities for this EA are similar to those used for the preparation of environmental impact statements.

Following the completion of the EA, DOE will evaluate and determine whether there may be significant impacts. If there may be significant impacts, DOE will prepare an environmental impact statement. If no significant impacts are identified following evaluation and considering mitigation, DOE will conclude the process with a finding of no significant impact.

4. **Comment on Characterization:** Characterization activities have not been completed for the ETEC site. DOE is basing their evaluation on information from Rocketdyne studies that have not been updated in several years. NEPA evaluation should be delayed until characterization is complete.

   EPA should complete an independent evaluation. The evaluation should include a detailed sampling plan that covers a wide range of sample sites, sample depths, and analyses for radioactive and hazardous materials. Previously released facility sites should be characterized to assure that they comply with current standards.

   Response: Extensive radiological characterization has been conducted at the ETEC site. Additional post-remediation characterization would be performed under the proposed action to verify that cleanup goals have been met. Additional sampling and analysis would also be performed at any sites suspected to be contaminated. Characterization of chemical contamination has also been performed at ETEC. Additional chemical characterization for the entire SSFL, including the ETEC site, is under way pursuant to the RCRA corrective action process. To date, EPA has validated release surveys for eight former radiological facilities. DOE also plans to support an independent verification survey for the site.

5. **Comment on Waste Management:** Waste material and temporary facilities from restoration activities have been shipped to waste sites and donated to the public without proper characterization.

   Response: All materials from radiological facilities are properly characterized, surveyed, evaluated, and approved for shipment to disposal or recycling facilities. All of these activities are performed under regulatory oversight. Follow-up surveys that were conducted of nonradiological office buildings have not indicated any contamination above the limits established by state and federal regulations.

6. **Comment on SSFL Cleanup Responsibilities:** Why is DOE only evaluating the ETEC site? DOE should evaluate the entire SSFL site for radiological contamination and hazardous material contamination. What area of SSFL is DOE responsible for, and what is being covered in the ETEC EA? Who is responsible for NEPA determination for the SSFL?

   Response: DOE is responsible only for DOE-owned facilities and DOE-funded operations at SSFL. Therefore, this EA only covers activities at ETEC and contamination releases from DOE operations at ETEC that may extend beyond its boundaries. The SSFL site is the responsibility of NASA, the Department of Defense, and the Boeing Company, which are responsible for management and funding of activities for their respective areas of the SSFL. The State of California will conduct an assessment and prepare an environmental impact report under the California Environmental Quality Act for the chemical contamination at SSFL, including the ETEC site. DOE is only responsible for

NEPA determination of ETEC, however as part of that EA, the Department did consider the potential for cumulative impacts.

7. **Comment on Alternatives:** DOE should evaluate several alternatives as part of the EA. Issues such as contamination in the bedrock and groundwater contamination should be evaluated.

   Response: DOE initially considered several alternatives but limited the detailed impacts to the 15 mrem and 0.05 mrem alternatives. This EA evaluates an alternative that would reduce the additional lifetime cancer risk to the maximally exposed individual residing on the ETEC site to 1×10^{-6}. This would involve removing substantial amounts of soil, in some cases down to bedrock. Groundwater contamination is being evaluated under RCRA.

8. **Comment on Notification:** How are people being notified of these meetings?

   Response: Over 1,600 mailings were sent out informing state and federal agencies and the public of the scoping meetings. Additionally, the meetings were announced in public media.

9. **Comment on Models and Assumptions:** Assumptions used for input into models should be as conservative as possible.

   Response: All risk models and input parameters are subject to review by regulatory agencies. Results are generally considered to be very conservative. Assumptions used for environmental effect analyses follow state and federal laws and regulations. Parameters used in risk models that are known, including contamination concentrations, are input as accurately as possible, with a bias toward being conservative. Parameters that cannot be accurately determined are estimated based on known information and regulatory guidance. The model input parameters are often selected to represent conservative values (i.e., likely to overestimate risk).

10. **Comment on Access Control:** Access to the site should be controlled so the public cannot be exposed to any remaining contamination.

    Response: Access to the site is currently being controlled by Rocketdyne. DOE cannot determine the long-term use of the site. Rocketdyne has no plans to release the site for public use anytime in the near future and will maintain control of the site. There is currently no restriction preventing the immediate or eventual development of the site for residential use.

11. **Comment on Sodium Reactor Experiment Meltdown Building:** What is the status of the building that housed a reactor meltdown in 1959?

    Response: All radioactive material was removed in the 1960s and 1970s. The facility was decommissioned and decontaminated in the late 1970s and early 1980s. It was released for unrestricted use in 1985. The building was torn down in 1999.

12. **Comment on Soil Contamination:** What is the status of the hazardous and radioactive soil contamination, how is it being shipped, and where is it being shipped?

    Response: Radioactive waste is shipped either to DOE sites in Washington and Nevada, or to a commercial facility in Utah. There is no decontamination and decommissioning of radiological facilities underway at the moment. Hazardous waste is shipped to landfills permitted to accept the waste. For additional information, please see Chapters 2,3, and 4 of this EA.

13. **Comment on Sodium Burn Pit:** The status of the remediation of the sodium burn pit is not clear. There should be a discussion of the sodium burn pit in the EA.

    Response: The Former Sodium Disposal Facility originally consisted of a rectangular, concrete-lined pit filled with water, two water-filled basins, and a small building (4886). The facility began operations in the 1950s and ceased operations in 1977. During operations, various components were opened to expose sodium and a sodium potassium alloy, washed with water, and often placed in the ponds to ensure complete reaction (burning) of the sodium. The items were then retrieved and disposed of offsite. Some components containing radioactive material were inadvertently placed in the Former Sodium Disposal Facility. In 1992, the California Department of Toxic Substances Control and the California Regional Water Quality Control Board approved the Former Sodium Disposal Facility Closure Plan, and DOE issued a categorical exclusion under NEPA for cleanup of the facility. In July 1992, soil excavation was initiated. All radiological and sodium components and all radioactive soil were removed by 1995 and the California Department of Health Services issued a release for unrestricted use with respect to radiological contamination in May 1998. The site is designated as a Solid Waste Management Unit under RCRA, and final verification that no chemical contamination poses a risk to human health or the environment will be addressed in the RCRA corrective action process, independently from the decisions made based on this EA. The Department of Toxic Substances Control is also preparing an environmental impact report that addresses chemical contamination at all of SSFL.

14. **Comment on Evaluating Past Actions:** Why are past cleanup activities not being addressed in this EA?

    Response: Past cleanup activities are not addressed in the EA because those activities are complete and are considered actions of independent utility. However, Alternative 2 does address the additional soil remediation that would be required to meet the 0.05 mrem cleanup standard.

15. **Comment on Fire Accident Scenario:** DOE should evaluate a brush fire and the potential for release of hazardous and radioactive materials due to such a fire.

    Response: The potential impacts of a brush fire at ETEC are addressed in Chapter 4 of this EA.

16. **Comments from the EPA:**

    a. "**Cleanup Levels:** We suggest DOE use this EA process as an opportunity to ask for public comment regarding soil and water cleanup levels and to explain to the public the process that will be used to select the cleanup levels. This would ideally involve an open process that is similar to the process used to select chemical cleanup levels under RCRA; i.e., EPA and DOE ask for public comment, hold a public meeting to explain the proposed levels and obtain comments, and then respond to the comments and select the remedy (including cleanup levels)."

    b. "**Site Characterization:** The EA is currently limited to the 90 acres of ETEC. There are several other areas that should be included in the assessment: 1) Leach Fields attached to former nuclear facilities, 2) Areas (if any) that have not been formally released if decontamination and decommissioning have already occurred."

    c. "**Unknown Areas of Contamination:** In the event that DOE suspects a building or area (beyond the 3 identified in the EA) that may be contaminated, we would like the EA to address the mechanism by which DOE will notify the regulatory agencies and the public. Further, if an area is discovered to actually be contaminated, we would like the EA to address how DOE will involve the regulatory agencies and the community in its decision-making process."

d. "**Remedy Costs:** We expect DOE to share remedy cost figures with the community as part of the alternatives analysis portion of the remedy selection process. Overall figures should be presented as part of the decision-making process. DOE's waste minimization policy should be included as an attachment or appendix to the EA as it would help the public understand the constraints, parameters, and guidance that DOE is operating under. Similarly, any other relevant cleanup policies or orders (such as DOE Order 5400.5 and the moratorium on recycling metal from radioactive buildings) should also be included. Finally, DOE should include a wide range of options in its analysis of alternatives. For example, would it be cheaper to dispose of a large portion of radioactive buildings as radioactive waste rather than surveying, sampling, decontaminating, and repeating?"

Responses:

a. **Cleanup Levels:** This EA process asked for public comment regarding cleanup levels and explains the process that will be used to select cleanup levels as requested. In fact, DOE analyzed the 1×10^{-6} additional lifetime cancer risk standard at the request of stakeholders. The opportunities and schedule for public input are provided in Section 1.4.

b. **Site Characterization:** Leach fields are identified as areas of concern and are addressed under the RCRA process. Leach fields are being sampled for chemical contamination under Department of Toxic Substances Control oversight and radiological contamination under Department of Health Services oversight. Past cleanup activities are not addressed in the EA because those activities are complete and considered actions of independent utility. However, a final status survey will be conducted according to MARRISM protocol to verify that all of Area IV meets current cleanup criteria prior to release of the site. This survey will include prior release sites.

c. **Unknown Areas of Contamination:** If additional radiological contamination is found at levels substantially beyond that analyzed in the EA, the document would be modified with appropriate opportunity for public involvement.

d. **Remedy Costs:** Cost data are not provided because DOE believes the EA should focus on potential environmental impacts rather than cost or technical issues. Rocketdyne's waste minimization policy is detailed in the *ETEC Waste Minimization and Pollution Prevention Awareness Plan* (Rocketdyne 1993), available from DOE Oakland. This plan complies with DOE Order 5400.1, *General Environmental Protection Program* (DOE 1988). The specific alternative of disposing of large portions of radioactive buildings as radioactive waste was considered but not analyzed in detail, as discussed in Chapter 3.

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APPENDIX B. LIST OF AGENCIES AND PERSONS CONSULTED AND CONTACTED

B.1 AGENCIES AND PERSONS CONSULTED

U.S. Environmental Protection Agency
- Larry Bowerman

California Department of Health Services
- Steve Hsu
- Roger Lupo

California Department of Toxic Substances Control
- Pauline Batarseh
- Gerard Abrams
- Eric Maher

U.S. Fish and Wildlife Service
- Rick Farris

B.2 AGENCIES AND PERSONS CONTACTED

TITLE	NAME	FIRM	ATTN	CITY (CA unless otherwise noted)
THE HONORABLE	BARBARA BOXER		U.S. SENATE	LOS ANGELES
THE HONORABLE	DIANNE FEINSTEIN		U.S. SENATE	LOS ANGELES
THE HONORABLE	A BEILENSON		U S HOUSE OF REP.ATTN MS SUSAN LITTLE	WOODLAND HILLS
THE HONORABLE	ELTON GALLEGLY		U S HOUSE OF REP. ATTN MR BRIAN MILLER	OXNARD
THE HONORABLE	HOWARD BERMAN		U S HOUSE OF REP. ATTN MS ROSE CASTENADA	MISSION HILLS
THE HONORABLE	HENRY WAXMAN		U S HOUSE OF REP.ATTN NOELLE BRENNAN	LOS ANGELES
THE HONORABLE	PAULA BOLAND		CALIFORNIA STATE ASSEMBLY MR SCOTT WILK	GRANADA HILLS
THE HONORABLE	CATHIE WRIGHT		CA STATE SENATE ATTN JAN SMITH	SIMI VALLEY
THE HONORABLE	RICHARD RIORDAN		CITY OF LOS ANGELES	LOS ANGELES
THE HONORABLE	GREG STRATTON		MAYOR CITY OF SIMI VLY ATTN LAURA HERRON	SIMI VALLEY
		SIMI VALLEY CITY HALL	ATTN MR MARK OYLER	SIMI VALLEY
		SIMI VALLEY CITY HALL	MR MIKE SEDELL CITY MANAGER ATTN D HARRIS	SIMI VALLEY
		CITY OF MOORPARK	STEVE KUENY CITY MANAGER	MOORPARK
		HIDDEN HILLS CITY HALL	CHERIE PAGLIA CITY MANAGER	HIDDEN HILLS
THE HONORABLE	LAURA CHICK		L.A. CITY COUNCIL 3RD DISTR MS DENISE SCHALL	RESEDA
THE HONORABLE	HILDA L SOLIS		STATE SENATOR	EL MONTE

TITLE	NAME	FIRM	ATTN	CITY (CA unless otherwise noted)
THE HONORABLE	HAL BERNSON		LA CITY COUNCIL 12TH DIST ATTN LEE HINTLIAN	LOS ANGELES
THE HONORABLE	Z YAROSLAVSKY		3RD SUPERVISIONAL DISTR MS LAURA FAY	CALABASAS
THE HONORABLE	GLORIA MOLINA		SUPERVISOR COUNTY OF LOS ANGELES	LOS ANGELES
		DEPT OF WATER AND POWER	ATTN MEL BLEVINS RM 1455	LOS ANGELES
THE HONORABLE	M ANTONOVICH		L A BOARD OF SUPERVISORS LETTA PISTONE	CHATSWORTH
THE HONORABLE	JUDY MIKELS		BOARD OF SUPERVISORS 4TH DIST JASON OLIVER	SIMI VALLEY
THE HONORABLE	FRANK SCHILLO		VTA BOARD SUPERVISORS 2ND DIST RON STARK	THOUSAND OAKS
		LOS ANGELES COUNTY FIRE DEPT	HEALTH HAZARDOUS MTRL DIV TOM KLINGER	LOS ANGELES
		VENTURA CO RESOURCE MGMT AGENCY	ENVIRONMENTAL HEALTH DIV DOUG BEACH	VENTURA
		VENTURA COUNTY RESOURCE MGMT AGENCY	ENVIRONMENTAL HEALTH DIV STEVE KEPHART	VENTURA
		COUNTY OF VENTURA	WATER WORKS DIST 17 ATTN REDDY PAKALA	MOORPARK
		COUNTY OF VENTURA WATERWORKS	ATTN ANNE DANA	MOORPARK
		COUNTY OF VENTURA	AIR POLLUTION CONTROL RICHARD BALDWIN	VENTURA
		DEPARTMENT OF TRANSPORTATION	ATTN WILFORD MELTON	LOS ANGELES
		CA WATER RESOURCES CONTROL BOARD	ATTN MS KAREN BESSETTE	SACRAMENTO
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DR	ROBERT HARRISON	CA DEPT OF HEALTH SERVICES	OCC HEALTH PRGM	OAKLAND
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		ALA SPACE & ROCKET CTR	ATTN REBECCA MCCALEB (AB10)	HUNTSVILLE
		NASA/HQ/NXG	ATTN ARTHUR R LEE	WASHINGTON
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	JEROME RASKIN			NORTHRIDGE
MR	SHELDON PLOTKIN		SO CALIFORNIA FEDERATION OF SCIENTISTS	LOS ANGELES
MS	BARBARA JOHNSON			SIMI VALLEY
		ROCKETDYNE OCCUPATIONAL HEALTH STUDY	DEPT OF EPIDEMIOLOGY DR H MORGENSTERN	LOS ANGELES
		SANTA MONICA MOUNTAINS	REC & CONSER AUTHORITY ATTN RORIE SKEI	MALIBU
		CANOGA PARK/WEST HILLS CHAMBER OF COMMER	ATTN ALINE HAUSMAN EXECUTIVE DIRECTOR	CANOGA PARK
		BELL CANYON ASSOCIATION	ATTN MS CAROL HENDERSON	CANOGA PARK
		SUSANA KNOLLS HOMEOWNERS	ATTN CARI CARUSO	SIMI VALLEY
		SAN FERNANDO VLY ASSOC OF REALTORS	MILLIE JONES PUBLIC AFFAIRS DIRECTOR	VAN NUYS
		GROUNDWATER RESOURCES CONSULTANTS	ATTN MS DINAH JASENSKY	TUCSON
		LAKE TIMES	C/O TODD C OLSEN ATTN BOB WOOD	NORTHRIDGE

TITLE	NAME	FIRM	ATTN	CITY (CA unless otherwise noted)
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		OAK PARK UNIFIED SCH DIS T	ATTN MR STAN MANTOOTH	OAK PARK
		DR NAOMI BISHOP PROFESSOR AND CHAIR	CSUN DEPARTMENT OF ANTHROPOLOGY	NORTHRIDGE
		LAUSD ENVIRONMENT	HEALTH & SAFETY ATTN EVAN ROSE	LOS ANGELES
		L A UNIFIED SCHOOLS	ENVIRONMENTAL HEALTH & SAFETY P VAISANEN	LOS ANGELES
		SIERRA CLUB	ATTN MS LIZ ALLEN	CLAREMONT
		ENVIRONMENTAL DEFENSE FUND	ROCKRIDGE MARKET MALL ATTN DAVID ROE	OAKLAND
		CITIZENS CLEARINGHOUSE HAZARDOUS WASTE	ATTN MS ANNA MARIE STENBERG	FORT BRAGG
		LEAGUE OF WOMEN VOTERS	ATTN MS ANNE COOMBES	LOS ALTOS HILLS
		CITIZENS FOR A BETTER ENVIRONMENT	ATTN CARLOS PORRAS	LOS ANGELES
		CLEAN WATER ACTION	ATTN MR BRUCE LIVINGSTON	SAN FRANCISCO
		FRIENDS OF LOS ANGELES RIVER		LOS ANGELES
		PLANNING AND CONSERVATION LEAGUE	ATTN MR GARY A PATTON	SACRAMENTO
		ENVIRONMENTAL HEALTH COALITION	ATTN MS DIANE TAKVORIAN	SAN DIEGO
		CALIFORNIA PUBLIC INTEREST RESEARCH	MS MARY RAFTERY LEGISLATIVE ADVOCATE	SACRAMENTO
		CA COUNCIL FOR ENVIRONMENTAL &	ECONOMIC BALANCE VICTOR WEISSER	SAN FRANCISCO
		LABOR/COMMUNITY STRATEGY CENTER		LOS ANGELES
		WASTE MANAGEMENT OF NO AMERICA	GOVERNMENT AFFAIRS ATTN CHUCK WHITE	SACRAMENTO
		MOTHERS OF EAST LOS ANGELES	ATTN JUANA GUITERREZ	LOS ANGELES
		CONCERNED CITIZENS OF SOUTH CENTRAL	ATTN JUANITA TATE	LOS ANGELES
	CHARLES CATE	CITY OF CALABASAS		CALABASAS
	JIM CHADA		OAK LAKE ASSOCIATION	WEST HILLS
	WILLIAM S HAYNES			CHATSWORTH
	LINDA HAYS		UNITED AUTO WORKERS LOCAL 1519	SAUGUS
	MICHAEL W KUHN		CITY OF SIMI VALLEY ENVIRONMENTAL SER	SIMI VALLEY
	STEPHEN LENSKE		PRESIDENT VLY WEST HILLS OWNER ASSOC	WEST HILLS
DR	MELANIE BECK		SANTA MONICA MOUNTAINS NTL REC AREA	THOUSAND OAKS
	STEVE MOGIL	WEST HILLS NEIGHBORHOOD ASSOC.		WEST HILLS
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		PEOPLE OF REASON IN SCIECE & MED		ANAHEIM
		SAN DIEGO BAY KEEPER	MR DELANO	SAN DIEGO
THE HONORABLE	SHEILA KUEHL		LAURA PLOTKIN 41ST ASSEMBLY DISTRICT	ENCINO
THE HONORABLE	TOM MCCLINTOCK		ATTN MICHELLE LUSE	GRANADA HILLS

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APPENDIX C. RADIATION AND HUMAN HEALTH

C.1 WHAT IS RADIATION?

Radiation is the emission and propagation of energy through space or through a material in the form of waves or bundles of energy called photons, or in the form of high-energy subatomic particles. Radiation generally results from atomic or subatomic processes that occur naturally. The most common kind of radiation is electromagnetic radiation, which is transmitted as photons. Electromagnetic radiation is emitted over a range of wavelengths and energies. We are most commonly aware of visible light, which is part of the spectrum of electromagnetic radiation. Radiation of longer wavelengths and lower energy includes infrared radiation, which heats material when the material and the radiation interact, and radio waves. Electromagnetic radiation of shorter wavelengths and higher energy (which are more penetrating) includes ultraviolet radiation (which causes sunburn), X-rays, and gamma radiation.

Ionizing radiation is radiation that has sufficient energy to displace electrons from atoms or molecules to create ions. It can be electromagnetic (for example, X-rays or gamma radiation) or subatomic particles (for example, alpha and beta radiation). The ions have the ability to interact with other atoms or molecules; in biological systems, this interaction can cause damage in the tissue or organism.

Radioactivity is the property or characteristic of an unstable atom to undergo spontaneous transformation (to disintegrate or decay) with the emission of energy as radiation. Usually the emitted radiation is ionizing radiation. The result of the process, called radioactive decay, is the transformation of an unstable atom (a radionuclide) into a different atom, accompanied by the release of energy (as radiation) as the atom reaches a more stable, lower energy configuration.

Radioactive decay produces three main types of ionizing radiation—alpha particles, beta particles, and gamma or X-rays—but our senses cannot detect them. These types of ionizing radiation can have different characteristics and levels of energy and, thus, varying abilities to penetrate and interact with atoms in the human body. Because each type has different characteristics, each requires different amounts of material to stop (shield) the radiation. Alpha particles are the least penetrating and can be stopped by a thin layer of material such as a single sheet of paper. However, if radioactive atoms (radionuclides) emit alpha particles in the body when they decay, there is a concentrated deposition of energy near the point where the radioactive decay occurs. Shielding for beta particles requires thicker layers of material such as several reams of paper or several inches of wood or water. Shielding from gamma rays, which are highly penetrating, requires very thick material such as several inches to several feet of heavy material (for example, concrete or lead). Deposition of the energy by gamma rays is dispersed across the body in contrast to the local energy deposition by an alpha particle. In fact, some gamma radiation will pass through the body without interacting with it.

Radiation that originates outside of an individual's body is called external or direct radiation. Such radiation can come from an X-ray machine or from radioactive materials (materials or substances that contain radionuclides) such as radioactive waste or radionuclides in soil. Internal radiation originates inside a person's body following intake of radioactive material or radionuclides through ingestion or inhalation. Once a radioactive material is in the body, its fate is determined by its chemical behavior and how it is metabolized. If the material is soluble, it might be dissolved in bodily fluids and transported to and deposited in various body organs; if it is insoluble, it might move rapidly through the gastrointestinal tract or be deposited in the lungs.

C.2 RADIATION DOSE

Exposure to ionizing radiation is expressed in terms of absorbed dose, which is the amount of energy imparted to matter per unit mass. Often simply called dose, it is a fundamental concept in measuring and quantifying the effects of exposure to radiation. The unit of absorbed dose is the rad.

The different types of radiation mentioned above have different effects in damaging the cells of biological systems. Dose equivalent is a concept that considers the absorbed dose and the relative effectiveness of the type of ionizing radiation in damaging biological systems, using a radiation-specific quality factor. The unit of dose equivalent is the rem.

In quantifying the effects of radiation on humans, other concepts are also used. The concept of effective dose equivalent is used to quantify effects of radionuclides in the body. It involves estimating the susceptibility of the different tissue in the body to radiation to produce a tissue-specific weighting factor. The weighting factor is based on the susceptibility of that tissue to cancer. The sum of the products of each affected tissue's estimated dose equivalent multiplied by its specific weighting factor is the effective dose equivalent. The potential effects from a one-time ingestion or inhalation of radioactive material are calculated over a period of 50 years to account for radionuclides that have long half-lives and long residence time in the body. The result is called the committed effective dose equivalent. The unit of effective dose equivalent is also the rem. Total effective dose equivalent is the sum of the committed effective dose equivalent from radionuclides in the body plus the dose equivalent from radiation sources external to the body (also in rem). All estimates of dose presented in this environmental assessment (EA), unless specifically noted as something else, are total effective dose equivalents, which are quantified in terms of rem or millirem (which is one one-thousandth of a rem).

More detailed information on the concepts of radiation dose and dose equivalent are presented in publications of the National Council on Radiation Protection and Measurements (NCRP 1993) and the International Commission on Radiological Protection (ICRP 1991).

The factors used to convert estimates of radionuclide intake (by inhalation or ingestion) to dose are called dose conversion factors. The International Commission on Radiological Protection and federal agencies such as the U.S. Environmental Protection Agency (EPA) publish these factors (Eckerman and Ryman 1993; Eckerman et al. 1988). They are based on original recommendations of the International Commission on Radiological Protection (ICRP 1977).

The radiation dose to an individual or to a group of people can be expressed as the total dose received or as a dose rate, which is dose per unit time (usually an hour or a year). Collective dose is the total dose to an exposed population. Person-rem is the unit of collective dose. Collective dose is calculated by multiplying the individual dose by the number of individuals in a population. For example, if 100 workers each received 0.1 rem, the collective dose would be 10 person-rem (100 × 0.1 rem).

Exposures to radiation or radionuclides are often characterized as being acute or chronic. Acute exposures occur over a short period of time, typically 24 hours or less. Chronic exposures occur over longer times (months to years); they are usually assumed to be continuous over a period, even though the dose rate might vary. For a given dose of radiation, chronic radiation exposure is usually less harmful than acute exposure because the dose rate (dose per unit time, such as rem per hour) is lower, providing more opportunity for the body to repair damaged cells.

On average, members of the public nationwide are exposed to approximately 300 millirem per year from natural sources (NCRP 1987). The largest natural sources are radon-222 and its radioactive decay products in homes and buildings, which contribute about 200 millirem per year. Additional natural sources include radioactive material in the Earth (primarily the uranium and thorium decay series, and potassium-40) and cosmic rays from space filtered through the atmosphere. With respect to exposures resulting from human activities, the combined doses from weapons testing fallout, consumer and industrial products, and air travel (cosmic radiation) account for the remaining approximate 3 percent of the total annual dose. Nuclear fuel cycle facilities contribute less than 0.1 percent (0.05 millirem per year) of the total dose.

C.3 POTENTIAL TO INCUR CANCER (LINEAR-NO-THRESHOLD MODEL)

Cancer is the principal potential risk to human health from exposure to low or chronic levels of radiation. When radiation interacts with tissue, it deposits a small amount of energy. The deposited energy—the dose – causes the molecules of tissue to undergo transformations. These transformations, in turn, create changes in cell function. If the dose is very high, these changes disrupt the function of the cells, tissues, and organism to such an extent that severe illness ("acute radiation syndrome") is induced. At low doses, these changes generally do not create significant effects in the cells and tissues as the body has a number of corrective defense systems that remove the damage or eliminate the damaged cell. Nevertheless, the possibility exists that these induced changes could escape the protective functions and result in the induction of cancer.

This EA expresses radiological health impacts as the incremental changes in the number of expected fatal cancers (latent cancer fatalities) for populations and as the incremental increases in lifetime probabilities of contracting a fatal cancer for an individual. The estimates are based on the dose received and on dose-to-health-effect conversion factors recommended by the International Commission on Radiological Protection (ICRP 1991). This is called the Linear-No-Threshold model of radiation risk. The Commission estimated that, for the general population, a collective dose of 1 person-rem will yield 0.0005 excess latent cancer fatality. For radiation workers, a collective dose of 1 person-rem will yield an estimated 0.0004 excess latent cancer fatality. The higher risk factor for the general population is primarily due to the inclusion of children in the population group, while the radiation worker population includes only people older than 18.

For example, a population would have to be exposed to a radiation dose of 2,000 person-rem for there to be 1 excess latent cancer fatality:

$$0.0005 \text{ latent cancer fatalities/person-rem} \times 2{,}000 \text{ person-rem} = 1 \text{ latent cancer fatality}$$

If a member of the public were exposed to a radiation dose of 15 millirem per year for 40 years,[1] the lifetime probability of a latent cancer fatality would be about 0.0003:

$$0.0005 \text{ latent cancer fatalities/person-rem} \times 15 \text{ millirem/year} \times 40 \text{ years} \times 1 \text{ rem/1,000 millirem} = 0.0003 \text{ probability of a latent cancer fatality}$$

If a member of the public were exposed to a radiation dose of 0.05 millirem per year for 40 years, the lifetime probability of a latent cancer fatality would be about 1×10^{-6}:

[1] The non-isotope specific fatal cancer risk factor in ICRP 60 (1991) is 0.0005 fatality per person-rem or an individual fatal cancer risk of 0.0005 per rem. EPA uses the non-isotope specific dose risk correlation of 15 millirem/year to an individual cancer risk of 3×10^{-4} (*see* OSWER 9200.4-18). Exposure period = (3×10^{-4} x 1.000 millirem/rem) / (15 millirem/y x 0.0005 per rem) = 40 years. Thus, a 40-year exposure period was used in order to make 0.0005 and 3×10^{-4} consistent.

0.0005 latent cancer fatalities/person-rem $\times$ 0.05 millirem/year $\times$ 40 years $\times$ 1 rem/1,000 millirem = 1×10^{-6} probability of a latent cancer fatality

Other health effects such as nonfatal cancers and genetic effects can occur as a result of chronic exposure to radiation. Inclusion of the incidence of nonfatal cancers and severe genetic effects from radiation exposure increases the total detriment by 40 to 50 percent (Table C-1), compared to the change for latent cancer fatalities (ICRP 1991). As is the general practice for any U.S. Department of Energy (DOE) EA, estimates of the nonfatal cancers and severe genetic effects were not included in this EA.

Table C-1. Risk of Latent Cancer Fatalities and Other Health Effects from Exposure to Radiation

Population	Latent Cancer Fatality	Nonfatal Cancer	Genetic Effects	Total Detriment
Workers	0.0004	0.00008	0.00008	0.00056
General Population	0.0005	0.00010	0.00013	0.00073

Source: ICRP (1991)

The Linear-No-Threshold model postulates that there is a theoretical, non-zero risk at low doses of radiation, even at or below the levels of background radiation. Exposure to high levels of ionizing radiation can and does result in detrimental health effects including cancer; however, there is no scientific evidence to support the presence of any increase in cancer risk at levels below 10,000 millirem in addition to background radiation. Exposure from natural background radiation averages 300 millirem per year in the United States. Therefore, in a normal lifetime of 75 years, an individual should expect to be exposed to approximately 22,500 millirem. This background radiation comes from soil and rock, food, cosmic rays, and indoor radon.

The Linear-No-Threshold model is based on scientists' estimate of the cancer risk from high levels of radiation exposure based upon cancers observed in the survivors of the nuclear explosions in Hiroshima and Nagasaki. These survivors were exposed to hundreds of rem (or hundreds of thousands of millirem) instantaneous dose, plus subsequent long-term exposure from fallout. Based on these studies, scientists have estimated the cancer risk from radiation exposure at high doses and high dose rates to be approximately 0.05 per 100 rem. That is to say, if a person receives 100-rem exposure he/she has a 5 percent or 5-in-100 chance of developing a fatal cancer.

Thus, using the Linear-No-Threshold model, the hypothetical cancer risk due to 1 millirem would be 0.0000005 or 5 in 10 million. Using the Linear-No-Threshold model and a *40-year residence* (exposure) period, the hypothetical risk due to exposure to 15 millirem per year would be 3 in 10,000. The dose rate equivalent to a hypothetical cancer risk of 1-in-a-million would be 0.05 millirem per year.

Using the Linear-No-Threshold model, the hypothetical cancer risk from background radiation for a *75-year lifetime* would be 75 years x 300 millirem/year x 0.0000005 = 0.01 or 1 in 100. Using the Linear-No-Threshold model, the hypothetical cancer risk from radiation exposure from clean soil, containing naturally occurring radionuclides, would be would be 75 years x 30 millirem/year x 0.0000005 = 0.001 or 1 in 1,000.

It is important to understand that the Linear-No-Threshold model is a hypothetical statistical model, and that its use at low dose rates is extremely conservative. There is no scientific evidence that small variations in radiation exposure, much less than the variability in natural background radiation levels, result in any increase in cancer risks. The following scientific and government bodies support the concept of a threshold at about 5,000 to 10,000 millirem above background, below which there is no cancer risk from radiation exposure.

- The National Academy of Sciences states, "With few exceptions, however, [cancer] effects have been observed only at relatively high doses and high dose rates. Studies of populations, chronically exposed to low level radiation, such as those residing in regions of elevated natural background radiation [10 - 100 times average US levels], have not shown consistent or conclusive evidence of an associated increase in the risk of cancer." (National Academy of Sciences 1990).

- The Health Physics Society states, "The Health Physics Society recommends against quantitative estimation of health risk below an individual dose of 5,000 millirem in one year or a lifetime dose of 10,000 millirem in addition to background radiation. There is substantial and convincing evidence of health risks at high dose. Below 10,000 millirem (which include occupational and environmental exposures), risks of health effects are either too small to be observed or are non-existent." (Health Physics Society 2001).

- The General Accounting Office states, "According to a consensus of scientists, there is a lack of conclusive evidence of low level radiation effects below total exposures of about 5,000 to 10,000 millirem." (GAO 2000).

C.4 ISOTOPE-SPECIFIC RISK FACTORS

Throughout the EA, a dose of 15 millirem per year is correlated to a theoretical lifetime cancer fatality risk of 3×10^{-4}. Likewise, by simple rationing, a theoretical lifetime cancer fatality risk of 10^{-6} has been correlated to a dose of 0.05 millirem per year. This simple statistical correlation derives from the Linear-No-Threshold model relating whole-body dose and risk. It is used by regulatory agencies, including the EPA, to correlate dose and risk (*see,* for example, OSWER Memorandum 9200.4-18 [EPA 1997]).

In reality, the correlation is more complex and depends on many more factors, including radioisotope generating the dose, radiation type generating the dose, period over which dose is received, body organ receiving the dose, cancer type incurred, age at exposure, age at onset of cancer, lag time between these two times, and other lifestyle and environmental confounders such as smoking history.

C.5 REFERENCES

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NCRP (National Council on Radiation Protection and Measurements), 1987. *Ionizing Radiation Exposure of the Population of the United States*. Bethesda, MD: National Council on Radiation Protection and Measurements; NCRP Report No. 93.

APPENDIX D. SENSITIVE SPECIES OBSERVED OR POTENTIALLY OCCURRING AT THE SSFL FACILITY

Tables D-1 through D-5 are excerpted from the April 1998 *Biological Conditions Report, Santa Susana Field Laboratory* (Ogden 1998), and updated in 2000 with information from the *Standardized Risk Assessment Methodology (SRAM) Work Plan, Santa Susana Field Laboratory, Ventura County, California* (Ogden 2000, Appendix C).

Table D-1. Sensitive Plant Species

Species Name	State Status	Federal Status	Likelihood of Occurrence[a]
Santa Susana tarplant *(Hemizonia minthornii)*	Rare	--	Observed throughout the SSFL, primarily on rock outcrops.
Southern California black walnut *(Juglans californica* var. *californica)*	Candidate (CNPS List 4)	--	Observed throughout the SSFL.
Braunton's milkvetch *(Astragalus brauntonii)*	Candidate (CNPS List 1B)	Endangered	Observed in Area IV.
Plummer's mariposa lily *(Calochortus plummerae)*	Candidate (CNPS List 1B)	--	Not observed. Low potential to occur in chaparral habitat onsite. Less common at higher elevations. Has been reported in area of the SSFL but not on or immediately adjacent to the SSFL.
San Fernando Valley spineflower *(Chorizanthe parryi* var. *fernandina)*	Candidate (CNPS List 1A)	Candidate	Not observed. Extremely low potential to occur at SSFL.
Santa Monica Mountains dudleya *(Dudleya cymosa* ssp. *ovatifolia)*	Candidate (CNPS List 1B)	Threatened	Not observed. Low potential to occur onsite. Known from fewer than 10 occurrences, none of which are at or adjacent to the SSFL.
Lyon's pentachaeta *(Pentachaeta lyonii)*		Endangered	Not observed. May occur onsite. Additional surveys planned.
California orcutt grass *(Orcuttia californica)*		Endangered	Not observed. May occur onsite. Additional surveys planned.
Many-stemmed dudleya *(Dudleya multicaulis)*	Candidate (CNPS List 1B)	--	Not observed. Low potential to occur in the coastal sage scrub and chaparral habitats onsite. Not reported to occur at or adjacent to the SSFL.

a. Likelihood of occurrence is based on known species range and the presence and quality of suitable habitat.

CNPS = California Native Plant Society
SSFL = Santa Susana Field Laboratory

Table D-2. Sensitive Reptile Species

Species Name	State Status	Federal Status	Likelihood of Occurrence[a]
San Diego horned lizard *(Phrynosoma coronatum blainvillei)*	Species of Special Concern	--	Not observed. High potential to occur in appropriate habitat at the SSFL. Known to occur within the Santa Susana Mountains.
Silvery legless lizard *(Anniella pulchra pulchra)*	Species of Special Concern	--	Not observed. Moderate potential to occur in appropriate habitat (chaparral and coastal scrub) at the SSFL.
Coastal rosy boa *(Lichanura trivirgata roseofusca)*	Protected	--	Not observed. High potential to occur in appropriate habitat (rocky chaparral-covered hillsides and canyons) at the SSFL.
Coast patch-nosed snake *(Salvadora hexalepis virgultea)*	Species of Special Concern	--	Not observed. High potential to occur in appropriate habitat (coastal chaparral) at the SSFL. Widely distributed throughout California.
Two-striped garter snake *(Thamnophis hammondi)*	Special Animal	--	Expected to occur throughout appropriate habitat at the SSFL.
Southern rubber boa *(Charina bottae umbratica)*	Species of Special Concern		Could potentially occur at SSFL.
Southern Pacific rattlesnake *(Crotalis viridis helleri)*	Species of Special Concern		Could potentially occur at SSFL.
San Diego mountain king snake *(Lampropeltis zonata pulchra)*	Protected	--	Not observed. Low to moderate potential to occur in the rock outcrop habitat at the SSFL. May be at edge of range.

a. Likelihood of occurrence is based on known species range and the presence and quality of suitable habitat.

SSFL = Santa Susana Field Laboratory

Table D-3. Sensitive Aquatic, Amphibian, and Insect Species

Species Name	State Status	Federal Status	Likelihood of Occurrence[a]
San Diego fairy shrimp *(Branchinecta sandiegoensis)*		Endangered	Could potentially occur at SSFL.
Western spadefoot toad *(Scaphiopus hammondi)*	Species of Special Concern	--	Not observed. Low to moderate potential to occur at the SSFL. Occurs primarily in native grasslands at lower elevations. Few small patches of native grassland occur at the SSFL and may not be sufficient to support toad populations.
Southwestern pond turtle *(Clemmys marmorata pallida)*	Species of Special Concern (under review for protected status)	--	Not observed. Low to moderate potential to occur in the aquatic habitat at the SSFL.
Arroyo southwestern toad *(Bufo microscaphus californicus)*		Endangered	Could potentially occur at SSFL.
California red-legged frog *(Rana aurora draytoni)*	Species of Special Concern	Threatened	Not observed. Low potential to occur in the aquatic habitat at the SSFL. Uncommon throughout southern California.
Quino checkerspot butterfly *(Euphydryas editha quino)*		Endangered	Could potentially occur at SSFL.

a. Likelihood of occurrence is based on known species range and the presence and quality of suitable habitat.

SSFL = Santa Susana Field Laboratory

Table D-4. Sensitive Bird Species

Species Name	State Status	Federal Status	Likelihood of Occurrence[a]
Double-crested cormorant *(Phalacrocorax auritus)*	Species of Special Concern	--	Observed on Silvernale Reservoir. There is only a low to moderate probability that this species nests on site.
Great blue heron *(Ardea herodias herodias)*	Special Animal	--	Observed in freshwater marsh and aquatic habitat at the Silvernale Reservoir. Moderate potential to nest in the large trees at SSFL and at the Building 56 Landfill.
California gnatcatcher *(Polioptila californica)*	Species of Special Concern	Threatened	Not observed. Low potential to occur in the sage scrub habitat on site. May be at edge of known range. Focused surveys did not detect gnatcatchers.
Southern California rufous-crowned sparrow *(Aimophila ruficeps canescens)*	Species of Special Concern	--	Observed near Area IV.
Loggerhead shrike *(Lanius ludovicianus)*	Species of Special Concern	--	Observed near Area IV. This species probably nests at SSFL.
Least Bell's vireo *(Vireo belii pusillus)*		Endangered	Could potentially occur at SSFL.
Southwestern willow flycatcher *Empidonax trailii extimus*		Endangered	Could potentially occur at SSFL.
Sharp-skinned hawk *(Accipiter striatus velox)*	Species of Special Concern	--	Observed flying over the SSFL. Historically documented at SSFL by Rocketdyne personnel.
Red-shouldered hawk *(Buteo lineatus elegans)*[b]	--	--	Observed evidence of nesting in Area IV.
Red-tailed hawk *(Buteo jamaicencis)*[b]	--	--	Observed roosting in the vicinity of Area IV and flying over the Building 56 Landfill.
Turkey vulture *(Cathartes aura)*[b]	--	--	Observed roosting and flying over the entire SSFL; expected to forage on the property.
Great horned owl *(Bubo virginianus)*[b]	--	--	Observed two owls roosting in the vicinity of Area IV.
Cooper's hawk *(Accipiter cooperii)*	Species of Special Concern	--	Observed a male and female roosting in the vicinity of Area IV. This species has a high probability of nesting on site.
Golden eagle *(Aquila chrysaetos canadensis)*	Species of Special Concern	Protected	Not observed during biological surveys; however, this species has been historically documented by Rocketdyne personnel.

a. Likelihood of occurrence is based on known species range and the presence and quality of suitable habitat.
b. Although no official status is given for these raptors, raptor nests are protected to varying degrees by separate state regulations. Additionally, raptors are considered important to the ecosystem due to their position at the top of the food chain.

SSFL = Santa Susana Field Laboratory

Table D-5. Sensitive Mammal Species

Species Name	State Status	Federal Status	Likelihood of Occurrence[a]
Bobcat *(Felis rufus)*	Harvest Species	--	Observed throughout the SSFL.
Mule deer *(Odocoileus hemionus)*	Harvest Species	--	Observed throughout the SSFL.
San Diego black-tailed jackrabbit *(Lepus californica bennettii)*	Species of Special Concern	--	Observed in Area IV.
Los Angeles little pocket mouse *(Perognathus longimembris brevinasus)*	Species of Special Concern	Under review for endangered or threatened status	Not observed. Low to moderate potential to occur in appropriate habitat at SSFL. A live-trapping study would need to be performed to determine if this subspecies is present at SSFL.
Ringtail *(Bassariscus astutus)*	Protected	--	Moderate to high potential to occur at SSFL in areas of rock outcrops.
Mountain lion *(Felis concolor)*	Harvest Species	--	Not observed. High potential to occur at SSFL. Known to occur in the area.
American badger *(Taxidea taxus jeffersoni)*	Species of Special Concern, Harvest Species	--	Not observed. High potential to occur at SSFL. Known to occur in the area.
San Diego desert woodrat *(Neotoma lepida intermedia)*	Species of Special Concern	--	Not observed during biological surveys; however, this species has been historically documented by SSFL personnel.

a. Likelihood of occurrence is based on known species range and the presence and quality of suitable habitat.

SSFL = Santa Susana Field Laboratory

REFERENCES

Ogden (Ogden Environmental and Energy Services Co., Inc.), 2000. *Standardized Risk Assessment Methodology (SRAM) Work Plan, Santa Susana Field Laboratory, Ventura County, California*. Available at the SSFL Public Information Repository.

Ogden (Ogden Environmental and Energy Services Co., Inc.), 1998. *Biological Conditions Report, Santa Susana Field Laboratory, Ventura County, California*. Available at the SSFL Public Information Repository.

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APPENDIX E. SOIL SAMPLING DATA

The impacts of Alternatives 1 and 2 and the No Action Alternative described in this environmental assessment (EA) are based on soil sampling data collected on Area IV by Rocketdyne. This appendix provides a discussion of the quality assurance of this data and an explanation of its use in the EA.

Two sets of soil data were used to characterize the soil at Area IV:

- 149 predominantly surface soil data taken during the 1994-95 Area IV Radiological Characterization Survey (A4CM-ZR-0011) (Rocketdyne 1996). These soil samples were analyzed for gamma-emitting radionuclides, isotopic thorium, isotopic uranium, isotopic plutonium, strontium-90, and tritium.

- 29 surface soil samples taken during 2000 at the Radioactive Materials Handling Facility (RMHF). These soil samples were analyzed for gamma-emitting radionuclides.

The California Department of Health Services, Environmental Management Branch observed the Area IV fieldwork and took 10 percent split soil samples. The analysis of those soil samples confirmed the Rocketdyne data, and the results were published in the Department's *1995 Annual Report of the DOE/Department of Health Services Agreement-in-Principle* (DHS 1995).

EPA ISSUES WITH AREA IV METHODOLOGY

Issue 1. EPA questioned the detectability and sensitivity of 7-meter by 7-meter (25-foot by 25-foot) spacing for 1-meter (3-foot), 1-minute gamma exposure measurements.

Response:

- These measurements were used to map gamma exposure at 1 meter for Area IV to compare to the U.S. Department of Energy's (DOE's) 5400.5 20-microRoentgen per hour action level and Rocketdyne's 5-microRoentgen per hour action level. It is noteworthy to point out that the proposed EPA survey of Area IV does not intend to map 1-meter exposures.

- Method was not designed or intended to detect all potential levels of contamination at all depths.

- The surface scanning of ground over every square foot was designed to detect hot spots.

- The offsite multi-media sampling survey, conducted in 1992 and 1994, had the same objective as the Area IV survey—to identify any potential contamination from Rocketdyne operations. The Environmental Protection Agency (EPA) participated in the offsite survey. Neither exposure mapping nor surface scanning was performed for the offsite survey. See *Multimedia Sampling Report for the Brandeis-Bardin Institute and the Santa Monica Mountains Conservatory* (McLaren-Hart 1993), and *Additional Soil and Water Sampling at the Brandeis-Bardin Institute and Santa Monica Mountains Conservatory* (McLaren-Hart 1995).

Issue 2. EPA questioned the correlation of the counts per minute from Sodium Iodide detectors, used in the field, with the microRoentgen per hour of a pressurized ionization chamber at a fixed location.

Response:

- Correlation measured thrice daily and applied to daily field measurements.
- Later measurements with Department of Health Services Radiologic Health Branch at different locations at Santa Susana Field Laboratory (SSFL), verified that correlation varied by no more than ±5 percent, which was less than the daily variability at a fixed location.
- When tested against radioactive waste at RMHF, Sodium Iodide detectors over-respond (conservatively) compared to pressurized ionization chambers.

Issue 3. EPA recommended the use of an 8-centimeter by 8-centimeter (3-inch by 3-inch) Sodium Iodide probe instead of a 3-centimeter by 3-centimeter (1-inch by 1-inch) Sodium Iodide probe for the 1—meter (3-foot), 1-minute measurements and use of multiple detectors.

Response:

- The instruments used were adequate for the purpose of mapping the Area IV exposure levels. The 1-meter (3-foot) measurements are not designed to detect low levels of contamination. They are designed to measure radiation levels to which persons are exposed.
- These measurements were not designed, or intended, to detect all potential levels of contamination at all depths.
- Dual, redundant detectors were used for quality control.

Issue 4. Surface scanning speed was too fast.

Response:

- Description of scan process in final report was misleading.
- Procedures required a side-to-side scan speed of approximately 1 foot per second across a 1.5-meter (5-foot) wide strip while standing stationary. One step forward, then repeat. Thus, the probe head is no more than 15 centimeters (6 inches) away from any point on the soil surface.
- Subsequent surface scanning, based on the same protocol, performed for the MARSSIM survey of the Hot Lab, has an actual scan sensitivity of 10.3 picocuries per gram of cesium-137, compared to a required scan sensitivity, derived concentration guideline (elevated measurement concentration), of 12.9 picocuries per gram.

Issue 5. "Anomalies" such as higher exposures at the edge of a grid blocks were not investigated.

Response:

- All exposure plots provided in the Area IV Survey Report were gaussian, indicating that there were no "anomalies" or indicators of contamination.

Issue 6. Criteria used to determine soil sample location (exceeding 5-microRoentgen/h) could have missed buried contamination.

Response:

- Only 12 soil sample locations were identified based on surface scan.
- Five other criteria were used to identify locations for 137 other soil samples.
- Scan sensitivity is less than MARSSIM derived concentration guideline (elevated measurement concentration) for cesium-137.
- All surface surveys (including EPA's) could be criticized as not guaranteeing detection of undefined subsurface contamination at undefined depth.

Issue 7a. EPA asked what formal data validation of laboratory data was performed.

Response:

- The Area IV Sampling and Analysis Plan describes the data validation process for soil sample analysis and includes the following:
  - Field data-sheets were reviewed for completeness and clarity.
  - Laboratory analysis reports were reviewed for completeness and conformance to the lab request and to verify that sample serial numbers in each batch corresponded to serial numbers reported in of analysis reports.
  - Chain-of-custody forms were reviewed for continuity.
  - Analysis results were reviewed to ensure reported radionuclide concentrations were consistent with method detection limits.
  - Anomalous or questionable results were reported to the laboratory and re-analyses requested. This was done for only four samples.
  - All Quality Control sample results were analyzed to determine factors such as precision and accuracy for each isotope. These results are reported in the Quality Assurance section of the Area IV Survey Report.
    - Blind Field Duplicates. 5 percent of scheduled samples. 88 percent pass rate.
    - Laboratory Duplicates. 7 percent of scheduled samples. 93 percent pass rate.
    - Laboratory Control Samples. 9 percent of scheduled samples. 99 percent pass rate.
    - Laboratory Blanks. 9 percent of scheduled samples. 96 percent pass rate.
    - Rinsate Samples. 5 percent of scheduled samples. 97 percent pass rate.
    - Department of Health Services Field Duplicates. 8 percent of scheduled samples. 69 percent pass rate.
  - Each data package received from the laboratory for every batch of soil samples (either 10 or 20 samples per batch) consisted of:
    - Case narrative (provided in the data appendix of the Area IV Survey Report)
    - Data summary (provided in the report appendix)
    - Chain-of-custodies
  - In addition, the laboratory prepared for each batch of samples:
    - Aliquot information
    - Preparation log for Quality Control samples
    - Calibration data for liquid scintillation counter–copies of raw data sheets including calibration data for gamma spectrometer

- In conclusion, the tabulation of Quality Control samples in Appendix G of the Area IV Survey Report is comprehensive and thorough.

Issue 7b. Laboratory data in Volumes II, III, and IV of the Area IV Survey Report were hard to follow.

Response:

In hindsight, Rocketdyne concurs that a better job of segregating the laboratory data could have been done. The raw data were exhaustively tabulated, graphed, statistically analyzed, and interpreted in the main body of the report, for the very reason that the raw lab data would be impossible to assimilate for the casual reader. Perhaps because of this, less effort was devoted to indexing/annotating/titling the raw laboratory data in Volumes II to IV. The laboratory reports were actually ordered chronologically, because any other way would have been even more confusing. In situations where re-analysis was requested and/or voluntarily performed by the laboratory, both original and re-analysis results are given in the chronological order in which the results were received.

Issue 7c. Little information was provided on the remediation activities in the rest of Area IV.

Response:

- The decommissioning and decontamination and radiological surveys of nuclear facilities by Rocketdyne, the independent verification surveys by third parties and regulatory agencies, and the radiological release process have been documented in numerous reports. These activities are driven and controlled by regulation.
- The (as then) current status of facilities was documented extensively in the Area IV Radiological Characterization Plan when it was issued.

Issue 8. EPA questioned the consistency between 5 microRoentgen per hour and 15 millirem (mrem) per year.

Response:

- The 5 microRoentgen per hour action level used and its translation into 44 mrem per year appears to be inconsistent with a cleanup standard of 15 mrem per year. This illustrates one of the problems with imposing cleanup goals that are very much lower than the variability of natural background.
- Instrument readings were not used exclusively to determine where we would take soil samples.
- Only 12 of 149 samples were taken because the 5 microRoentgen per hour level was exceeded.
- Use of a 1.7 microRoentgen per hour action level (equivalent to 15 mrem per year) would not be practical. Indeed use of 5 microRoentgen per hour is often problematic.
- Full range of exposure in Area IV was 6 to 21.4 microRoentgen per hour (mean = 14.6 ± 3.6 microRoentgen per hour).
- Thus, 5 microRoentgen per hour is less than the ±2 sigma spread.
- There was no correlation between measured contamination in soil samples and exposure levels.

- Exposure levels in Area IV are primarily a function of ground cover (grass, soil, concrete, asphalt), proximity to buildings, tree cover, and proximity to sandstone rock.

CRITICISM OF SAMPLING DENSITY (1 SAMPLE EVERY 2 ACRES) AS TOO SMALL

Response: Determining the impacts of cleanup of the ETEC site to particular cleanup standards required estimates of the soil excavation needed in Area IV to meet the cleanup goal. Although all remediation sites have had extensive pre- and post-remedial soil sampling performed, those sites are not individually characteristic of the balance of Area IV. The soil data for a specific small area site (several acres) should not be considered characteristic of all 1.2 square kilometers (290 acres) of Area IV. The only comprehensive set of soil samples taken in the non-remediated portions of Area IV were the Area IV survey samples taken in 1994-95. Therefore, this soil sample distribution was used to characterize the balance of Area IV soil. A pre-remediation soil sample data set was available for the RMHF and therefore was used to estimate relative impacts of RMHF soil excavation.

The assumption that the Area IV data set is representative of the all soil (including subsurface soil) at Area IV is extremely conservative. Use of Area IV survey data does not result in a low estimate of the excavated soil volume for Alternative 2; indeed the estimate is a large fraction (15 percent) of all Area IV soil.

The 149 soil samples taken in the 1994-95 Area IV Radiological Characterization Survey are actually a small fraction of the total number of soil samples taken in Area IV. A total of 25 of 28 original radiological facilities have been remediated in Area IV. Soil samples have been taken at the majority of these facilities, both prior to remediation, during remediation and post-remediation as part of final status surveys. In addition to Rocketdyne, several other organizations have taken verification samples, including Oak Ridge Associated Universities, Oak Ridge Institute of Science and Education, Argonne National Laboratories, California Department of Health Services Radiological Health Branch, and the California Department of Health Services Environmental Management Branch. Table E-1 gives a summary of the more than 1,600 post remedial soil samples associated with final status surveys. Because of the "as low as reasonably achievable" (ALARA) process, all soil samples are considerably less than approved cleanup standards equivalent to Alternative 1 and most are within the distribution of local background.

In addition to these samples, additional samples have been taken subsequent to the Area IV survey during excavation of septic tanks and leachfields at Buildings 4005, 4006, 4009, 4011, 4100, 4143, 4353, 4373, and 4487. No contamination has been observed. Soil samples have also been taken associated with the metal debris field at the Old Conservation Yard and at the recent installation of shallow piezometer wells in Area IV. No contamination has been observed.

In two recent MARSSIM designed soil surveys at Area IV, Rocketdyne used sample densities of 35 to 40 samples per acre for Class 1 survey units. Sample densities were calculated using MARSSIM statistical protocols, based on a 15 millirem per year (~3×10^{-4}) cleanup standard for cesium-137 of 9.2 picocuries per gram, measured a priori cesium distributions, and a and ß error factors of 0.05.

REFERENCES

DHS (California Department of Health Services), 1995. *1995 Annual Report of the DOE/Department of Health Services Agreement-in-Principle,* prepared by the Environmental Management Branch, September 30, 1995.

McLaren-Hart, 1995. *Additional Soil and Water Sampling at the Brandeis-Bardin Institute and Santa Monica Mountains Conservatory*, McLaren-Hart, January 19, 1995.

McLaren-Hart, 1993. *Multimedia Sampling Report for the Brandeis-Bardin Institute and the Santa Monica Mountains Conservatory*, March 10, 1993.

Rocketdyne, 1996. *Area IV Radiological Characterization Survey, Final Report*, A4CM-ZR-0011, Revision A, Rockwell International, Rocketdyne Division, August 15, 1996.

Facility Number	Facility Title	Rocketdyne Operations	Verification Surveys	Rocketdyne	ORISE	DHS	Other
OCY	Old Conservation Yard	D&D and survey complete	ORISE, DHS	20	1	*	-
RMHF	Radioactive Materials Handling Facility	Operational	-	TBD	TBD	TBD	-
003	Engineering Test Building	D&D and survey complete	ANL	15	-	-	9 (ANL)
005	Uranium Carbide Fuel Facility	D&D and survey complete	ORISE, DHS	59	2	*	-
009	Organic Moderated Reactor, Sodium Graphite Reactor	D&D and survey complete	DHS	199	-	-	-
011	Radiation Instrument Calibration Laboratory	Survey complete	DHS	-	-	-	-
010	SNAP-8 Experimental Reactor	D&D and survey complete	ANL	60	-	-	25 (ANL)
012	SNAP Critical Facility	D&D and survey complete	ORISE, DHS	-	-	-	-
17th St.	17th St. Drainage Area	D&D and survey complete	ORISE, DHS	22 + 24	8	*	-
019	Flight System Critical Assembly	D&D and survey complete	ORISE, DHS	-	-	-	-
020	Hot Lab Bldg.	D&D and survey complete	DHS	See below	See below	See below	-
020	Hot Lab Land	Survey complete	ORISE, DHS	85 + 216 + 195	20+10+12	*	-
023	Corrosion Test Loop	D&D and survey complete	ORISE, DHS	-	-	-	-
024	SNAP Environmental Test Facility	Operational	-	TBD	TBD	TBD	-
028	Shield Test Irradiation Reactor	D&D and survey complete	ORISE, DHS	-	-	-	-
029	Radiation Measurement Facility	D&D and survey complete	ORISE, DHS	4	-	-	-
030	van de Graaf Accelerator	D&D and survey complete	ORISE, DHS	-	-	-	-
055	Nuclear Materials Development Facility	D&D and survey complete	ORAU	36	20	-	-
059	SNAP Ground Prototype Test Building	Phase I D&D and survey complete	ORISE, DHS	See below	See below	See below	-
059	059 Land	-	-	TBD	TBD	TBD	-
064	Fuel Storage Facility	D&D and survey complete	ORISE, DHS	See below	See below	See below	-
064SY	064 Side Yard and land	D&D and survey complete	ORISE, DHS	52 + 136	21	*	-
073	Kinetic Experiment Water Boiler	D&D and survey complete	ANL	23	-	-	124 (ANL)
093	L-85 Reactor	D&D and survey complete	ORAU	5 + 12	6	-	-
100	Fast Critical Experiment	D&D and survey complete	NRC	-	-	-	-

Facility Number	Facility Title	Rocketdyne Operations	Verification Surveys	Rocketdyne	ORISE	DHS	Other
	Laboratory						
143	Sodium Reactor Experiment	D&D and survey complete	ANL	~ 40 +	-	-	~ 40 (ANL)
363	R&D Laboratory	D&D and survey complete	ORISE, DHS	-	-	-	-
373	SNAP Critical Facility	D&D and survey complete	DHS (document review only)	-	-	-	-
654	Interim Storage Facility	D&D and survey complete	ORISE, DHS	93	16	*	-
886	Sodium Disposal Facility	Rad. D&D and survey complete	DHS	109	-	13	10 (RWQCB)
Area IV	Area IV SSFL (1994-95)	Nuclear Research	DHS	149	-	12	-
Area IV	Miscellaneous	Miscellaneous	-	~ 50			-
Total				**1,604**	**104**	**25+**	**208**

* Verification survey report has not been provided.

APPENDIX F. RADIONUCLIDES OF CONCERN AT AREA IV

Radiological contaminants of concern at the Energy Technology Engineering Center (ETEC) and Area IV of the Santa Susana Field Laboratory (SSFL) are derived from two considerations: operating history and empirical observations from soil samples. The observed radionuclide concentrations are then compared against the approved soil release criteria, and the level of concern is determined by this comparison.

F.1 OPERATING HISTORY

Atomic Energy Commission-funded nuclear research started in Area IV in 1956. All the nuclear related research and development operations ceased in 1988, and the subsequent work has been directed toward decontamination and decommissioning. The operations at Area IV included ten nuclear research reactors, seven critical facilities, a large Hot Laboratory, a Nuclear Materials Development Facility, a Radioactive Materials Handling Facility (RMHF), and various test and nuclear material storage areas. As a result, a list of radionuclides involved in these operations is identified in Table F-1. These radionuclides, as they related to the past operations, are potential radionuclide contaminants. They are, however, not necessarily contaminants of concern at Area IV. Only those radionuclides that are released to the environment become radionuclides of concern. The list has served as a direction for selecting radionuclides to be analyzed in soil samples. Short-lived fission or activation products, such as iodine-131 (8-day half-life) and manganese-54 (300-day half-life), are not listed because they have decayed to stable isotopes during the period since shutdown of the last reactor at Area IV in 1980. Due to the atmospheric atomic bomb testing, all man-made radionuclides listed in the table could also come from the fallout.

F.2 OBSERVATIONS IN SOIL SAMPLES

During the past decades, several thousand soil samples in and around Area IV have been taken and analyzed for specific radionuclides. Table F-1 summarizes the results for the relevant radionuclides for the ETEC. The soil guidelines in the table were derived using RESRAD software and were approved by the California Department of Human Services and the U.S. Department of Energy (DOE) as the release criteria for soil. Because all the relevant radionuclides are also from either naturally occurring sources or global fallout, it is necessary to subtract background from these results before using them for risk assessment.

Americium-241, plutonium-241, and plutonium-242 are unlikely to be a major concern in soil because elevated plutonium-239 concentrations have not been found in soil samples.

To determine the potential radionuclides of concern for the decontamination and decommissioning work in Area IV, the following process was used. If the maximum observed concentration of a radionuclide is less than 10 percent of the release criteria, it is highly unlikely that this radionuclide will pose any risk to the environment and the public. If, however, the maximum observed concentration of a radionuclide exceeds 10 percent of the release criteria, further determination on background level is warranted. Uranium-238, thorium-232, cesium-137, strontium-90, and cobalt-60 fall into this category. Potassium-40 is a naturally occurring radionuclide, and DOE did not find significant differences between onsite and offsite observations from historical data.

In summary, the potential radionuclides of concern at Area IV are uranium-238, thorium-232, cesium-137, strontium-90, and cobalt-60.

Table F-1. Potential Radionuclides at Area IV

Source	Isotope	Half-Life	Principal Means of Production	Remarks
Fuel	Pu-239	2.4E4 y	Fuel material	Also fallout
	Th-232	1.4E10 y	Fuel material (in metal form)	Also naturally occurring, fallout
	U-234	2.3E5 y	Fuel material	Also naturally occurring, fallout
	U-235	7.1E8 y	Fuel material	Also naturally occurring, fallout
	U-238	4.5E9 y	Fuel material	Also naturally occurring, fallout
Transuranics	Am-241	458 y	Decay of Pu-241	Also from fallout
	Pu-238	86.4	Isotope in Pu fuel	Also from fallout
	Pu-240	6.6E3 y	Isotope in Pu fuel	Also from fallout
	Pu-241	13.2 y	Isotope in Pu fuel, multiple neutron capture from U-238 and Pu-239	Also from fallout
	Pu-242	3.8E5 y	Isotope in Pu fuel, multiple neutron capture from U-238 and Pu-239	Also from fallout
Fission Products	Cs-137	30.0 y	Fission	Also from fallout
	I-129	1.7E7 y	Fission	Also from fallout
	Sr-90	27.7 y	Fission	Also from fallout
Activation Products	Co-60	5.3 y	$Co^{59}(n, \gamma)$	Also from fallout
	Eu-152	12.7 y	$Eu^{151}(n, \gamma)$	Also from fallout
	Eu-154	16 y	$Eu^{153}(n, \gamma)$	Also from fallout
	Fe-55	2.6 y	$Fe^{54}(n, \gamma)$	Low hazard beta in rebar and steel
	H-3	12.3 y	$Li^{6}(n, \alpha)$	Also from fallout
	Ni-59	8.0E4 y	$Ni^{58}(n, \gamma)$	Low hazard beta in rebar and steel
	Ni-63	92 y	$Ni^{62}(n, \gamma)$	Low hazard beta in rebar and steel
Naturally Occurring and Its Progeny	U-238	4.5 E9 y	Primordial	
	U-234	2.5E5 y	progeny	
	Th-230	8.0E4 y	progeny	
	Ra-226	1.6E3 y	progeny	
	Pb-210	21 y	progeny	
	Th-232	1.4E10 y	Primordial	
	Ra-228	5.8 y	progeny	
	Th-228	1.9 y	progeny	
	K-40	1.3E9 y	Primordial	

APPENDIX G. ALARA PRINCIPLE

G.1 REGULATORY GUIDANCE ON ALARA

The U.S. Department of Energy (DOE), Nuclear Regulatory Commission (NRC), and California Department of Health Services (DHS) regulations and guidance require the implementation of the "as low as reasonable achievable" (ALARA) process. ALARA is defined as:

> "[T]he 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) and 10 CFR 834.2(a))

> " '[R]easonably achievable' is judged by considering the state of technology and the economics of improvements in relationship to all the benefits from these improvement. However a comprehensive consideration of risks and benefits will include risks from non-radiological hazards. An action taken to reduce radiation risks should not result in a significantly larger risk from other hazards." (NUREG 1727 [NRC 2000] and NRC Regulatory Guide 8.8 [NRC 1978])

> "Determination of the levels which are ALARA must take into account consideration of any detriments, such as traffic accidents, expected to potentially result from decontamination and waste disposal." (10 CFR 20.1403(a))

The ALARA process is defined as:

> "[A] logical procedure for evaluating alternative operations. Processes, and other measures, taking into account factors that relate to societal, technological, economic, practical, and public policy considerations in order to make a judgment with respect to what constitutes ALARA." (10 CFR 834.2(a))

The Nuclear Regulatory Commission has made certain statements related to cleanup levels that are already deemed ALARA:

> "In light of the conservatism in the building surface and surface soil generic screening levels developed by the NRC staff, the staff presumes, absent information to the contrary, that licensees or responsible parties that remediate building surfaces or soil to the generic screening levels do not need to demonstrate that these levels are ALARA." (NRC 2000, Appendix D, "ALARA Analysis," page D1)

> "For residual radioactivity in soil at sites that will have unrestricted release [*i.e.*, meet 25 millirem per year], generic analyses show that shipping [additional] soil to a low-level waste disposal facility [to achieve goals less than 25 millirem per year] is unlikely to be cost effective, largely because of the high costs of waste disposal." (NRC 2000, Appendix D, "ALARA Analysis," page D12)

Thus, the ALARA process is an "impact analysis" of the detriments and benefits of different cleanup levels. Rocketdyne utilized the modeling and data recommended in NUREG 1727, Appendix D, "ALARA Analysis" (NRC 2000), to assess the impact of various cleanup levels in the range of 0 to 15 millirem per year. Various impacts of Alternatives 1 and 2 were calculated, including person-rem averted (and associated lives saved), fatalities from worker accidents, truck accidents, and soil volumes excavated.

G.2 EXISTING CLEANUP STANDARDS ARE ALARA

The two principal cleanup goals are related to building facility surface contamination and soil volumetric contamination.

Building Surface Contamination. The recent *Surface and Volume Radioactivity Standards for Clearance* (ANSI/HPS 1999) has proposed new isotope specific standards for surface and volumetric contamination based on a 1-millirem-per-year standard. A comparison of the Regulatory Guide 1.86 limits (NRC 1974) (those currently utilized by NRC, DOE, DHS, and Rocketdyne) with these new proposed limits shows that Regulatory Guide 1.86 limits are equal or less than 1 millirem per year, thus demonstrating that cleanup standards for building surfaces are much less than a 15 millirem per year goal (Boeing 2001). Table G-1 illustrates this comparison.

Table G-1. Dose Equivalent to Regulatory Guide 1.86 Surface Contamination Limits

	Regulatory Guide 1.86		Recommended screening limits based on 1 mrem/y in ANSI/HPS 13.12-1999		First year dose equivalent to Reg. Guide 1.86 limits	First year risk equivalent to Reg. Guide 1.86 limits[a]
	$dpm/100cm^2$	Bq/cm^2	$dpm/100cm^2$	Bq/cm^2	mrem/year	
Transuranics (Pu-239, Pu-240, Pu-241, Am-241, etc.)	100	0.0166	600	0.1	0.166	8.3E-08
Ra-226, Ra-228	100	0.0166	600	0.1	0.166	8.3E-08
Th-228, Th-230	100	0.0166	600	0.1	0.166	8.3E-08
Thorium-nat, Th-232	1,000	0.166	600	0.1	1.66	8.3E-07
Strontium-90 (isolated)	1,000	0.166	6,000	1	0.166	8.3E-08
Uranium-nat, U-234, U-235, U-238	5,000	0.833	6,000	1	0.833	4.2E-07
Beta-gamma emitters (e.g., Cs-137, Co-60)	5,000	0.833	6,000	1	0.833	4.2E-07
Beta-gamma emitters (e.g., I-131)	1,000	0.166	60,000	10	0.0166	8.3E-09
Beta-gamma emitters (e.g., Fe-59)	5,000	0.833	60,000	10	0.0833	4.2E-08
Beta-gamma emitters (e.g., H-3, Fe-55, Ni-63)	5,000	0.833	600,000	100	0.00833	4.2E-09

a. Based on a lifetime cancer risk of 5×10^{-7} per millirem
Source: Boeing 2001.

Soil Volumetric Contamination. Table G-2 uses the RESRAD software to calculate isotope-specific dose risk correlations. Columns 5 and 7 show the soil concentration equivalent to a 15-millirem per year dose limit using the 2001 version of RESRAD (version 6.1) (ANL 2001). These are very similar to the data in Column 2 from *Approved Sitewide Release Criteria for Remediation of Radiological Facilities at*

Table G-2. Soil Cleanup Goals

	RESRAD (1996)			RESRAD Version 6.1			Derived Risk Standards based on RESRAD 6.1					
	N001SRR140131 15 mrem/y dose based standard			15 mrem/y dose based standard			3 x 10^{-4} risk based standard			1 x 10^{-6} risk based standard		
Isotope	Soil pCi/g	Soil[a] pCi/g	Risk[b]	Dose mrem/y	Risk	Soil pCi/g	Risk	Dose mrem/y	Soil pCi/g	Risk	Dose mrem/y	Soil pCi/g
Am-241	5.44	5.44	1.1E-05	15	1.1E-05	5.53	3.0E-04	405	149	1.0E-06	1.35	0.50
Co-60	1.94	1.94	8.5E-05	15	9.1E-05	2.07	3.0E-04	49	6.8	1.0E-06	0.16	0.02
Cs-134	3.33	3.33	3.3E-05	15	3.9E-05	3.92	3.0E-04	114	29.9	1.0E-06	0.38	0.10
Cs-137	9.20	9.20	2.4E-04	15	2.5E-04	9.31	3.0E-04	18	11.4	1.0E-06	0.06	0.04
Eu-152	4.51	4.51	1.7E-04	15	1.8E-04	4.63	3.0E-04	26	7.9	1.0E-06	0.09	0.03
Eu-154	4.11	4.11	1.3E-04	15	1.4E-04	4.27	3.0E-04	33	9.4	1.0E-06	0.11	0.03
Fe-55	629,000	629,000	1.6E-04	15	2.0E-04	764,500	3.0E-04	22	1,143,890	1.0E-06	0.07	3813
H-3	31,900	31,900	2.1E-04	15	2.9E-05	4,511	3.0E-04	154	46,457	1.0E-06	0.51	155
K-40	27.6	27.6	2.4E-04	15	2.5E-04	28.1	3.0E-04	18	33.9	1.0E-06	0.06	0.11
Mn-54	6.11	6.11	1.4E-05	15	2.0E-05	8.92	3.0E-04	221	131	1.0E-06	0.74	0.44
Na-22	2.31	2.31	3.9E-05	15	4.5E-05	2.66	3.0E-04	99	17.6	1.0E-06	0.33	0.06
Ni-59	151,000	151,000	8.6E-04	15	8.7E-04	153,900	3.0E-04	5	52,905	1.0E-06	0.02	176
Ni-63	55,300	55,300	6.9E-04	15	7.0E-04	56,260	3.0E-04	6	24,067	1.0E-06	0.02	80.2
Pu-238	37.2	37.2	1.3E-05	15	3.2E-05	90.9	3.0E-04	140	849	1.0E-06	0.47	2.83
Pu-239	33.9	33.9	1.4E-05	15	3.3E-05	82.1	3.0E-04	136	746	1.0E-06	0.45	2.49
Pu-240	33.9	33.9	1.4E-05	15	3.3E-05	82.1	3.0E-04	137	749	1.0E-06	0.46	2.50
Pu-241	230	230	1.2E-05	15	1.2E-05	234	3.0E-04	361	5,643	1.0E-06	1.20	18.8
Pu-242	35.5	35.5	1.3E-05	15	3.3E-05	86.3	3.0E-04	137	790	1.0E-06	0.46	2.63
Ra-226	0.20	5 and 15	5.0E-03	15	2.6E-04	0.26	3.0E-04	17	0.3	1.0E-06	0.06	0.0010
Sr-90	36	36	1.9E-04	15	1.9E-04	36.6	3.0E-04	24	57.9	1.0E-06	0.08	0.19
Th-228	2.81	5 and 15	5.2E-05	15	3.7E-05	3.61	3.0E-04	120	28.9	1.0E-06	0.40	0.10
Th-232	1.53	5 and 15	9.5E-04	15	3.4E-04	1.77	3.0E-04	13	2	1.0E-06	0.04	0.0053
U-234	106	30	3.1E-05	15	1.2E-04	114	3.0E-04	39	294	1.0E-06	0.13	0.98
U-235	32.1	30	2.3E-04	15	2.9E-04	38.3	3.0E-04	15	39.4	1.0E-06	0.05	0.13
U-238	90.9	35	6.3E-05	15	2.2E-04	122	3.0E-04	20	166	1.0E-06	0.07	0.55
Average				**15**	**1.8E-04**							

a. Includes non-RESRAD ARAR soil standards for Ra-226, Th-238, Th-232, U-234, U-235, and U-238.

b. Equivalent risk of approved cleanup standards based on the U.S. Environmental Protection Agency's (EPA) Health Effects Assessment Summary Tables (HEAST) (EPA 2001) morbidity dose/risk factors in RESRAD 6.1 (ANL 2001) and 30 year exposure period.

the SSFL (Boeing 1999) using the 1996 version of RESRAD. Column 6 shows the equivalent morbidity risk calculated by RESRAD based on the U.S. Environmental Protection Agency's Health Effects Assessment Summary Tables (HEAST) (EPA 2001) morbidity dose/risk factors and a 30-year exposure period. The risks for 15 millirem per year range from a high of 8.7×10^{-4} for nickel-59 to a low of 1.1×10^{-5} for americium-241. Thus, the range of risk factors are from 3x to 1/30x, the rule of thumb of 3×10^{-4}. The risk factor for cesium-137 is 2.5×10^{-4}, and the average risk for all radionuclides is 1.8×10^{-4}. Therefore, implementing a 15-millirem-per-year dose goal actually achieves many isotope-specific theoretical risks within the 10^{-6} to 10^{-4} risk range.

G.3 DEMONSTRATION OF ALARA EFFECTIVENESS WITH POST-REMEDIAL SAMPLING

The cleanup process, whether for building surfaces or soil, typically achieves much lower post-remediation levels than regulatory cleanup goals.

Building Surface Contamination. As an example, Table G-3 shows surface contamination measurements for total and removable beta contamination for survey unit 9, the vacuum equipment room within the Building 4059 basement. This facility was remediated and surveyed in 1999. This area had the highest removable contamination measurement and one of the highest total contamination measurements. All total measurements were below not only the cleanup standard of 5,000 disintegrations per minute per 100 square centimeters but also below the minimum detectable activity of 2,217 disintegrations per minute per 100 square centimeters. Forty percent of the removable measurements were less than the removable minimum detectable activity of 14 disintegrations per minute per 100 square centimeters. All removable measurements were less than 5 percent of the cleanup standard of 1,000 disintegrations per minute per 100 square centimeters.

Table G-3. Contamination Measurements for Vacuum Equipment Room of Building 4059[a]

	Maximum Beta (dpm/100 cm^2)	Minimum Beta (dpm/100 cm^2)	Average Beta (dpm/100 cm^2)	Minimum detectable activity (MDA) (dpm/100 cm^2)	Cleanup Standard (Reg. Guide 1.86) (dpm/100 cm^2)
Total	652	-78	107	2,217	5,000
Removable	54	2	18	14	1,000

a. Rocketdyne 1999.

Soil Volumetric Contamination. As an example of the ALARA process for cleanup of soil volumetric contamination, cesium-137 data for the land where the Hot Lab stood can be examined (*see* Table G-4). The majority of samples (83 percent or 70 of 84) were within the 95 percent confidence limit of 0.21 picocurie per gram for local background. Seventeen percent of samples exceeded this 0.21 picocurie per gram local background level, indicating potential man-made contamination. Only four samples (5 percent) exceeded 1.0 picocurie per gram. The maximum sample was 4.6 picocuries per gram net, or half the cleanup standard. No samples exceeded the cleanup standard of 9.2 picocuries per gram. This illustrates the ability of backhoe excavation operations and instrument screening techniques to achieve cleanup of soil significantly below approved cleanup standards.

Table G-4. Hot Lab Cesium-137 Soil Data[a]

Item	Data
No. of Samples	84
Maximum measured Cs -137 pCi/g (gross)	4.83
Minimum measured Cs -137 pCi/g (gross)	0.012
Mean measured Cs -137 pCi/g (gross)	0.26
Number of non-detects < ~ 0.01 pCi/g	12
Number less than bkgd of 0.21 pCi/g	70
Percent less than bkgd of 0.21 pCi/g	83%
Number greater than standard of 9.2 pCi/g (net)	Zero

a. Rocketdyne 2000.

Using the distribution of soil data for cesium-137 at the Hot Lab, a theoretical average risk for the 0.02-square-kilometer (5-acre) Hot Lab site can be calculated to be 5 x 10^{-6}, assuming the linear-no-threshold model is valid at the site average dose of 0.24 millirem per year.

Averaging Soil Data in Risk Analysis. Comments have been made questioning the use of averaging site risk. Some would say that in the case study above, the dose and risk should be calculated based on the maximum soil sample data, namely 4.6 picocuries per gram, giving 7.5 millirem per year or a theoretical risk of 1.5 x 10^{-4}. However, averaging is a valid and defensible technique and supported by regulation. Indeed, the computer model that is used to calculate soil concentration cleanup standards based on 15 millirem per year assumes uniform soil contamination for a 10,000-square-meter (108,000-square-foot) area and to a depth of 1 meter (3 feet). This is equivalent to 10,000 cubic meters (353,000 cubic feet) or 14,000 metric tons (15,000 tons) of contaminated soil. An area 10,000 square meters is approximately 2 acres and is similar to the assumed lot size of potential post-release development in Area IV. An individual is not expected to sit immobile over the maximally contaminated location for a 40-year exposure period. If smaller and smaller areas (and volumes) of contaminated soil are assumed in the computer models, higher values are obtained for soil concentration cleanup standards. Looking at it from another perspective, a 0.5-kilogram (1-pound) soil sample would not be expected to (and indeed does not) give the same dose as similarly contaminated 14,000 metric tons.

Current Onsite Radiation Risks of SSFL Soil. Based on the post-remedial soil sampling and assuming that the linear-no-threshold model is valid at low doses, the theoretical risk from soil at Area IV and at various major facilities can be calculated (*see* Table G-5).

Table G-5. Theoretical Existing Risk Levels of Contaminated Soil in Area IV and Major Facilities[a]

Facility/Area	Area (acres)	No. soil samples	Cs-137 Range (pCi/g net)	Average Risk[b]	Max. Risk[c]	Comments
Area IV	290	149	ND - 2.2	1.8 x 10^{-6}	7.2 x 10^{-5}	
Hot Lab	5	84	ND - 4.6	4.8 x 10^{-6}	1.5 x 10^{-4}	Remediated
FSDF	3	78	ND - 0.57	2.7 x 10^{-7}	1.2 x 10^{-5}	Remediated and released for unrestricted use
RMHF	3	29	ND - 52	1.5 x 10^{-4}	1.7 x 10^{-3}	Remediation planned

FSDF = Former Sodium Disposal Facility
RMHF = Radioactive Materials Handling Facility
a. Risk values calculated using the linear-no-threshold model, assuming it is valid at these low dose levels (*see* Appendix C).
b. Based on full range of cesium -137 sample data for that facility.
c. Conservatively assuming that all of the facility is contaminated at the maximum cesium -137 level for that facility.

From Table G-5, it can be seen that the facility average risk for Area IV as a whole and the Hot Lab fall in the lower end of the risk range of 10^{-6} to 10^{-4}. The Former Sodium Disposal Facility falls below 10^{-6}. Even using the maximum measured cesium-137 value, both Area IV and the Former Sodium Disposal Facility meet the 10^{-6} to 10^{-4} risk range. Using the maximum cesium level for the Hot Lab, it meets the 3×10^{-4} cleanup standard of Alternative 1. Even the Radioactive Materials Handling Facility soil (which has not yet been remediated) meets the 3×10^{-4} cleanup standard of Alternative 1 if averaging is used. However, in compliance with DOE's ALARA policy, this soil will be remediated to well below approved cleanup standards.

These numbers are calculated using the linear-no-threshold model, assuming it is valid at these low dose levels. Using the same model, the inherent risk level of clean, uncontaminated soil, as a result of naturally occurring radionuclides, is approximately 10^{-3} or 1-in-1,000, due to a dose rate of 30 to 50 millirem per year.

G.4 REFERENCES

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APPENDIX H. AIR QUALITY ANALYSIS

H.1 CONFORMITY DETERMINATION

Clean Air Act Requirements

Section 176(c)(1) of the Clean Air Act requires that federal actions conform to applicable state implementation plans for achieving and maintaining the National Ambient Air Quality Standards for criteria air pollutants (criteria air pollutants are sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone, lead, and particulate matter). In 1993, the U.S. Environmental Protection Agency (EPA) promulgated a rule entitled "Determining Conformity of General Federal Actions to State or Federal Implementation Plans" (58 Fed. Reg. 63214 (1993)), codified at 40 CFR Parts 6, 51, and 93. The rule is intended to ensure that criteria air pollutant emissions and their precursors (precursors are volatile organic compounds and nitrogen oxide) are specifically identified and accounted for in the attainment or maintenance demonstration contained in a state implementation plan. For there to be a conformity, a federal action must not contribute to new violations of air quality standards, increase the frequency or severity of existing violations, or delay timely attainment of standards in the area of concern.

The conformity rule applies to proposed federal actions that would cause emissions of criteria air pollutants above certain levels to occur in locations designated as nonattainment or maintenance areas for the emitted pollutants. Under the rule, an agency must engage in a conformity review process and, depending on the outcome of that review, conduct a conformity determination.

In a conformity review, the federal agency must (1) determine whether the proposed action would cause emissions of criteria pollutants or their precursors, (2) determine whether the emissions would occur in a nonattainment or maintenance area, (3) determine whether the proposed action is exempt from the conformity requirements, and (4) estimate the total emissions of the pollutants of concern from the proposed action and compare the estimates to the threshold emission rates and to the nonattainment or maintenance area's emissions inventory for each pollutant of concern.

Table H-1 lists the emission threshold emission rates. It should be noted that the Energy Technology Engineering Center (ETEC) is located in Ventura County, which is a severe nonattainment area for ozone. Los Angeles County, which is adjacent to Ventura County, is an extreme nonattainment area for ozone and a serious nonattainment area for carbon monoxide and particulate matter.

H.2 AIR POLLUTANT EMISSIONS

DOE analyzed the volume of air pollutants that could be released as a result of soil excavation and waste transportation activities under Alternatives 1 and 2.

Soil Excavation

Table H-2 summarizes the types, numbers, operating hours, and total horsepower hours (hp-hr) for heavy equipment expected to be used in ETEC soil excavation and demolition activities under Alternatives 1 and 2 (a horsepower-hour is 1 horsepower produced continuously for 1 hour). A comparative estimate of exhaust air pollution from this equipment was made using emission factors reported in the EPA report titled *Exhaust Emission Factors for Nonroad Engine Modeling- Compression Ignition* (EPA 1998). This report describes and documents exhaust emission factors used for compression ignition engines in the EPA NONROAD emission inventory model and covers factors for all diesel-fueled engines.

Table H-1. Consolidated List of Emission Rates

Criteria Pollutants and Air Quality Classifications	Threshold Emission Rates (tons/yr)
O_3 Precursors (VOCs, NOx)	
Serious nonattainment	50
Severe nonattainment	25
Extreme nonattainment	10
Other O_3 nonattainment areas outside an O_3 transport region	100
Marginal and moderate nonattainment areas inside an O_3 transport region	50 (VOCs) 100 (NOx)
CO, SO_2, or NO_2	
Nonattainment or maintenance	100
PM_{10}	
Moderate nonattainment	100
Serious nonattainment	70
Maintenance	100
Lead	
Nonattainment or maintenance	25

Table H-2. Estimated Equipment Types, Numbers, Operating Duration, and Total Horsepower-Hours for Soil Excavating and Demolition Equipment Under Alternatives 1 and 2

	Equipment Type	Estimated Number of Units To Be Used	Estimated Operating Hours/Unit/Yr	Estimated Total Operating Hours	Estimated Total Horsepower Hours
Alt. 1 (5 Years)	Grove 671 40-Ton Truck Crane 220 hp	1	298 (15% of Time)	1,488	327,360
	Komatsu Front-end Loader 120 hp, 2.5 cu yard	1	1,984 (Full Time)	9,920	1,190,400
	Komatsu Back Hoe Loader 98 hp, 1.25 cu. yard	1	1,984 (Full Time)	9,920	972,160
	Komatsu Excavator 107 hp, 1.12 cu yard	1	1,984 (Full Time)	9,920	1,061,440
Alt. 2 (8 years)	Grove 671 40-Ton Truck Crane 220 hp	1	198 (10% of time)	1,587	349,140
	Komatsu Front-end Loader 120 hp, 2.5 cu yard	3	1,984 (Full Time)	47,616	5,713,920
	Komatsu Back Hoe Loader 98 hp, 1.25 cu. yard	4	1,984 (Full Time)	63,488	6,221,824
	Komatsu Excavator 107 hp, 1.12 cu yard	2	1,984 (Full Time)	31,744	3,396,608
	Komatsu Dump truck 488 hp, 31.4 cu yard	4	1,984 (Full Time)	63,488	30,982,144
	Caterpillar 615 Series II Earth Mover (Scrapper) 265 hp	2	1,984 (Full Time)	31,744	8,412,160

The emission factors are estimates of the amount of pollution emitted by particular types of equipment during a unit of use, typically grams of pollutant per hp-hr. The report describes emission factors under regulations that establish three tiers of emission standards. The off-road engine regulations are structured as a three-tiered progression. Each tier involves a phase in (by horsepower rating) over several years. Tier 1 standards are phasing in from 1996 to 2000. A more stringent Tier 2 standard for all engine sizes is in effect from 2001 to 2006, and yet more stringent Tier 3 standards for engines rated over 37 kilowatts (50 hp) will phase in from 2006 to 2008 (DieselNet 2001). The Tier 3 standards are expected to lead to implementation of emission control technologies similar to those that will be used by manufacturers of highway heavy-duty engines (that is, trucks and buses) to comply with the 2004 highway engine standards. Further details on this tiered approach are available on the internet (*http://www.dieselnet.com/standards/us/offroad.html* (DieselNet 2001).

The equipment projected to be used in the 5-year (Alternative 1) or 8- year (Alternative 2) soil excavation on Area IV may include equipment engines operating under any of the three tiers depending on the year of equipment purchase and replacement. For comparison purposes, it is conservatively assumed (that is, impacts would be overstated) that all equipment would be operating under the least stringent (that is, Tier 1) standards.

Table 1 of *Exhaust Emission Factors for Nonroad Engine Modeling-Compression Ignition* (EPA 1998) provides steady-state emission factors in grams per horsepower-hour (g/hp-hr) for hydrocarbons, carbon monoxide, nitrogen dioxide, and particulate matter for various horsepower engines, for various model year engines, and for the three emission standard tiers discussed above. Table H-3 is excerpted from Table 1 of EPA 1998; it summarizes the emission factor data for Tier 1 engines within the engine horsepower ranges of equipment expected to be used for Area IV soil excavation/demolition under Alternatives 1 and 2. Applying the exhaust emission factors to the total estimated operating hours in each of the engine horsepower ranges anticipated provides an estimate in grams and tons of each of the four air pollutants. These values are reported in Table H-4 for Alternative 1 and Table H-5 for Alternative 2.

For Alternative 1, the annual emissions listed in Table H-4 do not exceed the threshold emission rates listed in Table H-1. For Alternative 2, the annual emissions of nitrogen dioxide listed in Table H-5 exceed the threshold emission rate listed in Table H-1 for a severe nonattainment area.

H.3 TRANSPORTATION ACTIVITIES

To assess air pollution emission, route characteristics were determined for shipments from ETEC to the Nevada Test Site (NTS) for low-level waste (LLW) and to Envirocare in Clive, Utah, for mixed low-level waste (MLLW). Representative highway routes were analyzed using the routing computer code WebTRAGIS (Johnson and Michelhaugh 2000). The routes were calculated using current routing practices and applicable routing regulations and guidelines.

The WebTRAGIS computer code predicts highway routes for transporting radioactive materials within the United States. The WebTRAGIS database is a computerized road atlas that currently describes approximately 386,000 kilometers (240,000 miles) of roads. Complete descriptions of the interstate highway system, U.S. highways, most of the principal state highways, and a number of local and community highways are identified in the database. The WebTRAGIS computer code calculates routes that maximize the use of interstate highways. This feature allows the user to determine routes for shipment of radioactive materials that conform to U.S. Department of Transportation regulations (as specified in 49 CFR Part 397). The calculated routes conform to applicable guidelines and regulations and therefore represent routes that could be used. However, they may not be the actual routes used in the future. The code is updated periodically to reflect current road conditions, and it has been benchmarked against reported mileages and observations of commercial truck firms.

Table H-3. Steady State Emission Factors for Selected Compression Ignition Engines in the EPA NONROAD Model

Engine Horsepower Range	Emission Factors (g/hp-hr)			
	Hydrocarbons	Carbon Monoxide	Nitrogen Dioxide	Particulate Matter
>50-100	0.7	1.0	6.9	0.72
>100-175	0.4	1.0	6.9	0.4
>175-300	0.4	1.0	6.9	0.4
>300-600	0.3	1.0	6.9	0.4

Source: EPA 1998, Table 1.

Table H-4. Estimated Exhaust Emission Totals in grams (tons) – Alternative 1

Engine Horsepower Range	Pollutant			
	Hydrocarbons	Carbon Monoxide	Nitrogen Dioxide	Particulate Matter
>50-100	680,512 (0.8)	972,160 (1.0)	6,707,904 (7.4)	699,955 (0.8)
>100-175	900,736 (1.0)	2,251,840 (2.5)	15,537,696 (17.1)	900,736 (1.0)
>175-300	130,944 (0.1)	327,360 (0.4)	2,258,784 (2.5)	130,944 (0.1)
>300-600	-	-	-	-
Total	**1,712,192 (1.9)**	**3,551,360 (3.9)**	**24,504,384 (27)**	**1,731,635 (1.9)**
Annual Total	**0.38 tons/yr**	**0.78 tons/yr**	**5.4 tons/yr**	**0.38 tons/yr**

Table H-5. Estimated Exhaust Emission Totals in grams (tons) – Alternative 2

Engine Horsepower Range	Pollutant			
	Hydrocarbons	Carbon Monoxide	Nitrogen Dioxide	Particulate Matter
>50-100	4,355,277 (4.8)	6,221,824 (6.9)	42,930,586 (47.3)	4,479,713 (4.9)
>100-175	3,644,211 (4.0)	9,110,528 (10.0)	62,862,643 (69.3)	3,644,211 (4.0)
>175-300	3,504,520 (3.9)	8,761,300 (9.7)	60,452,970 (66.6)	3,504,520 (3.9)
>300-600	9,294,643 (10.3)	30,982,144 (34.2)	213,776,794 (235.6)	12,392,858 (13.7)
Total	**20,798,651 (22.9)**	**55,075,796 (60.7)**	**380,022,993 (418.8)**	**24,021,302 (26.5)**
Annual Total	**2.9 tons/yr**	**7.6 tons/yr**	**52.3 tons/yr**	**3.3 tons/yr**

DOE also estimated mileage from ETEC to authorized locations for the disposal of hazardous waste and nonhazardous debris waste, and for uncontaminated soil as backfill.

Emission factors for nitrogen dioxide, hydrocarbons, and carbon monoxide for heavy truck diesel engines were obtained from Appendix H of AP-42, *Compilation of Air Pollutant Emission Factors* (EPA 2000). The emission factors for hydrocarbons, carbon monoxide, and nitrogen dioxide were 2.1 grams per mile, 10.3 grams per mile, and 6.5 grams per mile, respectively. The emission factor for diesel particulate matter (0.22 gram per mile) was obtained from the *Motor Vehicle-Related Air Toxics Study* (EPA 1993).

Table H-6 shows the parameters used for determining the potential air emissions that would occur as a result of the implementation of Alternative 1 or Alternative 2. All miles traveled offsite are assumed to be on paved roads. Table H-7 shows the total estimated exhaust emission totals in grams and tons for Alternative 1 and Alternative 2. These totals do not include the fraction of travel in nonattainment or maintenance areas.

H.4 RESULTS

For Alternative 1, the annual emissions listed in Table H-7 are below the thresholds listed in Table H-1. For Alternative 2, the annual emissions listed in Table H-7 are below the thresholds listed in Table H-1 for all pollutants except for nitrogen dioxide, which slightly exceeds the threshold for an extreme nonattainment area for ozone. However, not all travel will be in extreme ozone nonattainment areas, so it is unlikely that the annual emissions will exceed the thresholds listed in Table H-1.

H.5 REFERENCES

DieselNet, 2001. *Emission Standards, USA, Off-Road Diesel Engines*, available at [*http://www.dieselnet.com/standards/us/offroad.html]*.

EPA (U.S. Environmental Protection Agency), 2000. *Compilation of Air Pollutant Emission Factors, Volume II: Mobile Sources,* AP-42, Office of Transportation and Air Quality, November 24, 2000, fifth edition pending, Appendix H available at [http://www.epa.gov/otaq/ap42.htm].

EPA (U.S. Environmental Protection Agency), 1998. *Exhaust Emission Factors for Nonroad Engine Modeling- Compression Ignition*, Report No. NR-009A, revised June 15, 1998, available at [http://www.epa.gov/otaq/models/nonrdmdl/nr-009a.pdf]

EPA (U.S. Environmental Protection Agency), 1993. *Motor Vehicle-Related Air Toxics Study*, EPA 420-R-93-005, Office of Transportation and Air Quality, April 1993.

Michelhaugh, R.D., and P.E. Johnson, 2000. *Transportation Routing Analysis Geographic Information System (WebTRAGIS) User's Manual*, Oak Ridge National Laboratory, ORNL/TM-2000/86.

Table H-6. Parameters for Air Quality Impacts from Transportation

	Alternative 1	Alternative 2
Low-Level Waste		
Waste volume	7,500 cubic meters	406,850 cubic meters
Number of one-way shipments (volume/13.6 cubic meters per shipment)	553 shipments	30,000 shipments
Miles traveled (one-way), NTS	377 miles	377 miles
Total one-way miles traveled	208,481 miles	11.3 million miles
Vehicle type	17.5 ton diesel-powered truck	17.5 ton diesel-powered truck
Mixed Low-Level Waste		
Waste volume	20 cubic meters	20 cubic meters
Number of one-way shipments (volume/13.6 cubic meters per shipment)	20 shipments	20 shipments
Miles traveled (one-way), Envirocare	803 miles	803 miles
Total one-way miles traveled	16,060 miles	16,060 miles
Vehicle type	17.5 ton diesel-powered truck	17.5 ton diesel-powered truck
Hazardous Waste		
Waste volume	5 cubic meters	5 cubic meters
Number of one-way shipments (volume/13.6 cubic meters per shipment)	5 shipments	5 shipments
Miles traveled (one-way)	469.4 (weighted average)	469.4 (weighted average)
Total one-way miles traveled	2,347	2,347
Vehicle type	17.5 ton diesel-powered truck	17.5 ton diesel-powered truck
Nonhazardous Debris Waste		
Waste volume	25,300 cubic meters	25,300 cubic meters
Number of one-way shipments (volume/13.6 cubic meters per shipment)	1,860 shipments	1,860 shipments
Miles traveled (one-way), Bradley Landfill	50 miles one-way	50 miles one-way
Total one-way miles traveled	93,000 miles	93,000 miles
Vehicle type	17.5 ton diesel-powered truck	17.5 ton diesel-powered truck
Uncontaminated Soil		
Volume	5,500 cubic meters	354,390 cubic meters
Number of one-way shipments (volume/13.6 cubic meters per shipment)	400 shipments	26,000 shipments
Miles traveled (one-way)	On SSFL; 1 mile (unpaved)	PW Gillibrand borrow site; 25 miles
Total one-way miles traveled	400 miles	650,000 miles
Vehicle type	17.5 ton diesel-powered truck	17.5 ton diesel-powered truck

Total miles traveled, Alternative 1: 330,000 miles
Total miles traveled, Alternative 2: 12,000,000 miles

Table H-7. Estimated Exhaust Emission Totals in grams (tons) for Alternative 1 and Alternative 2

	Pollutant			
	Hydrocarbons	**Carbon Monoxide**	**Nitrogen Dioxide**	**Particulate Matter**
Alternative 1				
LLW	4.38E+05 (0.48)	2.15E+06 (2.4)	1.35E+06 (1.5)	4.63E+04 (0.051)
MLLW	3.37E+04 (0.037)	1.66E+05 (0.18)	1.04E+05 (0.11)	3.57E+03 (0.0039)
Hazardous waste	4.93E+03 (0.0054)	2.42E+04 (0.027)	1.52E+04 (0.017)	5.21E+02 (0.00057)
Nonhazardous debris waste	1.95E+05 (0.22)	9.60E+05 (1.1)	6.04E+05 (0.67)	2.06E+04 (0.023)
Uncontaminated soil	2.10E+04 (0.023)	1.03E+05 (0.11)	6.49E+04 (0.072)	2.22E+03 (0.0024)
Total – Alternative 1	6.93E+05 (0.76)	3.40E+06 (3.8)	2.14E+06 (2.4)	7.32E+04 (0.081)
Tons/yr – Alternative 1	**1.5E-01**	**7.5E-01**	**4.7E-01**	**1.6E-02**
Alternative 2				
LLW	2.38E+07 (26)	1.17E+08 (130)	7.34E+07 (81)	2.51E+06 (2.8)
MLLW	3.37E+04 (0.037)	1.66E+05 (0.18)	1.04E+05 (0.11)	3.57E+03 (0.0039)
Hazardous waste	4.93E+03 (0.0054)	2.42E+04 (0.027)	1.52E+04 (0.017)	5.21E+02 (0.00057)
Nonhazardous debris waste	1.95E+05 (0.22)	9.60E+05 (1.1)	6.04E+05 (0.67)	2.06E+04 (0.023)
Uncontaminated soil	1.37E+06 (1.5)	6.71E+06 (7.4)	4.22E+06 (4.7)	1.44E+05 (0.16)
Total – Alternative 2	2.53E+07 (28)	1.25E+08 (140)	7.83E+07 (86)	2.68E+06 (3.0)
Tons/yr – Alternative 2	**3.5**	**17**	**11**	**0.37**

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APPENDIX I. DOE RESPONSE TO COMMENTS ON DRAFT ETEC EA

The U.S. Department of Energy (DOE) received 63 comment letters, electronic mail messages, and verbal communications from individuals; groups; and federal, state, and local governmental entities during the 90-day comment period on the Draft environmental assessment (EA). In addition, 16 people provided comments in the Draft EA public comment sessions held on January 24, 2002. DOE has considered these comments individually and collectively and has made many changes to the Draft EA as a result of the comments. These changes are reflected in the Final EA. DOE's specific responses to the issues raised in the public comments are provided below.

1. **Using the Comprehensive Environmental Response, Compensation, and Liability Act** (**CERCLA) Process.** Commenters recommended that the CERCLA process be used to evaluate and select a cleanup alternative in order to conduct a risk-based cleanup evaluation.

   DOE Response:

   EPA-DOE Memorandum of Agreement
   The proposed cleanup activities for radionuclides are being performed under the DOE's AEA authority.[1] However, the NEPA process has been followed to evaluate the environmental impacts of response options and selection of a cleanup plan has been consistent with CERCLA in accordance with DOE's longstanding policy. The cleanup of non-radionuclides is being performed under the RCRA process which is also consistent with CERCLA and is expected to result in similar degrees of cleanup.

   In general, both the NEPA and CERCLA processes are consistent in that each requires: 1) the need for an action be demonstrated; 2) alternatives, including the no action alternative, be evaluated and compared against one another; 3) an administrative record be compiled of the information relied on in identifying a preferred alternative; 4) the public offered an opportunity to comment on the preferred alternative, and 5) the rationale and basis for the selected alternative outlined in a final decision document.

   On May 22, 1995, DOE and EPA signed a Memorandum of Agreement, which provided that DOE would conduct its decontamination and decommissioning activities consistent with CERCLA; specifically as non-time critical removal actions. Although two of the CERCLA evaluation criteria, effectiveness and implementability of alternatives were assessed in the EA, the third CERCLA criterion, cost, was not. DOE elected not to look at cost in the EA as the primary purpose of that analysis was to evaluate environmental impacts. DOE did consider costs however, in developing it's preferred response and concluded that the additional cost of $195 million for alternative 2 was not proportional to the risk reduction achieved.

   In many respects, DOE has not only been consistent with CERCLA, but has exceeded the specified requirements, particularly for public involvement DOE and other representatives of the Santa Susana Field Laboratory (SSFL) Workgroup regularly conduct public meetings (nominally on a quarterly basis) to provide an update of cleanup activities at the site and to afford the public an opportunity to comment on those and other activities. In addition, DOE and other representatives of the Workgroup hold monthly teleconferences for activity updates.

[1] DOE's authority to conduct decontamination and decommissioning activities is an implied authority flowing from Section 161 of the Atomic Energy Act (42 USC § 2201).

At the conclusion of the decontamination and decommissioning of each facility, DOE prepares a docket to document the successful completion of the effort and a notice of availability is published in the Federal Register.

Lastly, EPA is a standing member of the SSFL Workgroup and has had an active voice in the decontamination and decommissioning activities at ETEC for more than 10 years, despite EPA's determination in 1993 that the site did not pose sufficient risk to merit being listed on the National Priorities List of CERCLA sites.

2. **1 x 10^{-6} Risk Standard.** Commenters asked DOE to select the 1 x 10^{-6} risk standard (Alternative 2) for the cleanup of the ETEC site to protect public health and property values. DOE's preferred alternative of using a 15-millirem annual dose standard for ETEC, which relates to a 3 x 10^{-4} risk (Alternative 1) was said to be too high and not within a range permitted under CERCLA. Commenters stated that DOE was required by law and DOE policy to clean up to a 1 x 10^{-6} risk level unless technical reasons prevented cleanup to this level. They also stated that adding the risks associated with hazardous chemical contamination and radionuclides other than cesium would increase the risk standard above DOE's preferred 3 x 10^{-4} risk standard. Some commenters stated that there is "no cancer risk that is acceptable."

   DOE Response: DOE recognizes commenters' concerns regarding the 15 mrem cleanup standard, however, the actual cleanup will be conducted in accordance with the principle of ALARA. (see appendix G). Based on post-remedial verification inspections of previous cleanup activities at the ETEC site, the ultimate cleanup level reached will be in the 10^{-5} to 10^{-6} risk range. Furthermore, EPA has previously established 15 millirem per year (mrem/yr) dose limit as being protective. In the Office of Solid Waste and Emergency Response (OSWER) Directive 9200.4-18 (EPA 1997) EPA states: "This {15 millirem per year (mrem/yr)} level equates to approximately 3 x 10^{-4} increased lifetime risk and is consistent with levels generally considered protective in other governmental actions, particularly regulations and guidance developed by EPA in other radiation control programs. EPA goes on to explain that "Protectiveness for carcinogens under CERCLA is generally determined with reference to a cancer risk range of 10^{-4} to 10^{-6} deemed acceptable by EPA. Consistent with this range, EPA has considered cancer risk from radiation in a number of different contexts, and has consistently concluded that levels of 15 mrem/yr or less are protective and achievable.

   Cumulative Risk

   With respect to the contribution of other radionuclides and hazardous chemical contamination to residual risk levels, the ALARA process would ensure that no individual radionuclide would be present at sufficient concentrations to contribute a site risk level of 3 x 10^{-4}. Indeed, cesium-137, the primary radionuclide of concern, has been shown to contribute a theoretical risk of 2 x 10^{-6} at current levels. Potential theoretical contributions of other, less observed radionuclides would not result in additional theoretical risk approaching 1 x 10^{-4}. Similarly, levels of residual chemical contamination in soil are expected to be a very small fraction of the upper end of the CERCLA risk range. Therefore, summing the theoretical chemical and radiological risks would not exceed 1 x 10^{-4}**.**

   Theoretical Cancer Risks of the Linear-No-Threshold Model

   Finally, with respect to whether any additional cancer risk is acceptable, it is important to note that, although exposure to high levels of ionizing radiation can and does result in detrimental health effects including cancer, there is no scientific evidence to support the presence of any increase in cancer risk at levels below 10,000 millirem in addition to background radiation.

Additional information about the linear-no-threshold model is contained in Appendix C of this EA.

3. **Leaving Contaminated Soil Onsite.** Commenters stated that DOE's preferred alternative would leave "98% of contaminated soil in place" and would allow "300 times" and "10,000 times" more radioactivity in the soil than EPA standards would allow. Commenters also stated that the 15-millirem standard was the equivalent of 200 additional chest x-rays over a lifetime. These commenters asked that DOE clean up all contaminated soil at the site.

Commenters noted the relatively large soil concentration values for nickel-59, nickel-63, and iron-55, and the resulting high risk factors in Table I-1.

DOE Response: Leaving "98% of contaminated soil in place" refers to the difference between excavating 5,500 cubic meters (194,230 cubic feet) of soil under Alternative 1 and excavating 404,850 cubic meters (14.3 million cubic feet) under Alternative 2.

DOE is not allowing 10,000 times more radioactivity in the soil than EPA standards allow. This statement presumes the EPA requirement is to remediate soil to a 1×10^{-6} risk level. This is not the case. The EPA CERCLA standard is a range from 1×10^{-4} to 1×10^{-6}. As discussed in the previous response, Alternative I will result in residual radioactivity that is well below the EPA threshold of a 10^{-4} risk level. In fact, the residual contamination at ETEC would be lower than 15 millirem per year through the application of the ALARA principle under which DOE would act to attain doses as far below applicable limits as is reasonably achievable (*see* Appendix G). The current average risk at the site is only about 2×10^{-6} In the past, DOE has achieved residual dose risk on the order of 1×10^{-6} by the application of the ALARA principle and the 15 millirem residual contamination standard.

While a 15 mrem standard dose equates to an equivalent dose of 200 chest x-rays over a 100 year life span, the balance of Area IV is already below a 1 mrem effective dose. Using the actual effective dose, it would take over 1500 years to accumulate the equivalent does of 200 chest x-rays. In addition, the 15 mrem standard is only 5 percent of the average natural background radiation level of approximately 300 mrem per year and is less than the variability of natural background in the United States.

EPA Region 9 Table

In 1999, EPA Region 9 compiled a table to compare DOE- and DHS-approved Rocketdyne soil concentration cleanup standards at the 15 millirem per year level with soil concentrations at the 10^{-6} risk level. This table was referred to in public comments on the Draft EA, is included at the end of this section (Table I-1), and is explained below.

Column 3 in Table I-1, titled "EPA 10^{-6} Level (pCi/g)," references EPA document 402/R-96/011A, *Technical Support Document for the Development of Radionuclide Cleanup Levels for Soil* (EPA 1994). Radioisotope soil concentrations are provided for the 10^{-6} risk level and are compared to the approved Rocketdyne radioisotope soil concentrations in Column 2. There is an implication that EPA document 402/R-96/011A presented these 10^{-6} risk level soil concentrations and recommended a 10^{-6} risk cleanup level. This is incorrect.

In fact, EPA document 402/R-96/011A does not recommend cleanup standards and does not present radioisotope soil concentrations at 10^{-6} risk levels. EPA document 402/R-96/011A was originally written as a technical basis for the draft EPA Regulation 40 CFR Part 196, Radiation Site Cleanup Regulation, which does recommend cleanup levels but at the 3×10^{-4} or 15 millirem per year level. Subsequently, EPA OSWER Directive 9200.4-18, *Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination* (EPA 1997), has reiterated EPA's support for cleanup levels of 3 x 10^{-4} risk or 15 millirem per year.

In fact, EPA document 402/R-96/011A provides radioisotope soil concentrations at the 10^{-4}, 3 x 10^{-4}, and 15 millirem per year levels for various exposure scenarios, including rural residential. The EPA table (Table I-1) ratios radioisotope soil concentrations in EPA document 402/R-96/011A for the 10^{-4} risk level down to the 10^{-6} risk level by dividing all the data by 100.

EPA document 402/R-96/011A compares the radioisotope soil concentrations to both laboratory detection capabilities, field survey detection capabilities, and typical range of background. That document makes the following statements about the feasibility of using cleanup standards at the 10^{-4}, 3 x 10^{-4}, and 15 millirem per year levels:

> "An important consideration in the development of soil cleanup levels is the feasibility of implementing the cleanup criteria in actual practice in the field. If the cleanup levels are set below the lower limits of detection for laboratory and field measurement techniques, or if the background radiation or radioactivity levels are highly variable and comparable to the cleanup levels, it will be very difficult to implement and enforce the regulations based on those cleanup criteria." Section 7.2, page 7-14.
>
> "At the target risk level of 10^{-4}, no radionuclides can be detected using field measurements for the rural residential exposure scenario." Section 7.2.1.4, page 7-37.
>
> "It is important to emphasize that in some situations, it is the spatial variability in the levels of naturally occurring or anthropogenic background radioactivity rather than the minimum detectable concentration, that limits the technical feasibility of using field or laboratory techniques to assess contaminant concentrations at a site." Section 7.2.1.4, page 7-39.
>
> "At a target risk level of 10^{-4}, all radionuclides may by detectable above their respective background concentrations for the rural residential exposure scenario, except C-14**,** Cs-137, K-40, Pa-231, Pb-210, Ra-226, Ra-228, Sr-90, Th-228, Th-230, Th-232, U-234, and U-238." Section 7.2.2.3. page 7-42.

In summary, the EPA document 402/R-96/011A (EPA 1994), which was used to develop Table I-1, in fact fully supports the current DOE- and DHS-approved Rocketdyne cleanup standards and provides data to demonstrate that cleanup to even 10^{-4} levels may not always be feasible because of detectability and background variability issues.

Because of concerns relating to how Table I-1 could be used and interpreted, EPA later prepared a second table (Table I-2) showing the full range of soil concentrations from 10^{-6} to 15 millirem per year and both suburban residential and rural residential data. This version better represents the actual data in EPA document 402/R-96/011A. Table I-2 shows that the upper end of the EPA risk range for suburban scenarios (Column 3) agrees fairly closely with the DOE 15-millirem-per-year level for ETEC (Column 2). Remaining differences are due to different input assumptions, principally estimated fruit and vegetable intakes. Therefore, EPA analyses and limits are not significantly different from DOE analyses and limits.

Table I-1. A Comparison of DOE-Approved Cleanup Levels for ETEC, 10^{-6} Residential Levels, and "Background" Levels

Radionuclide	DOE Cleanup Level for ETEC[a] (pCi/g) (est. risk level[b])	EPA 10^{-6} Level[c] (pCi/g)	Background[d] (95% of distribution, not mean) (pCi/g)
Am-241	5.44 ($6x10^{-6}$)	0.90	
Co-60	1.94 ($5x10^{-4}$)	0.004	
Cs-134	3.33 ($3x10^{-4}$)	0.01	
Cs-137	9.20 ($9x10^{-4}$)	0.01	0.21
Eu-152	4.51 ($5x10^{-4}$)	0.01	
Eu-154	4.11 ($4x10^{-4}$)	0.01	
Fe-55	629,000 ($9x10^{-3}$)	67.62	
H-3	31,900 ($3x10^{-6}$)[e]	11,000[e]	0.525
K-40	27.6 ($1x10^{-3}$)	0.02	
Mn-54	6.11 ($6x10^{-4}$)	0.01	
Na-22	2.31 ($6x10^{-4}$)	0.004	
Ni-59	151,000 ($2x10^{-2}$)	8.97	
Ni-63	55,300 ($2x10^{-2}$)	2.86	
Pu-238	37.2 ($4x10^{-5}$)	1.01	0.07
Pu-239	33.9 ($3x10^{-5}$)	1.04	
Pu-240	33.9 ($3x10^{-5}$)	1.04	
Pu-241	230 ($7x10^{-6}$)	30.76	
Pu-242	35.5 ($3x10^{-5}$)	1.09	
Ra-226	5 and 15 ($5x10^{-5}$ and $2x10^{-4}$)	0.1 (includes risk from decay to radon)	
Sr-90	36 ($4x10^{-4}$)	0.01	0.12
Th-228	5 and 15 ($5x10^{-4}$ and $2x10^{-3}$)	0.01	1.7 (TMA) 0.9 (Teledyne)[f]
Th-232	5 and 15 ($2x10^{-3}$and $6x10^{-3}$)	0.003	1.58 (TMA) 1.1 (Teledyne)[f]
U-234	30 ($6x10^{-4}$)	0.05	2.2 (TMA) 0.79 (Teledyne)[f]
U-235	30 ($8x10^{-4}$)	0.04	0.1 (TMA) 0.04 (Teledyne)[f]
U-238	35 ($9x10^{-4}$)	0.04	1.8 (TMA) 0.84 (Teledyne)[f]

Notes on Table I-1:
a. From the *Proposed Sitewide Release Criteria for Remediation of Facilities at the SSFL*, August 22, 1996. DOE approved the release criteria on September 17, 1996. DHS approved the release criteria on August 6, 1996.
b. Estimated by comparison with Rural residential (10^{-4} level) contained in *Radiation Site Cleanup Regulations: Technical Support Document for the Development of Radionuclide Cleanup Levels for Soil* (EPA 1994).
c. Estimated by comparison with Rural residential (10^{-4} level) contained in *Radiation Site Cleanup Regulations: Technical Support Document for the Development of Radionuclide Cleanup Levels for Soil* (EPA 1994).
d. 95% (confidence interval) of the distribution, from the *Area IV Radiological Characterization Survey* (Rocketdyne 1996).
e. Based on Risk Comparison for Radionuclides in Soil, derived from RiskCalc software using RAGS HHEM Part B with its Default Scenario Values. According to footnote c, the 10^{-4} rural residential concentration is 34 pCi/g. However, this level seems low considering that EPA's MCL for tritium is 20 pCi/g (20,000 pCi/l).
f. The averages from both laboratories should be combined. Any samples collected outside the Chatsworth Formation should not be considered background for these radionuclides.

Table I-2. A Comparison of DOE-Approved Cleanup Levels for ETEC, EPA's Risk Range for Generic Suburban and Residential Scenarios, and "Background" Levels

Radionuclide	DOE 15 mrem Level for ETEC[a] (pCi/g)	EPA Risk Range[b] (Suburban) (pCi/g)	EPA Risk Range[b] (Rural Residential) (pCi/g)	Background[c] (95% of distribution, not mean) (pCi/g)
Am-241	5.44	2.26 - 74	0.90 - 26	
Co-60	1.94	0.004 - 1.3	0.004 - 1.2	
Cs-134	3.33	0.01 - 3	0.01 - 2	
Cs-137	9.20	0.02 - 6	0.01 - 5	0.21
Eu-152	4.51	0.01 - 3	0.01 - 3	
Eu-154	4.11	0.01 - 3	0.01 - 3	
Fe-55	629,000	1,401 - 601,443	67.62 - 31,793	
H-3	31,900	11,000[d]	N/A	0.525
K-40	27.6	0.05 - 20	0.02 - 9	
Mn-54	6.11	0.01 - 5	0.01 - 5	
Na-22	2.31	0.005 - 2	0.004 - 2	
Ni-59	151,000	69 - 53,744	8.97 - 7,049	
Ni-63	55,300	22 - 20,105	2.86 - 2,616	
Pu-238	37.2	3.25 - 100	1.01 - 31	0.07
Pu-239	33.9	3.38 - 88	1.04 - 27	
Pu-240	33.9	3.38 - 88	1.04 - 27	
Pu-241	230	77 - 2,524	30.76 - 870	
Pu-242	35.5	3.52 - 93	1.09 - 29	
Ra-226	5 and 15	0.001 - 0.1 (w/o radon) 0.005 - 1.0 (w/radon)	0.001 - 0.1 (includes risk from decay to radon) 0.004 - 1.0 (w/ radon)	
Sr-90	36	0.001 - 13	0.01 - 3	0.12
Th-228	5 and 15	0.01 - 2	0.01 - 2	1.7 (TMA) 0.9 (Teledyne)[e]
Th-232	5 and 15	0.004 - 1	0.003 - 1	1.58 (TMA) 1.1 (Teledyne)[e]
U-234	30	0.06 - 7	0.05 - 7	2.2 (TMA) 0.79 (Teledyne)[e]
U-235	30	0.04 - 7	0.04 - 6	0.1 (TMA) 0.04 (Teledyne)[e]
U-238	35	0.06 - 8	0.04 - 7	1.8 (TMA) 0.84 (Teledyne)[e]

Notes on Table I-2:
a. From the *Proposed Sitewide Release Criteria for Remediation of Facilities at the SSFL*, August 22, 1996. DOE approved the release criteria on September 17, 1996. DHS approved the release criteria on August 6, 1996.
b. In this table, the range has been set from a 1x 10^{-6} excess cancer risk to 15 milirem per year level. The 1x 10^{-6} level has been estimated by comparison with 10^{-4} level (for both suburban and rural residential scenarios) contained in *Radiation Site Cleanup Regulations: Technical Support Document for the Development of Radionuclide Cleanup Levels for Soil* (EPA 1994). As stated in the OSWER Directive 9200.4-18 (EPA 1997), "EPA generally sets site specific remediation levels for carcinogens at a level that represents an excess upper bound lifetime cancer risk to an individual of between 10^{-4} to 10^{-6}." It also states, "[g]uidance that provides for cleanups outside the risk range (in general, cleanup levels exceeding 15 milirems per which equates to 3x 10^{-4} increased lifetime risk) is similarly not protective under CERCLA and should not be used to establish cleanup levels."
c. 95% (confidence interval) of the distribution, from the *Area IV Radiological Characterization Survey* (Rocketdyne 1996).

Notes on Table I-2 (cont):
d. Based on Risk Comparison for Radionuclides in Soil, derived from RiskCalc software using RAGS HHEM Part B with its Default Scenario Values. According to the document referenced in footnote b, the 10^{-4} rural residential concentration is 34 pCi/g. However, this level seems low considering that EPA's MCL for tritium is 20 pCi/g (20,000 pCi/l).
e. The averages from both laboratories should be combined. Any samples collected outside the Chatsworth Formation should not be considered background for these radionuclides.

Nickel-59, Nickel-63, and Iron-55

Nickel-59, nickel-63, or iron-55 have not been observed in any soil at Area IV. No europium-152 or europium-154 was detected in any Area IV survey soil samples. Only three Area IV survey soil samples showed any detectable cobalt-60, at 0.04, 0.04, and 0.13 picocuries per gram. These levels are well below the cleanup standard of 1.9 picocuries per gram. Thus, it is apparent that there is no good transport mechanism for activation products, including nickel-59, nickel-63, and iron-55, from internal equipment and structural materials into environmental soil and or groundwater. Activation products, including nickel-59, nickel-63, and iron-55, are not therefore likely to be contaminants of concern.

In conclusion, the relatively high concentration limits and high theoretical risk values for nickel-59, nickel-63, and iron-55 are not meaningful or relevant because these isotopes have never been observed in Area IV soil.

4. **Rocketdyne/Boeing Soil Sampling.** Commenters questioned the use of the 1995 soil survey data compiled by Rocketdyne/Boeing as the basis for the analysis in the EA. They stated that EPA had recommended that the survey be withdrawn and that DOE had agreed to do so.

   DOE Response: Area IV soil sample data were used primarily to obtain a conservative estimate of the required soil to be excavated to achieve various levels of residual contamination. DOE did not agree to withdraw the data and believes it to be valid for the purpose for which it was used. In response to comments concerning the methodology used to obtain the soil data and whether the assumptions made on the basis of the data are overly conservative or not conservative enough, DOE has prepared a separate appendix regarding the soil survey data used as the basis of analysis in the EA (*see* Appendix E) which shows that the 1995 Area IV survey data set is representative of all soil in Area IV.

5. **EPA Survey.** Commenters stated that DOE promised to allow EPA to conduct a comprehensive survey of the site but that such a survey was no longer being proposed. Further, commenters stated that DOE was "refusing to check for the contamination to see where it still is and clean it up."

   DOE Response: A final status survey of Area IV will be done according to MARSSIM protocol before the site is released back to the property owner. The MARSSIM survey will verify that the site has been cleaned up to appropriate standards.

6. **Health Studies.** Commenters stated that there was anecdotal evidence of a large number of cancers in the area around SSFL. Commenters also sought information regarding the results of a worker exposure study conducted by the University of California at Los Angeles and an epidemiological study being conducted by the Agency for Toxic Substances and Disease Registry.

DOE Response: There have been three DHS studies of cancer rates in the communities surrounding SSFL in recent years. The first was published in 1990, the second was published in 1992, and the third published in 1997.

1990 Cancer Study

The first study (DHS 1990) investigated the rates of many forms of cancer in Los Angeles County census tracts to the east of SSFL and compared them with the Los Angeles County average cancer rates. No cancer rates in the proximity of SSFL were identified as statistically different from Los Angeles County averages. Bladder cancer in one census tract was identified as being 50 percent higher than the Los Angeles County average rate. However, the 1,300 Los Angeles County census tracts had a wide distribution of bladder cancer rates, such that approximately 20 percent or 250 census tracts in Los Angeles actually had higher bladder cancer rates than the census tract close by SSFL. Therefore, a 50 percent difference is not statistically significant. The 1990 study concluded, “these findings are consistent with random variation in cancer incidence rates” (*id*. at Page 1).

1992 Cancer Study

The 1992 report (DHS 1992) expanded the 1990 cancer study to include Ventura county census tracts, including those of Simi Valley, immediately to the north of SSFL and closest to the Area IV, where nuclear research was conducted. Bladder cancer rates, which were the highlight of the first study, were still observed to be elevated in Los Angeles County census tracts close to SSFL but only in men, not in women. Also, bladder cancer rates in the Simi Valley tracts close to SSFL were actually less than the rest of Ventura County. The 1992 report concluded that:

> “people living near the SSFL are not at increased risk for developing cancers associated with radiation exposure” (*id*. at Page ii).
>
> “We would expect that if community exposure to ionizing radiation were causing an elevation in cancers in this geographic area we would see the greatest increase among those cancers known to be most strongly associated with radiation exposure. Not only is such a pattern not evident, but the very radiosensitive cancer group appears to be somewhat underrepresented in people living near the SSFL” (*id*. at Page 8).

1997 Cancer Study

In 1997, a report (DHS 1997) by Health Care Services of Santa Barbara County compared cancer rates within 8 kilometers (5 miles) of SSFL with average data from San Luis Obispo, Santa Barbara, and Ventura Counties. They determined that:

> “residents of the study area seem to have cancer incidence risk which is similar to that of the other residents of the Tri-Counties Region…” (*id*. at Page 2).

The report further noted a significant decrease in leukemia in women (leukemia was a focus of attention in the later Rocketdyne Worker Health Study) and a slight decrease in bladder cancer in the study area (the focus of attention in the 1990 study). This study also noted a 17 percent increase in lung cancer over the Tri-County Region average. However, the study area lung cancer rate was within the observed range of individual census tract lung cancer rates, as with bladder cancer in the 1990 study. The report’s author did not regard a 17 percent increase in rates as statistically significant.

1999 Department of Toxic Substances Control Review of DHS Cancer Studies
Subsequent to these reports, the Department of Toxic Substances Control was directed to perform a review of the three DHS cancer studies (DTSC 1999). The inquiry was conducted under the direction of Special Assistant Harold Thomas and Chief Investigator Mary Locke. As part of the inquiry, a technical review of all DHS SSFL cancer registry studies was conducted by Dr. Myrto Petreas of the Department of Toxic Substances Control's Hazardous Materials Laboratory under the Direction of Dr. Bob Stevens, Deputy Director of the Department of Toxic Substances Control's Science, Pollution and Prevention and Technology Program. This review was titled "Health Studies at Santa Susana Field Laboratory - Expert Panel Review." Expert panel members, with no affiliation to the DHS, were selected to review all previous SSFL cancer registry studies. These panel members were Dr. James Beaumont, Associate Professor at the Department of Epidemiology and Preventive Medicine at the UC Davis School of Medicine, and Dr. Faith Davis, Professor and Director, Division of Epidemiology and Biostatistics, School of Public Health at the University of Illinois, Chicago.

Findings of the Expert Panel Review are provided below:

> "Three studies of cancer incidence in the vicinity of SSFL were reviewed. Whereas there were some differences in the geographic areas, time periods, case definitions and level of significance used in these three studies, the combined evidence from all three does not indicate an increased rate of cancer incidence in the regions examined. The extremely modest cancer incidence increases associated with known radiosensitive tumors could be easily explained by uncontrolled confounding or imprecision of the data. The results do not support the presence of any major environmental hazard."

1997 Rocketdyne Radiation Worker Health Study
In the early 1990s, DOE provided funding to the Public Health Foundation of the California DHS for the performance of an epidemiology study of Rocketdyne workers. The contract was eventually awarded to a team from University of California, Los Angeles. The first phase of the study to investigate the effects of ionizing radiation on Rocketdyne's radiation workers was conducted by Dr. Beate Ritz and commenced in January 1994. A report titled *Epidemiology Study to Determine the Possible Adverse Effects of Rocketdyne/Atomics International Workers from Exposure to Ionizing Radiation* was released in September 1997 (UCLA 1997). The following conclusions may be drawn from the study's data and results.

- Rocketdyne radiation workers have a 32 percent lower death rate from "all causes" and a 21 percent lower death rate from "all cancers" than the U.S. population.

- Rocketdyne radiation workers have a 38 percent lower death rate from "all causes" and an 11 percent lower death rate from "all cancers" than a similar worker control group who was not exposed to occupational radiation.

- Out of 4,563 Rocketdyne radiation workers exposed to external radiation, more than 99 percent (or 4,529) did not exhibit any increased cancer rates.

- The University of California at Los Angeles concluded that there was an increased rate of leukemia/lymphoma in those workers with external exposure above 200 milliSievert (20 rem). This was due to 1 leukemia death and 1 non-radiosensitive "Hodgkins Disease" death from 34 workers with exposure above 200 milliSievert (20 rem). The small sample size means that a large uncertainty is associated with this result. However, leukemia has been observed to be correlated to higher levels of radiation in other studies at other nuclear facilities in the United States.

- The University of California at Los Angeles concluded that there was an increased rate of lung cancer in those workers with external exposure above 200 milliSievert (20 rem). This was due to 2 lung cancer deaths from 34 workers with exposure above 200 milliSievert (20 rem). The small sample size means that a large uncertainty is associated with this result. This result was also in direct contradiction to results for internal (inhaled) radiation exposure which showed decreasing lung cancer rates with increasing internal (lung) radiation exposures.

- Rocketdyne and many national experts in radiation effects and radiation epidemiology have questioned all of the University of California at Los Angeles' conclusions based on internal radiation exposure data. The University's conclusions are not consistent with what has been seen in a majority of other worker studies that examined higher exposures and larger study groups.

- Rocketdyne radiation workers have received lower exposures than any other groups of radiation workers studied in the United States, United Kingdom, and Canada.

- No Rocketdyne radiation worker has ever exceeded the allowable annual regulatory limits for external radiation exposure.

- Since 1984, Rocketdyne has voluntarily limited annual exposures to less than 40 percent of regulatory limits.

- The study demonstrates that Rocketdyne's efforts to minimize risks to its employees in the area of radiation protection have been successful.

- The study demonstrates that there are no widespread health effects related to radiation exposure at Rocketdyne and that its radiation workers are generally healthier than other worker groups

Agency for Toxic Substances and Disease Registry/Eastern Research Group/University of California at Los Angeles Community Cancer Study

In December 1999, the Agency for Toxic Substances and Disease Registry issued a draft "Preliminary Site Evaluation for the Santa Susana Field Laboratory Site" (ATSDR 1999). This report addressed the concerns of the community and was a preliminary assessment of the potential for adverse human health effects from past, present, and future activities at the site. The Agency also reviewed five epidemiological studies from the SSFL (two were health studies of workers and three were evaluations of community cancer registry data). Based on a preliminary evaluation of the potential exposure pathways and associated health studies and on then-available data, the Agency concluded that:

- "[I]t is unlikely that people living in communities near the site have been exposed to substances from the site at levels that would have resulted in adverse health effects."

- "In this preliminary evaluation of available data and information, ATSDR has not identified an apparent public health hazard to the surrounding communities because people have not been, and are currently not being exposed to chemicals and radionuclides from the site at levels that are likely to result in adverse health effects."

- "Based on available data and information, there is no indication that off-site residential areas, including the Brandeis-Bardin Institute, the Santa Monica Mountains Conservancy, and Bell Canyon, have been adversely impacted by chemicals or radionuclides from SSFL."

Notwithstanding these conclusions, the Agency recommended several follow-up studies, including:

- "A more in-depth evaluation of exposure pathways that addresses past, present, and future exposure to chemicals and radionuclides from the SSFL should be conducted to improve the assessment of potential offsite exposures and public health implications associated with this site."

- Are-analysis of cancer registry data including additional years of newly available cancer data and updated demographic information should be conducted to see if the apparent increase in the incidence rates of bladder and lung cancers persist.

As a result of the last recommendation, the Agency contracted with the Eastern Research Group, which in turn has contracted (sole source) with the University of California at Los Angeles to perform another investigation of the cancer rates around SSFL. DOE is not aware of any progress made on this project.

7. **Radioactive Waste Disposal.** Commenters stated that DOE was proposing to dispose of radioactive waste in local municipal landfills rather than licensed radioactive waste disposal facilities.

DOE Response: As stated in Section 4.10, radioactive waste stored on the site and generated as a result of ongoing activities and decontamination is transported to and disposed of at DOE-managed or Nuclear Regulatory Commission -licensed radioactive waste disposal sites. DOE has not shipped radioactive waste to any municipal landfills or hazardous waste landfills and is not proposing to do so.

Building debris from demolished buildings that have been decontaminated and released for unrestricted use by federal and state agencies can be sent to municipal landfills without any further regulatory controls. Such material does not pose a health risk to the public or the environment.

Similarly, soil that has been released by federal and state agencies for unrestricted use may be disposed of at municipal landfills. This soil does not pose a health risk to the public or the environment.

Questions have been raised regarding the alleged disposal of radioactive waste from ETEC to various sanitary landfills. DOE only sends radioactive waste to facilities licensed to accept this type of waste. DOE complies with all federal, state, and local regulations regarding the disposal of waste. The comments regarding the legality of DOE actions stem from differences regarding the definition of radioactive waste. Inherent in this discussion is a difference over what dose is considered safe. The approved site release limit for soil at ETEC is a dose of 15 millirem per year using a suburban residential land use scenario. This limit is less than the state and DOE dose limit of 25 millirem per year. Consequently, any material below this dose limit is not considered radioactive waste by either the state or federal government. It is important to remember that the release limit for soil (15 millirem per year dose) is the dose above background radiation levels. Average background radiation is 300 millirem per year. Consequently, the ETEC release limit is only a small increment above background. Additionally, this dose is equivalent to a risk level that is within the CERCLA risk range (a fact that was publicly acknowledged by EPA in its testimony before the Los Angeles City Council in April 2002).

DOE has shipped waste to three sanitary landfills (Bradley, Sunshine, and Calabassas). All waste shipped to these facilities meets state requirements for disposal at these sites. None of the waste going to these landfills is classified as either radioactive or hazardous waste.

The waste sent to the Bradley landfill is building debris. It is noteworthy to point out that the release limit for building debris is less than that for soil (different regulations are involved). The release limit for debris is equivalent to a dose of less than one millirem per year above background levels. DOE must assure that the debris meets state and federal regulations regarding the unrestricted release of former radioactively contaminated facilities. ETEC was a multi-purpose facility. Currently, DOE has only three facilities at the site subject to radiological controls. DOE must assure that the debris meets state and federal regulations regarding the unrestricted release of former radioactively contaminated facilities. Radiological materials were not used in the balance of the facilities at ETEC. Consequently, they are not subject to radiological controls. Most of the waste shipped from ETEC does not require a survey for radioactivity because it does not come from a radiologically controlled facility. Hazardous materials are removed from all facilities prior to demolition. Hazardous waste is sent to a RCRA-permitted disposal site.

Through Executive Order D-62-02 (September 30, 2002), the Governor of California imposed a moratorium on the disposal of decommissioned materials into Class III landfills and unclassified waste management units, as described in Title 27, sections 20260 and 20230, of the California Code of Regulations. The moratorium affects material from former radiological facilities. It will remain in effect until the state completes its assessment of the public health and environmental safety risks associated with the disposal of decommissioned materials and the regulations setting dose standards for decommissioning.

8. Monitoring. Commenters sought information on water and air monitoring that had been done to ascertain radioactive releases that had occurred from the site. Commenters stated that radioactive carcinogens, including tritium, would continue to be released from the site due to wind and rain if the site were not cleaned up. Previous studies found contamination from ETEC had migrated off site.

DOE Response: DOE annually reports on the results of environmental monitoring done at each of its sites, including ETEC. The most recent ETEC report, *Site Environmental Report for Calendar Year 2000* (DOE 2001), contains information on radioactive effluent monitoring and sampling of ambient air, groundwater, surface water and domestic water supply, soil, vegetation, and ambient radiation. It also describes the results of non-radiological monitoring of surface water, air, and groundwater. The annual site environmental reports are public documents and available from DOE and library repositories (California State University at Northridge, Platt Street Library, and Simi Valley Library).

The 2000 Site Environmental Report indicates that the collective dose to the public in the 50-mile (80-kilometer) radius from SSFL is 2.2×10^{-4} person-rem. This may be compared to the 3×10^{6} person-rem dose as a result of exposure to natural background radiation (300 millirem per person per year). The discussion of the No Action Alternative in the EA addresses potential impacts of not cleaning up the area where the remaining ETEC facilities are located.

As discussed in Section 4.4.1 of the EA, DOE determined that the occurrence of the tritium in groundwater resulted from the formation of tritium in the reactor shielding in Building 4010, which has since been decontaminated, released for unrestricted use, and demolished. Prior to removal of the facility, tritiated water migrated from the concrete into the surrounding soil and subsequently into the groundwater. No tritium has been observed that exceeds EPA drinking water supplier standards.

9. **Future Use of the Site.** Commenters stated that DOE only analyzed 500 people living in 100 homes on 2,800 acres of land. They concluded that a larger number of people would eventually live on the site and that an analysis of a larger population would result in "significant numbers of cancers." Other commenters recommended that DOE consider prohibiting future residential use of the site.

   DOE Response: ETEC facilities are or were located within an approximate 0.4-square-kilometer (90-acre) area within Area IV of the SSFL. The habitable portion of Area IV is approximately 0.8-square-kilometer (200 acres). Because implementation of Alternative 2 would require excavation of some parts of Area IV, DOE analyzed the impacts to future residents on Area IV—the approximate 0.8-square-kilometer within which the ETEC facilities are or were located.

   Given the land use and population density of the community located nearest to the SSFL, DOE assumed that single-family houses would be built on 8,000-square-meter (2-acre) plots of land on the 0.8-square-kilometer (200-acre) Area IV. The 100 homes were assumed to house 5 people each, for a total of 500 people living on the site at any one time. A 15-millirem annual dose through all exposure pathways to each individual living on the site for 40 years would result in an individual risk of incurring a latent cancer fatality risk of 3×10^{-4}. Thus, a site population of 500 people would receive a total of 300 person-rem over 40 years, which could result in up to a 0.15 theoretical additional latent cancer fatality within the population during that time period. By comparison, this population would be expected to incur approximately three theoretical latent cancer fatalities as a result of exposure to background radiation over 40 years.

   Viewed differently, one additional latent cancer fatality could be expected in the population living on Area IV (following cleanup under Alternative 1) over a 270-year period. By comparison, approximately 20 latent cancer fatalities would be expected in a site population of 500 as a result of exposure to background radiation over 270 years. Implementation of the ALARA process (see Appendix G) would reduce exposures even further, making these theoretical cancer estimates ultraconservative.

   Under Alternative 2, a 0.05-millirem annual dose through all exposure pathways to each individual living on the site for 40 years would result in an individual risk of incurring a latent cancer fatality of 1×10^{-6}. A site population of 500 people would receive a total of 1 person-rem over 40 years, which could result in up to 0.0005 theoretical latent cancer fatality within the population during that time period. Following cleanup under Alternative 2, one latent cancer fatality could be expected in the population living on Area IV over an 80,000-year period.

   Commenters have assumed that higher population density homes (between 3.5-person, one-fifth-acre tract homes and 3.5-person, 30-units per acre) would be built on all 2,240 habitable acres of the SSFL, giving a residential population of between 39,200 and 235,200 people. Such assumptions are unrealistic given the surrounding land use of 8,000-square-meter (2-acre) plots.

Commenters have also assumed that all of the SSFL would have residual contamination resulting in a 15-millirem annual dose to all residents of the area constituting the SSFL. This is incorrect, inasmuch as there has been no use of radioactive materials in the 10 square kilometers (2,500 acres) that constitute Areas I, II, and III of the SSFL. There is no evidence of any radiological contamination in any of these other areas.

DOE does not own any part of the SSFL, including the land where ETEC facilities are or were located, and has no authority to restrict future uses of the site. Although it is possible that the land could remain open space in the future, DOE's obligation is to clean up the site to residential standards.

10. **No Action Alternative.** Commenters noted that implementation of the No Action Alternative would benefit current residents because truck transportation of soil would not occur and, for this reason, the No Action Alternative was safer. Implementation of Alternative 1 or 2 would benefit future generations who lived on the site.

    DOE Response: The commenter is correct in that the implementation of Alternative 1 or 2 would benefit future residents of the site, while imposing some impacts (for example, noise and vibrations as a result of truck traffic) to current residents near the site. DOE must balance the present and future benefits and impacts of all alternatives in determining which course of action to take.

11. **Other Alternatives.** Commenters suggested that DOE examine other cleanup alternatives. Finding an appropriate balance between the risks associated with truck transportation and the risks associated with residual radioactive contamination was suggested. Another alternative suggested using the CERCLA process for the selection of a remedy, active onsite management to reduce potential transportation impacts, the cleanup of the site to industrial levels, prohibiting residential use, leaving the area as a wildlife corridor or hiking area, and different transportation options.

    DOE Response: DOE believes Alternative 1 is the appropriate balance between the risks associated with truck transportation and the risks associated with residual radioactive contamination. The following table is a comparison between the risks associated with Alternative 1 and Alternative 2. Cleanup levels between these two alternatives would result in different balances between the risks associated with truck transportation and the risks associated with residual radioactive contamination.

Theoretical Residual Risk	Annual Exposure (millirem)	Latent Cancer Fatalities in Exposed Population (40 Year Exposure)	Traffic Fatalities Resulting from Soil Removal
3×10^{-4}	15	0.15	0.025
1×10^{-4}	5.0	0.05	0.035
1×10^{-5}	0.5	0.005	0.49
1×10^{-6}	0.05	0.0005	1.4

Cleanup to recreational/parkland levels would allow approximately five times more cesium-137 in the soil than residential levels would allow. As a result, no further soil excavation would be required in Area IV, even at the Radioactive Materials Handling Facility. DOE did not analyze this alternative cleanup level because the Department did not believe it was a reasonable alternative given the anticipated future use of the property.

The following table presents the levels of various radionuclides that could remain in the soil under different future use scenarios, assuming an annual exposure rate of no more than 15 millirem to an individual, using the 2001 version of RESRAD.

Single Radionuclide Soil Guidelines (picocuries/gram)

Isotope	Resident Farmer[a]	Industrial Worker[a]	Recreationist[a]	SSFL-Approved Soil Guidelines (Residential)[b]
Am-241	0.8	307	78	5.4
Co-60	1.7	5.9	55	1.9
Cs-134	2.9	11	35	3.3
Cs-137	6.1	27	47	9.2
Eu-152	3.9	13	384	4.5
Eu-154	3.6	12	353	4.1
Fe-55	33,110	3,295,000	39,120	629,000
H-3	601	129,500	4,150	31,900
K-40	8.6	87	31	28
Mn-54	7.3	25	709	6.1
Na-22	2.1	7.5	57	2.3
Ni-59	6,165	8,199,000	58,130	151,000
Ni-63	2,252	3,012,000	21,230	55,300
Pu-238	37	412	1,184	37
Pu-239	34	372	1,067	34
Pu-240	34	372	1,067	34
Pu-241	25	12,210	2,371	230
Pu-242	35	391	1,124	36
Ra-226	1.0	7.9	25	5 and 15[c]
Sr-90	2.5	2661	9.4	36
Th-228	3.0	10.3	292	5 and 15[c]
Th-232	1.0	5.4	38	5 and 15[c]
U-234	15	2,633	1,815	30[c]
U-235	3.4	112	136	30[c]
U-238	16	531	2,051	35[c]

a. Source: RESRAD 6.1 (ANL 2001) default parameters.
b. Source: Rocketdyne 1999 (using RESRAD 1996).
c. Based on applicable or relevant and appropriate requirements (ARARs).

The contaminated soil would be considered to be low-level radioactive waste (LLW). There is no "onsite management or treatment" of the waste that could occur in order to reduce potential transportation impacts. The impacts associated with transportation of LLW relate solely to the number of truck shipments required and not the level of radioactivity in the soil that would be transported.

With respect to other transportation alternatives, the only other potential transportation option would be rail. However, ETEC sits at the top of a range of hills with no current rail access. Constructing rail access to the site would be environmentally harmful and expensive. Moving contaminated soil from ETEC to the nearest railhead would still involve transportation of soil by truck.

12. **NEPA Compliance.** Commenters stated that DOE was improperly segmenting its analysis by only examining ETEC facilities and not analyzing hazardous chemical contamination. Commenters requested that the EA address the applicability of other laws and requirements to the proposed action. Commenters also stated that DOE had exempted itself from environmental law by issuing categorical exclusions for earlier cleanup activities. A commenter also questioned the extent to which DOE took public comments into account.

DOE Response: Although ETEC is located at the SSFL, DOE is responsible only for the facilities on Area IV that make up the ETEC. Most of those facilities have already been decontaminated, decommissioned, and demolished or abandoned for use by Boeing. However, DOE did evaluate the potential for cumulative impacts in the EA.

Applicable regulations require an agency to analyze connected, cumulative, and similar actions together in the same National Environmental Policy Act (NEPA) document (see 40 CFR 1508.8.25(a)). "Connected" actions are those that automatically trigger other actions, cannot proceed unless other actions are taken, or are interdependent parts of a larger action. The cleanup of hazardous chemical contamination is being undertaken as part of a RCRA process and is not related to the radiological decontamination and decommissioning of the remaining radiological facilities at ETEC. DOE is required to cleanup radiological contamination to a level protective of human health and the environment; this obligation is not affected by the clean up actions undertaken for hazardous chemical contamination. For this reason, the cleanup of radiological contamination and the cleanup of hazardous chemical contamination are not "connected actions" as that term is used in NEPA regulations.

In Section 2.2, the EA does address the applicability of other laws and regulations applicable to a cleanup of ETEC facilities.

Previous decontamination and decommissioning activities were undertaken pursuant to categorical exclusions in accordance with DOE and Council on Environmental Quality NEPA implementing regulations (see 10 CFR Part 1021, Subpart D and 40 CFR 1508.4). Application of a categorical exclusion is not only allowed by law but is encouraged to reduce paperwork and delay (see 40 CFR 1500.4(p) and 1500.5(k)). A categorical exclusion is an exemption from NEPA documentation requirements, not from NEPA itself. The prior decontamination and decommissioning activities were overseen by the California DHS, which concurred that the radiological facilities could be released for unrestricted use in accordance with state regulatory standards (the same standards are applicable to the proposed cleanup of the remaining ETEC radiological facilities). Although DOE agreed to conduct an EA due to stakeholder concern of segmentation, DOE saw no value in re-evaluating the decontamination and decommissioning decisions previously made that were approved by CA DHS and the facilities have been demolished or turned over to Boeing for reuse (see Table I-3).

DOE reviewed and considered all of the public scoping comments it received. DOE added, the $1x10^{-6}$ cleanup standard, Alternative 2, as an alternative at the request of stakeholders during the public scoping process. DOE has also reviewed and considered the comments it received on the Draft EA and has made changes to the document in response to those comments. These changes include a clarification of the areas to be cleaned up under Alternatives 1 and 2 and additional information regarding soil survey data, ALARA, radionuclides of concern, and air quality.

Table I-3. Status of All Radiological Facilities at ETEC

Facility Number	Facility Title	Rocketdyne Operations	Verification Surveys	Owner	Released By	Release Date	Building Demolition Date
OCY	Old Conservation Yard	D&D and survey complete	ORISE, DHS	Rocketdyne	DHS	1995	Land Only
RMHF	Radioactive Materials Handling Facility	Operational	-	DOE	-	ECD 2006	ECD 2006
003	Engineering Test Building	D&D and survey complete	ANL	Rocketdyne	DOE	1985	1999
005	Uranium Carbide Fuel Facility	D&D and survey complete	ORISE, DHS	Rocketdyne	DHS	1995	1996
009	Organic Moderated Reactor, Sodium Graphite Reactor	D&D and survey complete	DHS	Rocketdyne	DHS	1999	Not Planned
011	Radiation Instrument Calibration Laboratory	Survey complete	DHS	Rocketdyne	DHS	1998	Not Planned
010	SNAP-8 Experimental Reactor	D&D and survey complete	ANL	DOE	DOE	1982	1983
012	SNAP Critical Facility	D&D and survey complete	ORISE, DHS	DOE	DOE, DHS	1997	ECD 2004
17th St.	17th St. Drainage Area	D&D and survey complete	ORISE, DHS	Rocketdyne	Pending	ECD 2002	Land Only
019	Flight System Critical Assembly	D&D and survey complete	ORISE, DHS	DOE	Pending	ECD 2002	Not Planned
020	Hot Lab Bldg.	D&D and survey complete	DHS	DOE	DHS (concrete)	1997-99	1997-99

Table I-3. Status of All Radiological Facilities at ETEC (cont)

Facility Number	Facility Title	Rocketdyne Operations	Verification Surveys	Owner	Released By	Release Date	Building Demolition Date
020	Hot Lab Land	Survey complete	ORISE, DHS	DOE	Pending	ECD 2002	Land Only
023	Corrosion Test Loop	D&D and survey complete	ORISE, DHS	DOE	DOE, DHS	1997	1999
024	SNAP Environmental Test Facility	Operational (offices)	-	DOE	-	ECD 2005	ECD 2005
028	Shield Test Iradiation Reactor	D&D and survey complete	ORISE, DHS	DOE	DOE, DHS	1997	1998
029	Radiation Measurement Facility	D&D and survey complete	ORISE, DHS	DOE	DOE, DHS	1997	ECD 2003
030	van de Graaf Accelerator	D&D and survey complete	ORISE, DHS	DOE	DOE, DHS	1997	1999
055	Nuclear Materials Development Facility	D&D and survey complete	ORAU	Rocketdyne	NRC	1987	Not Planned
059	SNAP Ground Prototype Test Building	Phase I D&D and survey complete	ORISE, DHS	DOE	Phase I pending	ECD 2002	ECD 2003
059	059 Land	Phase II D&D and survey complete	ORISE, DHS	DOE	-	ECD 2004	Land Only
064	Fuel Storage Facility	D&D and survey complete	ORISE, DHS	DOE	DOE, DHS	1996	1997
064SY	064 Side Yard and land	D&D and survey complete	ORISE, DHS	DOE	Pending	ECD 2002	Land Only
073	Kinetic Experiment Water Boiler	D&D and survey complete	ANL	ERDA	ERDA	1976	1976

Table I-3. Status of All Radiological Facilities at ETEC (cont)

Facility Number	Facility Title	Rocketdyne Operations	Verification Surveys	Owner	Released By	Release Date	Building Demolition Date
093	L-85 Reactor	D&D and survey complete	ORAU	Rocketdyne	NRC	1987	1995
100	Fast Critical Experiment Laboratory	D&D and survey complete	NRC	Rocketdyne	NRC	1980	Not Planned
143	Sodium Reactor Experiment	D&D and survey complete	ANL	Rocketdyne	DOE	1985	1999
363	R&D Laboratory	D&D and survey complete	ORISE, DHS	Rocketdyne	DHS	1998	2001
373	SNAP Critical Facility	D&D and survey complete	DHS (document review only)	Rocketdyne	DHS	1995	1996-99
654	Interim Storage Facility	D&D and survey complete	ORISE, DHS	DOE	Pending	ECD 2002	Land Only
886	Sodium Disposal Facility	Rad. D&D and survey complete	DHS	Rocketdyne	DHS	1998 (Land)	1991(Bldg)

D&D: decontamination and decommissioning
ECD: estimated completion date

13. **EA Analysis.** Commenters thought the purpose, scope, and context of the EA should be clarified and that the bases for judgments and conclusions should be provided. Commenters also asked for clarification regarding the definition of risk and lifetime span as used in the EA. Additional information was requested regarding air quality impacts; potential radiological contamination of groundwater; locations and history of radiological releases at ETEC and the standards applied to previous cleanups; potential impacts to protected, sensitive, or threatened plant and wildlife species that are known to occur on the site; and potential impacts to wetland and riparian resources. Information regarding loading of pollutants into the watershed was also requested. One commenter recommended that project costs, including transportation and disposal, be included in the decisionmaking process.

    DOE Response: DOE has clarified the purpose, scope, and context of the EA in Chapter 1 and has added a discussion of the bases for judgments and conclusions where appropriate, particularly in Sections 3.2 and 3.3. DOE has also added Appendix E to specifically address the use of the Area IV soil survey data in the EA.

    DOE has also clarified the discussion of risk and lifetime span in Chapter 1 and Appendix C. Specifically, the text was modified to explain that the risk discussed is the risk of incurring a fatal cancer and that DOE analyzed a 40-year period of exposure as a result of living on a house constructed within Area IV after cleanup. Information was also added regarding air quality impacts, previous cleanups at the site (*see* Table I-3), and liquid effluents.

    With respect to impacts to biological resources, the EA identifies sensitive species that have been observed or that could potentially occur at the SSFL (*see* Appendix D). However, Section 4.6 of the EA also states that none of these would be affected under Alternative 1 because they are not present in the areas where the work would be performed. The EA acknowledges that the additional land disturbance required under Alternative 2 could increase the potential for disturbance of sensitive species and that consultation with the U.S. Fish and Wildlife Service could be necessary should DOE decide to implement Alternative 2. DOE believes the existing information on the difference in environmental impacts between alternatives 1 and 2 are sufficient to reach a defensible conclusion on which of the alternatives constitute the most appropriate response. Therefore, DOE has elected not to create detailed habitat maps or conduct biological resource surveys at this time to compare the potential environmental impacts of Alternatives 1 and 2; such additional analysis could be required, and would be conducted, if DOE decided to implement Alternative 2.

    Although jurisdictional wetlands occur at the SSFL, none would be affected by the implementation of any of the alternatives, as indicated in Section 4.4 of the EA. Therefore, additional information regarding potential impacts or mitigation measures to avoid those impacts is not necessary. Similarly, none of the alternatives would result in releases of radioactively contaminated liquid effluent.

    DOE intends to consider cost in its decisionmaking process. However, DOE did not include cost data in the EA because it focuses on potential environmental issues, not cost.

14. **Mitigation.** Commenters offered possible mitigation measures relating to truck transportation and activities to reduce air quality impacts from decontamination activities.

    DOE Response: Many of the mitigation measures suggested are “best practices” that DOE routinely implements. DOE will consider and implement all suggested mitigation to the fullest extent possible.

15. **Environmental Impact Statement.** Commenters stated that DOE should prepare an environmental impact statement for the proposed cleanup of the site. Reasons cited for preparing an environmental impact statement were that the cleanup would cost "a quarter of a billion dollars," there was a meltdown there in 1959, it was an "immense area with lots of chemical and radioactive contamination," and there had never been an environmental impact statement to look at the cleanup of the site.

    DOE Response: The purpose of an EA is to determine whether the impacts of a proposed action would be significant. Regardless of the cost or extent of a proposed action, an environmental impact statement is required when the impacts of the proposal may be significant. "Significance" is determined on a case-by-case basis. DOE prepared the *Draft Environmental Assessment for Cleanup and Closure of the Energy Technology Engineering Center* (DOE 2002) in order to determine whether the impacts of the proposed cleanup and cleanup alternatives would be significant. Based on its analysis, DOE determined that the impacts of the preferred alternative would not be significant and therefore that an environmental impact statement is not required.

    In preparing the EA, DOE conducted a public scoping process to elicit public input on the scope of the EA analysis. DOE also issued the EA in draft and held a public hearing to obtain comments on the draft document. The comment period on the draft was 4 months long. The public was afforded the same participation and commenting opportunities on the ETEC EA as would be conducted for the preparation of an environmental impact statement.

    Although it is not relevant to DOE's current cleanup proposal, DOE offers the following information regarding an accident at the site in 1959. The Sodium Reactor Experiment, also known as Building 4143, operated from April 1957 to February 1964. It supplied approximately 20 megawatts of nuclear powered electricity (less than 1 percent of the size of commercial power plants) to a commercial grid and supplied electricity to the city of Moorpark in the late 1950s.

    The Sodium Reactor Experiment accident occurred in July 1959 when there was an accidental partial blockage of sodium coolant in some of the reactor coolant channels. This resulted in the partial melting of 13 of the 43 reactor fuel assemblies and the release of some fission products that contaminated the primary reactor cooling system and some of the inside rooms of the facility. All of the reactor safety systems functioned properly, and the reactor was safely shut down. The primary pressure vessel containing the reactor core and sodium coolant remained intact. Under the oversight of the AEC, contamination within the building was cleaned up; the reactor fuel assemblies were then removed, inspected, and stored at the Radioactive Materials Handling Facility. (They were later declad in the Hot Lab, and the fuel and cladding was shipped off site to an AEC-approved disposal facility). A second fuel loading was inserted, and operations continued until the reactor was shut down in February 1964 due to termination of the project.

    A major portion of the radioactivity released from the fuel as a result of the fuel melting was contained in the sodium coolant, but some of the radioactivity was collected in the cover gas in the volume above the sodium coolant inside the reactor vessel. This radioactivity in the cover gas consisted principally of krypton-85 and xenon-135 gas and was the same type of radioactivity that collected in smaller quantities during normal operation of the experimental power plant.

    During normal routine operations, the cover gas was transferred to large holdup tanks in the Sodium Reactor Experiment facility for the specific purpose of collecting and retaining radioactive gases. After decay, the gas was normally exhausted to the atmosphere through a filtered ventilation system with large quantities of air for dilution of the radioactivity. The releases were always well below those permitted by regulations in existence both then and today. This was done with the approval and oversight of the AEC.

Following the accident, the contaminated reactor cover gas was again transferred to the holding tanks and held long enough for the xenon-135 to decay away (9.1-hour half-life). It was then released to the atmosphere through the stack in a controlled manner, in low concentrations that met federal requirements. This was done with the approval and oversight of the AEC. Based on measurements of the cover gas concentration and volume, less than 5 curies of krypton-85 (10.7-year half-life) was released in this way. The dispersion of the krypton-85 in the atmosphere diluted it so much that it would have resulted in a maximum theoretical calculated dose of 0.00006 millirem to someone living in Susana Knolls, the nearest residential area at that time. This is the amount of dose received from natural external radiation in about 15 seconds. The other fission products were retained in the primary coolant and were removed during cleanup operations.

Personnel employed in operating the reactor and those employed during the post-accident recovery, cleanup, and refurbishment were continually monitored for external and internal radiation exposure. No personnel exceeded annual exposure limits for radiation workers.

Established routine monitoring of the environment, including soil/vegetation sampling, surface water sampling and air sampling, before, during, and after the accident, failed to detect any increase in the ambient levels of naturally occurring radioactivity. Subsequent sampling in recent years has failed to detect any environmental contamination from the Sodium Reactor Experiment accident that would result in any exposure or risk to anyone living off the site.

16. **Extension of the Comment Period.** Commenters requested a 60-day extension of time in which to file comments. The Committee to Bridge the Gap was asked to provide documentation referred to in its oral comments. The extension was said to be necessary to assemble the "very extensive set of documentation relevant to the EA."

    DOE Response: DOE extended the comment period on the Draft EA to April 26, 2002. Although DOE sought information referenced by the Committee to Bridge the Gap in during the scoping meetings in October 2000, Mr. Hirsch stated at that time that he would not be able to provide written comments or references. DOE will review and consider any information provided by Mr. Hirsch in response to DOE's renewed request for relevant material. As of August 1, 2002, DOE has not received any additional documentation from Mr. Hirsch.

17. **Other Alternatives.** Commenters suggested that several other alternatives be considered.

    DOE Response:

    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's jurisdiction over the SSFL does not extend beyond ETEC and because DOE is not responsible for contamination at the SSFL 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.

Use CERCLA Approach to Select a Cleanup Remedy

EPA recommended that DOE consider using EPA's CERCLA approach to evaluate the need for and select a cleanup remedy for ETEC. Because ETEC is not a CERCLA site, DOE has elected to use the NEPA process to evaluate the need for and select a cleanup standard for ETEC. DOE does not believe that using a CERCLA approach is reasonable in these circumstances or would result in an analysis or disclosure of any impacts that have not been analyzed or disclosed in this EA. Use of either the CERCLA or the NEPA process to evaluate impacts does not itself result in environmental impacts.

Manage and Treat Radiological Materials Onsite

EPA recommended that DOE consider onsite active management or treatment of radiological materials to reduce potential impacts associated with transporting radiological materials. All nuclear research at ETEC ended in 1988 and DOE is closing the site. DOE is currently managing the radiological waste that has been generated and will be generated as a result of cleanup activities at ETEC, and conducts limited treatment of radioactive waste such as size reduction, stabilization, and evaporation. The impacts of transporting radioactive waste offsite for storage or disposal have been analyzed and found to be very small. For these reasons, DOE believes that additional onsite management and treatment of radiological materials is not a reasonable alternative. DOE did analyze the No Action Alternative.

Consider Other Transportation Options

EPA recommended that DOE consider different transportation options to mitigate some of the impacts of transportation under Alternative 1 or Alternative 2. There is no rail access to ETEC currently. Constructing rail access or an intermodal facility would be very costly and would not reduce the impacts to the neighborhoods most affected by the transportation of radioactive waste offsite. For these reasons, DOE believes that other transportation options are not reasonable.

Evaluate Restrictions on Residential Use

EPA recommended that DOE consider possible restrictions to prevent residential use on all or portions of Area IV where ETEC facilities are or were located. However, DOE does not own the site and has no control over future land use restrictions. Future land use restrictions would reduce exposure below that already analyzed in this EA. For this reason, DOE believes that evaluating restrictions on residential use is not a reasonable alternative.

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