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Draft Environmental Impact Statement for Remediation of Area IV and the Northern Buffer Zone of the Santa Susana Field Laboratory

Summary

U.S. Department of Energy
Office of Environmental Management

AVAILABILITY OF THE
DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR REMEDIATION
OF AREA IV AND THE NORTHERN BUFFER ZONE OF THE
SANTA SUSANA FIELD LABORATORY
(*Draft SSFL Area IV EIS*)

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COVER SHEET

Lead Agency: U.S. Department of Energy (DOE), Office of Environmental Management

Cooperating Agencies: National Aeronautics and Space Administration (NASA), U.S. Army Corps of Engineers, and the Santa Ynez Band of Chumash Indians

Title: *Draft Environmental Impact Statement for Remediation of Area IV and the Northern Buffer Zone of the Santa Susana Field Laboratory (Draft SSFL Area IV EIS)* (DOE/EIS-0402)

Location: Ventura County, California

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This document is available on the SSFL Area IV EIS website (http://SSFLAreaIVEIS.com) and the DOE NEPA website (http://energy.gov/nepa) for viewing and downloading.

Abstract:

This *Draft SSFL Area IV EIS* analyzes the potential environmental impacts of alternatives for conducting cleanup activities in Area IV of the Santa Susana Field Laboratory (SSFL) and the adjoining Northern Buffer Zone (NBZ), located in Ventura County, California. Remediation is needed to clean up residual chemicals and radionuclides from historical DOE operations at the Energy Technology Engineering Center (ETEC) in Area IV, in compliance with regulations, orders, and agreements. The alternatives analyzed in this draft environmental impact statement (EIS) involve the disposition of remaining DOE facilities and support buildings, remediation of soil and groundwater, and disposal of all resulting waste at existing licensed or permitted facilities in a manner that is protective of the environment and the health and safety of the public and workers. The information in this EIS will inform decision-makers and the public about the potential impacts of the proposed cleanup of both chemicals and radionuclides and will be considered along with other relevant factors in making decisions regarding cleanup of Area IV and the adjoining NBZ. DOE is proposing three sets of alternatives. Each set was developed to address a component of the SSFL Area IV and NBZ cleanup effort: soil remediation, building demolition, and groundwater remediation.

Preferred Alternative: DOE has no preferred alternative at this time.

Public Involvement:

DOE conducted a number of activities to encourage public input and assist the public in its role in the NEPA process. Following issuance of an Advance Notice of Intent to prepare a draft EIS in October 2007 (72 *Federal Register* [FR] 58834), DOE held informal discussions with the public and stakeholders to gather information used in preparing the Notice of Intent (NOI) published in May 2008 (73 FR 28437). During this first scoping period, DOE held six scoping public meetings to present the proposed alternatives and receive comments from agencies, organizations, and the public. DOE held scoping meetings in Simi Valley, Northridge, and Sacramento, California. In spring 2012, DOE sponsored three Community Alternative Development Workshops, in which community members were asked to articulate their preferences for alternatives that they would like to see included in this EIS. In consideration of site characterization activities conducted by DOE and the U.S. Environmental Protection Agency and changes in cleanup requirements (as a result of the 2010 *Administrative Order on Consent for Remedial Action* between DOE and the California Department of Toxic Substances Control), DOE published an Amended NOI in February 2014 (79 FR 7439), announcing a second scoping period from February to April 2014. During this second scoping period, DOE held two public scoping meetings, one each in Simi Valley and Agoura Hills, California, and a scoping meeting with Native American tribal members. DOE considered comments provided during both scoping periods, as well as input received from the 2012 Community Alternatives Development Workshops, in the preparation of this draft EIS.

Comments on this *Draft SSFL Area IV EIS* should be submitted within 60 days of the publication of the U.S. Environmental Protection Agency's Notice of Availability of this draft EIS in the *Federal Register* to ensure consideration in preparation of the *Final SSFL Area IV EIS*. DOE will consider comments received after the 60-day comment period to the extent practicable. Written comments may be submitted to Ms. Stephanie Jennings via U.S. mail to the address provided above or electronically, via a comment portal on the SSFL Area IV EIS website (http://SSFLAreaIVEIS.com). DOE will hold public hearings on this draft EIS during the comment period. DOE will announce the dates, times, and locations of these hearings via newspaper advertisements, the SSFL Area IV EIS website, the DOE NEPA website, and notifications to persons on the mailing list. Information on this EIS can be found at http://SSFLAreaIVEIS.com or http://energy.gov/nepa.

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Acronyms and Abbreviations

ALARA	as low as reasonably achievable
AOC	*Administrative Order on Consent for Remedial Action*
BMP	best management practice
Boeing	The Boeing Company
BTV	Background Threshold Value
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CFR	*Code of Federal Regulations*
CFWS	California Fish and Wildlife Service
CMWD	Calleguas Municipal Water District
CNEL	community noise equivalent level
CO	*Consent Order for Corrective Action*
CO_2	carbon dioxide
dBA	decibels A-weighted
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
DTSC	Department of Toxic Substances Control
EA	environmental assessment
EIR	environmental impact report
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ESAL	equivalent single-axle load
ETEC	Energy Technology Engineering Center
FAL	field action level
FONSI	Finding of No Significant Impact
FR	*Federal Register*
FSDF	Former Sodium Disposal Facility
HMSA	Hazardous Materials Storage Area
LCF	latent cancer fatality
LLW	low-level radioactive waste
LOS	level of service
LUT	Look-Up Table
MCL	maximum contaminant level
MDC	minimum detectable concentration
MLLW	mixed low-level radioactive waste
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NBZ	Northern Buffer Zone
NEPA	National Environmental Policy Act
NNSS	Nevada National Security Site
NOI	Notice of Intent
NO_X	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRHP	*National Register of Historic Places*
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	perchloroethylene

$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
PM_{10}	particulate matter less than 10 microns in diameter
RBSL	risk-based screening level
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RMHF	Radioactive Materials Handling Facility
ROD	Record of Decision
ROI	region of influence
SHPO	State Historic Preservation Officer
SRAIP	Soils Remedial Action Implementation Plan
SRAM	*Final Standardized Risk Assessment Methodology Revision 2 Addendum, Santa Susana Field Laboratory, Ventura County, California*
SRE	Sodium Reactor Experiment
SSFL	Santa Susana Field Laboratory
SO_2	sulfur dioxide
TCE	trichloroethylene
TPH	total petroleum hydrocarbons
USFWS	U.S. Fish and Wildlife Service
VOC	volatile organic compound

CONVERSIONS

METRIC TO ENGLISH			ENGLISH TO METRIC		
Multiply	**by**	**To get**	**Multiply**	**by**	**To get**
Area					
Square meters	10.764	Square feet	Square feet	0.092903	Square meters
Square kilometers	247.1	Acres	Acres	0.0040469	Square kilometers
Square kilometers	0.3861	Square miles	Square miles	2.59	Square kilometers
Hectares	2.471	Acres	Acres	0.40469	Hectares
Concentration					
Kilograms/square meter	0.16667	Tons/acre	Tons/acre	0.5999	Kilograms/square meter
Milligrams/liter	1 [a]	Parts/million	Parts/million	1 [a]	Milligrams/liter
Micrograms/liter	1 [a]	Parts/billion	Parts/billion	1 [a]	Micrograms/liter
Micrograms/cubic meter	1 [a]	Parts/trillion	Parts/trillion	1 [a]	Micrograms/cubic meter
Density					
Grams/cubic centimeter	62.428	Pounds/cubic feet	Pounds/cubic feet	0.016018	Grams/cubic centimeter
Grams/cubic meter	0.0000624	Pounds/cubic feet	Pounds/cubic feet	16,018.5	Grams/cubic meter
Length					
Centimeters	0.3937	Inches	Inches	2.54	Centimeters
Meters	3.2808	Feet	Feet	0.3048	Meters
Kilometers	0.62137	Miles	Miles	1.6093	Kilometers
Radiation					
Sieverts	100	Rem	Rem	0.01	Sieverts
Temperature					
Absolute					
Degrees C + 17.78	1.8	Degrees F	Degrees F - 32	0.55556	Degrees C
Relative					
Degrees C	1.8	Degrees F	Degrees F	0.55556	Degrees C
Velocity/Rate					
Cubic meters/second	2118.9	Cubic feet/minute	Cubic feet/minute	0.00047195	Cubic meters/second
Grams/second	7.9366	Pounds/hour	Pounds/hour	0.126	Grams/second
Meters/second	2.237	Miles/hour	Miles/hour	0.44704	Meters/second
Volume					
Liters	0.26418	Gallons	Gallons	3.7854	Liters
Liters	0.035316	Cubic feet	Cubic feet	28.316	Liters
Liters	0.001308	Cubic yards	Cubic yards	764.54	Liters
Cubic meters	264.17	Gallons	Gallons	0.0037854	Cubic meters
Cubic meters	35.314	Cubic feet	Cubic feet	0.028317	Cubic meters
Cubic meters	1.3079	Cubic yards	Cubic yards	0.76456	Cubic meters
Cubic meters	0.0008107	Acre-feet	Acre-feet	1233.49	Cubic meters
Weight/Mass					
Grams	0.035274	Ounces	Ounces	28.35	Grams
Kilograms	2.2046	Pounds	Pounds	0.45359	Kilograms
Kilograms	0.0011023	Tons (short)	Tons (short)	907.18	Kilograms
Metric tons	1.1023	Tons (short)	Tons (short)	0.90718	Metric tons
ENGLISH TO ENGLISH					
Acre-feet	325,850.7	Gallons	Gallons	0.000003046	Acre-feet
Acres	43,560	Square feet	Square feet	0.000022957	Acres
Square miles	640	Acres	Acres	0.0015625	Square miles

a. This conversion is only valid for concentrations of contaminants (or other materials) in water.

METRIC PREFIXES

Prefix	Symbol	Multiplication factor
exa-	E	1,000,000,000,000,000,000 = 10^{18}
peta-	P	1,000,000,000,000,000 = 10^{15}
tera-	T	1,000,000,000,000 = 10^{12}
giga-	G	1,000,000,000 = 10^{9}
mega-	M	1,000,000 = 10^{6}
kilo-	k	1,000 = 10^{3}
deca-	D	10 = 10^{1}
deci-	d	0.1 = 10^{-1}
centi-	c	0.01 = 10^{-2}
milli-	m	0.001 = 10^{-3}
micro-	μ	0.000 001 = 10^{-6}
nano-	n	0.000 000 001 = 10^{-9}
pico-	p	0.000 000 000 001 = 10^{-12}

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S.1 Introduction

The U.S. Department of Energy (DOE) prepared this *Draft Environmental Impact Statement for Remediation of Area IV and the Northern Buffer Zone of the Santa Susana Field Laboratory (Draft SSFL Area IV EIS)* in accordance with the National Environmental Policy Act (NEPA) and Council on Environmental Quality (CEQ) and DOE implementing regulations at Title 40, *Code of Federal Regulations*, Parts 1500-1508 (40 CFR Parts 1500-1508) and 10 CFR Part 1021, respectively. Past activities at the Santa Susana Field Laboratory (SSFL), Ventura County, California, resulted in chemical and radiological releases that impacted soil, buildings, and groundwater. Residual chemicals and radionuclides from historical operations in Area IV associated with soil, buildings, and groundwater, as well as soil contamination in the Northern Buffer Zone (NBZ) that is contiguous to and emanating from Area IV, need to be cleaned up. Extensive soil sampling and analysis in recent years has demonstrated that the chemical contamination is more widespread than the radiological contamination, and that contaminants are concentrated near certain facilities, rather than being evenly distributed across the site.

This environmental impact statement (EIS) analyzes the potential environmental impacts of alternatives for conducting cleanup activities in Area IV and the NBZ. There are separate alternatives for soil remediation, building demolition, and groundwater remediation.

For soil remediation, DOE's proposed action is to implement the technical requirements of the 2010 *Administrative Order on Consent for Remedial Action* (2010 AOC) (DTSC 2010a) between DOE and the California Department of Toxic Substances Control (DTSC)—that is, cleanup to meet the Look-Up Table (LUT) values for residual concentrations of chemicals and radionuclides in soil established in accordance with the 2010 AOC (Cleanup to AOC LUT Values Alternative). In preparing this EIS, DOE identified challenges to implementing this alternative, including difficulty determining when the AOC LUT values have been met and difficulty finding replacement soil that meets the AOC LUT values. Consistent with NEPA requirements, this EIS also analyzes a no action alternative (no soil treatment or removal), as well as two additional action alternatives (Cleanup to Revised LUT Values Alternative and Conservation of Natural Resources Alternative). The additional action alternatives would meet the cleanup objectives to be protective of the environment and the health and safety of the public and workers while avoiding some of the technical challenges and potential adverse environmental impacts associated with cleanup to the 2010 AOC LUT values.

For buildings, DOE's proposed action is to demolish the 18 structures it owns in Area IV and dispose of or recycle the materials off site (Building Removal Alternative); the EIS also analyzes a no action alternative of leaving the structures in place. To address groundwater contamination, this EIS analyzes current levels of monitoring (no action), additional monitoring to better support natural attenuation (Groundwater Monitored Natural Attenuation Alternative), and active treatment of contaminated groundwater (Groundwater Treatment Alternative).

This EIS will inform Federal decisions about remediation of contaminated soil and groundwater, building demolition, restoration of the impacted environment, and disposal of chemical and radioactive waste. DOE's conclusions resulting from the evaluation of alternatives in this EIS are presented in Section S.10 of this Summary. DOE does not have a preferred alternative and looks forward to receiving input from the public on this draft EIS.

This EIS also responds to an order by the U.S. District Court for the Northern District of California, which permanently enjoins DOE from transferring possession or otherwise relinquishing control over any portion of Area IV until DOE has completed an EIS and issued a Record of Decision (ROD). This *Order Granting Plaintiffs' Motion for Summary Judgment* (Case 3:04-CV-04448-SC, May 2, 2007) is the result of a lawsuit filed by the Natural Resources Defense Council, the Committee to Bridge the Gap, and the City of Los Angeles, which successfully challenged DOE's 2003 *Final Environmental Assessment for Cleanup and Closure of the Energy Technology Engineering Center* (*ETEC EA*) (DOE 2003) and Finding of No Significant Impact (FONSI) for remediation of Area IV.

DOE issued an Advance Notice of Intent to prepare an EIS and conduct public involvement activities in the October 17, 2007, *Federal Register* (FR) (72 FR 58834). A Notice of Intent (NOI) to prepare this EIS was published in May 2008 (*Notice of Intent to Prepare an Environmental Impact Statement for Remediation of Area IV of the Santa Susana Field Laboratory and Conduct Public Scoping Meetings* [73 FR 28437]).

Due to the availability of more-recent site characterization data and issuance of the 2010 AOC, DOE held a second scoping period in 2014 that was initiated by the *Amended Notice of Intent to Prepare an Environmental Impact Statement for Remediation of Area IV of the Santa Susana Field Laboratory and Conduct Public Scoping Meetings*, (79 FR 7439) published February 7, 2014.

S.2 Purpose and Need for Agency Action

DOE needs to complete remediation of Area IV and the NBZ to comply with applicable requirements for cleanup of radiological and hazardous substances. These requirements include regulations, orders, and agreements. To this end, DOE needs to remove the remaining DOE structures in Area IV of SSFL and clean up the affected environment in Area IV and the NBZ in a manner that is protective of the environment and the health and safety of the public and workers.

S.3 Proposed Action

DOE proposes to remove existing DOE-owned facilities and support buildings from Area IV (Building Removal Alternative); remediate chemically and radiologically impacted soil in Area IV and the NBZ (Cleanup to AOC LUT Values Alternative); remediate groundwater in Area IV and the NBZ (elements of the Groundwater Monitored Natural Attenuation and Groundwater Treatment Alternatives); dispose of resulting waste; and restore the affected environment in accordance with applicable laws, orders, regulations, and agreements with the State of California.

S.4 History of the Site

Located in Ventura County, California, on approximately 2,850 acres in the hills between Chatsworth and Simi Valley, SSFL was developed as a remote site to test rocket engines and conduct nuclear research (**Figure S–1**). Rockwell International's Rocketdyne Division (based in Canoga Park, California) began rocket engine testing in the Area I portion of SSFL in 1947. Rockwell created Atomics International in the early 1950s to conduct nuclear research in Area IV for the Atomic Energy Commission (a predecessor agency of DOE) and commercial entities. In 1996, Rockwell International sold its aerospace and defense business, including Area IV of SSFL, to The Boeing Company (Boeing).

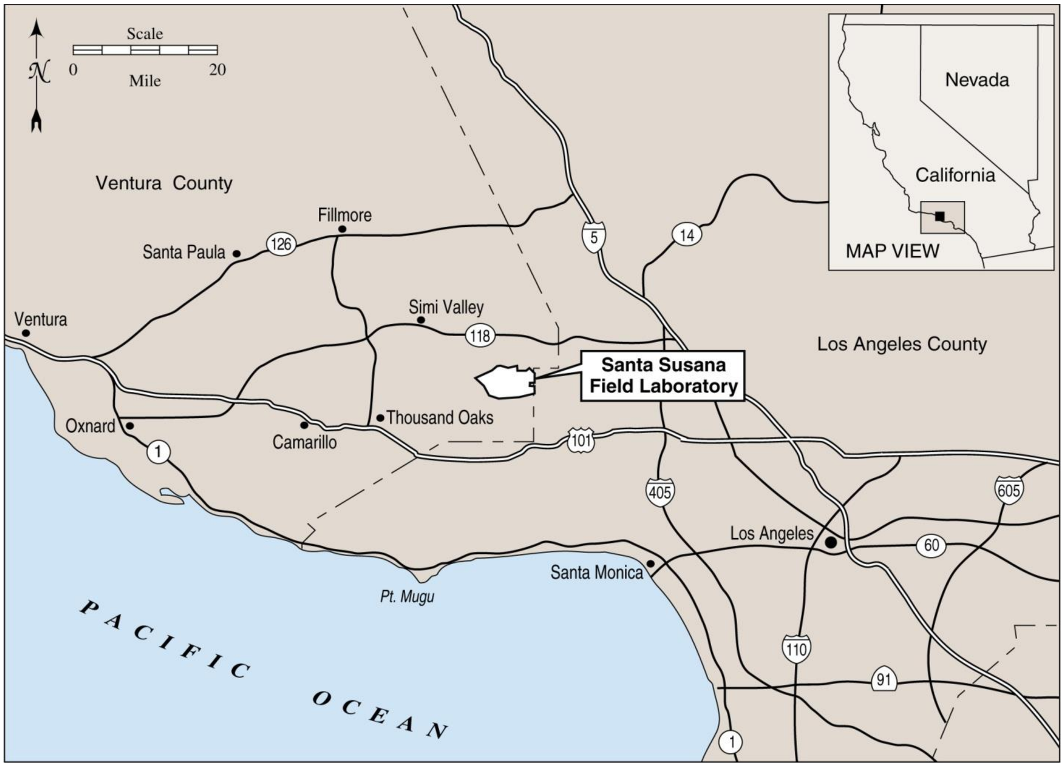

Figure S–1 Project Location, Santa Susana Field Laboratory

SSFL is divided into four administrative areas and two contiguous buffer zones north and south of the administrative areas. **Figure S–2** shows SSFL and the surrounding communities, including the layout of SSFL (Areas I, II, III, and IV and the adjacent buffer zones) and land ownership. The majority of Area I is owned and operated by Boeing. Area II and a 42-acre parcel within Area I are owned by the Federal Government and administered by the National Aeronautics and Space Administration (NASA). Areas III, IV, and the contiguous buffer zone areas to the north and south are owned by Boeing. DOE does not own any land at SSFL, but is the owner of 18 buildings in Area IV and is responsible for building demolition and cleanup of soils and groundwater in Area IV and the NBZ.

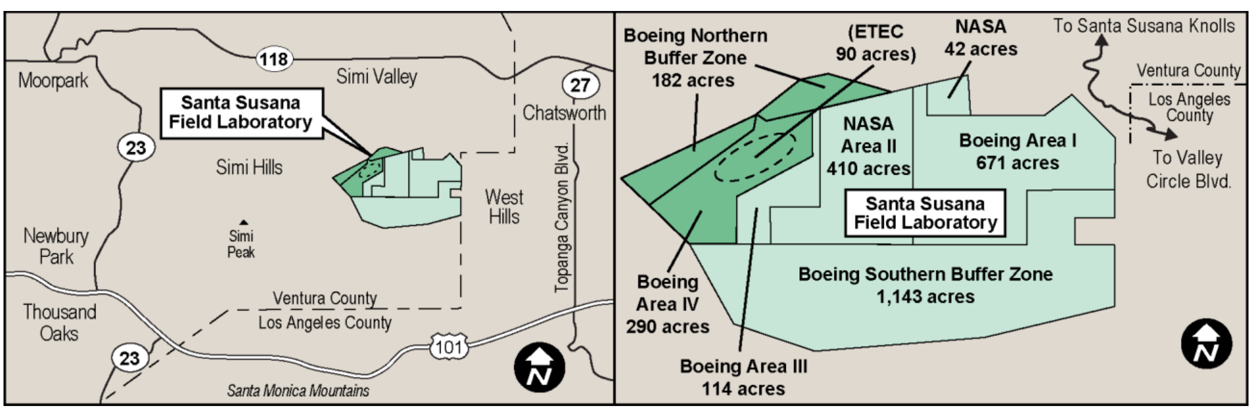

Figure S–2 Santa Susana Field Laboratory and Surrounding Communities

Starting in the mid-1950s, the Atomic Energy Commission funded nuclear energy research on a 90-acre parcel of land in what is now SSFL Area IV, which was leased from Rocketdyne. The Energy Technology Engineering Center (ETEC) was established by the Atomic Energy Commission on this parcel in the early 1960s as a "center of excellence" for liquid metals research (primarily sodium, potassium, and mercury) and general metals compatibility testing. In support of that mission, DOE built and operated 10 small nuclear reactors for various research activities over the years. As a result of operating these research reactors and conducting nuclear research, chemicals and radionuclides were released into the soil, bedrock, and groundwater.

As part of the operations of a research and development site, structures were constantly used, cleaned, and refurbished for a new purpose or demolished. Cleanup activities have been ongoing since the 1960s. DOE decontaminated and demolished several of its structures and facilities in Area IV to the standards in effect at the time decommissioning occurred (see, for example, the discussion of prior cleanup in Section S.10.2.2, under 2010 AOC Soil Cleanup Standards), in accordance with its authority under the Atomic Energy Act of 1954, as amended. The major periods of building demolition were 1975 through 1977 and 1995 through 2005. By 1980, all reactor operations had ceased, and nuclear research at ETEC was terminated in 1988. DOE has removed all nuclear materials from the site. By the time non-nuclear liquid metals research ended in 1998, many facilities had been decontaminated, decommissioned, and demolished, and contaminated materials had been removed. As appropriate, these activities were covered by categorical exclusions, in accordance with DOE's "NEPA Implementing Regulations" (10 CFR Part 1021, Appendix B to Subpart D).

In the early 2000s, DOE decided to prepare an environmental assessment (EA) for the remaining cleanup activities. An EA is used to assess whether a proposed Federal action would have significant impacts on the environment. DOE issued the *ETEC EA* (DOE 2003) in March 2003. The *ETEC EA* evaluated the potential impacts of implementing additional cleanup and closure activities, including decontaminating and decommissioning the remaining sodium facility and other support facilities. DOE issued a FONSI for the EA on March 31, 2003, and began cleanup activities by undertaking limited building demolition.

In October 2004, the Natural Resources Defense Council, the Committee to Bridge the Gap, and the City of Los Angeles challenged the *ETEC EA* and FONSI in a Federal district court, claiming DOE had violated NEPA; the Comprehensive Environmental Response, Compensation, and Liability Act; and the Endangered Species Act. In May 2007, the court issued its *Order Granting Plaintiffs' Motion for Summary Judgment* (Case 3:04-CV-04448-SC, May 2, 2007), which permanently enjoins DOE from transferring possession or otherwise relinquishing control over any portion of Area IV until DOE has completed an EIS and issued a ROD pursuant to NEPA. DOE suspended physical demolition and removal activities for its remaining facilities at ETEC, except for those activities necessary to maintain the site in a safe and stable configuration, until completion of the final EIS and ROD.

In 2007, DTSC issued the *Consent Order for Corrective Action* (2007 CO) (DTSC 2007) to DOE, NASA, and Boeing (as respondents), pursuant to DTSC's authority over hazardous waste under the California Health and Safety Code, Section 25187. The 2007 CO requires the respondents to clean up all chemically contaminated soils[1] and groundwater at SSFL to risk-assessment-based levels. The risk-assessment-based levels are based on a suburban resident scenario established for SSFL in the *Final Standardized Risk Assessment Methodology Revision 2 Addendum, Santa Susana Field Laboratory, Ventura County, California* (SRAM) (MWH 2014),[2] which assumed a receptor would be present on the site 24 hours per day, 350 days per year, for 30 years. The 2007 CO required further

[1] The 2010 AOC (DTSC 2010a) superseded the 2007 CO (DTSC 2007) with respect to cleanup of chemically and radioactively impacted soils; however, it incorporated the 2007 CO by reference for groundwater remediation. The 2010 AOC also added building demolition.

[2] The 2007 CO cited a 2005 version of the SRAM Work Plan. The currently applicable version of the SRAM (MWH 2014) was issued in 2014.

characterization of the nature and extent of contamination at SSFL and identified the Resource Conservation and Recovery Act (RCRA) studies and work plans that would be prepared.

The 2007 CO requires:

- cleanup of chemically contaminated soils by June 30, 2017, using the 2005 SRAM Work Plan (Rev. 2);
- implementation of DTSC-approved groundwater and unsaturated zone cleanup remedies in the Chatsworth Formation Operable Unit by June 30, 2017, or earlier; and
- completion of construction of the DTSC-approved long-term soil cleanup remedy in the surficial media operable unit by June 30, 2017, or earlier.

The SRAM (MWH 2014) describes a risk-assessment methodology for determining the areas that would need remediation. A hypothetical future suburban residential land use was identified for the evaluation of risk; other plausible receptors (such as recreational users or workers) were also identified.

In 2010, DOE entered into the 2010 AOC (DTSC 2010a) with DTSC. The 2010 AOC superseded the 2007 CO with respect to soil remediation and changed the framework for the soils characterization and cleanup process for Area IV and the NBZ.[3] The 2010 AOC stipulated that the soils cleanup standard would be based on LUT values, which are: (1) for chemicals, local background concentrations or method detection limits[4] for those chemicals whose method detection limits exceed local background concentrations, and (2) for radionuclides, local background concentrations or minimum detection limits for radionuclides whose detection limits exceed local background concentrations. The 2010 AOC defines the minimum detection limit for a radionuclide as the smallest amount of activity that can be quantified for comparison with regulatory limits.[5] The 2010 AOC indicates that, for soil remediation decisions, DOE is to compare the concentration of any chemical or radionuclide in each individual sample (not an average of samples in an area) with its respective LUT value. Thus, any soil samples that do not meet the LUT values for all chemicals or radionuclides would require a cleanup action to be taken.

The 2010 AOC (DTSC 2010a) identified characterization activities for both chemical and radiological contaminants and requires DOE to prepare a Soils Remedial Action Implementation Plan (SRAIP)[6] describing where soil cleanup will occur, any areas proposed for exemptions to protect biological or cultural resources, and any areas proposed for *in situ* or onsite treatment to

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[3] The 2007 CO remains in effect for groundwater remediation.

[4] Per the 2010 AOC, "detection limit" means the method reporting limit, which is the lowest concentration at which an analyte can be confidently detected in a sample and its concentration can be reported with a reasonable degree of accuracy and precision.

[5] In its *Final Technical Memorandum, Look-Up Table Recommendations, Santa Susana Field Laboratory Area IV Radiological Study* (HGL 2012b), EPA stated: "In exercising independent technical judgment, as identified in Section 5.2 of the 2010 AOC (DTSC 2010a), EPA recommends an adjustment to the BTVs [background threshold values] and minimum detectable concentrations [limits] (MDCs) to include appropriate consideration for [method uncertainty] to ensure an acceptably low decision error rate of approximately 5 percent. This adjustment is not believed by EPA to be contrary to the 2010 AOC requirement that LUT values incorporate BTVs and laboratory MDCs." The memorandum also stated: "For purposes of this technical memorandum, and for the appropriate use of BTVs, it is important to note that the MDC is not used as a detection decision criterion. Rather, the MDC is understood to represent a level of activity at which the associated uncertainty becomes predictably constrained to a level that is useful for defining a substitute cleanup value when the BTV is not practically or technologically supported by the laboratory data. The use of the MDCs in this case, defined as "the smallest amount of activity that can be quantified for comparison with regulatory limits," is consistent with the 2010 AOC requirements and definitions."

[6] The 2010 AOC requires DOE to prepare a SRAIP that includes a site description and history and a description of the nature and extent of radiological and chemical contamination, planned remedial actions, proposed exemptions, proposed areas for onsite treatment, proposed mitigations to address environmental impacts, and schedule. DOE may prepare multiple SRAIPs to address different implementation phases. DOE anticipates submitting the first of three planned SRAIPs to DTSC at the same time that DTSC issues the final program environmental impact report.

achieve cleanup goals. The 2010 AOC specifies that no "leave-in-place" alternative (onsite burial or landfill) is allowed. Chemicals and radionuclides in soil brought in as backfill also must meet the LUT values. Verification of cleanup levels and the acceptability of the backfill are required by DTSC for chemicals and by the U.S. Environmental Protection Agency (EPA) for radioactive constituents. The 2010 AOC also specifies that the SRAIP shall include a schedule that ensures that the identified (soil cleanup) activities can be accomplished by 2017 or sooner (see Section S.12). Due to a number of factors, as discussed in Chapter 2, Section 2.2.3, soil cleanup by 2017 is not possible under any action alternative.

Not all of the energy research conducted in Area IV was performed for DOE; some energy research was performed by Boeing and its predecessors for other customers. DOE has responsibility for cleanup of soils in the 290-acre Area IV. DOE shares responsibility with NASA for cleanup of soil in the 182-acre NBZ; NASA is responsible for cleanup of contamination in the NBZ that emanates from areas that it administers (DTSC 2010b). DOE shares responsibility with Boeing for groundwater remediation in Area IV and the NBZ, as defined in the 2007 CO (DTSC 2007). Boeing is responsible for management decisions regarding the Area IV buildings it owns.

S.5 Future of Area IV and the Northern Buffer Zone

Boeing is the landowner of Area IV and the NBZ; therefore, Boeing will decide the potential future land use of these areas. Boeing has stated that its intent is to maintain its portion of SSFL (including Area IV and the NBZ) as undeveloped open space. Further, Boeing states that it would restrict future land use to prevent development for any commercial, industrial, agricultural, or residential purpose. Boeing also states that it would restrict future land use to ensure the property would be protected as undeveloped open space, regardless of zoning changes beyond its control (Boeing 2016b).

Boeing has indicated it is committed to cleanup to a standard that is equivalent to a suburban residential standard that is more protective of human health than that applicable to open space uses (Boeing 2016b).

S.6 Cooperating Agencies

CEQ NEPA regulations (40 CFR 1501.6) establish the requirements for cooperating agencies (see text box). For this EIS, there are three cooperating agencies: NASA, the U.S. Army Corps of Engineers, and the Santa Ynez Band of Chumash Indians (a federally recognized Native American tribe with historical ties to the SSFL land). EPA and DTSC were also invited to be a cooperating agency, but declined.

Cooperating Agencies (from 40 CFR 1508.5)

"*Cooperating agency* means any Federal agency other than a lead agency that has jurisdiction by law or special expertise with respect to any environmental impact involved in a proposal (or a reasonable alternative) for legislation or other major Federal action significantly affecting the quality of the human environment. The selection and responsibilities of a cooperating agency are described in 40 CFR 1501.6. A State or local agency of similar qualifications or, when the effects are on a reservation, an Indian Tribe, may by agreement with the lead agency become a cooperating agency."

S.7 Decisions to Be Supported

DOE is proposing to remove existing DOE-owned facilities and support buildings, remediate radiologically and chemically impacted soil and groundwater, dispose of the resulting waste, and restore the affected environment. The 2007 CO (DTSC 2007), which is applicable to groundwater, requires a risk-based cleanup approach based upon the methodology in the SRAM (MWH 2014) that was approved by DTSC. The 2010 AOC (DTSC 2010a) requires soil cleanup to LUT values. These two DTSC Orders specify how the cleanup standards are to be developed for SSFL Area IV soil and groundwater remediation.

This EIS evaluates reasonable alternatives for how DOE can conduct the cleanup of Area IV and the NBZ. DOE has developed separate reasonable alternatives for the three components that make up its remediation project: soil remediation, building demolition, and groundwater remediation. As required by CEQ NEPA regulations (40 CFR 1508.25), DOE is also evaluating no action alternatives for soil remediation, building demolition, and groundwater remediation. For each component of its remediation project, DOE may select one of the alternatives described in this EIS, or DOE may combine different aspects of the alternatives and create a "hybrid" alternative.

The potential environmental impacts presented in this EIS, along with public input, cost, policy, and other factors, will be considered by DOE decision-makers in selecting alternatives for soil remediation, building demolition, and groundwater remediation for implementation. DOE's decision resulting from the analysis in this EIS will be announced in a ROD that will be issued no sooner than 30 days after the EPA Notice of Availability for the Final EIS is published in the *Federal Register*.

S.8 Public Involvement

DOE considers public involvement to be a critical element in the cleanup and closure of SSFL and has incorporated extensive public involvement opportunities for the planning activities it is conducting related to cleanup of Area IV and the NBZ. DOE has complied with the spirit and intent of NEPA public involvement requirements by implementing public involvement efforts seeking to include all SSFL stakeholders. SSFL stakeholders have expressed varying, and sometimes conflicting and competing, points of view.

DOE's efforts to enhance its interactions with the community began in earnest in 2008 when it commissioned interviews of SSFL stakeholders representing the range of perspectives among community members. These interviews revealed, among other issues, concerns about the completeness of the historical information available about the site. These observations and concerns are documented in *Report on Community Interviews: Community Concerns and Preferences for Public Participation in Cleanup of Area IV Santa Susana Field Laboratory* (P2 Solutions 2009).

Using the community interviews as a foundation, DOE prepared the *Community Involvement Plan Area IV Santa Susana Field Laboratory* in 2010 (DOE 2010). The plan describes how DOE provides timely, accurate, and credible information and/or access to information to the public, agencies, and organizations that are interested in and may be affected by the SSFL remediation and closure process. It also describes DOE plans to continue to provide opportunities for public contributions to selected project issues, reports, plans, and other project documents that DOE will use in its decision-making process. In addition, the plan describes the overarching objectives of building and improving relationships with regulators, elected officials, and the affected public; fostering a coordinated approach to address cleanup; and evaluating DOE activities to modify and enhance public participation (DOE 2010).

A principal component of the NEPA process is active public participation (see **Figure S–3**). DOE has conducted a number of activities to encourage public input in the NEPA process. DOE's NEPA regulations require a public meeting for scoping and a public hearing for a draft EIS (10 CFR 1021.311 and 1021.313, respectively). The regulations also require a minimum 30-day scoping comment period and a minimum 45-day public comment period on a draft EIS. These NEPA public involvement opportunities are described below.

The purpose of scoping-related public involvement activities is to inform the public about an EIS early in the process and obtain public input on issues of concern and development of alternatives. DOE issued an Advance Notice of Intent to prepare an EIS in October 2007. Scoping was initially conducted in 2008; however, because of changed soil remediation requirements resulting from the 2010 AOC (DTSC 2010a) and the availability of more-recent site characterization data, DOE issued an Amended NOI (79 FR 7439) and conducted another public scoping period in 2014.

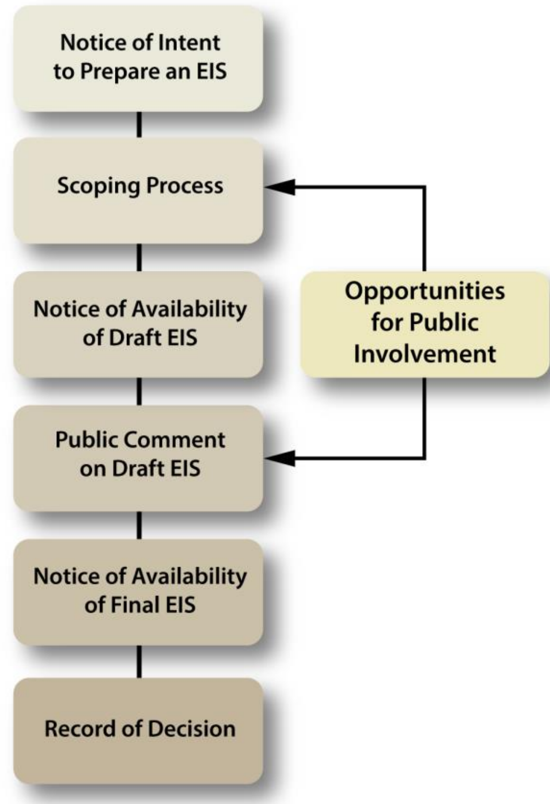

Figure S–3 EIS Public Involvement Opportunities

During the 2008 *Draft SSFL Area IV EIS* scoping period from May to August, DOE held six scoping meetings to present the proposed alternatives and receive comments from agencies, organizations, and the public. The scoping meetings were held in Simi Valley, Northridge, and Sacramento, California. DOE received 750 individual comments from 74 commenters, including individuals; elected officials; special interest groups; and Federal, state, and local agencies during the 2008 scoping period. The comments are documented in the *Scoping Comment Responses for the Environmental Impact Statement for Remediation of Area IV of the Santa Susana Field Laboratory* (DOE 2009).

In spring 2012, DOE sponsored three Community Alternatives Development Workshops in which the community was asked to articulate their preferences for alternatives that they would like to see included in this EIS. DOE presented information on how alternatives are developed and what criteria they need to meet. Stakeholders then broke into groups and developed alternatives to be considered by DOE.

The 2014 scoping period announced in the February 2014 Amended NOI ended on April 2, 2014. DOE held scoping meetings in Simi Valley and Agoura Hills/Calabasas, California. Over the 55-day scoping period, DOE received a total of 1,272 comments from 309 commenters, including individuals, an elected official, organizations, Government agencies, a Native American organization, and a Native American tribe. Information on scoping and comments received is included in the 2014 *Environmental Impact Statement for Remediation of Area IV and the Northern Buffer Zone of the Santa Susana Field Laboratory Final Scoping Summary Report* (DOE 2014a).

DOE reviewed the comments provided during the 2008 and 2014 scoping periods and the 2012 Community Alternatives Development Workshops. DOE developed alternatives for this EIS based, in part, on input from the stakeholders.

Summary documents of comments received during these scoping efforts, along with information on additional EIS-related public involvement activities, are available on the ETEC website at: http://etec.energy.gov/Char_Cleanup/EIS.html.

S.9 Organization of this Environmental Impact Statement

This EIS consists of 14 chapters and supporting appendices. The chapters and appendices are organized as follows:

- Chapter 1, "Introduction," describes DOE's purpose and need for action, background history for SSFL Area IV, decisions to be supported, related NEPA documents, and public involvement through the NEPA process.
- Chapter 2, "Alternatives," describes the range of reasonable alternatives for remediation of Area IV and the NBZ, as well as the alternatives that were considered but eliminated from detailed study in this EIS. It also presents a summary of the potential environmental impacts by alternative.
- Chapter 3, "Affected Environment," describes the potentially affected environments at Area IV and the NBZ. These data are provided as the baseline against which the potential impacts of each of the alternatives can be compared.
- Chapter 4, "Environmental Consequences," describes the potential impacts of the alternatives. Environmental consequences were evaluated for each alternative for the same resources areas described in Chapter 3.
- Chapter 5, "Cumulative Impacts," describes the potential cumulative impacts of the action alternatives in combination with other past, present, and reasonably foreseeable future actions. The chapter presents information regarding the cumulative impacts of DOE, NASA and Boeing activities, as well as the cumulative impacts from other activities in the region.
- Chapter 6, "Measures to Minimize Impacts and Mitigation Measures," provides information on planned measures to minimize potential impacts, as well as potential methods of mitigating impacts under the action alternatives.
- Chapter 7, "Resource Commitments," addresses sustainability, potential unavoidable adverse impacts to the environment, irreversible and irretrievable commitments of resources, and short-term impacts versus long-term productivity of Area IV and the NBZ from implementing the action alternatives.
- Chapter 8, "Laws, Regulations, and Other Requirements," describes the environmental and health and safety compliance requirements governing implementation of the alternatives.
- Chapter 9, "Native American Histories and Perspectives," describes the significance of SSFL to the native peoples who inhabited the site before it began operations as a field laboratory.
- Chapters 10, 11, 12, 13, and 14 are the "References," "Glossary," "Index," "List of Preparers," and "Distribution List" chapters, respectively.
- Appendices are included to provide more-detailed information to support this EIS.
  - Appendix A, "*Federal Register* Notices"
  - Appendix B, "Environmental Consequences Methodologies"
  - Appendix C, "Alternatives Development"
  - Appendix D, "Detailed Project Information"
  - Appendix E, "Consultations"

- Appendix F, "Cultural Resources"
- Appendix G, "Human Health"
- Appendix H, "Evaluation of Transportation and Traffic Impacts"
- Appendix I, "Wetlands Assessment"
- Appendix J, "Cost-Benefit Analysis Report"
- Appendix K, "Contractor Disclosure Statement(s)"

S.10 Alternatives

This section describes the reasonable alternatives for remediation of SSFL Area IV and the NBZ. DOE is evaluating separate alternatives for soil remediation, building demolition, and groundwater remediation. DOE proposes to complete remediation of Area IV and the NBZ to comply with applicable requirements for cleanup of chemical and radioactive constituents. Orders, regulations, and agreements affecting the development of this EIS include, but are not limited to, the *Order Granting Plaintiffs' Motion for Summary Judgment* from the lawsuit challenging DOE's 2003 *ETEC EA* (DOE 2003) and FONSI (see Section S.4); the CEQ and DOE NEPA regulations; the 2010 AOC (DTSC 2010a), and the 2007 CO (DTSC 2007). This section further discusses these requirements and explains how they informed the development of action alternatives analyzed in this EIS.

Whereas the development of alternatives for building demolition and groundwater remediation was straightforward, the alternatives for soil remediation evolved as DOE considered comments from the public and cooperating agencies (Chumash 2014) and evaluated the complexities of implementing soil cleanup in accordance with the 2010 AOC. It is important for decision-makers, people living near SSFL, and other stakeholders to understand the process DOE employed in identifying the soil remediation alternatives evaluated in this EIS.

DOE considered a number of soil remediation alternatives, informed by public input. After entering into the 2010 AOC, DOE developed an action alternative for soil remediation that implemented the technical requirements of that consent order—that is, cleanup to meet the LUT values for residual concentrations of chemicals and radionuclides in soil established in accordance with the 2010 AOC. DTSC published LUT values for 116 chemicals and provisional LUT values for 16 radionuclides in 2013 (see Appendix D, Section D.2). In accordance with the 2010 AOC, these LUT values are generally meant to limit contaminants remaining in soil after cleanup to local background levels, considering technical limitations in the measurement of these constituents in soil.

As data on levels of chemical and radioactive constituents in soil at Area IV, the NBZ, and background locations[7] became available and the AOC LUT values were established, DOE recognized that there would be technical issues (see Evaluation of Implementation of 2010 AOC Cleanup Requirements in Section S.10.2.2) associated with implementing a cleanup that meets the 2010 AOC requirements. DOE also determined that implementing the 2010 AOC requirements and remediating soil to meet the AOC LUT values would have the potential for adverse environmental impacts due to the large area of land that would be disturbed and the large volume of soil that would be removed. The CEQ NEPA regulations state that an EIS "shall provide full and fair discussion of significant environmental impacts and shall inform [decision-makers] and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the

[7] Background reference areas located 3 to 6 miles from SSFL were identified to be representative of SSFL onsite soil conditions. Soils and sediments in these areas were sampled and analyzed to establish chemical and radiological background levels (HGL 2011; URS 2012).

quality of the human environment" (40 CFR 1502.1). The Santa Ynez Band of Chumash Indians, a cooperating agency on this EIS, also expressed their expectation that DOE would include "a robust analysis of alternatives" (Chumash 2014). DOE therefore determined that it was necessary to develop additional action alternatives for soil remediation that were protective of human health and the environment to be analyzed in this EIS. Evaluation of additional soil remediation alternatives allows decision-makers and the public to compare the potential impacts from implementing the alternatives with those from implementing a cleanup that meets the 2010 AOC requirements.

For purposes of comparison, the soil remediation action alternatives evaluated in this EIS address remediation of the soil in Area IV and the NBZ to AOC LUT values for chemicals and radionuclides, revised LUT values for chemicals (that is, LUT values that are based on individual chemical risk), or risk-assessment-based values for chemicals and radionuclides (expressed as a radiation dose for radionuclides). The building demolition action alternative (i.e., the Building Removal Alternative) addresses removal of the remaining DOE-owned buildings in Area IV and disposal of the debris off site. The groundwater remediation action alternatives address implementation of management practices to clean up groundwater in accordance with the requirements of the 2007 CO (DTSC 2007).

Each of the three sets of alternatives allows independent evaluation and comparison of the potential impacts of implementing each component of DOE's cleanup action. In addition, DOE evaluated the potential combined impacts of implementing each of the three cleanup components: soil remediation, building demolition, and groundwater remediation.

Under all alternatives, steps would be taken to protect biological and cultural resources, including limiting the amount of soil disturbance in biologically or culturally sensitive areas as provided for in the 2010 AOC. To the extent practicable, and as approved by DTSC, DOE would use onsite treatment and natural attenuation to reduce the volume of soil that would be transported and disposed of off site. Soil in which chemical constituents would not attenuate (degrade) naturally on site to levels meeting cleanup criteria would be transported off site to permitted disposal facilities based on the type of waste. Locations where soil is excavated would be backfilled, re-contoured, and stabilized with new vegetation. To the extent practicable, DOE would implement green remediation technologies and revegetate with native species.

A no action alternative is included for each of the three sets of alternatives. Evaluation of a no action alternative is required in accordance with CEQ NEPA regulations (40 CFR 1502.14(d)) because it establishes the baseline against which the potential environmental impacts of the action alternatives can be compared.

S.10.1 Alternatives Development

This section presents the alternatives development process, as well as a discussion of regulatory drivers, community involvement, and the alternative concepts that were considered, but dismissed from detailed analysis.

S.10.1.1 Applicable Laws, Regulations, Orders, and Agreements

Removal of existing DOE-owned facilities and support buildings from Area IV, remediation of chemically and radiologically impacted soil and groundwater in Area IV and the NBZ, disposal of resulting waste, and restoration of the affected environment would be conducted in accordance with applicable laws, regulations, and orders and agreements with the State of California. The 2007 CO (DTSC 2007), which applies to groundwater in Area IV and the NBZ, calls for a risk-based cleanup approach for groundwater based on the methodology in the SRAM (MWH 2014)[8] that was approved by DTSC. The 2010 AOC (DTSC 2010a) requires soil cleanup to the AOC LUT values, which are based on soil background levels or method/minimum detection limits. DOE expects that, in order for the implementation of any alternative to be consistent with the 2010 AOC, changes to the AOC would be required. In addition, DOE would conduct its remediation activities in compliance with other applicable regulations and orders. These include other environmental regulations such as those implementing the Endangered Species Act and the National Historic Preservation Act, safety regulations such as those addressing worker and public safety, and applicable Executive Orders and DOE Orders.

S.10.1.2 Process and Criteria

Community input has been a major driver in the development of the alternatives for analysis in this EIS, and DOE has provided many opportunities over a number of years for the public to provide input. As discussed in Section S.1, preparation of this EIS began with an Advance NOI (72 FR 58834) in October 2007. Informal discussions with the public and other stakeholders were held, and the resulting information was used in developing the May 16, 2008, NOI (73 FR 28437). The 2008 NOI presented DOE's proposed alternatives and, in accordance with NEPA regulations, the public was invited to comment on the proposed alternatives or suggest other alternatives or alternative concepts.

Preparation of this EIS was delayed to allow EPA to conduct radiological characterization of Area IV and the NBZ; DOE to conduct chemical characterization; and DTSC to develop LUT values identifying the cleanup levels for chemicals and radionuclides. EPA's radiological characterization effort entailed a historical site assessment of past operations and radiological releases to identify locations for soil sampling; a gamma radiation scan, also to identify areas for soil sampling; collection and radiological analysis of 3,487 soil and 55 sediment samples; and radiological characterization of groundwater and surface water (HGL 2012a).[9] DOE's chemical characterization effort entailed collection and chemical analysis of 5,854 samples and conducting a data gap analysis that reviewed site operations and chemical releases and assessed the adequacy of existing data to guide soil sampling. DTSC published the provisional AOC LUT values for radionuclides in January 2013 and the AOC LUT values for chemicals in June 2013.[10] These AOC LUT values are presented in Appendix D, Tables D–2 and D–3.

To meet revised regulatory requirements and commitments and to accommodate, to the extent practicable, the preferences of the communities surrounding SSFL and other stakeholders, the alternatives evaluated in this EIS have evolved from those identified in the 2008 NOI (73 FR 28437). As a result, with the exception of a No Action Alternative, the alternatives proposed in 2008 are not among the alternatives evaluated in this EIS. This EIS, however, includes alternatives based on risk and dose for a hypothetical suburban residential scenario, similar to some of the alternatives identified in 2008 that also considered risk, based on future land use scenarios (for example, agricultural, residential, and open space). The alternatives proposed in the 2008 NOI are discussed in Section S.10.1.3, Alternative Concepts Considered but Dismissed from Detailed Study.

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[8] The 2007 CO (DTSC 2007) originally also applied to soil remediation in Area IV and the NBZ; the 2010 AOC (DTSC 2010a) superseded the 2007 CO for soil remediation. The 2014 SRAM (MWH 2014) supersedes the 2005 SRAM that was cited in the 2007 CO.

[9] HydroGeoLogic, Inc., was the EPA contractor for the radiological characterization of Area IV and the NBZ.

[10] The radionuclide LUT values are provisional. EPA recommended not selecting final LUT values until a single laboratory is selected to conduct the radionuclide analysis for the cleanup confirmation sampling and the selected laboratory can demonstrate its ability to meet EPA's defined measurement quality objectives. The chemical AOC LUT values are not provisional because they provide analytical standards for multiple laboratories to report and use when establishing data quality objectives (see Appendix D, Section D.2).

Since initial efforts to prepare this EIS began, DOE has engaged the public about cleanup of Area IV and the NBZ through interviews, workshops, and informational meetings. In spring 2012, DOE sponsored a series of three Community Alternatives Development Workshops in which community members were asked to articulate their preferences for alternatives they would like to see analyzed in this EIS. The workshops resulted in four cleanup concepts that reflect the diverse preferences in the community. Appendix C provides details about the workshop process and the alternative cleanup concepts proposed by the community.

Despite the differences in their approaches to cleanup, the four community-developed concepts were similar in their focus on cleaning up and restoring Area IV and the NBZ to a level that allows use of the site as open space for wildlife or human enjoyment, as well as use of "green" and sustainable methods whenever possible to minimize the impact of cleanup on the site and the surrounding communities. All four of the alternative concepts recommended that DOE should take actions to minimize damage to the natural environment during cleanup. DOE has referred to one of the submitted concepts as the Green Cleanup Alternative Concept (see Appendix C). While DOE did not retain this concept as a separate alternative, it designed all of the action alternatives to incorporate green cleanup methodologies. A summary of green cleanup principles adopted by DOE to guide the development of alternatives is included in the following Green Cleanup text box.

In addition, community concepts called for minimizing transportation impacts, preferential use of native plants for restoration of the site, and implementation of measures to prevent the spread of invasive, non-native plants. DOE considered all of these community concepts in preparing this EIS; these concepts informed the development of alternatives for this EIS.

Green Cleanup

DOE is committed to integrating sustainability in its projects consistent with the requirements of Executive Order 13693, *Planning for Federal Sustainability in the Next Decade*. Impacts on the natural environment would be expected to result from the cleanup of Area IV and the NBZ, regardless of which action alternative is selected. DOE is committed to minimizing impacts by using the principles of "green cleanup." This approach is consistent with the DOE Office of Environmental Management's recognition of sustainability as an organizational goal at the highest levels of management (DOE 2015). To the extent practical, green and sustainable remediation and innovative technology practices will be integrated into all phases of remediation. Chapter 7 of this EIS provides additional detail on implementation of greener cleanup principles.

For this project, cleanup decisions for all action alternatives would be guided to the extent possible by the EPA *Principles for Greener Cleanups* (EPA 2009), the ASTM International *Standard Guide for Greener Cleanups* (ASTM 2013), and DTSC's *Interim Advisory for Green Remediation* (DTSC 2009). The purpose of EPA's principles, ASTM's standard guide, and DTSC's Advisory is to improve the decision-making process involved with site cleanup, while assuring the protection of human health and the environment by minimizing the environmental "footprint" of cleanup activities. Principal elements of green sustainable remediation are:

- **Minimize total energy and maximize use of renewable energy**
- **Minimize air pollutants and greenhouse gas emissions**
- **Minimize water use and impacts to water resources**
- **Reduce, reuse, and recycle materials and waste**
- **Protect land and ecosystems**

Many community members who have expressed concerns about transportation, biological, and cultural resources impacts requested that DOE evaluate a risk-based cleanup alternative that might minimize these impacts. In response, in addition to evaluating an alternative for soil cleanup that meets the AOC LUT values, DOE evaluated alternatives that use a risk-based methodology to determine areas and soil volumes that require remediation, based on cleanup to risk levels, similar to concepts considered in the 2008 NOI (73 FR 28437).

As input to its 2014 Amended NOI (79 FR 7439), DOE reviewed and evaluated in detail the 2008 scoping comments and concepts developed during the 2012 Community Alternatives Development Workshops. In the Amended NOI, DOE summarized the history of the SSFL Area IV cleanup project, changes in regulatory requirements, and NEPA efforts to that date; presented the 2012 Community Alternatives Development Workshops concepts; announced scoping meetings and its intention to prepare this EIS; and provided the public with further opportunities to provide comments on the scope of this EIS and the alternatives to be evaluated.

After receiving stakeholder input from the 2014 scoping comments and the 2012 Community Alternatives Development Workshops, DOE developed screening and balancing criteria to identify alternatives to be evaluated in this EIS. The screening criteria were developed to ensure the proposed alternatives would meet the purpose and need for agency action as described in Section S.2. The balancing criterion included principles for cleanup in a manner that is as environmentally sensitive as possible. Descriptions of the criteria, including their development and selection process, are provided in Appendix C.

The main screening criteria selected were:

- Regulatory Compliance,
- Protect Public and Worker Health and Safety,
- Effectiveness, and
- Ease of Implementation.

The balancing criteria included:

- Protect the Environment,
- Protect Native American Interests,
- Cost,
- Community Acceptance,
- Return to Natural State,
- Minimize Transportation Impacts, and
- Preference for Onsite Treatment of Soils.

The concepts proposed by members of the community and DOE were first evaluated against the main screening criteria. These criteria were considered the most important criteria in developing the alternatives. The Regulatory Compliance criterion included compliance with applicable requirements of regulations, orders and agreements. The Protect Public and Worker Health and Safety criterion considered the overall safety of the public and workers. The Effectiveness criterion was based on cleanup methods that could be implemented quickly enough to address any short-term risks and provide reliable protection over time. Under the Ease of Implementation criterion, consideration was given to the various components of the proposed concepts and the ease or difficulty with which each could be implemented. If a concept was proposed that was not feasible or effective because it did not meet the purpose and need (such as some of the soil treatment concepts discussed in Chapter 2, Section 2.2.3), it was eliminated from further consideration in DOE's NEPA review. Those concepts posing too great a safety risk were eliminated as not being reasonable. Alternative concepts were also screened against regulations, orders, and agreements governing hazardous and radiological materials cleanup and disposal, including the 2007 CO (DTSC 2007) and the 2010 AOC (DTSC 2010a). This screening process resulted in an initial selection of concepts that were then further refined using the balancing criteria and used to build the alternatives for soil remediation, building demolition, and groundwater remediation (see Sections S.10.2 through S.10.4).

The balancing criterion, Protect the Environment, included principles for cleanup in a manner that is as environmentally sensitive as possible. This included protecting biological and cultural resources, disturbing or removing as little soil as possible for offsite disposal, incorporating green cleanup principles, and minimizing consumption of resources such as water. Southern California has been under drought conditions for several years, and on April 1, 2015, Governor Brown issued Executive Order B-29-15, which directed the State Water Resources Control Board to impose restrictions that would achieve a statewide 25 percent reduction in potable water usage through February 28, 2016 (CA EO 2015). As a result, Californians reduced their potable urban water use by 24 percent compared to 2013 usage (New York Times 2016). In May 2016, California suspended the mandatory 25 percent reduction and directed local communities to set their own conservation standards (SWRCB 2016). Southern California remains in a severe drought condition.

DOE also included a separate Protect Native American Interests criterion. The Santa Ynez Band of Chumash Indians has designated the entire SSFL as a Native American sacred site (referred to herein as the Santa Susana Sacred Site) and believes that the site is eligible for inclusion on the *National Register of Historic Places* (NRHP) as a traditional cultural property. In 2014, the tribe filed paperwork with the State of California nominating the site to be included in the State of California Native American Heritage Commission Sacred Lands Inventory (NAHC 2014). Executive Order 13007, *Indian Sacred Sites*, requires Federal agencies that manage Federal lands and activities to "accommodate access to and ceremonial use of Indian sacred sites" and avoid adversely affecting the physical integrity of sacred sites. DOE is consulting with the State Historic Preservation Officer (SHPO), the Santa Ynez Band of Chumash Indians, and the Santa Susana Field Laboratory Sacred Sites Council (SSFL Sacred Sites Council), an organization of Native Americans with historical ties to SSFL land, to develop an agreement intended to resolve adverse impacts through avoidance, minimization, or mitigation of impacts during and subsequent to cleanup activities.

The Cost criterion was included to consider the estimated capital, operational, and maintenance costs of implementing each of the alternatives relative to the degree of environmental and human health protection afforded. Cost is often a factor in the decision-making process or in determining whether a proposed alternative is feasible. A cost-benefit analysis of the soil remediation alternatives is included as Appendix J of this EIS.

The Community Acceptance criterion was included to consider whether the community would find an alternative acceptable, based on whether there was general public support, general opposition, or a mixture of support and opposition expressed for an alternative concept.

The objective of the Return to Natural State criterion was to leave Area IV and the NBZ in as near a natural state as possible to be conducive to their use as open space, parkland, or a wildlife corridor. Notwithstanding this goal, DOE does not own the land and cannot legally determine the ultimate land use.

The Minimize Transportation Impacts criterion focused on minimizing, as much as possible, both the onsite and offsite impacts from transporting materials and equipment onto the site for remediation activities and waste and recyclable materials off the site for disposition. Considerations under this criterion included total distance traveled to disposal sites, traffic congestion and safety on local roads and long-haul routes, air emissions, and transfer of non-native or nuisance species onto or off the site.

The final balancing criterion, Preference for Onsite Treatment of Soils, was included to give preference to alternatives and treatment methodologies that would treat soil to cleanup standards and leave it on the site rather than remove it for treatment or disposal.

S.10.1.3 Alternative Concepts Considered but Dismissed from Detailed Study

A number of alternative concepts were proposed by the public during the EIS scoping period in 2008, the Community Alternatives Development Workshops in 2012, and the EIS scoping period in 2014. Not all of these concepts are evaluated in detail as alternatives in this EIS. However, DOE incorporated most of these concepts into the alternatives described in this summary. **Table S–1** briefly describes the alternative concepts that were considered but dismissed from detailed analysis and the reasons why these concepts were not carried forward as alternatives evaluated in this EIS. More-detailed descriptions of these concepts, as well as a discussion of the analysis undertaken to evaluate each concept and inform DOE's dismissal of the concept from detailed study, are provided in Chapter 2, Section 2.2.3.

S.10.2 Soil Remediation Alternatives

This section discusses the four soil remediation alternatives analyzed in this EIS: No Action Alternative, Cleanup to AOC LUT Values Alternative, Cleanup to Revised LUT Values Alternative, and Conservation of Natural Resources Alternative.

S.10.2.1 Soil No Action Alternative

Under the Soil No Action Alternative, no soil would be treated to reduce constituent concentrations to levels that would meet cleanup criteria or be removed for offsite disposal. Soil would be left in place in perpetuity. Over time, radioactive constituents would continue to decay, and some chemicals would be reduced through natural decomposition processes. Boeing is currently providing site security for the entire SSFL site. If that were to change, then DOE, in accordance with its Atomic Energy Act responsibilities, would provide security at SSFL Area IV and the NBZ.

S.10.2.2 Cleanup to AOC Look-Up Table Values Alternative

Under this alternative, DOE would remediate soil in Area IV and the NBZ to meet the chemical and radionuclide cleanup LUT values established in accordance with the 2010 AOC. DOE's planning assumption for cleanup of Area IV and the NBZ is that building removal would be conducted during the first 2 years of the project, followed by soil remediation. Soil removal would be the primary method for cleanup to the AOC LUT values, with onsite treatment (monitored natural attenuation) used where feasible for selected, low-concentration chemicals. Soil would be removed on a systematic basis until all of the soil removal required to meet AOC LUT values is accomplished. Approximately 933,000 cubic yards of soil would be removed and disposed of off site (see **Table S–2**). Fifteen to 25 workers would be involved with soil removal activities at any one time, not including truck drivers hauling soil off site. Approximately 69,975 truck round trips over 10 years would be required to remove the soil for disposal under this alternative, although additional time could be necessary to allow for partially full trucks and weather delays, as well as to ensure restoration activities and onsite treatment methods are effective. As many as 45,636 truck round trips would be needed to bring backfill to the site (see Table S–5 in Section S.10.2.4).

Table S–1 Matrix of Alternative Concepts Considered but Dismissed from Detailed Study

Alternative Concept	*Alternative Description*	*Reason(s) for Dismissal*
Cleanup by 2017, consistent with the 2010 AOC or any other action alternative	Soil cleanup by 2017 would involve remediation of up to 130 acres and transport of up to 933,000 cubic yards of soil in less than 1 year, resulting in up to 470 daily and 118,200 annual truck trips.	There is insufficient time to complete regulatory actions (e.g., this EIS and the DOE ROD and the DTSC program EIR and decision) and to load and move the necessary number of trucks from SSFL to complete any action alternative by the 2017 deadline.
Transportation-Related Alternative Concepts	Proposed concepts ranged from minimizing the amount of transported soil to evaluating alternative transportation routes and methods.	Some of these concepts (e.g., minimizing the amount of transported soil) were incorporated into the alternatives evaluated in this EIS. DTSC is conducting a transportation study that will be issued in conjunction with its program EIR that evaluates alternative means of transporting debris and soil from SSFL. DOE will evaluate, when available, the study and determine the need for additional NEPA analysis.
Ultimate Land Use of Area IV after Cleanup	Potential future land uses include museums and parks, a land grant to Native Americans, open space, a wildlife corridor, and a wildlife preserve.	DOE does not own the land in Area IV or the NBZ and cannot make decisions about its ultimate use. DOE's cleanup would be compatible with Boeing's intended future land use of undeveloped open space (Boeing 2016a, 2016b).
Other Soil Cleanup Concepts	Installation and use of catch basins downstream of relatively inaccessible areas of the northern drainages that contain chemicals or radionuclides exceeding AOC LUT values to capture water flushed down drainages (clean water would be introduced upstream to flush contaminants to the catch basins, where the then-contaminated water would be collected and treated for offsite disposal); helicopters/mules for difficult-to-access locations; dilution through soil mixing; and soil compaction into trucks.	These concepts raised regulatory or safety concerns: - Flushing contaminants from drainages does not meet DOE's purpose and need (e.g., is not protective of human health and the environment) - The safety risks associated with the use of helicopters or mules in steep terrain are greater than the expected benefits. - Dilution through soil mixing is not allowed for hazardous waste under RCRA regulations (40 CFR 268.3). For nonhazardous soils, this approach may not be effective in meeting cleanup goals because the concentrations of chemical and radioactive constituents in background soil are not significantly different from those in Area IV and NBZ soils. - Compacting soil in trucks would increase the need for water, present industrial hazards, and add to the timeline to complete the proposed action (e.g., time for loading and unloading each truck).
Cleanup Based on Different Land Use Scenarios	Cleanup based on a range of land uses.	The landowner's (Boeing's) intended future land use for their portion of SSFL, including Area IV and the NBZ, is undeveloped open space. Consistent with Boeing's basis for analysis, DOE assumed cleanup levels based on a hypothetical suburban residential land use scenario.[a] This scenario is more protective than an open land use scenario (Boeing 2016b).
No Action (Abandon Area IV)	Proposed in the 2008 NOI. Cessation of all DOE management and oversight of SSFL Area IV.	DOE determined that the No Action Alternative of continued maintenance is adequate to provide a baseline for evaluating the action alternatives.
Onsite Containment at SSFL Area IV	Proposed in the 2008 NOI. Onsite containment (which would include burial) of buildings, wastes, and radiological and chemical contaminants, aligned with potential future land use scenarios including, but not limited to, agricultural, residential, and open space.	This concept was eliminated because the 2010 AOC does not allow onsite burial or landfilling (excavating and burying) of contaminated debris or soil, and it would entail a decision affecting future land use for land that DOE does not own. DOE's non-AOC alternatives (see Section S.10.2.3) include leaving in place constituents determined to meet risk-based standards, but do not include excavating soil and burying it elsewhere in Area IV.

Alternative Concept	*Alternative Description*	*Reason(s) for Dismissal*
Offsite Disposal of SSFL Area IV Materials (cleanup based on agricultural or open space risk assessment scenarios)	Proposed in the 2008 NOI. This alternative consisted of demolition of buildings and removal of contaminated media, aligned with potential future land use scenarios including, but not limited to, agricultural, residential, and open space. Nonradiological wastes would be transported to approved disposal or treatment facilities and radiological wastes to approved out-of-state disposal facilities.	This concept was partially considered in the development of the alternatives discussed in Sections 2.4.1 and 2.4.2 for soil remediation, in that the Cleanup to Revised LUT Values Alternative addresses soil cleanup based on chemical risk and soil cleanup under the Conservation of Natural Resources Alternative is based on risk for both chemicals and radionuclides (using radiation dose as a surrogate when evaluating radionuclides). To be consistent with the SRAM (MWH 2014), DOE used the hypothetical suburban residential scenario [a] as the potential future land use.
Combination Onsite/Offsite Disposal Alternative for SSFL Area IV	Proposed in the 2008 NOI. Demolition of buildings and onsite containment (which would include burial) of contaminated media, aligned with potential future land use scenarios including, but not limited to, agricultural, residential, and open space. Nonradiological wastes would be transported to approved disposal or treatment facilities and radiological wastes to an approved out-of-state disposal facility.	The onsite disposal portion of this concept was eliminated because the 2010 AOC does not allow onsite burial or landfilling (excavating and burying) of contaminated debris or soil, and it would entail a decision affecting future land use for land that DOE does not own. DOE's non-AOC alternatives (see Section S.10.2.3) include leaving in place constituents determined to meet risk-based standards, but do not include excavating soil and burying it elsewhere in Area IV.
Alternate Use of Area IV Buildings	Possible use of the ETEC Office Building (Building 4038) as an interpretive center and the former Sodium Pump Test Facility (Buildings 4462 and 4463) for commercial purposes.	At this time, none of these concepts is sufficiently developed to be considered in this EIS. If any of these concepts develop into actual proposals, additional NEPA analysis would be required.
Particle Size Separation/Soil Washing	Particle size separation: Use size separation to separate the contaminated size fractions from the non- or less-contaminated size fractions (typically sand and larger soil particles).	Soil treatability studies conducted on Area IV soil demonstrated that particle size separation was not effective in producing soil fractions that met the AOC LUT values and, thus, would require additional treatment (Matsumoto and Martin 2015).
	Soil washing: Place contaminated soil into treatment units (similar to washing machines) in which mechanical agitation and a washing solution are used to remove contaminants from the soil.	Soil washing is not considered a viable option because of the estimated large volume of water and length of time required to complete the effort: approximately 36 years and between 80,000 and 160,000 gallons per day of water would be required to treat all 933,000 cubic yards of soil (see Appendix D). Soil washing is normally performed as a volume reduction process to reduce the amount of material being disposed of as hazardous waste, not to remove all of the soil contaminants to background levels. In addition, either an onsite water treatment capability for reuse or offsite disposal of the wash water would be required, and it is uncertain whether soil washing could meet AOC LUT values or other applicable cleanup requirements.
Phytoremediation and bioremediation	Use plants and/or soil organisms to remove or break down contaminants in the soil.	Studies determined that these processes were ineffective in removing or breaking down most of the constituents; however, natural attenuation may be useful for low concentrations of certain hydrocarbons (Nelson et al. 2015b, 2015c).

AOC = *Administrative Order on Consent for Remedial Action*; Boeing = The Boeing Company; CFR = *Code of Federal Regulations*; DTSC = Department of Toxic Substances Control; EIR = environmental impact report; EIS = environmental impact statement; ETEC = Energy Technology Engineering Center; LUT = Look-Up Table; NBZ = Northern Buffer Zone; NEPA = National Environmental Policy Act; NOI = Notice of Intent; RCRA = Resource Conservation and Recovery Act; ROD = Record of Decision; SRAM = *Final Standardized Risk Assessment Methodology Revision 2 Addendum, Santa Susana Field Laboratory, Ventura County, California.*

[a] Although Boeing's intended future land use is undeveloped open space (Boeing 2015b, 2016a, 2016b), the human health impacts analysis in this EIS includes a hypothetical onsite suburban residential scenario that includes the direct exposure pathways of dermal chemical exposure, direct radiation exposure, inhalation of chemical and radioactive constituents, and incidental ingestion of chemical and radioactive constituents (MWH 2014). The hypothetical onsite suburban residential scenario is a more conservative scenario than that of open space; that is, it would yield higher potential human health impacts. Because Boeing has stated that it will restrict future land use and prohibit residential houses and backyard gardens (Boeing 2016b), DOE did not include the indirect garden pathway of ingestion of homegrown fruits and vegetables.

Table S–2 Preliminary Estimated Soil Volumes for Remedial Actions per 2010 AOC Considerations

Soil Category Description	*Soil Volumes (cubic yards)*
Estimated volume of soil exceeding the chemical AOC LUT values only (radionuclides below the AOC LUT values)	1,320,000
Estimated volume of soil exceeding the chemical AOC LUT values with radionuclides above the AOC LUT values	88,000
Estimated volume of soil exceeding the radionuclide AOC LUT values only (chemicals below the AOC LUT values)	3,000
Total volume of soil exceeding the chemical or radionuclide AOC LUT values	**1,413,000**
Volume of soil potentially subject to proposed biological and cultural exemptions per the 2010 AOC	330,000
Volume of TPH/PAH-contaminated soil potentially subject to natural attenuation	150,000
Total volume of soil potentially subject to removal	**933,000**

AOC = *Administrative Order on Consent for Remedial Action*; LUT = Look-Up Table; TPH = total petroleum hydrocarbons; PAH = polycyclic aromatic hydrocarbon.
Note: Sums presented in the table may differ from those calculated from table entries due to rounding.

Soil treatment studies found evidence that natural attenuation (degradation) of chemicals has been occurring at SSFL since they were first released and predicted that natural processes will continue (Nelson et al. 2015a). DOE therefore concluded that natural attenuation could be effective for management of certain low-concentration, petroleum-contaminated (total petroleum hydrocarbons [TPH] and polycyclic aromatic hydrocarbons [PAHs]) soils. DOE has estimated that implementing onsite treatment in the form of monitored natural attenuation for these hydrocarbons could reduce the amount of soil to be considered for removal from Area IV and the NBZ by 150,000 cubic yards (see Appendix D). Such onsite treatment would have to be approved by DTSC. This onsite treatment was assumed to occur regardless of the soil remediation alternative considered (that is, the 150,000 cubic yards were not included in the total volume of soil considered for removal and offsite disposal under the soil remediation action alternatives).

Overview of Soil Remediation

DOE would begin soil remediation following completion of building demolition. **Figure S–4** shows the extent of the chemical and radioactive constituents above the AOC LUT values in the soil in Area IV and the NBZ. DOE's remediation responsibilities include the NBZ. However, a portion of the NBZ was impacted by chemicals carried from NASA facilities in Area II; these areas, shown in Figure S–4, would be cleaned up by NASA. Based on analysis of more than 11,000 soil samples, for this EIS DOE has estimated that a volume of 1,413,000 cubic yards of soil does not meet the AOC LUT values (see Table S–2) (see Appendix D).[11] The most frequently observed chemical constituents include polychlorinated biphenyls (PCBs), PAHs, TPH, dioxins, and metals (antimony, cadmium, chromium VI, mercury, selenium, and silver) (CDM Smith 2017). The most frequently observed radionuclide constituents are cesium-137 and strontium-90 (HGL 2012a). The estimated volume of soil requiring remediation was adjusted, as described below, to account for proposed exemptions to protect biological and cultural resources and soil with low concentrations of TPH and PAHs that would be treated on site by monitored natural attenuation.

[11] DOE estimates the volume of soil that may not meet the AOC LUT values could range from 1,000,000 cubic yards to 2,500,000 cubic yards (see Appendix D). The estimated volume of soil (i.e., 1,413,000 cubic yards) not meeting the AOC LUT values was calculated using a geographic information system evaluation of the vertical and lateral distribution of contamination found during sampling. DOE recognizes that there is uncertainty associated with extrapolating data collected at individual points and, therefore, identified a range of soil volumes.

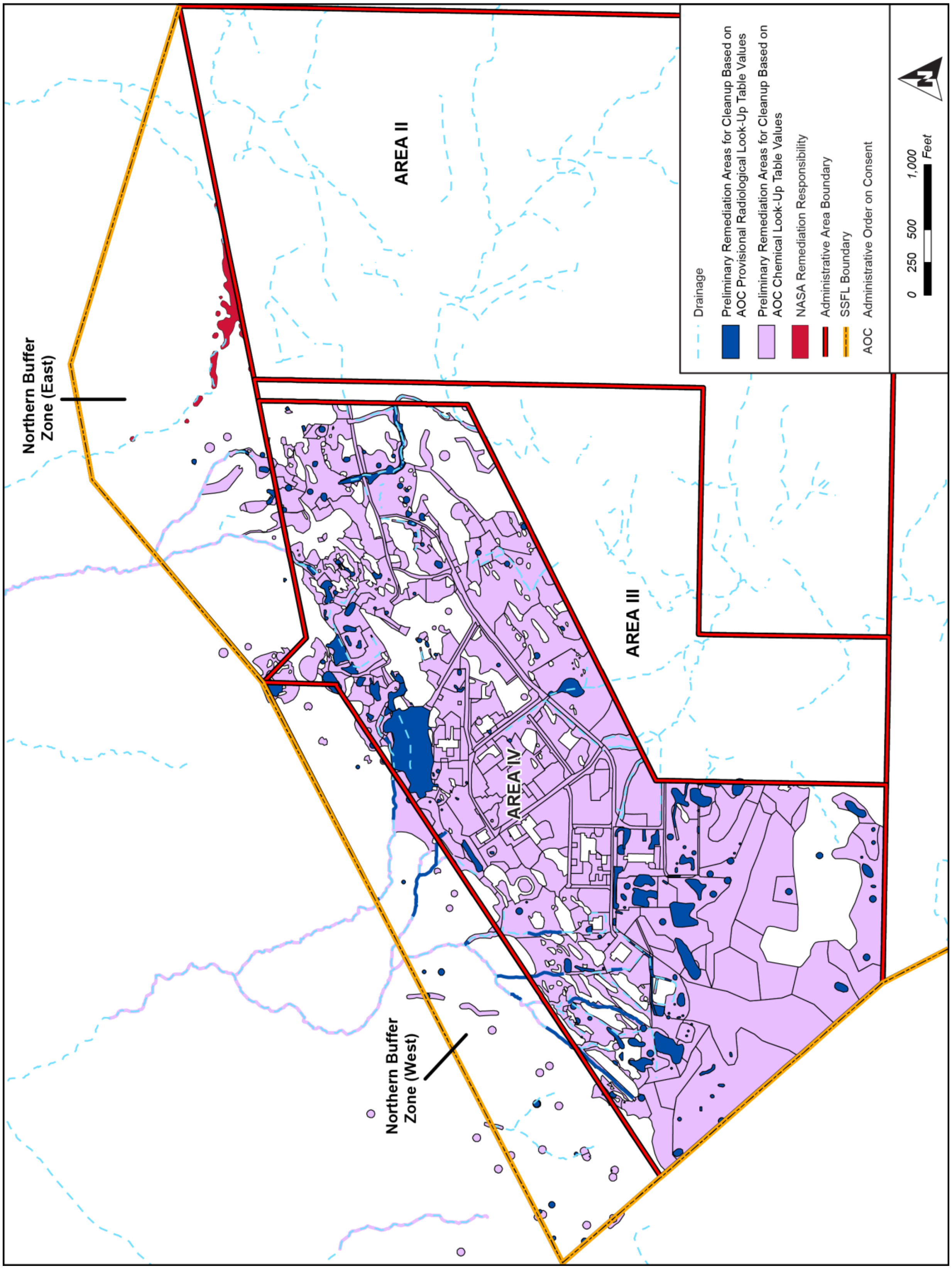

Figure S–4 Extent of Radiological and Chemical Constituents Above AOC Look-Up Table Values

The 2010 AOC (DTSC 2010a) includes exemptions to protect biological resources, in accordance with the Endangered Species Act, and cultural resources that are eligible for inclusion in the NRHP, in accordance with the National Historic Preservation Act or the *California Register of Historical Resources*. DOE is currently consulting with the U.S. Fish and Wildlife Service (USFWS) and the California Fish and Wildlife Service (CFWS) regarding biological resources. DOE is also consulting with the California SHPO, the Santa Ynez Band of Chumash Indians, and the SSFL Sacred Sites Council, to support DOE's determination of the eligibility of cultural resources at SSFL for listing in the NRHP or the *California Register of Historical Resources*. Locations proposed for protection of biological and cultural resources are identified in this EIS (see **Figure S–5**). These areas would be protected under any of the soil remediation alternatives. DOE would not take action in any of these areas unless it is demonstrated that levels of chemical or radioactive constituents in the soil pose a risk to human health or the environment, as determined using risk-based screening levels (RBSLs) from the SRAM (MWH 2014). The preliminary estimated volume of soil within areas subject to the proposed biological/cultural exemptions under the 2010 AOC is 330,000 cubic yards (see Appendix D). These areas would be avoided under any of the soil remediation alternatives.

Based on soil treatability studies, it appears that natural attenuation will be able to reduce TPH and PAH concentrations adequately to meet the AOC LUT values given sufficient time (due to the low existing concentrations, it would take an estimated 70 years for concentrations to degrade below the AOC LUT values) (CDM Smith 2015b). DOE assumes that DTSC would approve use of natural attenuation processes for low-concentration, petroleum-contaminated (TPH and PAH) soil. The estimated volume of soil at locations with only TPH and PAH contamination is 150,000 cubic yards (see Appendix D). Natural attenuation for this soil was assumed under all soil remediation alternatives.

As a result of these adjustments to the soil volume, 933,000 cubic yards of soil exceeding the AOC LUT values is considered in the Cleanup to AOC LUT Values Alternative in this EIS (see Appendix D). Table S–2 summarizes the preliminary estimated soil volumes by 2010 AOC considerations.

The 2010 AOC also allows exemptions from soil remediation (up to 5 percent by volume) for unforeseen circumstances. DOE would propose use of these exemptions as necessary to prevent damage in remote locations and avoid areas that are too risky for workers to access. DOE may also propose use of the exemption for soil with constituents that are above the AOC LUT values, are deeper than 5 feet below ground surface, and do not threaten groundwater. Exemptions proposed for these purposes will be described in the forthcoming SRAIPs and were not used in developing the above adjustments to estimated soil volumes analyzed in this EIS.

The 2010 AOC (DTSC 2010a) stipulates that soils be cleaned up to LUT values that are local background concentrations or method/minimum detection limits for contaminants for which the method/minimum detection limits exceed background concentrations. Based on the chemical concentrations relative to hazardous waste criteria, risk-based concentrations, and the AOC LUT values, as well as the radionuclide concentrations relative to risk-based concentrations and the AOC LUT values, the following six categories of soil are expected to be removed during remediation efforts:

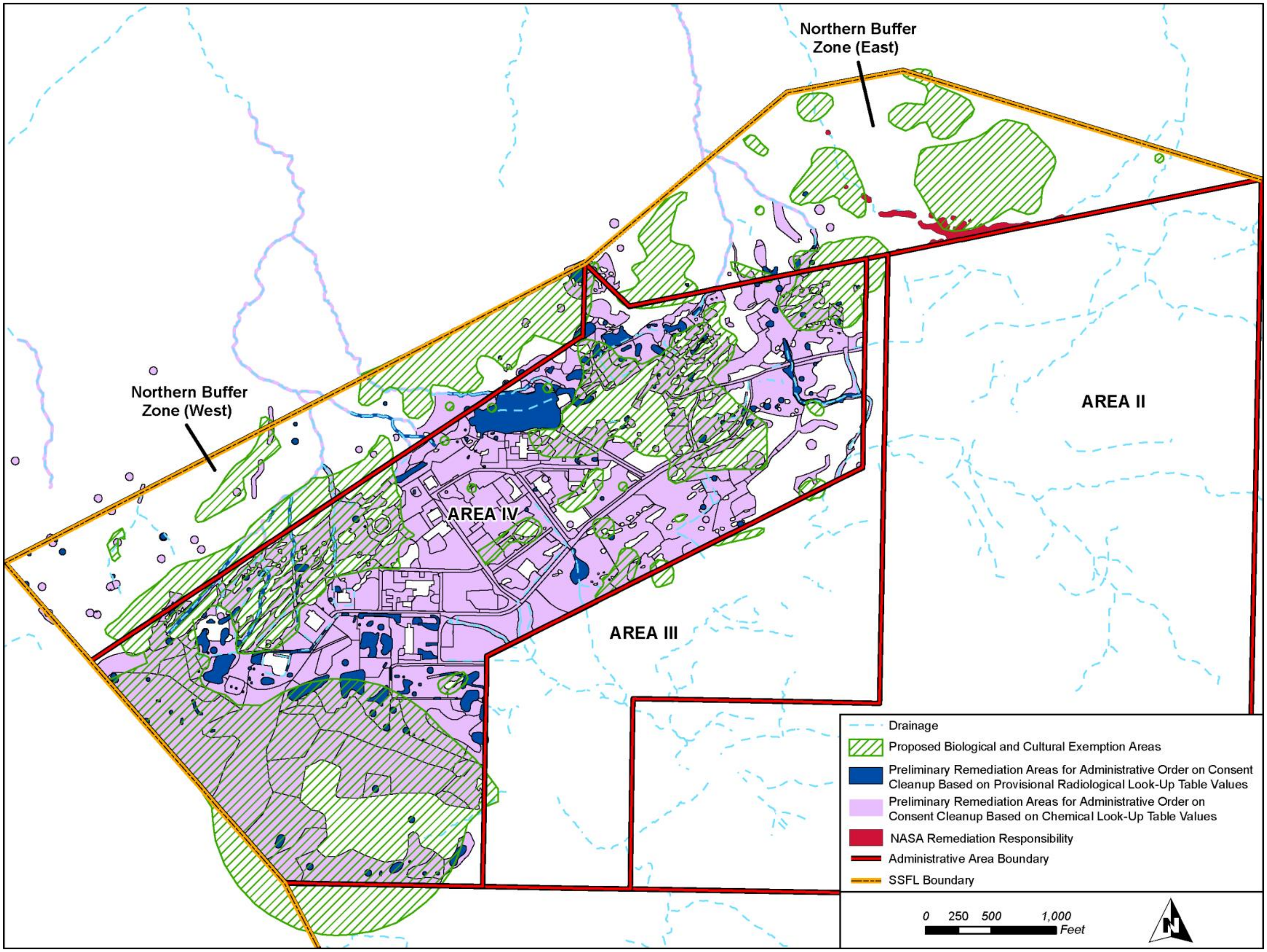

Figure S–5 Extent of Radiological and Chemical Constituents Above AOC Look-Up Table Values with Proposed Exemption Areas

1. *Soil containing chemical constituent concentrations below both hazardous waste standards and risk-based levels, but above the chemical AOC LUT values, and radionuclides at or below the radiological AOC LUT values.* This soil does not meet the definition of hazardous or radioactive waste and would be transported to a permitted California Class II or Class III[12] disposal facility, based on the acceptance criteria of the facility. At most sites in the United States, including California, this soil would be left in place (see Appendix D, Section D.3, for comparison with other cleanup projects in California).
2. *Soil containing chemical constituent concentrations below hazardous waste standards and above risk-based levels and radionuclide concentrations at or below the radiological AOC LUT values.* This soil does not meet the definition of hazardous or radioactive waste and would be transported to a permitted California Class II or Class III disposal facility, based on the acceptance criteria of the facility.
3. *Soil containing chemical constituent concentrations exceeding hazardous waste standards and radionuclide concentrations at or below the radiological AOC LUT values.* This soil would be transported to a permitted California Class I or out-of-state hazardous waste disposal facility, based on the acceptance criteria of the facility.
4. *Soil containing chemical constituent concentrations above the AOC LUT values, but below risk-based levels and hazardous waste standards, and radionuclide concentrations above the radiological AOC LUT values, but below risk-based levels.* This soil would be transported to a licensed or authorized low-level radioactive waste (LLW) disposal facility, based on the acceptance criteria of the facility.
5. *Soil containing chemical constituent concentrations above risk-based levels that may be a hazardous waste and radionuclide concentrations above the radiological AOC LUT values.* This soil would be transported to a facility permitted to receive hazardous waste and licensed or authorized to receive radioactive waste, based on the acceptance criteria of the facility.
6. *Soil containing chemical constituent concentrations at or below the AOC LUT values and radionuclide concentrations above risk-based levels.* This soil would be transported to a licensed or authorized LLW disposal facility, based on the acceptance criteria of the facility.

Table S–3 presents the preliminary estimates of soil volumes based on the soil categories for transportation and disposal considerations.

Figure S–5 is a composite map of Area IV and the NBZ showing areas with chemical and radioactive constituents above the AOC LUT values overlain by the proposed exemption areas for sensitive biological and cultural resources, as allowed under the 2010 AOC (DTSC 2010a). The final exemption areas for biological resources will be determined through consultation with USFWS and CFWS as part of the USFWS Biological Opinion. The final exemptions for cultural resources will be determined through consultation with the California SHPO, the Santa Ynez Band of Chumash Indians, and the SSFL Sacred Sites Council. The exemptions are ultimately subject to other agency approval. If levels of constituents in these areas pose a risk to human health and the environment, as determined using RBSLs from the SRAM (MWH 2014), DOE would remove them through carefully planned, focused removals that would result in minimum disturbance. In this EIS, it was assumed that the potential impacts from these focused removals would be a fraction of those associated with the balance of the soil remediation efforts and within the uncertainty associated with the analysis of impacts.

[12] Siting and construction requirements for California Class I landfills are similar to those for hazardous waste permitted under Subtitle C of RCRA (e.g., double composite liners and leachate collection systems). Siting and construction requirements for California Class II and Class III landfills are similar to those for nonhazardous waste permitted under Subtitle D of RCRA (e.g., liners and leachate collection systems), except additional requirements exist for Class II landfills compared to those for Class III landfills.

Table S–3 Preliminary Estimated Soil Volumes for Transportation

Soil Category	*Soil Chemical/Radionuclide Classifications*	*Soil Volumes (cubic yards)*
1	Chemicals above AOC LUT values, but below risk-based levels and hazardous waste standards. Radionuclides at or below AOC LUT values.	741,000
2	Chemicals above risk-based levels, but below hazardous waste standards. Radionuclides at or below AOC LUT values.	52,000
3	Chemicals above hazardous waste standards. Radionuclides at or below AOC LUT values.[a]	49,000
4	Chemicals above AOC LUT values, but below risk-based levels and hazardous waste standards. Radionuclides above AOC LUT values, but below risk-based levels.	44,000
5	Chemicals above risk-based levels that may be a hazardous waste. Radionuclides above AOC LUT values.[a]	44,000
6	Chemicals at or below AOC LUT values. Radionuclides above risk-based levels.	3,000
Total		**933,000**

AOC = *Administrative Order on Consent for Remedial Action*; LUT = Look-Up Table.
[a] A total of 93,000 cubic yards of soil, with and without radionuclides, is estimated to exceed chemical hazardous waste standards.
Note: The total does not equal the sum of the individual entries due to rounding.

In accordance with the 2010 AOC, following soil removal, cleanup would be verified by DTSC for chemicals and EPA for radionuclides before backfilling of the excavated areas would start. The verification process would involve collection of confirmatory samples following soil removal, analysis of the samples for constituents of concern, and transmission of the data to the agencies for their review. This verification process could take up to 6 weeks following soil removal.

Following confirmation by DTSC and EPA that cleanup standards have been met, excavated areas would be backfilled and graded, slopes would be stabilized, and disturbed areas would be revegetated using native plant species. It was assumed that approximately 75 percent of the soil volume removed would be backfilled to accomplish slope stabilization (see Appendix D). This would require transporting up to 700,000 cubic yards of backfill (if 933,000 cubic yards of soil were removed) to the site. DOE conducted an initial evaluation of three off-SSFL sources of soil for backfill and found none that meets the requirements of the 2010 AOC (that the backfill meets the AOC LUT values) (see Appendix D).[13] In addition, DOE has had bags of soil from two home improvement stores analyzed and found that both samples failed to meet the AOC LUT values (see Appendix D). Because the AOC LUT values are very low, finding soil of this purity, especially soil that is comparable to the existing local soil (i.e., that would support the native plant communities), is expected to remain a challenge. If a source of backfill soil that meets all of the AOC LUT values cannot be reasonably found, then DTSC, DOE, and EPA would enter into a consultation process, and DTSC would determine the best available source of backfill (DTSC 2010a).

Stormwater discharges from the entire SSFL site are regulated by a site-specific National Pollutant Discharge Elimination System (NPDES) permit and a California Regional Water Quality Control Board, Los Angeles Region, Order issued to Boeing, the landowner (CRWQCB 2007). To maintain compliance, Boeing has implemented a comprehensive, site-wide best management practices (BMP) program that utilizes both structural and nonstructural BMPs (Geosyntec 2012; MWH 2012). The existing NPDES stormwater control and monitoring system would remain in place during soil remediation and restoration. This stormwater control and monitoring system was designed to

[13] In support of project implementation, DOE would again search for and evaluate sources of backfill.

provide for the full treatment of runoff from 95 percent of the storms that could occur on site and partial treatment for the remaining 5 percent of the storms (Boeing 2008). DOE would coordinate with Boeing and schedule and perform its soil-disturbing work to minimize the potential to cause perturbations and permit exceedances.

DOE would apply a surfactant or soil binder to exposed areas to control dust and deploy wattles (long tubes of inert, usually natural materials such as straw that filter water and retain sediments) to control runoff. Foot and vehicle traffic in exposed areas would be restricted to maintain the surfactant crust. Following concurrence from DTSC and EPA that backfill soil is acceptable, DOE would place the backfill on the excavated areas and re-grade and re-contour as necessary. The area would then be seeded with a native plant seed mixture. DOE would conduct vegetation monitoring per the Revegetation and Habitat Restoration Plan discussed in Chapter 6 of this EIS.

Evaluation of Implementation of 2010 AOC Cleanup Requirements

This section addresses the technical aspects of implementing the "cleanup to background" approach described in the 2010 AOC (DTSC 2010a) that compelled DOE to look at other soil cleanup alternatives beyond those described in Sections S.10.2.1 and S.10.2.2. In this section, DOE also considers its legal and regulatory responsibilities for considering alternatives for soil cleanup actions.

2010 AOC Soil Cleanup Standards

The soil cleanup standards specified in the 2010 AOC are based on "cleanup to background" for soil contaminants. The 2010 AOC stipulated that the soils cleanup standard would be based on LUT values, which are local background concentrations or minimum detection limits for constituents whose minimum detection limits exceed local background concentrations (see Section S.4). The cleanup standard definition applies to chemical as well as radionuclide constituents found in Area IV and the NBZ. DTSC has established AOC LUT values for chemicals and provisional AOC LUT values for radionuclides based on either background concentrations or detection limits (see Appendix D).

Background concentrations and minimum detection limits are lower than what is typically used as a standard for soil cleanups. Most cleanups are based on a risk assessment that follows EPA guidance. For example, the risk-based standard (based on the SRAM [MWH 2014]) for mercury is 16.8 parts per million, while the AOC LUT value is 0.13 parts per million. PCBs do not naturally occur, so they do not have a background concentration; therefore, the minimum detection limit is used for the AOC LUT value. For Aroclor 1254, one of the PCBs found in Area IV, the SRAM risk-based standard is 232 parts per billion, and the AOC LUT cleanup standard is 17 parts per billion. For petroleum hydrocarbons, the AOC LUT value is currently set at 5 parts per million; environmental screening levels normally used at other locations in California (SFWQCB 2013) and applicable to other cleanups (EPA 2015b) range from 100 to 500 parts per million. This 1 to 2 orders of magnitude (that is, multiples of 10) difference between what is normally used in soil cleanup and the AOC LUT value occurs for most of the chemicals detected within Area IV and the NBZ.[14]

For cesium-137, the cleanup standard applied to Area IV soil removal actions (prior to establishment of the provisional radionuclide AOC LUT values per the 2010 AOC) was 9.2 picocuries per gram (Boeing 1999, 2000). The current DOE cleanup standard for cesium-137 in soil using a suburban residential land use scenario (consistent with the SRAM [MWH 2014])

[14] See Appendix D, Table D–3, for a list of AOC LUT values for chemical constituents and the corresponding risk-based standards determined in accordance with the SRAM (MWH 2014).

corresponds to a soil concentration of 10.3 picocuries per gram. The provisional AOC LUT value for cesium-137 is 0.225 picocuries per gram.[15]

The 2010 AOC (DTSC 2010a) confirmation protocol compares every soil sample with the AOC LUT values for 116 chemicals and 16 radionuclides (see Appendix D). Should any chemical or radionuclide exceed its respective AOC LUT value, then the soil must be cleaned up. This EIS refers to this approach as a point-by-point cleanup process.

To understand how a point-by-point process would be implemented, DOE reviewed similar cleanup actions at other sites. While there are sites where point-by-point cleanups have been applied, these sites contained only a few chemicals or radionuclides of concern and not the large number of constituents (132) included in the AOC LUTs. DOE reviewed two large remediation projects in California—Hunters Point near San Francisco and McClellan Air Force Base near Sacramento, because they dealt with multiple contaminants. However, both of these cleanups were risk-assessment-based (not point-by-point decisions), were focused on about 30 constituents (not 132), and allowed leaving contamination in place. When there are only a few constituents and/or a risk assessment approach is used, a small number of constituents need to meet the established standard. Moreover, the AOC LUT values do not account for the natural occurrence of many constituents in the soil, meaning that they could lead to decisions to remove soil that has not been contaminated by Area IV operations. Therefore, meeting the 2010 AOC LUT values would require an unprecedented approach and effort.

High Level of Uncertainty in Cleanup Decisions

To be certain that what DOE is cleaning up is contamination resulting from ETEC operations, there must be confidence in the analytical result that the contaminants are actually present and their concentrations exceed the cleanup standard. The 2010 AOC specifies that the detection limits for the chemical AOC LUT values should be based on the "lowest concentrations at which an analyte can be confidently detected in a sample and its concentration can be reported with a reasonable degree of accuracy and precision." For many of the chemicals (e.g., PCBs) and radionuclides (e.g., strontium-90), however, the AOC LUT values are set at the lower end of the analytical instruments' abilities to accurately report the presence of the constituent. Exceeding such values does not necessarily indicate that contamination is present because some constituents may be at background levels. As a result, DOE may perform soil cleanup at locations where contamination does not exist.

Acceptable Error Rate

DTSC has set an acceptable error rate in sample analysis of 5 percent. This means that, for 100 soil samples analyzed for one chemical near the minimum detection limit, five sample analyses could falsely report the chemical's presence when it is not actually in the sample. A 5 percent error rate may be acceptable when the project involves only one chemical, but, consistent with the 2010 AOC (DTSC 2010a), DOE must consider 116 chemicals and 16 radionuclides. Compounding a 5 percent error rate over 132 different potential constituents in each sample means a much greater chance that DOE would be remediating clean soil, not contaminated soil.

Background Data AOC LUT Failures

DTSC conducted a soil background study that involved collecting soil samples from two sites approximately 3 to 4 miles west of SSFL (URS 2012).[16] DTSC analyzed 148 soil samples for

[15] See Appendix D, Table D–2, for a list of provisional AOC LUT values for radioactive constituents.

[16] URS Corporation was the DTSC contractor for the chemical characterization of off-SSFL reference areas. The characterization data provide background soil concentrations to which samples collected at SSFL can be compared.

110 different chemicals[17] and used this data set for development of the chemical AOC LUT values. Comparing the background soil results with the AOC LUT values, 46 of the 110 chemicals analyzed (42 percent) exceeded their respective AOC LUT values in at least one sample. This implies that, if the point-by-point, chemical-by-chemical process described in the 2010 AOC were applied to the background study locations, they would be declared contaminated and subject to soil remediation. It also demonstrates that it is difficult to differentiate background concentrations from contamination from ETEC operations based on the low AOC LUT values; thus, where to stop soil remediation cannot be clearly defined.

Total Petroleum Hydrocarbon AOC LUT Value

The AOC LUT value for TPH was set at 5 parts per million without considering its natural presence. The analytical method (EPA Method 8015) is not specific to TPH, but detects any chemical molecule, many of which naturally occur, within the carbon ranges of TPH. Therefore, for any soil sample analyzed for TPH, there is a high level of uncertainty regarding whether the result is actually TPH. In addition, the environmental screening levels normally used at other locations in California (SFWQCB 2013) and applicable to other cleanups (EPA 2015b) range from 100 to 500 parts per million; for this reason, analytical laboratories are not set up to analyze for TPH at 5 parts per million. DOE provided soil samples to two laboratories, and they could not reproduce TPH results below 100 parts per million (Nelson et al. 2015d). California Polytechnic State University, San Luis Obispo, evaluated the types of organic molecules in soil to demonstrate that the results being reported were not TPH. The study demonstrated that there are technical problems with measuring TPH concentrations at such low levels (Nelson et al. 2015d). A review of the TPH data produced for Area IV indicates that as much as 300 parts per million of the reported TPH in any given sample actually results from normally occurring organic materials and are not petroleum-related (Burgesser 2015).

Changes in Site Knowledge Since the Signing of the 2010 AOC

When the 2010 AOC (DTSC 2010a) was signed, there was a general belief that there was widespread radioactive contamination in Area IV. However, EPA's radiological study did not show that Area IV was highly contaminated. EPA concluded, "[a] majority of the Radiological Areas of Interest are congregated within specific areas or are associated with key facilities;" and, "Approximately 70 percent of soil samples with radionuclide concentrations greater than the FALs [field action levels][18] are located within five Area IV Radiological Areas of Interest: RMHF [Radioactive Materials Handling Facility] complex, SRE [Sodium Reactor Experiment] complex, 17th Street Drainage, Former Fuel Element Storage Facility, and New Conservation Yard Drainage" (HGL 2012a). Each of these areas were known to be impacted by radionuclides prior to EPA's study and had been subject to prior soil removal actions by DOE to an approximate 9.2 picocurie per gram cleanup standard (see, for example, Boeing 1999 and Boeing 2000). Review of data in the *Final Radiological Characterization of Soils, Area IV and the Northern Buffer Zone, Area IV Radiological Study, Santa Susana Field Laboratory, Ventura County, California* (HGL 2012a) showed that, of the over 3,500 soil samples analyzed by EPA, only about 12 percent of the samples exhibited radionuclide concentrations exceeding EPA's FALs. Cesium-137 and strontium-90 constituted 94 percent of the reported radionuclides, consistent with site knowledge prior to the EPA study. As a result, the EPA findings disproved the general belief that Area IV is highly contaminated by radionuclides throughout.

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[17] DTSC also analyzed samples for pH (acidity), but soil pH is not a parameter in the chemical AOC LUT.

[18] EPA notes in its final soils report (HGL 2012b) that FALs do not consider EPA's recommended uncertainty factors, and locations with results exceeding the FALs "do not represent areas of contamination or areas of remediation." Nonetheless, the FALs were used during site characterization to identify areas of potential radiological contamination.

What was not clearly known at the time of the signing of the 2010 AOC was the extent of soil contamination by chemicals. The RCRA Facility Investigation (RFI) studies completed during the years 2000 through 2009 focused on chemical contamination associated with Solid Waste Management Units and Areas of Concern (CH2M Hill 2008, 2009; MWH 2006, 2007, 2009). The RFI studies were based on risk assessment standards, and the need to conduct extensive soil sampling away from the investigation areas was not warranted.

The AOC LUT values became the basis for soil investigations under the 2010 AOC. DOE concluded that low AOC LUT values, coupled with the false positive issues and the inability to accurately distinguish TPH from a range of other organic molecules (described above), resulted in data showing almost the entirety of Area IV to exceed an AOC LUT value for at least one chemical. In accordance with the 2010 AOC, soil exceeding the AOC LUT for even one chemical would require remediation. As a result, cleanup planning for Area IV and the NBZ was transformed from a mostly radiologically impacted soil cleanup (approximately 91,000 cubic yards) to a mostly chemically impacted soil cleanup (approximately 1,410,000 cubic yards), based on the chemical AOC LUT values (DTSC 2013).

2010 AOC Backfill Soil Requirements

Attachment B (Final Agreement in Principle) of the 2010 AOC states the following with regard to use of backfill soil:

> "Backfill/replacement soils must not exceed local background levels.
>
> - Onsite soils that do not exceed local background levels may be used as backfill/replacement soils.
> - Offsite soils that have been verified to not exceed local background levels may be used as backfill/replacement soils."

Attachment C (Confirmation Protocol "Not to Exceed" Background Cleanup Standard) of the 2010 AOC (DTSC 2010a) states:

> "Backfill/replacement soils may be from onsite or offsite locations, with a preference for onsite locations. For purposes of this protocol, "onsite" locations are those within the geographic boundaries of the SSFL site)."
>
> "For backfill soils obtained from outside the Santa Susana Field Lab, the relevant Look-up Table shall be for the formation to which the backfill soils are to be placed."

There are no onsite borrow sources for DOE's use at SSFL. Developing onsite borrow sources would significantly add to potential biological impacts at SSFL. In February 2015, DOE conducted an initial evaluation of off-SSFL borrow sites for soil meeting the chemical AOC LUT values.[19] The three evaluated sites failed to meet 2010 AOC requirements because multiple chemicals of concern exceeded the AOC LUT values (see Appendix D). In addition, DOE tested packaged soil products sold by home improvement stores. All products tested exceeded the AOC LUT values for multiple chemicals (see Appendix D). Based on this initial evaluation and given the low AOC LUT values, it appears unlikely that replacement soil meeting the AOC requirements can be found. If a soil were found that could meet the AOC LUT values, there is concern that the soil would not be comparable to the physical, chemical, and microbial characteristics of existing soil, making it difficult to re-establish native vegetation in Area IV and the NBZ.

[19] In support of project implementation, DOE would again search for and evaluate sources of backfill. If a source of backfill soil that meets all of the AOC LUT values cannot be reasonably found, then DTSC, DOE, and EPA would enter into a consultation process, and DTSC would determine the best available source of backfill (DTSC 2010a).

NEPA Guidance and Regulations for Addressing Alternatives in EIS Documents

DOE consulted applicable CEQ and DOE NEPA regulations and guidance in determining reasonable alternatives to the cleanup to AOC LUT values for analysis in this EIS.

As noted above, the CEQ NEPA regulations state that an EIS "shall inform [decision-makers] and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment" (40 CFR 1502.1). In discussing the contents of an EIS, the regulations further indicate the importance of the analysis of alternatives:

> §1502.14 Alternatives including the proposed action. This section is the heart of the environmental impact statement…. In this section agencies shall:
>
> (a) Rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated.
>
> (b) Devote substantial treatment to each alternative considered in detail including the proposed action so that reviewers may evaluate their comparative merits.

CEQ's "Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations" (CEQ 1981) provides the following guidance:

- <u>Range of Alternatives</u> – "The phrase 'range of alternatives' refers to the alternatives discussed in environmental documents. It includes all reasonable alternatives, which must be rigorously explored and objectively evaluated. . ."
- <u>Alternatives Outside of the Capability of Applicant or Jurisdiction of Agency</u> – "Section 1502.14 [NEPA Regulations 40 CFR Parts 1500 – 1508] requires the EIS to examine all reasonable alternatives to the proposal. In determining the scope of alternatives to be considered, the emphasis is on what is 'reasonable' rather than on whether the proponent or applicant likes or is itself capable of carrying out a particular alternative. Reasonable alternatives include those that are practical or feasible from the technical and economic standpoint and using common sense, rather than simply desirable from the standpoint of the applicant."

2003 Litigation Involving ETEC

In addition to the 2010 AOC, this EIS responds to the outcome of a lawsuit filed by the Natural Resources Defense Council, the Committee to Bridge the Gap, and the City of Los Angeles, which successfully challenged DOE's 2003 *ETEC EA* (DOE 2003) and Finding of No Significant Impact for remediation of Area IV in the U.S. District Court for the Northern District of California

Potential Environmental Consequences of Cleanup to AOC LUT Values

As described in Chapter 4 of this EIS, the Cleanup to AOC LUT Values Alternative would result in appreciable resource use and waste generation. Characteristics of this alternative include:

- 130 acres of land disturbed in Area IV and the NBZ;
- 933,000 cubic yards of soil removed and 700,000 cubic yards of backfill emplaced, resulting in 116,000 truck round trips (up to 39,000,000 million truck miles);
- 62,500 round trips of cars or light-duty trucks primarily due to worker commutes;
- substantial increase in the wear on local roadways;
- 40 million gallons of water used;

- 2.8 to 8.2 million gallons of fuel used for trucks and heavy equipment;[20] and
- 28,000 to 84,000 metric tons (total) of greenhouse gases (as carbon dioxide [CO_2]) generated.[21]

Disturbing 130 acres of land in order to remove 933,000 cubic yards of soil would kill plants and animals, destroy portions of their habitats, and require a substantial, focused, and prolonged effort to achieve revegetation and restoration. Habitat could also be affected by incompatible backfill and invasive species brought to SSFL in the 700,000 cubic yards of backfill or on vehicles. In addition, land disturbance would produce fugitive dust that could impact downwind onsite and offsite areas.

Transportation for disposal of 933,000 cubic yards of soil would result in 116,000 truck trips (39,000,000 million truck miles) over 10 years and 62,500 round trips of cars or light-duty trucks would result in increases in traffic and noise on local roads. In addition, the increased traffic, in particular the heavy haul trucks, would accelerate road deterioration, requiring repair sooner than currently anticipated.

The 40 million gallons of water (used primarily for dust suppression) would further deplete the already stressed Southern California water supply. In addition, the irreversible consumption of 2.8 to 8.2 million gallons of fuel for truck transportation and heavy equipment use would contribute to the generation of a total of 28,000 to 84,000 metric tons of greenhouse gases.

S.10.2.3 Additional Soil Remediation Action Alternatives

This EIS includes two alternatives in addition to the Soil No Action and Cleanup to AOC LUT Values Alternatives discussed in the previous section. Under the Cleanup to Revised LUT Values Alternative, DOE would continue to apply cleanup criteria on a point-by-point basis, but would implement revised chemical constituent LUT values for making cleanup decisions (the radionuclide LUT values would be the same as under the Cleanup to AOC LUT Values Alternative). Under the Conservation of Natural Resources Alternative, DOE would apply a traditional risk-assessment approach to making cleanup decisions, including using area averaging to determine concentrations and developing risk and dose criteria, as described below. DOE expects that, in order for the implementation of any alternative to be consistent with the 2010 AOC, changes to the AOC would be required.

***SSFL Area IV EIS* Alternatives**

Soil Remediation Alternatives

- No Action
- Cleanup to AOC Look-Up Table Values Alternative
- Cleanup to Revised Look-Up Table Values Alternative
- Conservation of Natural Resources Alternative

Building Demolition Alternatives

- No Action
- Building Removal Alternative

Groundwater Remediation Alternatives

- No Action
- Monitored Natural Attenuation Alternative
- Groundwater Treatment Alternative

Cleanup to Revised LUT Values Alternative

Under this alternative, a revised set of LUT values would be established for chemical constituents, and the LUT values for radioactive constituents would be the same as those under the Cleanup to AOC LUT Values Alternative. The revised chemical LUT values would be based on RBSLs. The

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[20] This large range results from the analysis considering disposal in facilities near SSFL, as well as in facilities long distances from SSFL (for example, a hazardous waste disposal facility in Idaho).
[21] See footnote above.

RBSLs would be calculated for the direct pathways[22] of the hypothetical suburban residential land use scenario established for SSFL (MWH 2014), in which it is assumed that a receptor would be present on the remediated site 24 hours per day, 350 days per year, for 30 years. The revised LUT values for chemical constituents would be concentrations that correspond to a 1×10^{-6} (1 chance in 1 million) risk of developing a cancer and/or a toxicity hazard quotient[23] of 1.

Soil would first be removed in the SRE and RMHF areas, where hazardous chemicals and radioactive constituents above the revised LUT values are most prevalent. Remediation would then expand outward from those areas to remove the remaining soil with chemical and/or radioactive constituents present above revised LUT values. As under the Cleanup to AOC LUT Values Alternative, cleanup decisions would be made on a point-by-point basis. That is, if the soil in a particular area exceeded the revised LUT value for any chemical or radioactive constituent, the soil would be removed.

Approximately 192,000 cubic yards of soil would be removed under this alternative. **Figure S–6** shows the total extent of chemical and radioactive constituents above the revised LUT values and those areas from which soil would be removed. Approximately 14,400 truck round trips over a little more than 2 years would be required to remove the soil for disposal under this alternative, although additional time could be necessary to allow for partially full trucks and weather delays, as well as to ensure restoration activities are effective. Approximately 9,400 truck round trips (rounded value) would be needed to bring 144,000 cubic yards of backfill to the site.

Some, but not all, of the issues associated with implementing the Cleanup to AOC LUT Values Alternative would also affect the Cleanup to Revised LUT Values Alternative. Like the Cleanup to AOC LUT Values Alternative, this alternative would require point-by-point decisions on individual constituents. However, each sample would have to meet the revised LUT values for 34 constituents (18 chemicals that exceed risk-based screening levels from the SRAM [MWH 2014] and 16 radionuclides). If any one of the constituents were to exceed its respective revised LUT value, DOE would make a decision to remediate the area represented by the sample. Although fewer constituents would need to be evaluated under the Cleanup to Revised LUT Values Alternative, the point-by-point cleanup decisions would be subject to issues similar to those under the Cleanup to AOC LUT Values Alternative. Specifically, if any one constituent fails to meet its revised LUT value, a cleanup decision would be required. Although the decision thresholds would be higher, the potential for false positives introduces uncertainty in determining whether a detection actually represents contamination from ETEC operations (see Section S.10.2.2). Under this alternative, a smaller volume of backfill would be needed (144,000 cubic yards), and the chemical LUT values applicable to the backfill would be less restrictive than those under the Cleanup to AOC LUT Values Alternative. As with the Cleanup to AOC LUT Values Alternative, finding a source of backfill that has the physical, chemical, and microbial characteristics that would support establishment of native vegetation may be a challenge. A search for such soil would be conducted in support of project implementation.

[22] Direct exposure pathways include inhalation, incidental ingestion, and dermal contact with the chemicals in the soil. The indirect pathway of a garden from which the hypothetical suburban resident derives all of his or her fruits and vegetables is not included in the analysis in this EIS.

[23] Hazard index is the sum of hazard quotients of noncarcinogenic chemicals. A hazard index below 1.0 will likely not result in adverse noncancer health effects over a lifetime of exposure. A hazard quotient is a unitless value determined by: (1) dividing the exposure concentration by the EPA reference concentration for inhalation exposures, or (2) dividing the average daily dose by the EPA reference dose for oral exposures. The reference concentration (for inhalation) or reference dose (for ingestion) (reported in EPA's Integrated Risk Information System [EPA 2015a]) is an estimate of a continuous exposure of the human population (including sensitive subgroups) that will likely not result in adverse health over a lifetime of exposure.

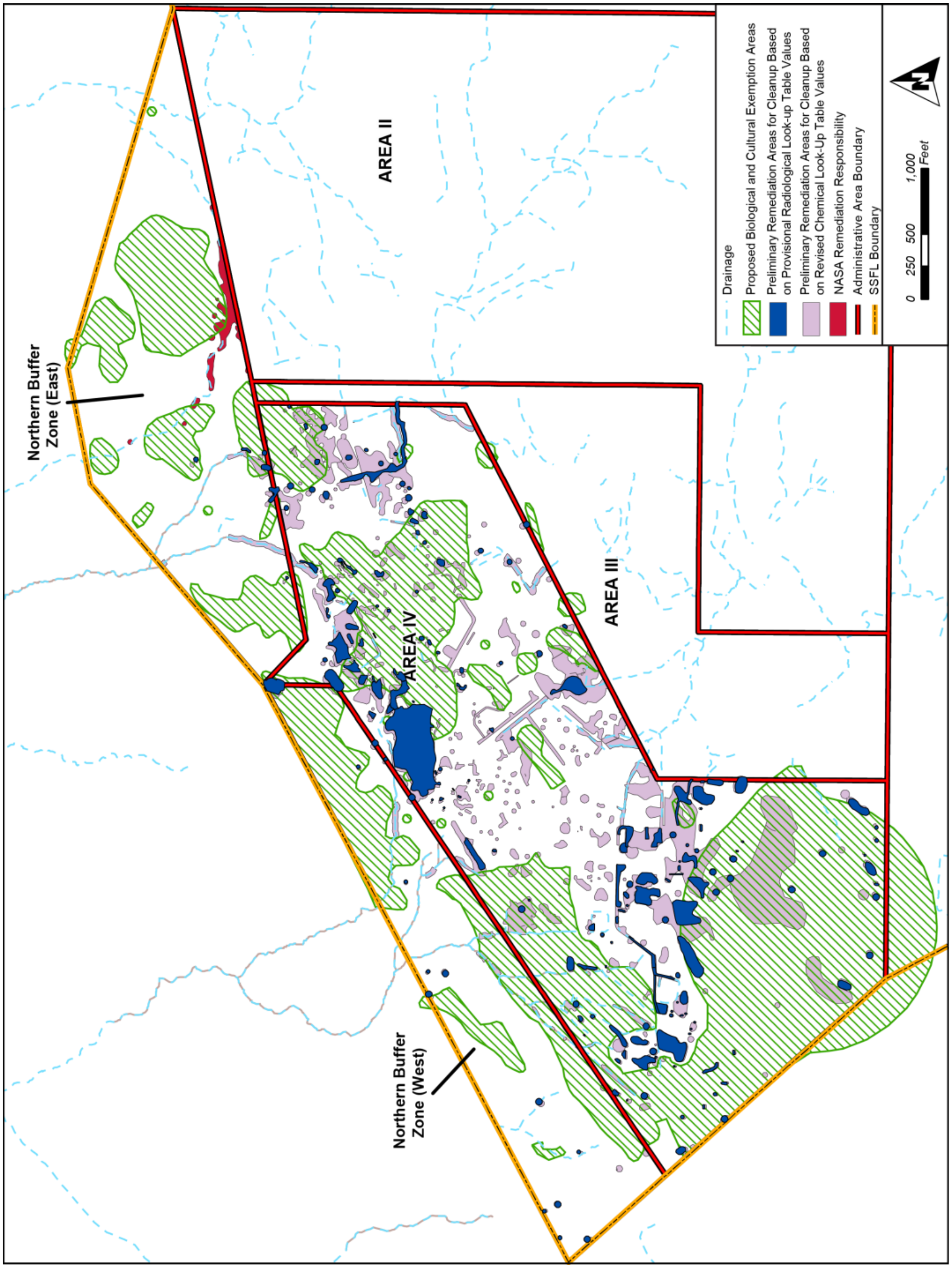

Figure S–6 Soil Remediation – Cleanup to Revised LUT Values Alternative with Proposed Exemption Areas

Conservation of Natural Resources Alternative

Under this alternative, DOE would remediate Area IV and the NBZ to reduce the concentrations of chemical and radioactive constituents in the soil to levels necessary to protect human health. This alternative reduces risk to the public and the environment, yet conserves natural resources, including biological, cultural, and water resources. The hypothetical onsite suburban residential exposure scenario (using the direct pathways) as identified in the SRAM (MWH 2014) was selected as the basis for the risk assessment. Cleanup would be targeted at locations posing risk based on the outcome of a risk assessment and dose analysis. Area IV and the NBZ would be subdivided into smaller areas or units for which concentrations would be averaged for purposes of evaluating risk or radiation exposure. For each unit, risk assessment calculations would be performed individually for each chemical, and then the results summed to determine the risk value. The risk results for each unit would be compared with the risk limit of 1×10^{-6} (1 chance in 1 million) for cancer-causing chemicals and/or to a hazard index of 1 for noncarcinogenic chemicals to make decisions regarding cleanup of the contaminated soil. DOE would cleanup chemicals in accordance with applicable requirements. For each unit, a dose assessment would also be performed to determine the level of radionuclide cleanup needed. Cleanup would be performed to levels as low as reasonably achievable (ALARA)[24] below the DOE standard of 25 millirem per year (DOE Order 458.1) to the hypothetical suburban resident.

In applying the ALARA principle to soil remediation, DOE would clean up soil to limit public and worker radiation exposures to the lowest levels practical commensurate with sound economic and social considerations (DOE 2014b). Soil would be cleaned up to reduce potential doses to a hypothetical member of the public to below 25 millirem per year, with the specific level determined through the ALARA analysis. The DOE standard of 25 millirem per year serves as an upper limit to the range of doses that may be acceptable and is evaluated as a starting place for ALARA analysis. If this alternative is chosen, DOE would evaluate different cleanup options (that is, levels corresponding to doses below 25 millirem per year) to determine whether additional cleanup would provide the optimal balance of the benefits from exposure reduction (e.g., health protection, regulator and public goodwill) with the costs (e.g., economic, schedule, social), considering doses that may be received by hypothetical members of the public and by workers performing cleanup.

If the ALARA analysis resulted in implementation of a cleanup level less than 25 millirem per year, some or all of the additional 44,000 cubic yards of soil containing radionuclides above the AOC LUT values would be remediated (see soil volumes on Table S–4 in Section S.10.2.4). The potential impacts of removing additional soil would fall between those presented for this alternative and those for the Cleanup to Revised LUT Values Alternative.

Cleanup based on risk assessments for individual units accounts for the receptor's exposure to an average concentration in the unit in contrast to the point-by-point evaluation of the Cleanup to AOC LUT Values Alternative and the Cleanup to Revised LUT Values Alternative, where each sample must meet the LUT values for each constituent.

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[24] ALARA is based on the system of dose limitation recommended in International Commission on Radiological Protection (ICRP) Publication 26: "all exposures shall be kept as low as reasonably achievable, economic and social factors taken into account" (ICRP 1977). In ICRP Publication 37 (ICRP 1983), this component was referred to as "the optimization of radiation protection." ALARA is an approach to radiation protection to manage and control releases of radioactive material to the environment and exposure to members of the public and the work force so that levels are as low as reasonable, taking into account societal, environmental, technical, economic, and public policy considerations. As used in DOE Order 458.1, *Radiation Protection of the Public and the Environment* (DOE 2011a), ALARA is not a specific release or dose limit, but a process whose goal is to optimize control and management of releases of radioactive material to the environment and doses so that they are as far below the applicable limits of the order as reasonably achievable.

This alternative would result in the least amount of ground disturbance and soil that would be removed for offsite disposal: 148,000 cubic yards (see Table S–4 in Section S.10.2.4). The volume of soil containing chemicals above risk-based levels that would be removed would be approximately the same as that under the Cleanup to Revised LUT Values Alternative (approximately 145,000 cubic yards), as would the volume of soil removed that only exceeds risk-based levels for radionuclides (3,000 cubic yards). This alternative would avoid the excavation and offsite transport of soil with concentrations that are less than risk-based levels. **Figure S–7** shows the extent of soil removal that would be required under this alternative. As shown in Table S–5 (see Section S.10.2.4), approximately 11,100 truck round trips over 2 years would be required to remove the soil for disposal under this alternative, although additional time could be necessary to allow for partially full trucks and weather delays as well as to ensure restoration activities are effective. As many as 7,200 truck round trips (rounded value) would be needed to bring 111,000 cubic yards of backfill to the site.

Implementation of the Conservation of Natural Resources Alternative would entail different issues than implementation of either the Cleanup to AOC LUT Values Alternative or Cleanup to Revised LUT Values Alternative. DOE would divide Area IV and the NBZ into risk assessment units and evaluate those units against risk and dose criteria. An assessment of each area would be required to determine the relative quantities of chemicals and/or radionuclides that would trigger a cleanup decision. Rather than a single number for a given constituent across the entire Area IV and NBZ, the value that would result in cleanup has to be considered in concert with other constituents in an area to determine whether soil meets the cleanup targets (i.e., a chemical risk of 1×10^{-6} [a lifetime chance of 1 in 1 million of developing a cancer], a hazard index of 1 [the level below which no toxic effects would be expected], and an annual dose of 25 millirem [plus ALARA]). The approach of averaging the concentrations of constituents across assessment units has the potential of leaving localized areas of contamination that would be removed under a point-by-point cleanup like the Cleanup to AOC LUT Values Alternative or Cleanup to Revised LUT Values Alternative. Although a smaller volume of backfill would be required (111,000 cubic yards), and the allowable concentrations of chemical and radionuclides would be less restrictive than those for the Cleanup to AOC LUT Values Alternative and similar to those for the Cleanup to Revised LUT Values Alternative, finding a backfill source that has the physical, chemical, and microbial characteristics that would support establishment of native vegetation may be a challenge. A search for such soil would be conducted in support of project implementation.

S.10.2.4 Summary of Soil Remediation Alternatives

It is DOE's policy that work be conducted safely and efficiently and in a manner that ensures protection of workers, the public, and the environment. To achieve this policy for SSFL remediation, effective safety requirements and goals would be established through the adoption of applicable national and international consensus standards and where necessary to address unique conditions, through development and implementation of additional standards. DOE would implement Integrated Safety Management in accordance with DOE directives and include related requirements in remediation contractor contracts.

DOE's ultimate goal is zero accidents, work-related injuries and illnesses, regulatory violations, and reportable environmental releases. DOE would ensure that for all activities and phases in the remediation of SSFL, appropriate mechanisms are in place to ensure that exposures to workers, the public, and the environment to radiological and nonradiological hazards are maintained below regulatory limits. Furthermore, DOE would ensure that deliberate efforts are taken to keep exposures to radiation ALARA, consistent with DOE Order 458.1 and 10 CFR 835.

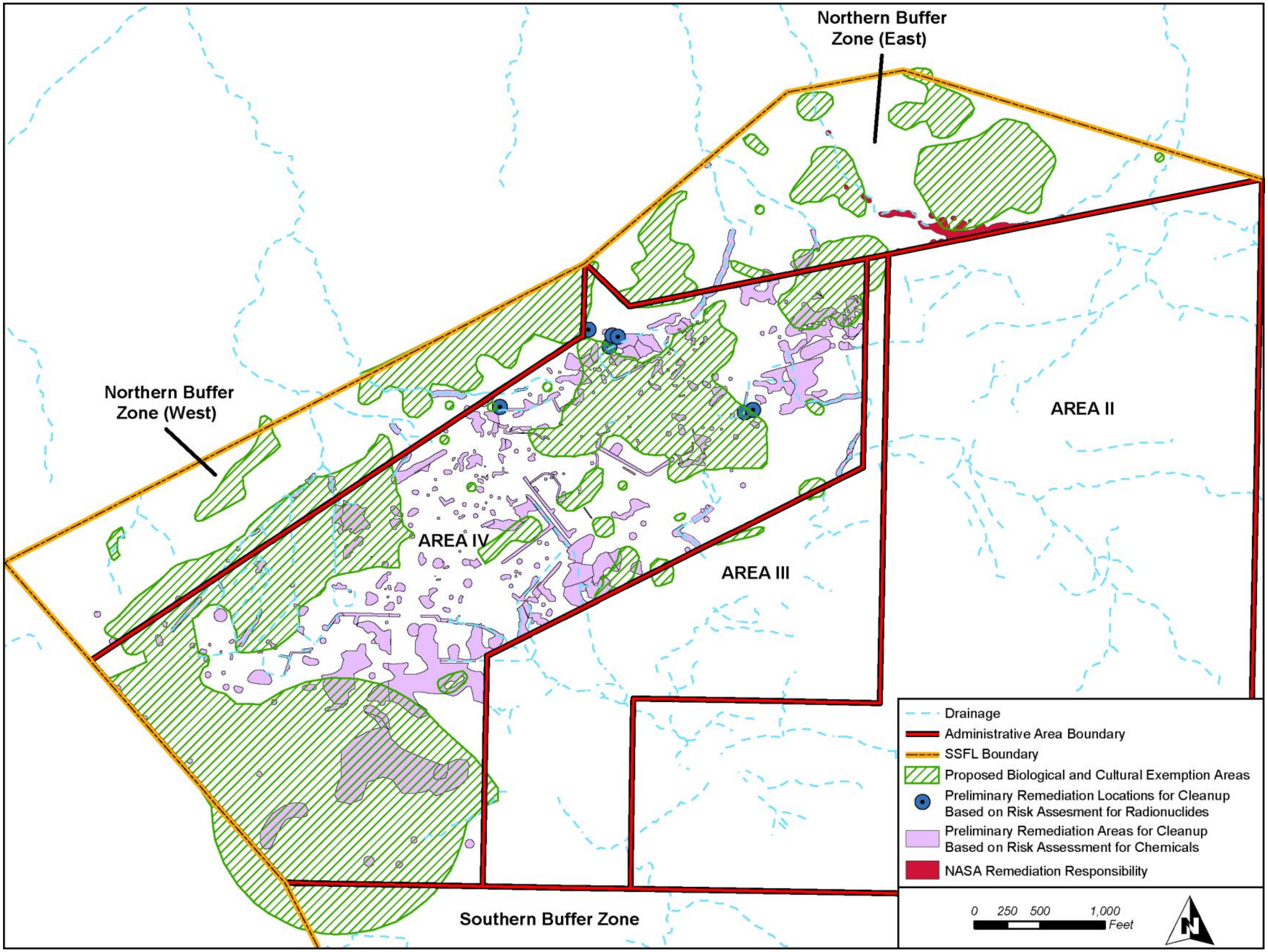

Figure S–7 Soil Remediation – Conservation of Natural Resources Alternative with Proposed Exemption Areas

As described in the preceding sections, DOE evaluated the No Action Alternative and three action alternatives for soil cleanup within Area IV and the NBZ. Under each of the action alternatives, DOE assumes that DTSC will approve the use of monitored natural attenuation for the onsite treatment of 150,000 cubic yards of soil containing low levels of TPH and PAHs.

- No Action Alternative – DOE would continue monitoring and maintenance activities and ensure that site security is maintained. There would be no treatment of soil to reduce constituent concentrations or removal of soil for disposal off site. Soil would be left in place in perpetuity.
- Cleanup to AOC LUT Values Alternative – DOE would start at one side of the site and proceed across Area IV and the NBZ, removing soil exceeding the AOC LUT values, based on a point-by-point determination. An estimated 933,000 cubic yards of soil would be removed from the site over a 10-year time frame. The number of truck round trips (rounded values) would be about 70,000 for removing soil from the site and 46,000 for transporting backfill to the site.
- Cleanup to Revised LUT Values Alternative – DOE would remove soil exceeding the revised LUT values. Chemical cleanup levels would be based on the direct exposure pathways for the hypothetical onsite suburban residential scenario, as outlined in the SRAM (MWH 2014). Levels would be based on a cancer incidence risk of 1 chance in 1 million and a hazard quotient of 1. The radionuclide LUT values would be the same as those for the Cleanup to AOC LUT Values Alternative. DOE would remove all soil in Area IV and the NBZ exceeding the revised LUT values. As with the prior alternative, DOE would make soil remediation decisions on a point-by-point basis. An estimated 192,000 cubic yards of soil would be removed from the site over a little more than 2-year time frame. The number of truck round trips (rounded values) would be about 14,400 for removing soil from the site and 9,400 for transporting backfill to the site.
- Conservation of Natural Resources Alternative – DOE would clean up soil to a level that would protect human health by removing soil with concentrations of chemical or radioactive constituents that exceed criteria established using a risk assessment process. This alternative would reduce risk to the public and the environment, yet conserve natural resources by disturbing less land than the other alternatives, thereby reducing the potential of impacting visual, biological, cultural, and water resources. Cleanup levels would be based on a hypothetical onsite suburban residential scenario, as outlined in the SRAM (MWH 2014), and averaging the concentrations over a risk assessment area or unit. Chemically impacted soil would be removed to achieve a cancer incidence risk of 1 chance in 1 million and a hazard index of 1; radiologically impacted soil would be removed to ALARA levels below the dose rate of 25 millirem per year. An estimated 148,000 cubic yards of soil would be removed from the site within a 2-year time frame. The number of truck round trips (rounded values) would be about 11,100 for removing soil from the site and 7,200 for transporting backfill to the site.

Each of the action alternatives would require approximately 4.0 million gallons of water each year for dust suppression during soil excavation and loading of trucks. Although the annual need is within the Calleguas Municipal Water District's (CMWD) current capacity, water use is an important consideration in the comparison of soil remediation alternatives, given the current drought conditions in the State of California and Governor Brown's Executive Order requiring a statewide 25 percent reduction in potable water use (CA EO 2015).

Similarly, regardless of the action alternative that DOE may select, transportation of material to and from SSFL is a key issue. Each of the action alternatives would include transportation of large quantities of building debris and soil to offsite disposal facilities. Whereas there are major highways north and south of SSFL, access to and from those highways requires travel on local roadways through commercial and residential areas. The section of roadway nearest SSFL over which all traffic to and from SSFL would pass is a 2.5-mile-long, two-lane road (Woolsey Canyon Road). Woolsey Canyon Road[25] would be used by all large vehicles and most personal vehicles accessing SSFL in support of DOE, NASA, and Boeing as each is responsible for implementing its respective SSFL remediation activities.

Contaminated soil and building demolition debris would be transported off site for disposal in haul trucks with a 23-ton payload or in containers placed on trucks with a 20-ton payload. Trucks would be covered or other appropriate methods would be used to minimize dust and contain the contents while in transit to disposal destinations. DOE would consider use of alternative-energy-fueled vehicles, if available and practicable, to minimize transportation impacts.

DOE, NASA, and Boeing, have responsibility for cleaning up their respective portions of SSFL and may do so simultaneously until each has completed its effort. Because of the large number of trucks that would be required and concern regarding how many trucks could reasonably and safely be accommodated on the main access road to SSFL, DOE, NASA, and Boeing have entered into an agreement that establishes the total number of truck round trips that would be allowed daily and how those trips would be apportioned among them (Boeing 2015a).

The agreement allows a maximum of 96 truck round trips at SSFL each workday (Monday through Friday), equally divided among the entities engaged in cleanup activities. The number of trucks that would transport materials each day would depend on a number of factors: the building demolition rate, the soil excavation rate, and the truck staging and loading rate; the distance to the disposal sites; the availability of trucks; and project funding. Under the agreement, as the number of entities involved in cleanup decreases, the number of truck round trips available to the remaining entities would increase. In this EIS, DOE assumes that it would be allotted 32 truck round trips daily for the first two years of the project and an average of 48 round trips daily thereafter. Even if DOE were allotted as many as 96 round trips daily, the average rate would be 48 round trips, with occasional surges to accommodate periods of higher activity (e.g., to expedite cleanup).

Table S–4 provides the soil volumes that would be removed under each action alternative. As shown in Table S–4, within the accuracy of the estimates of soil volume and weight, the same quantities of soil in Categories 2, 3, 5, and 6 would be remediated under all of the action alternatives. Under the Cleanup to Revised LUT Values Alternative, soil in Category 4 (soil with radionuclide concentrations above AOC LUT values that would not cause a dose in excess of 25 millirem per year via the direct exposure pathways for the hypothetical onsite suburban residential scenario) would also be removed. Under the Cleanup to AOC LUT Values Alternative, in addition to the Category 4 soil, Category 1 soil (soil that does not meet the definition of either hazardous or radioactive waste and does not contain chemical constituents that exceed risk-based levels, contains chemical constituents above the AOC LUT values) would be removed. **Table S–5** shows the number and timing of the truck round trips that would be required to transport the soil for disposal and backfill for site restoration. Costs of the alternatives correlate to the quantity of soil removed; that is, the larger the quantity of soil removed, the higher the costs. Although there would be some reduction in the risk remaining following remediation with each increment of soil removed, proceeding from the alternative with the least soil removed (Conservation of Natural Resources Alternative) to that with the most soil removed (Cleanup to AOC LUT Values Alternative), the

[25] Woolsey Canyon Road is the only serviceable road for heavy truck traffic to and from SSFL. The pavement on Woolsey Canyon Road shows few signs of structural failure, but is showing signs of age and brittleness, indicating that the pavement is near the end of its useful life. Portions of the roadway have recently been repaired.

largest reduction in risk would occur between the No Action and Conservation of Natural Resources Alternatives. A smaller reduction in risk would be realized between the Conservation of Natural Resources and Cleanup to Revised LUT Values Alternatives. Even though the largest increment of soil would be removed between the Cleanup to Revised LUT Values and Cleanup to AOC LUT Values Alternatives, there would be minimal change in the risk remaining following cleanup. (See the text box, Comparison of Risk Management and Cost Among Soil Remediation Alternatives.)

Under all action alternatives, the amount of soil removed and the areal extent of the cleanup would incorporate the proposed 2010 AOC (DTSC 2010a) exemption areas for sensitive biological and cultural resources per USFWS, CFWS, SHPO, Santa Ynez Band of Chumash Indians, and SSFL Sacred Sites Council consultation (see Figures S–5, S–6, and S–7). DOE would use exemptions provided in the 2010 AOC that are approved by DTSC and would not take action in any of these areas unless it is demonstrated that levels of constituents in the soil pose a risk to human health or the environment (as determined using RBSLs from the SRAM [MWH 2014]) and soil removal is necessary. DOE would implement these exemptions on a case-by-case basis in consultation with DTSC, only remove the quantity of soil necessary to reduce the risk, and take all precautions to protect the environment as part of the action.

Comparison of Risk Management and Cost Among Soil Remediation Alternatives

Appendix J of this EIS presents an analysis of the costs and benefits of the soil remediation alternatives. The costs are presented in terms of present worth, that is, the cost in current dollars, taking into account the duration of the alternative and the future value of money. The benefits are presented as risks to human health as measured by the risk of cancer or the hazard index (for non-cancer-causing chemicals) remaining after implementation of an alternative. The analysis is based on evaluation of four locations; the representative locations were selected because they were identified by EPA as having radionuclide contamination, had been subject to prior cleanup actions, and provided a range of chemical constituents characteristic of Area IV operations. The range of risk in these four exposure areas is expected to represent the upper boundary across Area IV and the NBZ for cancer risk and for noncancer hazard. Results of these analyses as applied to Area IV and the NBZ are summarized below. As shown below, the cancer risks and toxic hazards (as indicated by the hazard index) decrease across the alternatives from the highest level (under the No Action Alternative) to the lowest level (under the Cleanup to AOC LUT Values Alternative). Conversely, the costs increase across the alternatives in reverse order, with the lowest cost under the No Action Alternative and the highest cost under the Cleanup to AOC LUT Values Alternative.

No Action Alternative

Cost: $3 million
Cancer risk: 6.3×10^{-5} to 3.5×10^{-4} or 1 chance in 3,000 to 16,000
Hazard index: 0.8 to 30

Conservation of Natural Resources Alternative

Cost: $124 million
Cancer risk: 1.1×10^{-5} to 4.0×10^{-5} or 1 chance in 25,000 to 91,000
Hazard index: 0.6 to 1

Cleanup to Revised LUT Values Alternative

Cost: $168 million
Cancer risk: 3.7×10^{-6} to 9.8×10^{-6} or 1 chance in 100,000 to 270,000
Hazard index: 0.04 to 0.5

Cleanup to AOC LUT Values Alternative

Cost: $468 million
Cancer risk: 3.2×10^{-6} to 9.6×10^{-6} or 1 chance in 100,000 to 310,000
Hazard index: 0.02 to 0.4

Note: Consistent with normal practices at this stage of project development, rough order of magnitude costs for implementing the alternatives were estimated. Actual costs would be expected to fall within a range from 20 percent less to 40 percent more than the rough order of magnitude estimate.

Table S–4 Remediation Soil Quantities and Truck Traffic by Alternative

	Cleanup to AOC LUT Values Alternative	*Cleanup to Revised LUT Values Alternative*	*Conservation of Natural Resources Alternative*
Soil Category 1 Chemicals above AOC LUT values, but below risk-based levels and hazardous waste standards. Radionuclides at or below AOC LUT values.	741,000 cubic yards 1,112,000 tons 55,600 truckloads		
Soil Category 2 Chemicals above risk-based levels, but below hazardous standards. Radionuclides at or below AOC LUT values.	52,000 cubic yards 78,000 tons 3,900 truckloads	52,000 cubic yards 78,000 tons 3,900 truckloads	52,000 cubic yards 78,000 tons 3,900 truckloads
Soil Category 3 Chemicals above hazardous waste standards. Radionuclides at or below AOC LUT values.	49,000 cubic yards 73,500 tons 3,700 truckloads	49,000 cubic yards 73,500 tons 3,700 truckloads	49,000 cubic yards 73,500 tons 3,700 truckloads
Soil Category 4 Chemicals above AOC LUT values, but below risk-based levels and hazardous waste standards. Radionuclides above AOC LUT values, but below risk-based levels.	44,000 cubic yards 66,000 tons 3,300 truckloads	44,000 cubic yards 66,000 tons 3,300 truckloads	
Soil Category 5 Chemicals above risk-based levels and may be a hazardous waste. Radionuclides above AOC LUT values.	44,000 cubic yards 66,000 tons 3,300 truckloads	44,000 cubic yards 66,000 tons 3,300 truckloads	44,000 cubic yards 66,000 tons 3,300 truckloads
Soil Category 6 Chemicals at or below AOC LUT values. Radionuclides above risk-based levels.	3,000 cubic yards 4,500 tons 230 truckloads	3,000 cubic yards 4,500 tons 230 truckloads	3,000 cubic yards 4,500 tons 230 truckloads
Area Affected	130 acres	40 acres	32 acres
Total Volume	933,000 cubic yards	192,000 cubic yards	148,000 cubic yards
Total Weight	1,399,500 tons	288,000 tons	222,000 tons
Total Truck Round Trips [a]	70,000 truckloads	14,400 truckloads	11,100 truckloads

AOC = *Administrative Order on Consent for Remedial Action*; LUT = Look-Up Table.

[a] Truck round trips were conservatively estimated based on transporting 20 tons of containerized waste per truck. If 23-ton trucks were used for nonradioactive waste, truck trips would be reduced by 11 percent under the Cleanup to AOC LUT Values Alternative and the Cleanup to Revised LUT Values Alternative, and 9 percent under the Conservation of Natural Resources Alternative.

Notes:

- Sums and products may not equal those calculated from table entries due to rounding.
- Cubic yards are converted to tons using a conversion factor of 1.5 tons per cubic yard (see Appendix D).

Table S–5 DOE Truck Round Trips by Year for Remediation Alternatives[a]

	Number of Truck Round Trips per Year												
	Year 1	***Year 2***	***Year 3***	***Year 4***	***Year 5***	***Year 6***	***Year 7***	***Year 8***	***Year 9***	***Year 10***	***Year 11***	***Year 12***	***Totals***
Soil Remediation Alternatives													
Cleanup to AOC LUT Values Alternative													
Radionuclides above background concentrations; with and without chemicals above AOC LUT values (LLW and MLLW).	0	0	695	708	708	708	708	708	708	708	708	463	6,825
Chemicals exceeding AOC LUT values; includes hazardous wastes.	0	0	6,433	6,554	6,554	6,554	6,554	6,554	6,554	6,554	6,554	4283	63,150
Backfill soil	0	0	4,649	4,736	4,736	4,736	4,736	4,736	4,736	4,736	4,736	3,097	45,636
Totals	0	0	11,778	11,999	11,999	11,999	11,999	11,999	11,999	11,999	11,999	7,841	115,611
Cleanup to Revised LUT Values Alternative													
Radionuclides above background concentrations; with and without chemicals above Revised LUT values (LLW and MLLW).	0	0	3,413	3,412									6,825
Chemicals exceeding Revised LUT values; includes hazardous wastes.	0	0	3,716	3,851	9								7,575
Backfill soil	0	0	4,649	4,736	5								9,391
Totals	0	0	11,778	11,999	14								23,791
Conservation of Natural Resources Alternative													
Radionuclides above background concentrations; includes chemically contaminated soil.	0	0	3,413	112									3,525
Chemicals exceeding risk assessment levels; includes hazardous waste.	0	0	3,716	3,859									7,575
Backfill soil	0	0	4,649	2,590									7,239
Totals	0	0	11,778	6,561									18,339
Building Removal Alternative													
Building removal	750	750											1,500
Backfill soil	63	815											878
Totals	813	1,565											2,378

	Number of Truck Round Trips per Year												
	Year 1	***Year 2***	***Year 3***	***Year 4***	***Year 5***	***Year 6***	***Year 7***	***Year 8***	***Year 9***	***Year 10***	***Year 11***	***Year 12***	***Totals***
Groundwater Remediation Alternatives													
Groundwater Monitored Natural Attenuation Alternative													
Well installation and monitoring	1	1	6	1	1	1	1	1	1	1	1	1	17
Groundwater Treatment Alternative													
Sr-90 Source Removal – Bedrock	0	0	128 [b]										128
Backfill soil	0	0	83										83
Totals	0	0	211										211

AOC = *Administrative Order on Consent for Remedial Action*; LLW = low-level radioactive waste; LUT = Look-Up Table; MLLW = mixed low-level radioactive waste; Sr = strontium.

[a] This table shows round trips for heavy-duty trucks hauling waste from the site and backfill to the site. A few additional heavy-duty truck shipments would also be required for delivery of equipment, and light- and medium-duty truck shipments would be required for supplies, sample delivery, groundwater treatment medium exchange, and similar activities. Those miscellaneous shipments are not reflected in this table, but have been accounted for in the analysis. Trucks would operate 250 days per year in accordance with the agreement with NASA and Boeing (Boeing 2015a). Backfill soil round trips would go from the backfill source to Area IV and return for additional backfill. Soil removal trucks would go from Area IV to the disposal facility or an intermodal facility, where the soil containers would be loaded on a train; the trucks would then return to Area IV for an additional soil removal load. DOE's cleanup schedule is based on an average of up to 32 truck round trips per workday for the first 2 years, then 48 truck round trips per workday for the remainder of the project.

[b] In-ground volume of solid rock would be approximately 1,050 cubic yards; the removed rock is assumed to have an expanded volume of 1,700 cubic yards (see Appendix D). Using a conversion of 1.5 tons per cubic yard and 20 tons per truck would result in 128 truckloads for strontium-90 source removal from the bedrock.

Notes:

- Annual truck round trips are rounded values. As a consequence, sums presented in the table may differ from those calculated from table entries.
- Blanks indicate no heavy-duty truck transport activity would occur in the year.

S.10.3 Building Demolition Alternatives

S.10.3.1 Background

A total of 22 structures remain in Area IV; 18 are owned by DOE and 4 by Boeing, as shown in **Figure S–8**. In this EIS, DOE is evaluating disposition of its 18 structures in Area IV. DOE has never had buildings in the NBZ. Seven of the 18 DOE structures are metal sheds used for material storage; the other 11 are more-substantial structures, consisting of prefabricated metal buildings constructed on grade-level, concrete platforms; buildings with formed concrete basements; and buildings with cinder block/concrete walls and metal roofs. The more substantial structures are the Sodium Pump Test Facility (Buildings 4462 and 4463), ETEC Office Building (Building 4038), Building 4057 Warehouse, Hazardous Waste Management Facility (Buildings 4029 and 4133), RMHF (Buildings 4021, 4022, and 4034), and former reactor complex buildings (Buildings 4019 and 4024). The seven metal sheds are part of the RMHF (Buildings 4044, 4075, 4563, 4621, 4658, 4665, and 4688). The Hazardous Waste Management Facility no longer manages hazardous waste and RMHF no longer manages radioactive waste. The Building 4057 Warehouse is used for field equipment storage, but the remaining buildings are unoccupied and unused. In addition to the structures, the associated parking lots are included as part of the building demolition activity.

Two alternatives are being evaluated for building demolition: the No Action Alternative and the Building Removal Alternative.

S.10.3.2 Building No Action Alternative

Under the Building No Action Alternative, the 18 DOE-owned structures in Area IV would remain in place. DOE would conduct surveillance and maintenance as needed for safety (e.g., preventing access). Because radiological materials would remain in some buildings, DOE would continue its responsibilities in accordance with the Atomic Energy Act and ensure continuation of security that restricts access to Area IV and the structures.

S.10.3.3 Building Removal Alternative

Under this alternative, DOE would demolish the 18 structures it owns in Area IV and dispose of or recycle the materials off site. Building demolition would start following the DOE ROD for this EIS and a decision following completion of the DTSC program environmental impact report (EIR) prepared under the California Environmental Quality Act (CEQA)[26] and would take approximately 2 years to complete, contingent on funding. Building removal activities are estimated to disturb about 8.4 acres. Approximately 1,500 truck round trips would be required to haul the DOE building demolition debris from Area IV for either disposal or recycle (see Table S–5).

Building demolition plans would be prepared for each structure by DOE's demolition contractor to ensure worker safety is maintained throughout the demolition process and regulatory requirements and DOE guidelines are met for each facility. These plans would include identifying potential hazards for each structure (such as the presence of radiological or chemical materials or building structural issues) and specifying protective equipment and procedures to protect workers from specific hazards.

[26] DTSC is preparing a program EIR for the entire SSFL (Areas I through IV, the NBZ, and the Southern Buffer Zone). The program EIR will evaluate remediation activities of DOE, NASA, and Boeing. The draft program EIR is currently in preparation.

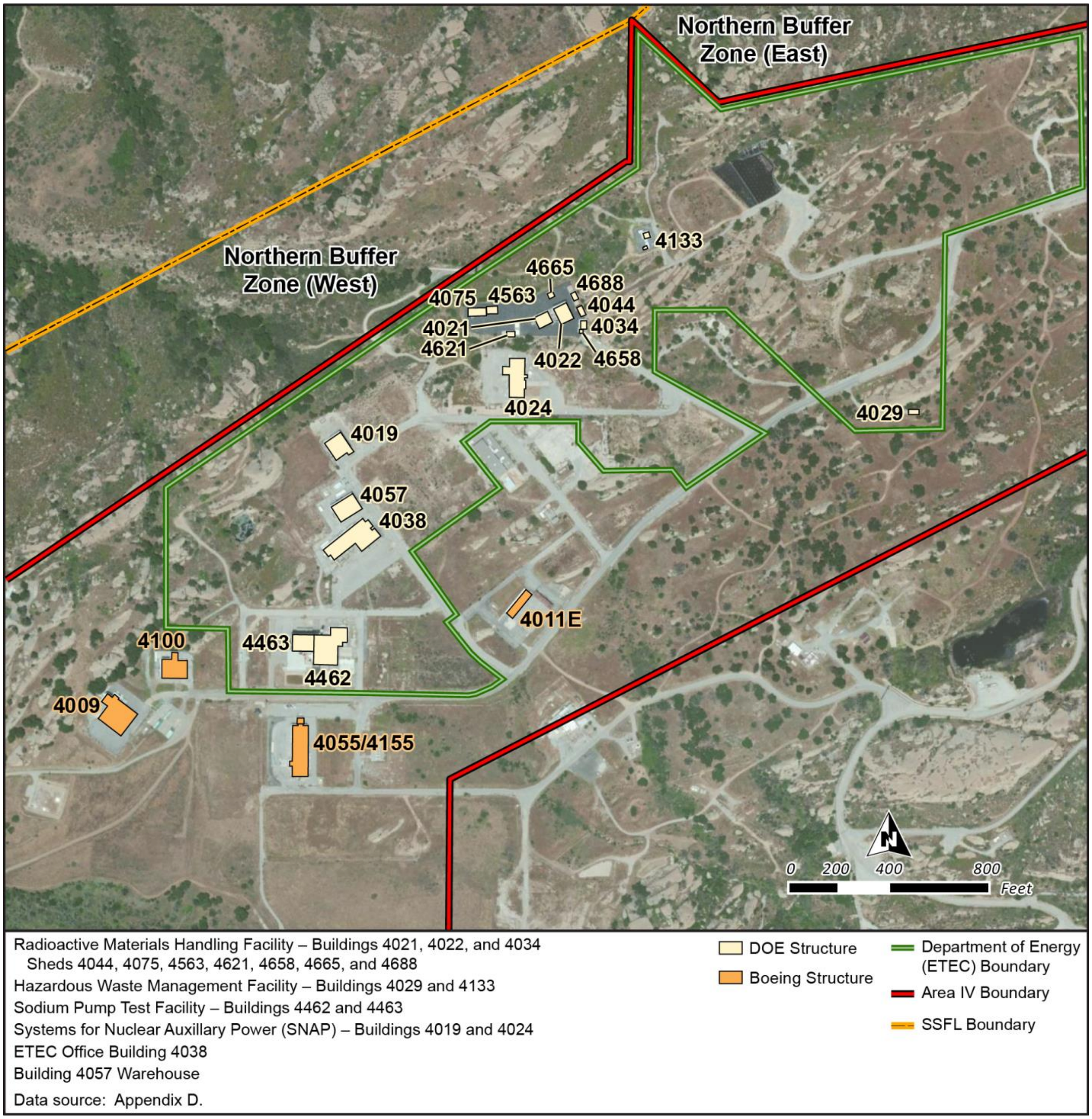

Figure S–8 Remaining Structures in Area IV

At least two staging areas would be established to support building demolition and soil remediation work. The first would be the main staging area within the north-central portion of Area IV, near Building 4024. This staging area may be supplemented by an additional area south of Building 4038 (see Figure S–8) that would include a contractor trailer, worker parking, portable restrooms, heavy equipment parking, and a decontamination pad. As necessary, temporary RCRA storage areas would be established to store wastes while awaiting shipment off site for disposal. The storage areas would consist of areas approximately 20 feet square, with berms around the perimeter and liners to capture any potential spills.

In preparation for demolition activities, surveys of building structural materials for the presence of radioactivity would be conducted. Building materials that do not have a radioactive history, have been determined to be free of radioactive contamination, and do not contain hazardous materials would be transported to a recycle facility to the extent possible or a permitted waste disposal facility.

Materials from buildings that cannot be shown to be suitable for free release[27] would be managed as radioactive waste and would be transported to a Federal or commercial radioactive waste disposal facility such as the Nevada National Security Site (NNSS) in Nevada or Energy*Solutions* in Utah.[28] Building materials from structures associated with hazardous waste management or chemical usage permits would be transported to a permitted California Class I or out-of-state hazardous waste disposal facility.

Table S–6 shows the estimated quantities of building demolition waste and debris that would be disposed of or recycled by type. A larger quantity of radioactive waste than other types of waste is identified because materials from buildings with a radiological history would be managed as radioactive waste for disposal purposes unless they can be demonstrated to be suitable for free release. Following removal of the slabs and subgrade structures, radiological surveys of building footprints would be conducted. Soil sampling for chemicals and radionuclides would be conducted in accordance with DTSC-approved plans. Any soil encountered above the soil remediation level selected for implementation would be remediated or removed and disposed of during the soil remediation effort. Soil would be replaced to the extent necessary to ensure safe working conditions. Dust and erosion control measures, such as spraying with water, surfactants, or a soil binder and/or covering exposed soil with mulch or straw wattles, would be used to minimize dust and erosion issues until the area is re-contoured and revegetated.

Table S–6 Estimated DOE Area IV Building Demolition Materials

Type	*Volume (cubic yards)* [a]
From Buildings with a Radioactive History [b]	
Low-level radioactive waste	3,280
Mixed low-level radioactive waste	18
Free-released debris [c]	7,220
Free-released hazardous debris [c]	110
From Buildings with No Radioactive History [b]	
Hazardous waste	120
Recyclable steel, concrete, and asphalt	3,540
Nonhazardous debris	1,220

[a] Volumes estimated from North Wind 2014. Demolition materials would be transported offsite in approximately 1,500 heavy-duty truck loads.
[b] For purposes of estimating waste volumes, buildings with no radioactive history include 4038, 4057 Warehouse, 4462, and 4463; all other building were considered to have a radioactive history.
[c] Materials from buildings with a radiological history would be managed as radioactive waste for disposal purposes unless they can be demonstrated to be suitable for free release. Free-released debris and free-released hazardous debris do not exhibit radioactivity above background levels.

S.10.4 Groundwater Remediation Alternatives

S.10.4.1 Background

Investigation of bedrock groundwater in Area IV was initiated in 1986 with the installation of a well at the Building 4056 landfill site. Since then, 61 additional bedrock wells have been installed throughout Area IV (two wells were deemed no longer necessary when Building 4059 was removed). Investigation of the near-surface groundwater at SSFL was initiated in March 2001. As part of the investigation of near-surface groundwater, DOE has installed 45 wells (one of which has since been

[27] Materials are suitable for free release if they do not exhibit radioactivity above background levels.
[28] See Appendix D, Section D.4 for a discussion of the sites that were considered reasonable disposal locations for the different waste types and those that were selected as representative and analyzed in detail in this EIS.

closed and sealed). The Area IV groundwater monitoring well network comprises 104 wells: 44 are shallow wells (less than 100 feet deep) and 60 are between 100 feet and 400 feet deep. Approximately 40 wells are sampled each year.[29]

Figure S–9 illustrates six primary areas of groundwater requiring cleanup within Area IV:

- a trichloroethylene (TCE) plume associated with the Former Sodium Disposal Facility (FSDF),
- a TCE plume associated with the Building 4100/4056 landfill,
- a perchloroethylene (PCE) plume near Building 4057 Warehouse,
- a TCE plume associated with the Hazardous Materials Storage Area (HMSA),
- a tritium plume (associated with the former Building 4010 area), and
- a strontium-90 source associated with the RMHF leach field.

Additionally, there are two other areas with lower concentrations of groundwater contamination, mainly solvents, which are being evaluated: the RMHF TCE plume and the Metals Clarifier TCE plume.

The 2010 AOC (DTSC 2010a) incorporated by reference the requirements for investigation and cleanup of groundwater contained in the 2007 CO (DTSC 2007). The 2007 CO directs cleanup to be completed in accordance with RCRA requirements. Groundwater characterization requirements were evaluated during development of the RCRA Facility Investigation Work Plan (CDM Smith 2015a). A RCRA Corrective Measures Study is currently being developed independently from this EIS; the study is to evaluate and select groundwater treatment technologies (e.g., pumping and treatment [commonly called pump and treat], soil vapor extraction, monitored natural attenuation) to be applied as remedial actions. In support of the Corrective Measures Study, DOE has completed collecting hydrogeologic data that will allow modeling of the transport and fate of groundwater contamination and support remedy selection. All groundwater remedies would involve monitoring to confirm modeling assumptions and assess remedy effectiveness.

Potential environmental impacts of implementing the groundwater treatment technologies are evaluated in this EIS. DOE may select any or all of these technologies for action depending on the contaminant, source, and location of the impacted groundwater. Because the results of the Corrective Measures Study are yet to be determined, this EIS evaluates the potential impacts that could occur during groundwater remediation activities, assuming implementation of those technologies that would result in the largest potential impacts. DOE anticipates submitting the Corrective Measures Study to DTSC in 2017, prior to the DOE ROD for this EIS. Descriptions of possible groundwater actions are described in the following paragraphs.

S.10.4.2 Groundwater No Action Alternative

Under the Groundwater No Action Alternative, current groundwater monitoring would continue. DOE would not implement additional monitoring. As part of the SSFL-wide groundwater interim measures, the currently planned FSDF Groundwater Interim Measure would be initiated to extract TCE-contaminated groundwater. Over time, concentrations of radiological and chemical constituents would be reduced through natural attenuation (decay, degradation, dispersion, and dilution).

[29] The wells to be sampled and the analyses to be performed are described in the *Site-Wide Water Quality Sampling and Analysis Plan, Revision 1, Santa Susana Field Laboratory, Ventura County, California* (Haley and Aldrich 2010).

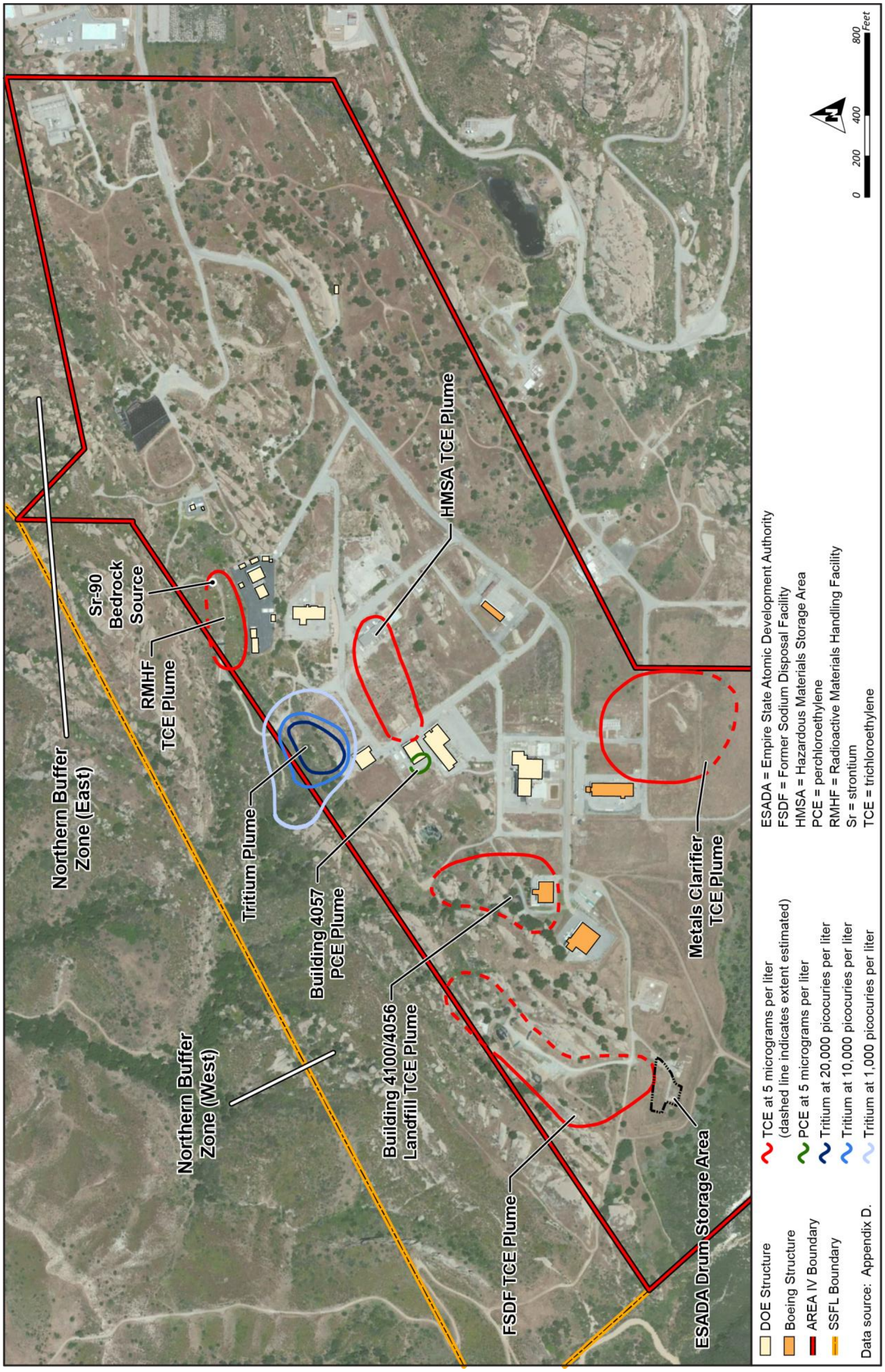

Figure S–9 Area IV Groundwater Plumes

S.10.4.3 Groundwater Monitored Natural Attenuation Alternative

Natural attenuation is the process whereby some constituents naturally decrease in concentration over time. Mechanisms include biodegradation, which is the degradation of contamination resulting from naturally occurring microbes, and radioactive decay. Concentrations can also decrease through dilution and dispersion of the chemical in the groundwater. Monitored natural attenuation includes sampling and analysis of groundwater to confirm that the concentrations of constituents of interest are in fact decreasing. Under favorable geochemical and microbial conditions, chlorinated solvents like TCE and PCE have been shown to break down in chemically reducing environments and in the presence of certain naturally occurring microbes; concentrations of these chemicals would be reduced through biodegradation.

Under this alternative, no active remediation of any DOE groundwater plumes would occur. In addition to the wells that would continue to be monitored under the No Action Alternative, DOE would propose to DTSC the installation and monitoring of additional wells. The plumes would be sampled (i.e., monitored) on an established schedule to confirm that reduction of the contaminant concentrations continues as anticipated. Monitoring periods would be based on the expected radionuclide decay or natural chemical decomposition over time. Most monitoring would be completed in 10 to 50 years. Monitoring of strontium-90 contamination at the RMHF leach field would last more than 100 years. The time frames for monitoring would be adjusted, based on sampling results. The DOE plumes, the contaminants and their concentration, and the expected time frames for monitoring are listed below (CDM Smith 2015a):

- For the FSDF TCE plume, TCE is currently above 1,000 parts per billion, and there are low levels (below the maximum contaminant levels [MCLs]) of perchlorate present (CDM Smith 2015a). The remaining TCE would be monitored for approximately 30 to 50 years until it reached the MCL of 5 parts per billion.
- For the HMSA perched groundwater plume with TCE at 90 parts per billion (CDM Smith 2015a), monitoring would continue for approximately 20 years.
- For the Building 4100/4056 landfill TCE plume, TCE is currently approximately 48 parts per billion (CDM Smith 2015a). The TCE would be monitored for approximately 20 years.
- For the Building 4057 Warehouse PCE plume (currently at 48 parts per billion) (CDM Smith 2015a), monitoring would be needed for approximately 20 years until it reached the MCL of 5 parts per billion.
- For the Metals Clarifier TCE plume (currently at 9.3 parts per billion and decreasing) (CDM Smith 2015a), monitoring would be needed for approximately 10 years.
- For the RMHF leach field, both strontium-90 and TCE would be monitored. Strontium-90 has a 28.8-year half-life (the period of time required for half of the strontium-90 to decay to a nonradioactive isotope). With an MCL of 8 picocuries per liter and maximum activity concentrations of 183 picocuries per liter in 2010 and 29.5 picocuries per liter in 2015, monitoring would need to continue for 50 to 150 years. For the TCE plume (currently at about 6 parts per billion), monitoring would continue until the 5 parts per billion MCL is reached. The time frame for monitoring is uncertain because TCE in this plume has been relatively constant at approximately 6 parts per billion for about 15 years. This constant concentration is consistent with the conceptual model that assumes that TCE in the bedrock fractures has been removed and the current source is slow, continuous diffusion of TCE from the bedrock matrix.

- For the tritium plume, data indicate that radioactive decay would reduce tritium (with a 12.3-year half-life) to its 20,000 picocuries per liter drinking water MCL by 2025. Tritium in the plume was measured at 40,000 picocuries per liter in February 2014 (CDM Smith 2015a).

S.10.4.4 Groundwater Treatment Alternative

Under the Groundwater Treatment Alternative, treatment would be selected following the completion of a RCRA Corrective Measures Study. The following treatment methods are being considered for groundwater remediation.

The plumes with chlorinated solvents (e.g., FSDF, HMSA, Building 4100/4056 landfill, and Building 4057 Warehouse) could be treated using one or a combination of methods including pump and treat, followed by local re-injection of treated water; enhanced groundwater treatment, consisting of *in situ* treatment such as chemical injection or biological enhancement; or soil vapor extraction. The HMSA perched groundwater plume could also be treated by dewatering (i.e., removing the perched plume by pumping).

The RMHF leach field strontium-90 source could be remediated by removing the bedrock that is contaminated with strontium-90 (source removal), source isolation, or lowering the groundwater table by through active pumping.

The Metals Clarifier TCE plume and the RMHF TCE plume concentrations are less than 10 parts per million and would not be amenable to treatment. Because the tritium plume would meet its MCL by 2025 through radioactive decay, it would not be addressed by any active treatment. Remediation of these plumes would be accomplished by monitored natural attenuation, as under the Monitored Natural Attenuation Alternative.

S.10.5 Preferred Alternative

DOE has no preferred alternative at this time.

S.11 Summary of Potential Environmental Consequences

S.11.1 Comparison of Potential Environmental Consequences of Alternatives

This section summarizes the consequence analyses for the alternatives evaluated in this EIS. The summaries are provided in table format for each component of the Area IV and NBZ cleanup. **Table S–7** provides the summary of consequences for the soil remediation alternatives, **Table S–8** for the building demolition alternatives, and **Table S–9** for the groundwater remediation alternatives.

Table S–7 Summary of Potential Environmental Consequences under the Soil Remediation Alternatives

Resource Area	*Alternatives* *Soil No Action*	*Cleanup to AOC LUT Values*	*Cleanup to Revised LUT Values*	*Conservation of Natural Resources*
Land resources	- The land use designation for Area IV and the NBZ would be consistent with Ventura County requirements. - No impacts are expected on use of Sage Ranch Park or other recreation areas in the SSFL vicinity. - Electricity and water use would be minimal. - No change in aesthetics and visual quality from baseline conditions.	- Remediation would be consistent with the landowner's (Boeing's) intent to maintain its land as undeveloped open space (Boeing 2016b). - During 10 years of soil removal, the average daily traffic on Woolsey Canyon Road would increase by up to 7.3 percent, which could discourage weekday use of Sage Ranch Park. Traffic on evaluated roads other than Woolsey Canyon Road is expected to increase by no more than 2.7 percent, with no expected impacts on use of other recreation areas in the SSFL vicinity. - Electricity use would be minimal. Annual water use would be about 4.0 million gallons; total water use would be about 40 million gallons. Annual use would represent about 0.007 percent of CMWD's annual supply. Water use is an important consideration because of California's current drought conditions and Governor Brown's call to reduce water use (CA EO 2015). - There would be onsite impacts on aesthetics and visual quality during the 10 years of soil removal, but long-term improvements to aesthetics and visual quality resulting from returning Area IV to a stabilized, revegetated state. The terrain would retain the appearance of an open space crossed by roads.	- Remediation would be consistent with the landowner's (Boeing's) intent to maintain its land as undeveloped open space (Boeing 2016b). - Impacts on recreation areas would be similar to those under the Cleanup to AOC LUT Values Alternative, except that increased traffic would last for slightly more than 2 years. - Electricity use would be minimal. Annual impacts on water would be the same as those under the Cleanup to AOC LUT Values Alternative; total water use would be about 8.3 million gallons. Water use is an important consideration for the same reasons as those under the Cleanup to AOC LUT Values Alternative. - Impacts on aesthetics and visual quality would be similar to those under the Cleanup to AOC LUT Values Alternative, but the impact duration would be less because soil removal would last for slightly more than 2 rather than 10 years.	- Remediation would be consistent with the landowner's (Boeing's) intent to maintain its land as undeveloped open space (Boeing 2016b). - Impacts on recreation areas would be similar to those under the Cleanup to AOC LUT Values Alternative, except that increased traffic would last for about 2 years. - Electricity use would be minimal. Annual impacts on water would be the same as those under the Cleanup to AOC LUT Values Alternative; total water use would be about 8.0 million gallons. Water use is an important consideration for the same reasons as those under the Cleanup to AOC LUT Values Alternative. - Impacts on aesthetics and visual quality would be similar to those under the Cleanup to AOC LUT Values Alternative, but the impact duration would be less because soil removal would last for 2 rather than 10 years.
Geology and soils	No impacts are expected on geologic (bedrock) and paleontological resources (i.e., loss of fossils) or onsite soil function. No activities would take place in zones where earthquake-induced landslides could occur. Minimal soil erosion is expected from site maintenance activities, and there would be no need for backfill obtained from offsite sources.	- No adverse impacts are expected on geologic (bedrock) resources. - Potential impacts on paleontological resources (i.e., loss of fossils) would be minimal because the Santa Susana Formation containing these resources is largely located within the proposed exemption areas.[a] Outside of the proposed exemption areas, about 1 acre of land overlying the Santa Susana Formation would be remediated.	- Impacts on geologic resources would be the same as those under the Cleanup to AOC LUT Values Alternative. - Potential impacts on paleontological resources would be similar to those under the Cleanup to AOC LUT Values Alternative, except that only 0.2 acres of land overlying the Santa Susana Formation (and not within the proposed exemption area) would be remediated.	- Impacts on bedrock geologic resources would be the same as those under the Cleanup to AOC LUT Values Alternative. - Potential impacts on paleontological resources would be similar to those under the Cleanup to AOC LUT Values Alternative, except less than 0.1 acre of land overlying the Santa Susana Formation (and not within the proposed exemption area) would be remediated.

Resource Area	Alternatives			
	Soil No Action	***Cleanup to AOC LUT Values***	***Cleanup to Revised LUT Values***	***Conservation of Natural Resources***
Geology and soils (cont'd)		- Some activities could take place in zones where earthquake-induced landslides could occur, leading to worker risks that DOE would minimize as needed using the 2010 AOC exemption process. - Soil erosion is possible because of the disturbance of about 130 acres of land, but would be minimized using BMPs, as summarized in Chapter 6. In the periods before completion of stabilization activities, precipitation runoff may erode soil, leading to a reduction of soil quality and functional capability within eroded areas. - About 700,000 cubic yards of backfill would be required, with chemical and radioactive constituents in concentrations meeting AOC LUT values. Loss of soil function is possible if the backfill is not of equal soil quality (including regenerative structures, organic carbon, seed bank, and beneficial soil organisms) to that of current soil at Area IV and the NBZ.	- Potential impacts associated with earthquake-induced landslides and management of worker risks would be similar to those under the Cleanup to AOC LUT Values Alternative, but the areas of the seismic hazard zones would be about 8 acres smaller. - Potential soil erosion impacts would be reduced compared to those under the Cleanup to AOC LUT Values Alternative because less acreage would be disturbed (about 40 acres). - About 144,000 cubic yards of backfill would be required, with concentrations of chemicals meeting revised LUT values and radionuclides meeting AOC LUT values. The Area IV-wide potential for loss of soil function would be reduced compared to that under the Cleanup to AOC LUT Values Alternative.	- Potential impacts associated with earthquake-induced landslides and management of worker risks would be similar to those under the Cleanup to Revised LUT Values Alternative, but the areas of the seismic hazard zones would be about 0.3 acres smaller. - Potential soil erosion impacts would be reduced compared to those under the Cleanup to Revised LUT Values Alternative because less acreage would be disturbed (about 32 acres). - About 111,000 cubic yards of backfill would be required, with concentrations of chemicals and radionuclides meeting risk-assessment-based values. The Area IV-wide potential for loss of soil function would be reduced compared to under the Cleanup to Revised LUT Values Alternative.
Surface water resources	No changes would occur to the onsite NPDES stormwater control and outfall monitoring system. Radioactive and chemical constituents would remain in soil, representing a source of potential surface water contamination if an unusually large rainstorm that exceeds the design of the NPDES system were to occur.	No adverse short-term impacts on surface water quality and runoff quantity and velocity are normally expected. During soil remediation, 130 acres would be disturbed. If an unusually large rainstorm were to occur, the design capacity of the existing onsite NPDES stormwater control and outfall monitoring system could be exceeded, resulting in offsite transport of soil and possible overwhelming of regional stormwater control capacity. However, the measures to minimize impacts, as summarized in Chapter 6, would likely forestall this risk. There would be a long-term reduction of potential sources of surface water contamination.	Same as the Cleanup to AOC LUT Values Alternative, except the potential for impacts would be much less because much less acreage (40 acres) would be disturbed.	Same as under the Cleanup to Revised LUT Values Alternative, except the potential for impacts would be less because less acreage (32 acres) would be disturbed.
Groundwater resources	A source of potential groundwater contamination would remain. There would be no requirement to withdraw site groundwater.	No adverse impacts are expected; positive impacts would result from removal of a potential source of groundwater contamination. There would be no requirement to withdraw site groundwater.	Same as the Cleanup to AOC LUT Values Alternative.	Same as the Cleanup to AOC LUT Values Alternative.

Resource Area	Alternatives			
	Soil No Action	*Cleanup to AOC LUT Values*	*Cleanup to Revised LUT Values*	*Conservation of Natural Resources*
Biological resources	No adverse impacts on vegetation and wildlife habitat and biota; aquatic and wetland habitats and biota; and threatened, endangered, or rare species are expected.	- Removal of existing vegetation and topsoil from about 130 acres would increase the difficulty of re-establishing native plant species and would reduce or eliminate the value of re-established habitat for most wildlife species. Remediation would require prolonged focused efforts to restore native vegetation and wildlife habitat. If backfill is substantially different from the original topsoil, it may not support re-establishment of native vegetation. About 51 acres of relatively undisturbed native habitat (including coast live oak woodland, northern mixed chaparral, and Venturan coastal scrub) would be affected. There would be fewer impacts within the proposed exemption areas because remediation within these areas would occur via focused removal actions that would minimize soil and habitat disturbance. - Less than one total acre of wetlands, ephemeral drainages, and drainage ditches in upland habitats would be affected. Potential indirect impacts on aquatic and wetland habitats and associated biota, including jurisdictional waters of the U.S., from erosion and movement of sediment or soil would be minimized by use of BMPs and mitigation measures. - Within the proposed exemption areas where most threatened, endangered, or rare species in Area IV and the NBZ are located, as well as critical habitat for two federally listed species, impacts would be minimized through use of focused removal actions.	- Impacts on vegetation and wildlife habitat and biota would be reduced because the remediated acreage (40 acres) would be less than that under the Cleanup to AOC LUT Values Alternative. The smaller area affected by remediation would increase the feasibility of restoration, and there would be more undisturbed habitat between remediated portions of the site, facilitating recolonization by native plant and wildlife species and beneficial soil organisms. About 17 acres of relatively undisturbed native habitat (including coast live oak woodland, northern mixed chaparral, and Venturan coastal scrub) would be affected by remediation activities outside the proposed exemption areas. Impacts within the proposed exemption areas would be generally as described under the Cleanup to AOC LUT Values Alternative. - Impacts on aquatic and wetland habitats and biota would be similar to those under the Cleanup to AOC LUT Values Alternative, but the area of ephemeral drainages directly affected would be about 0.4 acres. - Impacts on threatened, endangered, or rare species and critical habitat would be similar to those under the Cleanup to AOC LUT Values Alternative.	- Impacts on vegetation and wildlife habitat and biota would be reduced because the remediated acreage (about 32 acres) would be less than that under the Cleanup to AOC LUT Values Alternative. Impacts would be slightly less than those under the Cleanup to Revised LUT Values Alternative (32 acres vs. 40 acres). The smaller area affected by remediation would increase the feasibility of restoration, and there would be more undisturbed habitat between remediated portions of the site, facilitating recolonization by native plant and wildlife species and beneficial soil organisms. About 13 acres of relatively undisturbed native habitat (including coast live oak woodland, northern mixed chaparral, and Venturan coastal scrub) would be affected. Impacts within the proposed exemption areas would be generally as described under the Cleanup to AOC LUT Values Alternative. - Impacts on aquatic and wetland habitats and biota would be similar to those under the Cleanup to AOC LUT Values Alternative, but the area of ephemeral drainages directly affected would be about 0.4 acres. - Impacts on threatened, endangered, or rare species and critical habitat would be similar to those under the Cleanup to AOC LUT Table Values Alternative.
Air Quality and climate	No emissions of pollutants, including CO_2, above baseline conditions are expected.	Pollutants such as VOCs, CO, NO_X, SO_2, and particulates would be emitted from onsite activities, with nearly all particulate emissions arising from fugitive dust. Additional emissions would occur from on-road vehicles. A total of 28,000 to 84,000 metric tons of CO_2 would be emitted, primarily from vehicles.	The same types of pollutants would be emitted as those under the Cleanup to AOC LUT Values Alternative, but in smaller total quantities. A total of 12,000 to 33,000 metric tons of CO_2 would be emitted, primarily from vehicles.	The same types of pollutants would be emitted as those under the Cleanup to AOC LUT Values Alternative, but in smaller total quantities. A total of 7,700 to 24,000 metric tons of CO_2 would be emitted, primarily from vehicles.

Resource Area	Alternatives			
	Soil No Action	*Cleanup to AOC LUT Values*	*Cleanup to Revised LUT Values*	*Conservation of Natural Resources*
Noise	No noise impacts above baseline conditions are expected.	- Noise levels from onsite remediation are expected to increase at the closest residence during the 10 years of soil removal, but would be well below 65 dBA CNEL and a 5 dBA CNEL increase, a threshold for potential adverse noise impacts established per the *L.A. CEQA Thresholds Guide, Your Resource for Preparing CEQA Analyses in Los Angeles* (LA 2006). - No adverse noise impacts from traffic are expected during the 10 years of soil removal, although traffic noise would increase compared to baseline conditions. Time-averaged daily noise levels at a distance of 100 feet from the evaluated roads could increase by up to 3.5 dBA CNEL, where the final noise level would be below 65 dBA CNEL (the threshold for an adverse impact is an increase of 5 dBA CNEL). Along one section of Valley Circle Boulevard, where the noise level already exceeds 65 dBA CNEL, the noise level would increase by no more than 0.6 dBA CNEL (the threshold for an adverse impact when the final noise level exceeds 65 dBA CNEL is an increase of 3 dBA CNEL).	Similar to the Cleanup to AOC LUT Values Alternative, except the duration of increased noise due to site activities or traffic would be slightly more than 2 years.	Similar to the Cleanup to AOC LUT Values Alternative, except the duration of increased noise due to site activities or traffic would be 2 years.
Transportation [a]	No impacts above baseline conditions are expected.	**Shipment of radioactive waste – truck option** [b] Shipments – 6,830 truck shipments *Incident-free risks:* - Crew LCFs: 0 (3×10^{-4} to 8×10^{-4}) - Population LCFs: 0 (8×10^{-5} to 2×10^{-4}) *Accident risks:* - Population LCFs: 0 (4×10^{-10} to 4×10^{-9}) - Traffic fatalities: 0 (0.04 to 0.3)	**Shipment of radioactive waste – truck option** Same as the Cleanup to AOC LUT Values Alternative.	**Shipment of radioactive waste – truck option** [b] Shipments – 3,530 truck shipments *Incident-free risks:* - Crew LCFs: 0 (2×10^{-4} to 4×10^{-4}) - Population LCFs: 0 (4×10^{-5} to 1×10^{-4}) *Accident risks:* - Population LCFs: 0 (2×10^{-10} to 2×10^{-9}) - Traffic fatalities: 0 (0.02 to 0.1)

Resource Area	Alternatives			
	Soil No Action	*Cleanup to AOC LUT Values*	*Cleanup to Revised LUT Values*	*Conservation of Natural Resources*
Transportation [a] (cont'd)		**Shipment of radioactive waste – truck/rail option [b]** Shipments – 6,830 truck shipments from SSFL to an intermodal facility and then 430 rail shipments *Incident-free risks:* - Crew LCFs: 0 (1×10^{-4} to 2×10^{-4}) - Population LCFs: 0 (1×10^{-4}) *Accident risks:* - Population LCFs: 0 (3×10^{-10}) - Traffic fatalities: 0 (0.2) **Shipment of nonradioactive waste, backfill, equipment, and supplies [b]** *Truck option:* - 110,000 truck shipments - Traffic fatality risks: 1 (0.52) *Truck/rail option:* - 63,000 truck shipments of waste from SSFL to an intermodal facility, then 3,900 rail shipments; 45,700 truck shipments of backfill, equipment, and supplies - Traffic fatality risks: 3 (2.6)	**Shipment of radioactive waste – truck/rail option** Same as the Cleanup to AOC LUT Values Alternative. **Shipment of nonradioactive waste, backfill, equipment, and supplies [b]** *Truck option:* - 17,000 truck shipments - Traffic fatality risks: 0 (0.25) *Truck/rail option:* - 7,580 truck shipments of waste from SSFL to an intermodal facility and then 470 rail shipments; 9,440 truck shipments of backfill, equipment, and supplies - Traffic fatality risks: 0 (0.32)	**Shipment of radioactive waste – truck/rail option [b]** Shipments – 3,530 truck shipments from SSFL to a an intermodal facility, then 220 rail shipments *Incident-free risks:* - Crew LCFs: 0 (6×10^{-5} to 1×10^{-4}) - Population LCFs: 0 (5×10^{-5} to 7×10^{-5}) *Accident risks:* - Population LCFs: 0 (1×10^{-10}) - Traffic fatalities: 0 (0.1) **Shipment of nonradioactive waste, backfill, equipment, and supplies [b]** *Truck option:* - 14,900 truck shipments - Traffic fatality risks: 0 (0.25) *Truck/rail option:* - 7,580 truck shipments of waste from SSFL to an intermodal facility and then 470 rail shipments; 7,290 truck shipments of backfill, equipment, and supplies - Traffic fatality risks: 0 (0.31)
Traffic	No increases in average daily traffic or LOS are expected on roads in the SSFL vicinity, with no traffic-induced damage to road pavement.	The weekday average daily traffic on Woolsey Canyon Road would increase by 7.2 to 7.3 percent during 9 years of soil removal and 5.6 percent during the final year. Traffic increases on other evaluated roads would be much smaller. Weekday motorist delays could occur on Woolsey Canyon Road and at its intersection with Valley Circle Boulevard. The LOS for Woolsey Canyon Road could change from a B rating to a C rating (see Appendix H, Table H–19). Other than Woolsey Canyon Road, traffic volumes on the evaluated roads may be reduced by use of multiple routes between SSFL and major highways. Traffic would impose about 200,000 ESALs on the evaluated roads, which would cause damage to the pavement and lead to roads needing repairs sooner than currently anticipated.	Impacts would be similar to those under the Cleanup to AOC LUT Values Alternative, except the increased level of traffic would last for a little more than 2 years. Traffic would impose about 51,000 ESALs on the evaluated roads, which would cause less damage than that under the Cleanup to AOC LUT Values Alternative, but would still lead to roads needing repairs sooner than currently anticipated.	Impacts would be similar to those under the Cleanup to AOC LUT Values Alternative, except the increased level of traffic would last for about 2 years. Traffic would impose about 40,000 ESALs on the evaluated roads, which would likely cause less damage than that under the Cleanup to Revised LUT Values Alternative, but would still lead to roads needing repairs sooner than currently anticipated.

Resource Area	Alternatives			
	Soil No Action	*Cleanup to AOC LUT Values*	*Cleanup to Revised LUT Values*	*Conservation of Natural Resources*
Human health	**Workers** Minimal exposures from monitoring and maintenance activities; workers would be protected from chemical and radiation exposure and industrial hazards through compliance with DOE requirements for worker safety and radiation protection. **Valley fever** [c] There would be no change in the risk of exposure to the fungus spores that cause valley fever. **Members of the public** [d] *Hypothetical Onsite Suburban Resident* – Cancer risk and toxicity impacts from chemicals and/or radionuclides [d] in Area IV and the NBZ are comparable to or less than those determined for background soil. *Hypothetical Onsite Recreational User* – Cancer risk and toxicity impacts from chemical and/or radionuclides [e] in Area IV and the NBZ are comparable to or less than those determined for background soil.	**Workers** Exposure would be higher than those under the No Action Alternative during 10 years of soil remediation. Remediation workers would be protected from chemical and radiation exposure through compliance with DOE requirements for worker safety and radiation protection. Radiation protection practices would be employed so that radiation doses are ALARA. **Valley fever** The potential for exposure of workers and the public to fungus spores would be managed through control of fugitive dust, but would be largest among the action alternatives because of the volume of soil that would be disturbed (933,000 cubic yards). **Members of the public** Chemically and radioactively impacted soil exceeding AOC LUT values would be removed. Thereafter, risks to a hypothetical onsite suburban resident or recreational user would be less than those under the No Action Alternative.	**Workers** The duration of higher exposures would be slightly more than 2 years. Workers would have less exposure to chemically impacted soil than under the Cleanup to AOC LUT Values Alternative; exposure to radioactive constituents would be the same. Remediation worker protection would be the same as under the Cleanup to AOC LUT Values Alternative. **Valley fever** The potential for exposure of workers and the public to fungus spores would be managed through control of fugitive dust and would be smaller than that under the Cleanup to AOC LUT Values Alternative because the volume of soil that would be disturbed would be less (192,000 cubic yards). **Members of the public** Chemically impacted soil exceeding revised LUT values would be removed, as would radioactively contaminated soil exceeding AOC LUT values. Thereafter, risks to a hypothetical onsite suburban resident or recreational user would be less than those under the Soil No Action Alternative, but more than those under the Cleanup to AOC LUT Values Alternative.	**Workers** The duration of higher exposures would be 2 years. Workers would have less exposure to chemical and radioactive constituents than under the Cleanup to AOC LUT Values Alternative. Remediation worker protection would be the same as under the Cleanup to AOC LUT Values Alternative. **Valley fever** The potential for exposure of workers and the public to fungus spores would be the lowest among the action alternatives because the smallest volume of soil would be disturbed (148,000 cubic yards). **Members of the public** Chemically and radioactively impacted soil exceeding risk assessment-based values would be removed. Thereafter, risks to a hypothetical onsite suburban resident or recreational user would be less than those under the Soil No Action Alternative, but more than those under the Cleanup to AOC LUT Values or Cleanup to Revised LUT Values Alternative.

Resource Area	*Alternatives* Soil No Action	Cleanup to AOC LUT Values	Cleanup to Revised LUT Values	Conservation of Natural Resources
Waste management	Very small quantities of waste from site maintenance activities may be annually generated, which would be transported to offsite waste management facilities with no impacts on the disposal capacities of these facilities.	LLW/MLLW – 91,000 cubic yards Hazardous waste – 49,000 cubic yards Nonhazardous waste – 793,000 cubic yards No exceedance of total waste capacity or a daily or annual waste acceptance limit is expected at any evaluated facility.	LLW/MLLW – 91,000 cubic yards Hazardous waste – 49,000 cubic yards Nonhazardous waste – 52,000 cubic yards No exceedance of total waste capacity or a daily or annual waste acceptance limit is expected at any evaluated facility.	LLW/MLLW 47,000 cubic yards Hazardous waste – 49,000 cubic yards Nonhazardous waste – 52,000 cubic yards No exceedance of total waste capacity or a daily or annual waste acceptance limit is expected at any evaluated facility.
Cultural resources	No archaeological or architectural cultural resources would be affected. No adverse impacts are expected on traditional cultural resources.	Archaeological and architectural cultural resources would not be affected. During 10 years of soil removal, adverse impacts on the integrity of traditional cultural resources are possible from changes in setting, augmented site access during remediation, disturbance of landscape (130 acres), and potential discovery of unanticipated archaeological sites.	Archaeological and architectural cultural resources would not be affected. Adverse impacts on the integrity of traditional cultural resources are possible, similar to those under the Cleanup to AOC LUT Values Alternative, but less likely. There would be reduced changes in setting because soil removal and site access would occur for slightly more than 2 years, with less disturbance of landscape (40 acres) and less soil removed, which would reduce the potential for discovery of unanticipated archaeological sites.	Archaeological and architectural cultural resources would not be affected. Adverse impacts on the integrity of traditional cultural resources are possible, similar to those under the Cleanup to Revised LUT Values Alternatives, but less likely. There would be slightly reduced changes in setting because soil removal and site access would occur for 2 years, with less disturbance of landscape (32 acres) and less soil removed, which would further reduce the potential for discovery of unanticipated archaeological sites.

Resource Area	*Alternatives*			
	Soil No Action	***Cleanup to AOC LUT Values***	***Cleanup to Revised LUT Values***	***Conservation of Natural Resources***
Socioeconomics	No socioeconomic impacts on employment, businesses, infrastructure and municipal services, housing, or local government revenue are expected in Los Angeles and Ventura Counties. No traffic-related impacts are expected at offsite disposal facilities.	- Employment would increase by 25 workers for 10 years, with minor beneficial socioeconomic impacts. - Truck traffic in the SSFL vicinity would last for 10 years, but is not expected to have socioeconomic impacts on businesses on the evaluated routes between SSFL and major highways. - Traffic could damage road pavement along segments of the routes to major highways, which could affect government finances. DOE may need to negotiate with local governments to contribute its portion of the cost for maintenance and repair of affected roads. No other impacts on municipal services are expected. - Workers would be primarily employed from the SSFL ROI, with no impacts on housing availability. - Revenue from taxes from purchases of materials and fuel and rental of equipment, as well as permitting fees for project activities, could increase revenues for local governments during the 10 years of remediation. - Because of the small numbers of daily deliveries of soil to the evaluated radioactive and hazardous waste facilities, no socioeconomic impacts are expected on businesses near these facilities. For deliveries of nonhazardous soil to the evaluated facilities, no or minimal socioeconomic impacts are expected on businesses near these facilities. Disposal fees could increase revenues for public or private entities. Any adverse impacts may be reduced by shipping soil waste to multiple authorized disposal facilities, using multiple local routes (as available) to a disposal facility, or shipping waste by rail to rail-accessible facilities.	- Employment would increase by 25 workers for slightly more than 2 years, with minor beneficial socioeconomic impacts. - Truck traffic in the SSFL vicinity would last for slightly more than 2 years, but is not expected to have socioeconomic impacts on businesses on the evaluated routes between SSFL and major highways. - Same as under the Cleanup to AOC LUT Values Alternative, except there would be fewer truck round trips, which would have a smaller potential for damage of road pavement. - Impacts on housing availability would be the same as those under the Cleanup to AOC LUT Values Alternative. - Potential funding impacts and benefits would be reduced compared to those under the Cleanup to AOC LUT Values Alternative because of the shorter operational duration of slightly more than 2 years. - Similar disposal facility impacts as those under the Cleanup to AOC LUT Values Alternative, except that there would be increased daily deliveries to evaluated radioactive and hazardous waste facilities, and significantly reduced daily and total deliveries to the evaluated nonhazardous waste facilities. There would be reduced disposal fees at the evaluated hazardous waste facilities. No socioeconomic impacts on businesses are expected from delivery of waste to any evaluated facility.	- Employment would increase by 25 workers for 2 years, with minor beneficial socioeconomic impacts. - Truck traffic in the SSFL vicinity would last for 2 years, but is not expected to have socioeconomic impacts on businesses on the evaluated routes between SSFL and major highways. - Same as under the Cleanup to Revised LUT Values Alternative, except there would be fewer truck round trips, which would have a smaller potential for damage of road pavement. - Impacts on housing availability would be the same as those under the Cleanup to AOC LUT Values Alternative. - Potential funding impacts and benefits would be reduced compared to those under the Cleanup to Revised LUT Values Alternative because of the slightly shorter operational duration of 2 years. - Similar disposal facility impacts as those under the Cleanup to Revised LUT Values Alternative, except that shipments to radioactive waste facilities would be reduced, meaning that disposal fees that could provide revenues for public or private entities also would be reduced. No socioeconomic impacts on businesses are expected from delivery of waste to any evaluated facility.

Resource Area	Alternatives			
	Soil No Action	***Cleanup to AOC LUT Values***	***Cleanup to Revised LUT Values***	***Conservation of Natural Resources***
Environmental justice	- Potential risks to a hypothetical (after 100 years) onsite suburban resident or recreational user would be extremely low (see Human Health). No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI. - No traffic impacts above baseline conditions are expected in the SSFL ROI. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI. - No traffic impacts above baseline conditions are expected in the regional ROIs. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the regional ROIs.	- After remediation, potential risks to a hypothetical onsite suburban resident or recreational user would be extremely low. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI. - During the 10 years of soil removal, weekday traffic in the SSFL ROI would increase, but the evaluated routes would traverse minority and non-minority communities, as well as low-income and non-low-income communities, and would not pass through Native American lands. This indicates that traffic impacts on Native American, minority, or low-income populations would be the same as those experienced by the general population. No disproportionately high and adverse impacts are expected in the SSFL ROI. - There would be no noticeable increase in traffic in the vicinities of the disposal facilities evaluated for receipt of radiologically contaminated or hazardous soil, as well as no or minimal impacts in the vicinities of the facilities evaluated for receipt of nonhazardous soil. By using multiple disposal facilities or rail transport to rail-accessible facilities, traffic in the vicinities of the evaluated disposal facilities could be reduced. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the regional ROIs.	- Impacts on Native American tribes and minority and low-income populations in the SSFL ROI and in the vicinities of the disposal facilities would be similar to those under the Cleanup to AOC LUT Values Alternative, except that they would last for slightly more than 2 years. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations.	- Impacts on Native American tribes and minority and low-income populations in the SSFL ROI and in the vicinities of disposal facilities would be similar to those under the Cleanup to AOC LUT Values Alternative, except that they would last for 2 years. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations.

Resource Area	*Alternatives*			
	Soil No Action	*Cleanup to AOC LUT Values*	*Cleanup to Revised LUT Values*	*Conservation of Natural Resources*
Sensitive-aged populations	- No traffic impacts above baseline conditions are expected in the SSFL ROI, with no disparate impacts (markedly distinct impacts relative to those on the general population) on sensitive-aged populations. - No traffic impacts above baseline conditions are expected in the regional ROIs, with no disparate impacts on sensitive-aged populations.	- During the 10-year duration of soil removal, there could be an increased risk to pedestrians along or crossing Woolsey Canyon Road, but this risk would be experienced by persons of all ages. There is not expected to be a significantly larger population of sensitive-aged persons in the group that could experience this risk compared to groups of persons living elsewhere in the SSFL ROI. Traffic volumes, and therefore risks, to pedestrians along other evaluated routes are not expected to be noticeably larger than those under baseline conditions. No disparate impacts on sensitive-aged populations are expected in the SSFL ROI. - There would be no or minimal impacts due to increased traffic in the regional ROIs. Using multiple facilities or rail transport to rail-accessible facilities, traffic may be reduced along any route that may pass near a school or recreation area. No disparate impacts are expected on sensitive-aged populations in the regional ROIs.	- Impacts in the SSFL ROI would be similar to those under the Cleanup to AOC LUT Values Alternative, except that increased traffic would occur for slightly more than 2 rather than 10 years. - Compared to under the Cleanup to AOC LUT Values Alternative, there would be larger traffic increases in the regional ROIs containing radioactive and hazardous waste disposal facilities and smaller traffic increases in the regional ROIs containing nonhazardous waste facilities. Increased traffic would occur for slightly more than 2 years. No disparate impacts are expected on sensitive-aged populations in the regional ROIs.	- Impacts in the SSFL ROI would be similar to those under the Cleanup to AOC LUT Values Alternative, except that increased traffic would occur for 2 rather than 10 years. - Similar traffic increases would occur in the regional ROIs containing radioactive, hazardous, and nonhazardous waste disposal facilities as those under the Cleanup to Revised LUT Values Alternative, except that the increased traffic to each type of facility would be of a shorter duration, with the longest duration being 2 years. No disparate impacts are expected on sensitive-aged populations in the regional ROIs.

ALARA = as low as reasonably achievable; AOC = *Administrative Order on Consent for Remediation*; BMP = best management practice; Boeing = The Boeing Company; CO = carbon monoxide; CO_2 = carbon dioxide; CMWD = Calleguas Municipal Water District; CNEL = community noise equivalent level; dBA = decibels A-weighted; ESAL = equivalent single-axle load; LCF = latent cancer fatality; LLW = low-level radioactive waste; LOS = level of service; LUT = Look-Up Table; MLLW = mixed low-level radioactive waste; NBZ = Northern Buffer Zone; NO_X = nitrogen oxides; NPDES = National Pollutant Discharge Elimination System; ROI = region of influence; SO_2 = sulfur dioxide; VOC = volatile organic compound.

[a] "Proposed exemption areas" refers to areas that are identified for the protection of biological and cultural resources in accordance with the 2010 AOC (DTSC 2010a). DOE would not take action in the proposed exemption areas unless it is demonstrated that levels of chemical or radioactive constituents in the soil would pose a risk to human health or the environment, as determined using risk-based screening levels from the *Final Standardized Risk Assessment Methodology Revision 2 Addendum, Santa Susana Field Laboratory, Ventura County, California* (MWH 2014).

[b] Transportation risks are presented as whole numbers with the actual calculated values presented in parentheses. Values in parentheses that have a negative power of 10 are less than 1. The larger the negative value of 10, the smaller the number.

[c] Valley fever is the initial form of coccidioidomycosis infection, a fungal infection caused by inhalation of airborne *Coccidioides* spp. spores that are present in certain arid soils. Spores from the fungus are found in the top 2 to 12 inches of soil in many parts of arid United States southwest. When soil containing this fungus is disturbed by activities such as digging or by the wind, the fungal spores can get into the air (CDC 2014; HESIS 2013).

[d] Because members of the public would be restricted from accessing the site through fencing, signage, and routine patrols by site security personnel, and DOE's intent would be to prevent public access to the site, impacts calculated for the onsite suburban resident and recreational user under the Soil No Action Alternative are hypothetical.

[e] All impacts for soil constituents are based on the mean (for chemicals) or median (for radionuclides) concentration for all constituents that had one or more exceedances of the LUT values.

Table S–8 Summary of Potential Environmental Consequences under the Building Demolition Alternatives

Resource Area	*Alternatives*	
	Building No Action	***Building Removal***
Land resources	- The land use designation for Area IV would be consistent with Ventura County requirements. - No impacts on use of Sage Ranch Park or other recreation areas in the SSFL vicinity are expected. - Electrical service to DOE-owned buildings would be severed, but electrical service in Area IV would remain. Electrical and water requirements would continue to be minimal. - No short-term changes to the aesthetics and visual quality of Area IV are expected, but DOE-owned buildings could dilapidate over time, decreasing aesthetics and visual quality.	- After removal of DOE-owned buildings, the remediated area would be consistent with the landowner's (Boeing's) intent to maintain its land as undeveloped open space (Boeing 2016b). - If waste and backfill were shipped over a 2- to 5-month period in each working year, the average daily traffic on Woolsey Canyon Road would increase by up to 5.3 percent, which could discourage weekday use of Sage Ranch Park. But if waste and backfill were shipped throughout each working year, the average daily traffic on Woolsey Canyon Road would increase by less than 1 percent, which would be unlikely to discourage weekday use of Sage Ranch Park. No impacts on the use of other recreation areas in the SSFL vicinity are expected; nonetheless, traffic on other roads past other recreation areas may be reduced by routing truck traffic among multiple routes between SSFL and major highways. - Annual electricity requirements would be minimal. About 315,000 gallons of water from CMWD would be annually used during 2 years. Although this annual water use would represent about 0.0005 percent of CMWD's annual supply, water use is an important consideration because of California's current drought conditions and Governor Brown's call for a statewide 25 percent reduction in potable water use (CA EO 2015). - There would be impacts on views of Area IV during the 2 years of building demolition, but long-term improvements to Area IV visual quality from returning the area to a stabilized, revegetated state.
Geology and soils	No impacts on geologic and paleontological resources are expected, and no worker activities would take place in zones where earthquake-induced landslides could occur. No impacts from soil erosion or loss of soil function are expected, and there would be no need for backfill obtained from offsite sources.	- No adverse impacts are expected on bedrock geologic resources. - Minimal impacts are expected on paleontological resources during building removal. - No risks to workers are expected from potential earthquake-induced landslides because building removal would occur outside of zones where such landslides could occur; however, in the event of an earthquake, there could be a risk to demolition workers resulting from building collapse. - Soil erosion would be minimized using BMPs, as summarized in Chapter 6. However, in the period between building removal and completion of site stabilization efforts, disturbed soil could erode, leading to some reduction of soil quality and functional capability within eroded areas. Because most of the area to be disturbed is currently occupied by buildings or asphalt, soil quality and functional capability within potentially eroded areas would likely be already reduced compared to that before development of Area IV. - Up to 13,500 cubic yards of backfill would be required, with chemical and radioactive constituents in concentrations meeting prescribed values (e.g., AOC LUT, revised LUT, or risk-assessment-based values).[a] Loss of soil function is possible if the backfill is not of equal soil quality, including the presence of regenerative structures, organic carbon, seed bank, and beneficial soil organisms, as that for current soil at Area IV. Because most of the area to be disturbed is currently occupied by buildings or asphalt, soil quality and functional capability would likely be already reduced compared to that before development of Area IV.
Surface water resources	No changes in surface water quality and stormwater runoff quantity and velocity from existing conditions are expected. Sources of potential surface water contamination would remain.	During building demolition, no adverse impacts on surface water quality are expected from stormwater runoff. Sources of potential surface water contamination would be removed. No increases in runoff quantity and velocity are expected that could overwhelm SSFL or regional stormwater control capacities.
Groundwater resources	No adverse impacts on groundwater quality and quantity are expected.	No adverse impacts are expected on groundwater quality. This alternative may require dewatering of the basement of Building 4024 to enable safe demolition. If this occurs, up to 200,000 gallons of groundwater could be withdrawn from Area IV that would be managed by methods such as treatment (as needed) and onsite discharge.

Resource Area	*Alternatives*	
	Building No Action	***Building Removal***
Biological resources	No adverse impacts on vegetation and wildlife habitat and biota; aquatic and wetland habitats and biota; or threatened, endangered, or rare species are expected.	- Removal of buildings would not be expected to cause measureable loss of native plant and wildlife communities, although habitat would be lost for native wildlife species using the buildings for roosting or nesting, with potential disturbance of MBTA-protected species. There would be offsetting beneficial impacts on native wildlife from elimination of habitat for nuisance species and creation of restored habitat after the buildings are removed. If backfill is substantially different from soil present before development of Area IV, it may not support restoration of vegetation similar to that previously present. - Wetlands or jurisdictional waters of the United States would not be directly impacted. Existing drainage structures and impervious surfaces may be removed, but replaced by more natural drainage patterns. Indirect impacts from runoff would be minimized by use of BMPs and mitigation measures. - Impacts on special-status animal species or their habitats would be short-term, may be mitigated or avoided, and would be unlikely to result in take of listed wildlife species. Adverse impacts on individual Santa Susana tarplants could occur if they are established next to buildings at the time that demolition occurs. No other special-status plant species are likely to be impacted because none have been observed or would be expected in the already disturbed areas adjacent to the buildings.
Air quality and climate	No emissions of airborne pollutants, including greenhouse gases, above baseline conditions are expected.	Emissions of pollutants such as VOCs, CO, NO_X, SO_2, and particulates would occur from onsite activities, with nearly all particulate emissions arising from fugitive dust; additional emissions would occur from vehicles, including those transporting waste and backfill. A total of 1,800 to 3,900 metric tons of CO_2 would be emitted, primarily from vehicles.
Noise	No noise impacts from onsite activities or from traffic to and from SSFL above baseline conditions are expected.	Noise levels at the closest residence to Area IV are expected to be well below 65 dBA CNEL, with no expected adverse noise impacts. No adverse noise impacts are expected from traffic along the evaluated routes between SSFL and major highways. Time-averaged daily noise levels at a distance of 100 feet from the evaluated roads could increase by up to 3.5 dBA CNEL, where the final noise level would be below 65 dBA CNEL (the threshold for an adverse impact is an increase of 5 dBA CNEL). Along one section of Valley Circle Boulevard, where the noise level already exceeds 65 dBA CNEL, the noise level would increase by no more than 0.6 dBA CNEL (the threshold for an adverse impact when the final noise level exceeds 65 dBA CNEL is an increase of 3 dBA CNEL).
Transportation [b]	No impacts above baseline conditions are expected.	**Shipment of radioactive waste – truck option** [b] Shipments – 1,030 truck shipments *Incident-free risks:* - Crew LCFs: 0 (5×10^{-5} to 1×10^{-4}) - Population LCFs: 0 (1×10^{-5} to 3×10^{-5}) *Accident risks:* - Population LCFs: 0 (5×10^{-11} to 6×10^{-10}) - Traffic fatalities: 0 (6×10^{-3} to 4×10^{-2})
		Shipment of radioactive waste – truck/rail option [b] Shipments – 1,030 truck shipments from SSFL to an intermodal facility, then 65 rail shipments *Incident-free risks:* - Crew LCFs: 0 (2×10^{-5} to 4×10^{-5}) - Population LCFs: 0 (2×10^{-5}) *Accident risks:* Population LCFs: 0 (4×10^{-11}) Traffic fatalities: 0 (3×10^{-2})
		- **Shipment of nonradioactive waste, backfill, equipment, and supplies** [b] *Truck option:* - 1,400 truck shipments of waste, backfill, equipment, and supplies - Traffic fatality risks: 0 (2.3×10^{-3}) *Truck/rail option:* - 130 truck shipments of hazardous/nonhazardous waste from SSFL to an intermodal facility, and then 10 rail shipments; plus 1,260 truck shipments of recyclable material, backfill, equipment, and supplies Traffic fatality risks: 0 (7.0×10^{-3})

Resource Area	*Alternatives*	
	Building No Action	***Building Removal***
Traffic	No increases in average daily traffic or LOS on roads in the SSFL vicinity are expected, with no traffic-induced damage to road pavement.	The weekday average daily traffic on Woolsey Canyon Road would increase by about 3.4 percent in the first year of the project and 5.3 percent in in the second year, leading to potential weekday motorist delays on this road, assuming waste and backfill shipments occurred during a 2- to 5-month period in each working year. Traffic increases on other evaluated roads would be smaller. Increases in weekday average daily traffic on Woolsey Canyon Road could be reduced to less than 1 percent, with corresponding reductions on other roads, assuming waste and backfill shipments were made throughout each working year. Except for Woolsey Canyon Road, traffic on the evaluated roads may be further reduced by distributing traffic among multiple routes between SSFL and major highways. Assuming waste and backfill shipments are made during 2 to 5 months in each year, the LOS for Woolsey Canyon Road could change from a B rating to a C rating. No change in LOS rating would be expected if waste and backfill shipments were made throughout each working year. LOS ratings for other roads are not expected to change. Truck traffic would impose about 5,200 ESALs on the evaluated routes between SSFL and major highways. This increased traffic would likely have some adverse impacts on road pavement, so that the affected roads may require repair sooner than currently anticipated.
Human health	**Workers** Exposures from monitoring and maintenance activities would be minimal. Workers would be protected from radiation exposure and industrial hazards through compliance with DOE requirements for worker safety and radiation protection. **Members of the public** No impacts are expected because access to the buildings would be restricted.	**Workers** Conservatively assuming no reduction in exposure as D&D progresses, impacts would be: *Individual worker* - Dose: 240 millirem per year - Project LCF risk: 1 in 10,000 *Worker population* - Total Dose: 12.5 person-rem - Project LCFs: 0 (0.003) Building demolition workers would be protected from radiation exposure and industrial hazards through compliance with DOE requirements for worker safety and radiation protection. **Members of the public** No impacts are expected during building removal. Following building removal, there would be no impacts attributable to the buildings to a hypothetical onsite suburban resident or recreational user. Any residual impacts would be associated with chemicals or radionuclides in the soil (see Table S–7).
Waste management	Very small quantities of waste from site maintenance activities may be annually generated, which would be transported to offsite waste management facilities with no impacts on the disposal capacities of these facilities.	LLW/MLLW – 10,600 cubic yards Hazardous waste – 120 cubic yards Nonhazardous waste – 1,220 cubic yards Recyclable material – 3,540 cubic yards No exceedance of total waste capacity or a daily or annual waste acceptance limit is expected at any evaluated facility.

Resource Area	Alternatives	
	Building No Action	**Building Removal**
Cultural resources	No archaeological or structural cultural resources would be affected. No adverse impacts on traditional cultural resources are expected.	No adverse effects are expected on archaeological or architectural cultural resources; nor would adverse impacts be expected on traditional cultural resources.
Socioeconomics	No socioeconomic impacts on employment, regional truck traffic, infrastructure and municipal services, housing, and local government revenue are expected in Los Angeles and Ventura Counties. No socioeconomic impacts are expected on businesses in the vicinities of the offsite recycle and disposal facilities.	- Building removal would employ 26 workers with minor beneficial socioeconomic impacts. - Increased traffic during 2 years of building demolition is not expected to have socioeconomic impacts on businesses along the evaluated routes between SSFL and major highways. - Road pavement deterioration would increase expenses for local governments. DOE may need to negotiate with local governments to contribute its portion of the cost for maintenance and repair of affected roads. No other impacts are expected on municipal services such as police or fire services. Because workers would be primarily employed from Los Angeles and Ventura Counties, workers would already be living in the ROI and would not need new housing. Therefore, there would be no impacts on housing availability - Potential increased expenses for local governments in the SSFL ROI due to pavement deterioration could be countered by potential increased tax revenues due to purchases of materials and fuel and rental of equipment, as well as permitting fees for project activities. - No noticeable increases in traffic volumes are expected at the evaluated recycle and disposal facilities, with no expected socioeconomic impacts on businesses in the regional ROIs.
Environmental justice	No human health impacts are expected on members of the public. There would be no increases in traffic above baseline conditions in the SSFL and regional ROIs, and thus, no additional traffic-related impacts. Therefore, no disproportionately high and adverse impacts are expected on Native American tribes and minority or low-income populations in the SSFL ROI and the regional ROIs.	- No impacts are expected on members of the public during building removal; following building removal, there would be no impacts on an onsite suburban resident or recreational user that would be attributable to the buildings. Therefore, no high and disproportionate adverse impacts are expected on Native American tribes and minority or low-income populations in the SSFL ROI. - Traffic in the SSFL ROI would increase, but the evaluated routes between SSFL and major highways would traverse minority and non-minority communities, as well as low-income and non-low-income communities, and would not pass through Native American lands. This indicates that traffic impacts on Native American, minority, or low-income populations would be the same as those experienced by the general population. Therefore, no disproportionately high and adverse traffic-related impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI. - There would be no noticeable increase in heavy-duty truck traffic in the vicinities of the evaluated recycle and disposal facilities. Nonetheless, use of multiple facilities or rail transport to rail-accessible facilities would reduce truck traffic in the vicinities of the evaluated facilities. Therefore, no disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the regional ROIs.

Resource Area	*Alternatives*	
	Building No Action	***Building Removal***
Sensitive-aged populations	There would be no increases in traffic above baseline conditions in the SSFL ROI or the regional ROIs, and thus, no disparate impacts (markedly distinct impacts relative to those on the general population) are expected on sensitive-aged populations.	- Assuming shipment of waste and backfill occurs during a 2- to 5-month period in each working year, there could be an increased risk to pedestrians along or crossing Woolsey Canyon Road, but this risk would be experienced by persons of all ages. Traffic volumes could be reduced by instead shipping waste and backfill throughout each working year, and, on other than Woolsey Canyon Road, by using multiple routes between SSFL and major highway systems, thereby reducing traffic on any evaluated road that may pass by or near a school or recreation area. Therefore, no disparate impacts on sensitive-aged populations are expected in the SSFL ROI. - There would be no noticeable increase in heavy-duty truck traffic in the vicinities of the evaluated recycle and waste disposal facilities. Nonetheless, use of multiple recycle and disposal facilities or rail transport to rail-accessible facilities could reduce traffic through communities or locations (e.g., schools, recreation areas) where sensitive-aged populations may be present along the transit routes. Therefore, no disparate impacts are expected on sensitive-aged populations in the regional ROIs.

AOC = *Administrative Order on Consent for Remediation*; BMP = best management practice; Boeing = The Boeing Company; CO = carbon monoxide; CO_2 = carbon dioxide; CMWD = Calleguas Municipal Water District; CNEL = Community Noise Equivalent Level; D&D = decontamination and decommissioning; dBA = decibels A-weighted; ESAL = equivalent single-axle load; LCF = latent cancer fatality; LLW = low-level radioactive waste; LOS = level of service; LUT = Look-Up Table; MBTA = Migratory Bird Treaty Act; MLLW = mixed low-level radioactive waste; NO_X = nitrogen oxide; ROI = region of interest; SO_2 = sulfur dioxide; VOC = volatile organic compound.

[a] Estimates of backfill volume range from 8,140 cubic yards to 13,500 cubic yards (see Appendix D); the larger estimate (13,500 cubic yards) was used for analysis in this EIS.

[b] Transportation and human health population risks are presented as whole numbers, with the actual calculated values presented in parentheses. Values in parentheses that have a negative power of 10 are less than 1. The larger the negative value of 10, the smaller the number.

Table S–9 Summary of Potential Environmental Consequences under the Groundwater Remedial Alternatives

Resource Area	*Alternatives*		
	Groundwater No Action	***Groundwater Monitored Natural Attenuation***	***Groundwater Treatment***
Land resources	- The land use designation for Area IV and the NBZ would be consistent with Ventura County requirements. - No impacts on use of Sage Ranch Park or other recreation areas in the SSFL vicinity are expected. - Electrical and water requirements would continue to be minimal. - There would be no change in Area IV aesthetics and visual quality from baseline conditions.	- No change is expected in land use designation. - The minimal additional traffic would not restrict access to or impact activities at Sage Ranch Park or other recreation areas in the SSFL vicinity. - Electricity requirements would be minimal. A total of 5,000 gallons of water from CMWD would be used during installation of five monitoring wells, which would represent about 9×10^{-6} percent of CMWD's annual supply. - There would be visual impacts during well installation due to views of drill rigs and supporting equipment. These impacts would occur for less than 1 year. Monitoring activities would not alter Area IV aesthetics or visual quality compared to baseline conditions.	- No change is expected in land use designation. - Traffic volumes would be larger than those under the Groundwater Monitored Natural Attenuation Alternative, but would not restrict access to, or impact activities at, Sage Ranch Park or other recreation areas in the SSFL vicinity. - Electricity requirements would be minimal. A total of 8,000 gallons of water from CMWD would be used for dust suppression during bedrock removal, which would represent about 1×10^{-5} percent of CMWD's annual supply. - There would be visual impacts during groundwater treatment system construction and operation due to the presence of water storage tanks, treatment units and other structures, and overland piping. These impacts would occur during 0.5 years of treatment system installation, followed by 5 years of treatment system operation. Long-term views at Area IV would be similar to baseline conditions.
Geology and soils	No impacts on geologic (bedrock) and paleontological resources are expected. No activities would take place in zones where earthquake-induced landslides could occur. No soil erosion or loss of soil function is expected from well monitoring activities, and there would be no need for backfill obtained from offsite sources.	Same as under the Groundwater No Action Alternative, except there would be a minimal potential for soil erosion and loss of soil function during well installation.	- Loss of 1,050 cubic yards of subsurface bedrock. - No impacts are expected on paleontological resources. - No activities would take place in zones where earthquake-induced landslides could occur. - There would be minimal risk of soil loss due to erosion. - Loss of soil function may occur at some treatment system locations during the installation of groundwater treatment systems, including overland piping, and during the subsequent projected 5 years of treatment system operations. - About 1,280 cubic yards of backfill would be required, with chemicals and radionuclides in concentrations meeting prescribed values (e.g., AOC LUT, revised LUT, or risk-assessment-based values).
Surface water resources	No short-term changes from baseline conditions on surface water quality are expected, although there would be a long-term reduction of sources of potential surface water contamination. No change from baseline conditions on stormwater runoff quantity and velocity are expected.	No adverse impacts on surface water quality during well installation and well monitoring. Long-term reduction of sources of potential surface water contamination. No adverse impacts on SSFL or regional stormwater control capacities are expected.	No adverse impacts on surface water quality during treatment system installation and operation. The time required to eliminate sources of potential surface water contamination would be much shorter than that under the Groundwater Monitored Natural Attenuation Alternative. No adverse impacts on SSFL or regional stormwater control capacities are expected.

Resource Area	*Alternatives*		
	Groundwater No Action	***Groundwater Monitored Natural Attenuation***	***Groundwater Treatment***
Groundwater resources	No additional adverse impacts on groundwater quality are expected. Groundwater quality would improve over time as chemical and radioactive constituents attenuate or decay. There would be no requirement to withdraw site groundwater above baseline conditions.	The same impacts on groundwater quality are expected as those under the Groundwater No Action Alternative. There could be slightly increased withdrawals of Area IV groundwater as part of groundwater monitoring operations.	No adverse impacts on groundwater quality or quantity are expected. Positive impacts on water quality would result from removal of contamination sources or treatment of groundwater.
Biological resources	Minor adverse impacts on vegetation and wildlife habitat and biota would occur from groundwater monitoring operations. No adverse impacts on aquatic and wetland habitats and biota or threatened, endangered, or rare species are expected.	Five new wells would be installed. Because these wells would be installed generally in previously disturbed areas, impacts on vegetation and wildlife habitat and biota from periodic groundwater sampling would be minor and localized. No adverse impacts on aquatic and wetland habitats and biota are expected. If a monitoring well were installed in a proposed exemption area, BMPs and mitigation measures would avoid or minimize adverse impacts of well installation and monitoring on threatened, endangered, or rare species; no adverse impacts on these species are expected from monitoring activities outside the proposed exemption areas.	Impacts on vegetation and wildlife habitat and biota would be larger than those under the Groundwater Monitored Natural Attenuation Alternative, but nonetheless localized and minor. Installation of groundwater treatment systems would generally be in previously disturbed habitats, with localized and minor impacts. Assuming sandstone bedrock containing strontium-90 source is removed, up to 0.25 acre of previously disturbed land near RMHF would be affected. No adverse impacts are expected on aquatic and wetland habitats and biota. Potential impacts on threatened, endangered, or rare species would be minimal as described under the Groundwater Monitored Natural Attenuation Alternative.
Air quality and climate	No emissions of airborne pollutants, including greenhouse gases, above baseline conditions are expected.	Minor quantities of pollutants such as VOCs, CO, NO_X, SO_2, and particulates would be emitted during monitoring well installation and groundwater monitoring and from on-road vehicles. Minimal emissions of CO_2 are expected.	Small quantities of VOCs, CO, NO_X, SO_2, and particulates would be emitted during bedrock removal and treatment system installation. Additional emissions would occur from on-road vehicles. A total of 180 to 360 metric tons of CO_2 would be emitted, primarily from vehicles.
Noise	No noise impacts above baseline conditions from onsite activities or from traffic to and from SSFL are expected.	Noise levels at the closest residence could increase slightly compared to those under the Groundwater No Action Alternative, but are still expected to be well below 65 dBA CNEL, with no adverse noise impacts. There could be 11 heavy-duty truck round trips distributed over a working year, with no expected adverse traffic-related noise impacts.	Noise levels from onsite activities at the closest residence could slightly increase compared to those under the Groundwater Monitored Natural Attenuation Alternative, but are still expected to be well below 65 dBA CNEL, with no adverse noise impacts.

Resource Area	Alternatives		
	Groundwater No Action	**Groundwater Monitored Natural Attenuation**	**Groundwater Treatment**
Transportation [a]	No impacts above baseline conditions are expected.	**Shipment of nonhazardous waste, equipment, and supplies** [a, b] Shipments – 280 shipments by truck. Traffic fatality accident risks – 0 (1.5×10^{-4})	**Shipment of radioactive waste – truck option** [a] Shipments – 130 truck shipments *Incident-free risks:* - Crew LCFs: 0 (6×10^{-6} to 1×10^{-5}) - Population LCFs: 0 (2×10^{-6} to 4×10^{-6}) *Accident risks:* - Population LCFs: 0 (7×10^{-12} to 8×10^{-11}) - Traffic fatalities: 0 (8×10^{-4} to 5×10^{-3}) **Shipment of radioactive waste – truck/rail option** [a] Shipments – 130 truck shipments from SSFL to an intermodal facility, then 10 rail shipments *Incident-free risks:* - Crew LCFs: 0 (2×10^{-6} to 3×10^{-6}) - Population LCFs: 0 (2×10^{-6} to 3×10^{-6}) *Accident risks:* - Population LCFs: 0 (5×10^{-12}) - Traffic fatalities: 0 (4×10^{-3}) **Shipment of nonradioactive waste, backfill, equipment, and supplies** [a] *Truck option:* - 420 truck shipments - Traffic fatality risks: 0 (0.015) *Truck/rail option:* Not applicable. All shipments are by truck.
Traffic	No increases in average daily traffic or LOS on roads in the SSFL vicinity are expected, with no traffic-induced damage to road pavement.	The weekday average daily traffic on Woolsey Canyon Road would increase by 0.16 percent during 1 year. Traffic increases on other roads and during other years when shipments could occur would be smaller. No traffic-related impacts are expected. LOS ratings would not change for any evaluated road. No noticeable increase in ESALs would occur on the evaluated roads between SSFL and major highways, with no damage to road pavement.	The weekday average daily traffic on Woolsey Canyon Road would increase by 0.36 percent during 1 year. Traffic increases on other roads and during other years when shipments could occur would be smaller. No traffic-related impacts are expected. LOS ratings would not change for any evaluated road. Truck traffic would impose about 990 ESALs on the evaluated roads between SSFL and major highways, with minimal potential for damage to road pavement.

Resource Area	Alternatives		
	Groundwater No Action	***Groundwater Monitored Natural Attenuation***	***Groundwater Treatment***
Human health	**Worker** There would be no impacts on workers solely attributable to continuation of the current groundwater monitoring program; workers could receive a radiation dose from buildings and soil from monitoring and maintenance activities.	**Worker** Same as the Groundwater No Action Alternative.	**Worker** Workers would receive a radiation dose from excavation of contaminated bedrock. *Individual worker* - Dose: 130 millirem - Project LCF risk: 1 in 100,000 *Worker population* - Total Dose: 0.7 person-rem - Project LCFs: 0 (5×10^{-5}) Workers would be protected from industrial hazards and radiation exposure through compliance with DOE requirements for worker safety and radiation protection.
	Members of the public No impacts on a hypothetical future onsite suburban resident or recreational user are expected because groundwater wells do not produce sufficient water for residential use, and well water use by a recreational user is not expected. Considering the slow movement of Area IV groundwater and the concentrations of chemicals and radionuclides, no impacts on offsite members of the public are expected because groundwater migration is not expected to reach offsite receptors prior to decay below screening levels.	**Members of the public** Same as the Groundwater No Action Alternative.	**Members of the public** Same as the Groundwater No Action Alternative.
Waste management	No impacts are expected on the capacity of the permitted wastewater treatment plant that would receive approximately 250 gallons of purge water annually from Area IV.	Nonhazardous waste – 10 cubic yards Well development water – 5,000 gallons Monitoring purge water – 250 gallons/year No exceedance of total waste capacity or a daily or annual waste acceptance limit is expected at any evaluated facility.	LLW/MLLW – 1,700 cubic yards [c] Hazardous waste – 26 cubic yards [c] No exceedance of total waste capacity or a daily or annual waste acceptance limit is expected at any evaluated facility.

	Alternatives		
Resource Area	***Groundwater No Action***	***Groundwater Monitored Natural Attenuation***	***Groundwater Treatment***
Cultural resources	No archaeological or architectural cultural resources would be affected. No adverse impacts on traditional cultural resources are expected.	Archaeological and architectural cultural resources likely would not be affected. Regarding traditional cultural resources, changes to setting are possible from installation of five additional monitoring wells.	Archaeological and architectural cultural resources likely would not be affected. Regarding traditional cultural resources, changes to setting are possible during installation and operation of groundwater treatment systems and strontium-90 source removal.
Socioeconomics	No socioeconomic impacts on employment, regional truck traffic, infrastructure and municipal services, housing, and local government revenue are expected in Los Angeles and Ventura Counties. No socioeconomic impacts on businesses in the vicinities of the offsite waste management facilities are expected.	Minimal beneficial socioeconomic impacts from worker employment and purchases of equipment and supplies. There would be no socioeconomic impacts on businesses in the SSFL vicinity and no damage to pavement from additional traffic that could increase expenses for local governments.	Minimal beneficial socioeconomic impacts from worker employment and purchases of equipment and supplies. There would be no socioeconomic impacts on businesses in the SSFL vicinity and minimal damage to pavement from additional traffic that could increase expenses for local governments.
Environmental justice	No impacts on the health of members of the public are expected. There would be no increases in traffic above baseline conditions in the SSFL and regional ROIs, and thus, no additional traffic-related impacts. No disproportionate impacts on Native American tribes and minority and low-income populations are expected in the SSFL ROI or regional ROIs.	- No impacts on the health of members of the public are expected. Therefore, no disproportionately high and adverse impacts on Native American tribes and minority and low-income populations in the SSFL ROI are expected. - Because the increase in average daily traffic on the evaluated roads in the SSFL vicinity is very small (much less than 1 percent), no traffic impacts are expected. No disproportionately high and adverse impacts on Native American tribes and minority and low-income populations in the SSFL ROI are expected. - There would be no noticeable increase in truck traffic in the vicinity of any facility receiving waste under this alternative, with no expected traffic impacts. No disproportionately high and adverse impacts on Native American tribes and minority and low-income populations in the regional ROIs are expected.	- No impacts on the health of members of the public are expected. Therefore, no disproportionately high and adverse impacts on Native American tribes and minority and low-income populations in the SSFL ROI are expected. - The increase in average daily traffic on the evaluated roads in the SSFL vicinity would be slightly greater than that under the Groundwater Monitored Natural Attenuation Alternative, but the peak-year increase would still average less than 1 percent, with no expected traffic impacts. Therefore, no disproportionately high and adverse impacts on Native American tribes and minority and low-income populations in the SSFL ROI are expected. - There would be no noticeable increase in truck traffic in the vicinity of any facility receiving waste under this alternative, with no expected traffic impacts. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the regional ROIs.

Resource Area	*Alternatives*		
	Groundwater No Action	***Groundwater Monitored Natural Attenuation***	***Groundwater Treatment***
Sensitive-aged populations	There would be no increases in traffic above baseline conditions in the SSFL ROI and the regional ROIs, and thus, no additional traffic-related impacts. No disparate impacts (markedly distinct impacts relative to those on the general population) on sensitive-aged populations are expected.	- Because the increase in average daily traffic on the evaluated roads is very small (much less than 1 percent), no disparate impacts are expected on sensitive-aged populations in the SSFL ROI. - There would be no noticeable increase in truck traffic in the vicinities of disposal facilities, with no disparate impacts expected on sensitive-aged populations in the regional ROIs.	- The increase in average daily traffic on the evaluated roads would be slightly greater than that under the Groundwater Monitored Natural Attenuation Alternative, but the peak-year increase in average daily traffic would still be less than 1 percent. No disparate impacts are expected on sensitive-aged populations in the SSFL ROI. - There would be no noticeable increase in truck traffic in the vicinity of any facility receiving waste under this alternative, with no disparate impacts expected on sensitive-aged populations in the regional ROIs.

AOC = *Administrative Order on Consent for Remediation*; BMP = best management practice; CNEL = community noise equivalent level; CO = carbon monoxide; CO_2 = carbon dioxide; CMWD = Calleguas Municipal Water District; dBA = decibels A-weighted; ESAL = equivalent single-axle load; LCF = latent cancer fatality; LLW = low-level radioactive waste; LOS = level of service; LUT = Look-Up Table; MLLW = mixed low-level radioactive waste; NBZ = Northern Buffer Zone; NO_X = nitrogen oxide; RMHF = Radioactive Materials Handling Facility; ROI = region of influence; SO_2 = sulfur dioxide; VOC = volatile organic compound.

[a] Transportation risk results are presented as whole numbers with the actual calculated values presented in parentheses. Values in parentheses that have a negative power of 10 are less than 1. The larger the negative value of 10, the smaller the number.

[b] Wastes generated under the Groundwater Monitored Natural Attenuation Alternative consist of very small quantities of cuttings from monitoring well installation and water from well installation and sampling that are shipped by truck only. These wastes are not expected to be classified as low-level or mixed low-level radioactive waste, but if determined otherwise when generated, would be safely transported to appropriate authorized or permitted facilities for disposition.

[c] These volumes reflect conservative estimates of waste generation considering the range of groundwater treatment technologies that may be implemented in the future.

S.11.2 Potential Environmental Consequences of Combined Action Alternatives

This section addresses potential impacts for each resource area, assuming (1) implementation of six possible combinations of action alternatives, as summarized in the text box below, and (2) each combination includes *one* soil remediation action alternative, *one* building demolition action alternative, and *one* groundwater remediation action alternative (also see below).

Action Alternative Combination	Designation
Cleanup to AOC LUT Values + Building Removal + Groundwater Monitored Natural Attenuation	–
Cleanup to AOC LUT Values + Building Removal + Groundwater Treatment	Action Alternative Combination with the Largest Environmental Consequences (High Impact Combination)
Cleanup to Revised LUT Values + Building Removal + Groundwater Monitored Natural Attenuation	–
Cleanup to Revised LUT Values + Building Removal + Groundwater Treatment	–
Conservation of Natural Resources + Building Removal + Groundwater Monitored Natural Attenuation	Action Alternative Combination with the Smallest Environmental Consequences (Low Impact Combination)
Conservation of Natural Resources + Building Removal + Groundwater Treatment	–

AOC = *Administrative Order on Consent for Remedial Action*; LUT = Look-Up Table.

For most resource areas, the largest potential impacts (e.g., most waste generated, most truck round trips) are associated with the combination of the Cleanup to AOC LUT Values, Building Removal, and Groundwater Treatment Alternatives. This combination of action alternatives is termed the "High Impact Combination." Conversely, for most resource areas, the smallest impacts are associated with the combination of the Conservation of Natural Resources, Building Removal, and Groundwater Monitored Natural Attenuation Alternatives. This combination of action alternatives is termed the "Low Impact Combination." To avoid repetition, these terms are used as a shorthand way to refer to the above combinations of action alternatives. However, for those resource areas where the impacts to be addressed are not necessarily encompassed by these combinations of action alternatives, the applicable combination was specified and evaluated.

The suite of groundwater treatment technologies to be implemented would be determined independently from this EIS by means of a RCRA Corrective Measures Study (see Chapter 2, Section 2.6). Because the results of this Corrective Measures Study are yet to be determined, this EIS evaluates the potential impacts that could occur during groundwater remediation activities, assuming the implementation of those technologies planned for inclusion in the Corrective Measure Study that would result in the largest potential impacts. In addition, DOE could decide to implement elements of both groundwater remediation action alternatives rather than one alternative or the other. In this event, the potential impacts for some resource areas could be slightly larger than those under the High Impact Combination (which includes potential impacts from the Groundwater Treatment Alternative, but not the Groundwater Monitored Natural Attenuation

Alternative). These potential incremental impacts are addressed as appropriate in the following subsections.

Land resources. Land resources were evaluated for land use at Area IV and the NBZ, access to recreation areas in the SSFL region of influence (ROI), Area IV infrastructure, and Area IV and the NBZ aesthetics and visual quality.

Land use. No combination of action alternatives would cause a change in land use designation; after remediation, Area IV and the NBZ would be compatible with the landowner's (Boeing's) intent to maintain its land as undeveloped open space (Boeing 2016b).

Recreation. The High Impact Combination would result in average daily heavy-duty truck round trips ranging over 12 years from about 8 to 48. The weekday average daily traffic on Woolsey Canyon Road would conservatively increase by 3.4 to 5.3 percent during the first 2 years, by 7.3 percent to 7.6 percent during the next 9 years, and by 5.6 percent during the final year. There would be smaller increases in traffic on other evaluated roads. Traffic would not be noticeably increased if both groundwater remediation action alternatives were implemented.

The Low Impact Combination would result in heavy-duty truck traffic that would primarily occur over 4 years. The average daily truck trips during these years would range from about 8 to 47, and the average daily traffic on Woolsey Canyon Road would increase by 3.5 to 7.4 percent. There would be smaller increases in traffic on other evaluated roads. There would be minor increases in average daily traffic in subsequent years (e.g., less than 0.1 percent on Woolsey Canyon Road), primarily due to shipments of monitoring well purge water and environmental monitoring samples.

Under all action alternative combinations, motorists could experience or perceive delays in using Woolsey Canyon Road to access Sage Ranch Park, which could reduce its weekday use during the years of site remediation. Increased traffic, however, would occur for about three times as many years under the High Impact Combination as those under the Low Impact Combination. Except for Woolsey Canyon Road, traffic on any evaluated road that may pass a recreation area in the SSFL vicinity could be reduced by distributing truck traffic among the four evaluated routes between SSFL and major highways.

Infrastructure. Annual electrical requirements would be minimal under all combinations of action alternatives.

CMWD is the expected source for water for remediation activities such as dust suppression. Over 12 years, about 41 million gallons of water would be used under the High Impact Combination. The maximum annual water use would be about 4.0 million gallons, representing about 0.007 percent of CMWD's current imported and local water supply. If both groundwater remediation action alternatives were implemented, both the maximum annual and total water use would increase by about 5,000 gallons. Over 4 years, about 8.6 million gallons of water would be used under the Low Impact Combination. The maximum annual water use would be about 4.0 million gallons, again representing about 0.007 percent of CMWD's combined imported and local water supply.

Under any combination of action alternatives, water use is important because of California's current drought conditions and Governor Brown's Executive Order requiring a statewide 25 percent reduction in potable water use (CA EO 2015). Water use may be potentially reduced through measures such as using surfactants to assist in dust control.

*Aesthetics and visual quality***.** Over all combinations of action alternatives, all DOE-owned buildings and considerable quantities of soil would be removed. Soil would be backfilled on excavated areas and re-graded and re-contoured as necessary, and disturbed areas would be stabilized and revegetated. During remediation operations, onsite views at Area IV and the NBZ would be degraded. In the long term, stabilization and revegetation of affected areas would introduce a new surface texture and color in areas that were previously barren and improve onsite aesthetics and visual quality.

Geology and soils. Excavation of 1,050 cubic yards of subsurface bedrock was assumed under action alternative combinations that include the Groundwater Treatment Alternative (such as the High Impact Combination). Excavation of this bedrock would have minimal potential adverse impacts on bedrock geologic resources.

Under any combination of action alternatives, there would be minimal potential impacts on paleontological resources (i.e., loss of fossils) because the Santa Susana Formation where these resources largely occur is mostly located within the proposed exemption areas. Nonetheless, potential impacts on paleontological resources would likely be largest under action alternative combinations that include the Cleanup to AOC LUT Values Alternative and smallest for action alternative combinations that include the Conservation of Natural Resources Alternative. Outside of the proposed exemption areas, about 1 acre of land containing chemical or radioactive constituents exceeding AOC LUT values overlies the Santa Susana Formation, but less than 0.1 acre of land containing chemical (but no radioactive) constituents exceeding risk-assessment-based values overlies the Santa Susana Formation.

There could be risks to workers remediating soil in some locations at Area IV and the NBZ that are within zones where earthquake-induced landslides could occur. Buildings are not in areas of landslide risk, but bedrock assumed to be removed under the Groundwater Treatment Alternative is on the edge of a geologic hazard zone. Potential risks to workers from landslides would be largest under the High Impact Combination and smallest under the Low Impact Combination (because of the lesser extent of soil remediation and no bedrock removal). DOE would minimize risks to workers by implementing the 2010 AOC (DTSC 2010a) exemption process for certain areas if, during the planning and design of soil remediation activities, it was determined that excavating soil in these areas would present unacceptable risks. Seismic shaking can also pose a risk to workers removing buildings. Risks to workers due to proximity to structures that could collapse due to seismic shaking would be the same under all action alternative combinations. These risks would not be affected if DOE implemented both groundwater remediation action alternatives.

About 138 acres of land outside the proposed exemption areas would be disturbed under the High Impact Combination, while about 40 acres outside the proposed exemption areas would be disturbed under the Low Impact Combination. Disturbed land would primarily include areas where buildings and pavement are removed and soil is remediated. Although potential impacts from soil erosion would be minimized using BMPs, as summarized in Chapter 6, rainstorms could result in soil erosion, leading to a reduction of soil quality and functional capability within eroded areas.

About 715,000 cubic yards of backfill from offsite sources may be required under the High Impact Combination. The quality of this backfill for biological activity, filtration, and vegetation support may be less than that of current soil at Area IV and the NBZ, in which case the backfill would be less able to support growth of vegetation similar to that present before development of Area IV. Sources for this large quantity of backfill, containing chemical and radioactive constituents in concentrations less than AOC LUT values and of comparable quality, have not been located, and it appears unlikely that a source of backfill meeting chemical AOC LUT values can be found (see Section S.10.2.2). As noted in Section S.10.2.2, if a source of backfill that meets all of the AOC LUT values cannot be reasonably found, then DTSC, DOE, and EPA would enter into a consultation process, and DTSC would determine the best available source of backfill (DTSC 2010a).

About 125,000 cubic yards of backfill from offsite sources may be required under the Low Impact Combination. This backfill would need to be of comparable quality to that of current soil at Area IV and the NBZ and contain chemical and radioactive constituents in concentrations that meet risk-assessment-based values. DOE has not identified and evaluated potential sources of backfill to determine whether it would meet constituent concentration values consistent with risk-assessment-based values. However, because the allowable constituent concentrations in backfill under this combination of action alternatives would generally be higher than AOC LUT values, DOE expects that finding acceptable sources of backfill would be more likely.

Surface water resources. The High Impact Combination would have the greatest potential for impacts on surface water, primarily because of the large area of disturbed land (138 acres). The Low Impact Combination would have the smallest potential for impacts on surface water because it would have the least soil disturbance (40 acres) and would result in the least potential for soil erosion that could increase sediment levels in runoff. The Groundwater Monitored Natural Attenuation Alternative would have less potential for soil erosion than the Groundwater Treatment Alternative because it would disturb less soil that is currently shielded from erosion by vegetation when compared to the excavation and earthmoving actions required under the Groundwater Treatment Alternative. If DOE implemented both groundwater remediation action alternatives, the potential for soil disturbance would be essentially the same as that from implementing the Groundwater Treatment Alternative alone.

Under any combination of action alternatives, the BMPs and minimization measures described in Chapter 6 would be implemented to filter sediments and other contaminants from surface water runoff and limit increases in runoff velocity and volume. Except possibly for scenarios where an unusually large rainstorm occurs in the interval between soil excavation and revegetation of disturbed areas, coupled with exceedance of the stormwater control system capacity, no impacts are expected on surface water quality on site and in regional waterways or on SSFL or regional stormwater control capacities. To forestall the risks of potential impacts under these scenarios, DOE would evaluate mitigation measures; these measures could including requiring that, in areas excavated to bedrock, excavation and backfill activities be completed prior to or following the typical rainfall of December through May. DOE would also construct additional stormwater retention structures (such as catch basins or retention basins) and/or implement additional erosion control measures if runoff studies indicate the NPDES stormwater control system design capacity would be exceeded.

Implementing any combination of action alternatives would result in a long-term improvement in surface water resources at Area IV and its vicinity because a potential source of surface water contamination would be removed.

Groundwater resources. The combination of action alternatives with the largest positive impact on groundwater quality, in the shortest time frame, would be the High Impact Combination. Nearly all of the positive impact would result from implementation of the Groundwater Treatment Alternative. Although the Building Removal Alternative would be considered under all combinations of action alternatives, the Area IV buildings are not a source of chemicals or radionuclides to groundwater. Although the Cleanup to AOC LUT Values Alternative would remove more chemical constituents in soil than the Cleanup to Revised LUT Values or Conservation of Natural Resources Alternative, and the Cleanup to AOC LUT Values and Cleanup to Revised LUT Values Alternatives would remove more radioactive constituents in soil than the Conservation of Natural Resources Alternative, there would be little difference expected among the soil removal action alternatives in terms of potential positive impacts on groundwater. The added benefit to groundwater cleanup from soil removal is relatively low because the most highly impacted soil has already been removed. There would be no adverse impacts on groundwater from soil removal. The Low Impact Combination would have a comparable positive impact on groundwater quality, but this positive impact would be achieved over a much longer time frame.

If both groundwater remediation action alternatives were implemented, the advantageous features of monitored natural attenuation would be combined with other technologies employing active measures to remediate groundwater. The source of the water used for site remediation activities is expected to be CMWD.

Biological resources. The High Impact Combination would have the largest overall potential impacts. Although the soil remediation action alternatives would each have substantial potential impacts on biological resources, the largest would occur under the Cleanup to AOC LUT Values Alternative. Vegetation and wildlife habitat and soil would be removed from about 130 acres of land outside the proposed exemption areas, including about 51 acres of relatively undisturbed native habitat, including coast live oak woodland, northern mixed chaparral, and Venturan coastal scrub. This activity would cause profound disturbance to affected areas and require a substantial, focused, and prolonged effort to achieve revegetation and restoration of habitat, including replacement of removed soil with soil similar in parent material, texture, and nutrient status; collection and propagation of native plants, including oaks and shrubs; and several years of maintenance, weed control, and monitoring until the vegetation is self-sustaining.

Building removal would occur in previously disturbed habitats with low to moderate potential impacts on biological resources. Native species of birds and bats that roost or nest in the buildings would lose these sites when the buildings are removed. However, direct impacts on nesting or roosting species could be avoided or minimized through a combination of seasonal timing of demolition activities to avoid seasons when nesting is occurring, humane hazing of individuals using the buildings prior to demolition (e.g., by human activity in proximity to perching birds, inducing them to leave), and measures to prevent their reentry until demolition is complete. If listed species such as Santa Susana tarplant are established in proximity to buildings, direct impacts could be minimized by surveys and avoidance where possible. (No other sensitive plant species are expected in the approximately 8.4 acres of highly disturbed habitat adjacent to the buildings to be removed.) Unavoidable impacts on individual tarplants could be mitigated by salvage of seed, propagation, and replanting as part of restoration activities following demolition.

Compared to the Groundwater Monitored Natural Attenuation Alternative, there would be greater surface disturbance under the Groundwater Treatment Alternative through the assumed emplacement and operation of treatment units and excavation of subsurface bedrock; however, potential impacts on threatened, endangered, or rare species would likely be avoidable due to the localized nature of the activities, the small areas affected, and the proximity of well sites to existing access roads and disturbed areas. If both groundwater remediation action alternatives were implemented, surface disturbance would be essentially the same as that under the Groundwater Treatment Alternative alone.

The Low Impact Combination would have the smallest overall potential impacts. The Conservation of Natural Resources Alternative would remove vegetation and wildlife habitat from about 32 acres outside the proposed exemption areas, which is about 25 percent of the disturbed acreage under the Cleanup to AOC LUT Values Alternative and 8 acres less than the disturbed acreage under the Cleanup to Revised LUT Values Alternative. The Conservation of Natural Resources Alternative would have far fewer impacts on vegetation and wildlife habitat and biota, wetland and aquatic habitats and biota, and threatened, endangered, or rare species than the Cleanup to AOC LUT Values Alternative, and also fewer potential impacts than the Cleanup to Revised LUT Values Alternative. Potential impacts under the Building Removal Alternative have been summarized above. Impacts on these resources under the Groundwater Monitored Natural Attenuation Alternative would be smaller than those under the Groundwater Treatment Alternative, but either groundwater action alternative would have comparatively low impacts on biological resources, and the differences between the groundwater action alternatives in terms of biological impacts are modest.

Air quality and climate. The air quality analysis evaluated three combinations of action alternatives that would result in the highest potential impacts: (1) the Cleanup to AOC LUT Values, Building Removal, and Groundwater Treatment Alternatives; (2) the Cleanup to Revised LUT Values, Building Removal, and Groundwater Treatment Alternatives; and (3) the Conservation of Natural Resources, Building Removal, and Groundwater Treatment Alternatives. Emissions under the Groundwater Monitored Natural Attenuation Alternative were not quantitatively estimated because this alternative would generate very low emissions, and the Groundwater Treatment Alternative represents worse-case emissions for either groundwater remediation action alternative. Emissions presented in this section for the three combinations of action alternatives would be slightly smaller if the Groundwater Monitored Natural Attenuation Alternative were implemented under any action alternative combination, and slightly larger if both groundwater remediation action alternatives were implemented.[30]

Projected emissions were evaluated relative to air quality conditions within three air domains and their applicable Federal, state, and local air pollution standards and regulations. These domains are:

- Ventura County and the area directly adjacent to SSFL, which are within the South Central Coast Air Basin;
- South Coast Air Basin, which includes portions of Los Angeles County; and
- regions beyond Ventura County and the South Coast Air Basin, spanning several air basins and jurisdictional agencies.

For criteria pollutants where an evaluated domain is in attainment of the National Ambient Air Quality Standards (NAAQS), annual emissions were compared to the EPA Prevention of Significant Deterioration threshold for new major sources (250 tons per year of a pollutant) as an indicator of the magnitude of projected potential air quality impacts. For criteria pollutants where an ROI does not attain or is in maintenance of a NAAQS, annual emissions were compared to the applicable pollutant threshold that requires a conformity determination for that region. For example, because Ventura County attains the NAAQS for all pollutants except ozone, emissions from proposed activities within this ROI were compared to the following annual emission thresholds: (1) 50 tons of volatile organic compounds (VOCs) and nitrogen oxides (NO_X); and (2) 250 tons of carbon monoxide, sulfur dioxide (SO_2), particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), and particulate matter less than 10 microns in diameter (PM_{10}). If emissions were determined to potentially exceed an EPA Prevention of Significant Deterioration or conformity threshold, further analysis was conducted to determine whether they would contribute to exceedance of an ambient air quality standard or conform to the approved State Implementation Plan.

[30] The term, "High Impact Combination," is not used in this subsection because the largest potential impacts are not necessarily encompassed by the combination of the Cleanup to AOC LUT Values, Building Removal, and Groundwater Treatment Alternatives. This is primarily because the main focus of the air impacts analysis is on comparison of emissions against annual emission thresholds and daily ambient air quality standards rather than total emissions. The term, "Low Impact Combination," is not used because the potential impacts from the Groundwater Monitored Natural Attenuation Alternative are negligibly small and are not addressed. Rather, the appropriate action alternative combinations are specified and evaluated. Three potential action alternative combinations are addressed to ensure comparison of the ranges in emissions from these combinations against the annual thresholds and daily standards.

Estimates were made of peak annual and peak daily emissions. Peak annual emissions from the combinations of action alternatives were compared to annual indicator emission thresholds for the three evaluated domains, whereas peak daily emissions were used to indicate the potential for an action alternative combination to contribute to an exceedance of an ambient air quality standard. The thresholds assumed for the air domain outside of Ventura County and the South Coast Air Basin include ranges of values that encompass air quality conditions within all regions traversed by the proposed truck trips.

Ventura County. Peak annual emissions under all three evaluated combinations of action alternatives would be well below the indicator emissions thresholds identified for Ventura County. There is also little difference in peak annual and peak daily emissions for the three evaluated combinations of action alternatives. For example, the ranges in annual emissions vary by no more than about 7 percent for VOCs, carbon monoxide, NO_X, and SO_2 across the three evaluated combinations of action alternatives, by 35 percent for PM_{10}, and by 9 percent for $PM_{2.5}$. The projected elevated levels of PM_{10} emissions primarily result from fugitive dust from operation of equipment and trucks on unpaved surfaces and trucks on paved roads internal to SSFL. DOE would implement measures to control fugitive dust emissions (PM_{10} and $PM_{2.5}$) from the proposed activities, including measures to comply with Ventura County Air Pollution Control District Rule 55 (Fugitive Dust), which restricts emissions of fugitive dust from being visible beyond the property line of a source. Therefore, these controls and restrictions would ensure that emissions of fugitive dust from the combined action alternatives would not contribute to an exceedance of a PM_{10} ambient air quality standard at any offsite location.

South Coast Air Basin. For the South Coast Air Basin, the ranges in peak annual and daily emissions for the three evaluated combinations of action alternatives would be somewhat larger than those for the Ventura County ROI, but nonetheless reflect only minor differences in projected emissions. For example, considering both the nearby and distant disposal scenarios, the ranges in annual emissions vary by no more than about a factor of 2 for VOCs, carbon monoxide, NO_X, and SO_2 across the three combinations of action alternatives, by 57 percent for PM_{10}, and by 50 percent for $PM_{2.5}$. None of the annual emissions would exceed the South Coast Air Basin indicator emission thresholds, except for NO_X under the distant disposal site scenario. These emissions would occur intermittently from an average of up to 48 daily truck round trips and would extend over several miles of roads across the South Coast Air Basin. As a result, these emissions would be diluted in the atmosphere to the point that they would produce minimal ambient impacts in a localized area and would not contribute to an exceedance of an ambient air quality standard. For this same reason, these combined action alternatives also would produce minimal ambient impacts of hazardous air pollutants and toxic air contaminants within the South Coast Air Basin.

Outside Ventura County and the South Coast Air Basin. To define the worst-case indicator emission thresholds for the regions outside of Ventura County and the South Coast Air Basin, the most degraded air quality conditions were assumed for any area where trucks would travel between SSFL and offsite disposal facilities. Hence, the worst-case air quality conditions for the regions traversed by trucks to nearby (Buttonwillow site) and distant (NNSS or US Ecology in Idaho) disposal sites occur within the San Joaquin Valley Air Basin and the Mojave Desert Air Basin. For two of the three combinations of action alternatives (the Cleanup to Revised LUT Values, Building Removal, and Groundwater Treatment Alternatives and the Conservation of Natural Resources, Building Removal, and Groundwater Treatment Alternatives), peak annual emissions generated by truck travel between SSFL and the disposal facility locations would exceed these worst-case NO_X emission thresholds. However, truck mileages driven solely within the San Joaquin Valley Air Basin and Mojave Desert Air Basin would produce emissions that would remain below their applicable NO_X

emission thresholds. Trucks driven within all other air basins also would produce emissions that would remain below their applicable NO_X emission thresholds.

Although relatively high levels of daily NO_X emissions were estimated for regions outside Ventura County and the South Coast Air Basin, these emissions would occur intermittently from an average of up to 48 daily haul truck round trips and would extend over hundreds of miles of roadways. As a result, these emissions would be diluted in the atmosphere to the point that they would produce minimal ambient impacts in a localized area and would not contribute to an exceedance of an ambient air quality standard. For this same reason, minimal ambient impacts of hazardous air pollutants and toxic air contaminants are expected outside of Ventura County and the South Coast Air Basin.

Green cleanup. The above discussion addresses calculated impacts assuming use of California average off-road and on-road vehicle fleets for calendar year 2019. Implementing equipment that meets EPA Nonroad Tier 3 and 4 emission standards and new trucks that meet the most recent EPA on-road standards would reduce these potential impacts (see Chapter 6, Mitigation Measure AQ-1). In the Ventura County domain, emissions from the average year 2019 fleet, as averaged over all air pollutants, would be reduced by 21 percent for off-road equipment that meets EPA Nonroad Tier 3 standards, and 58 percent for on-road heavy-duty trucks. In the South Coast Air Basin and the evaluated domain outside Ventura County and the South Coast Air Basin, emissions from the average year 2019 fleet, as averaged over all air pollutants, would be reduced by 61 percent. Therefore, implementing the proposed green cleanup fleets would produce substantial emission reductions compared to use of California average fleets.

Climate change. Peak annual emissions of CO_2 would range from about 3,000 to 8,900 metric tons under the combination of the Cleanup to AOC LUT Values, Building Removal, and Groundwater Treatment Alternatives; 6,000 to 17,000 metric tons under the combination of the Cleanup to Revised LUT Values, Building Removal, and Groundwater Treatment Alternatives; or 6,100 to 17,000 metric tons under the combination of the Conservation of Natural Resources, Building Removal, and Groundwater Treatment Alternatives. Total emissions of CO_2 would range from about 30,000 to 89,000 metric tons under the combination of the Cleanup to AOC LUT Values, Building Removal, and Groundwater Treatment Alternatives; 14,000 to 37,000 metric tons under the combination of the Cleanup to Revised LUT Values, Building Removal, and Groundwater Treatment Alternatives; or 9,700 to 29,000 metric tons under the combination of the Conservation of Natural Resources, Building Removal, and Groundwater Treatment Alternatives. Emissions under each combination of action alternatives would be slightly smaller if the Groundwater Monitored Natural Attenuation Alternative was implemented and slightly larger if both groundwater action alternatives were implemented.

Climate change could impact implementation of the alternatives and the adaptation strategies needed to respond to future conditions. Within Ventura County, the main effect of climate change is increased temperature and aridity. Analyses predict that, in the future, the region will experience: (1) an increase in temperatures, droughts, and wildfires; and (2) and scarcities of water supplies (California Energy Commission 2012; IPCC 2013; USGCRP 2014). Current operations at SSFL have adapted to droughts, high temperatures, wildfires, and scarce water supplies; however, future exacerbation of these conditions could impede proposed activities during extreme events.

Noise. There would be little difference in the intensity of noise emanating from Area IV for any combination of action alternatives. All combinations would require use of heavy equipment, and similar noise intensities would be experienced at the nearest residence, with no expected noise impacts. In addition, all combinations would entail up to 48 average daily heavy-duty truck round trips, with possible occasional spikes to 96 round trips. Over the entire range of daily truck round trips, time-averaged noise levels in residential areas would increase by no more than 3.5 decibels A-weighted (dBA) community noise equivalent level (CNEL) along all roads where noise would remain below 65 dBA CNEL and would increase by no more than 0.6 dBA CNEL along the road where noise levels would exceed 65 dBA CNEL (one section of Valley Circle Boulevard already exceeds 65 dBA CNEL). Although the increased traffic would be audible to persons in the vicinities of the evaluated roads, the increased noise would not be expected to exceed "normally acceptable" levels and would not exceed the adverse impact thresholds per the *L.A. CEQA Thresholds Guide, Your Resource for Preparing CEQA Analyses in Los Angeles* (LA 2006).

The combination of action alternatives having the longest noise duration (12 years) would be the High Impact Combination, primarily because of the volume of soil removed. There would be no change in noise duration if both groundwater remediation action alternatives were implemented. The combination of action alternatives having the shortest noise duration would be the Low Impact Combination. Because much less soil would be removed, almost all remediation activities under this combination of action alternatives would be completed in 4 years. After that, there would be very minor traffic noise, primarily from transport of monitoring well purge water for offsite disposition and monitoring samples to offsite laboratories.

Transportation. Maximum risks of transporting radioactive waste to the evaluated disposal facilities would occur under the High Impact Combination or the combination of the Cleanup to Revised LUT Values, Building Removal, and Groundwater Treatment Alternatives. For incident-free transport and assuming all radioactive waste shipments were by truck, maximum latent cancer fatality (LCF) risks to truck crews and the population would occur for shipment to Energy*Solutions* in Utah. The risk of a single LCF among the truck crews or in the population would be 9×10^{-4} (1 chance in 1,100) and 2×10^{-4} (1 chance in 5,000), respectively. If shipments were made using the truck/rail option, the maximum risk of a single LCF among the truck/rail crews would be 3×10^{-4} (1 chance in 3,300) for shipment to NNSS. The maximum truck/rail option risk of a single LCF in the population would be 2×10^{-4} (1 chance in 5,000) for shipment to Energy*Solutions* in Utah. The risk of a single LCF from an accident, considering all possible accidents from minor to severe, would be 5×10^{-9} (1 chance in 200 million), assuming all shipments were by truck to Energy*Solutions* or 3×10^{-10} (1 chance in 3.3 billion) by the truck/rail option to either evaluated facility.

Minimum risks would occur under the Low Impact Combination. For incident-free transport and assuming all radioactive waste shipments were by truck, maximum LCF risks to truck crews and the population would occur for shipment to Energy*Solutions* in Utah. The risk of a single LCF among the truck crews or in the population would be 5×10^{-4} (1 chance in 2,000) and 1×10^{-4} (1 chance in 10,000), respectively. If shipments were made using the truck/rail option, the maximum risk of a single LCF among the truck/rail crews would be 2×10^{-4} (1 chance in 5,000) for shipment to NNSS. The maximum truck/rail option risk of a single LCF occurring in the population would be 9×10^{-5} (1 chance in 11,000) for shipments to Energy*Solutions*. The maximum risk of a single LCF from an accident, considering all possible accidents from minor to severe, would be 3×10^{-9} (1 chance in 330 million), assuming all shipments were sent by truck to NNSS or 2×10^{-10} (1 chance in 5 billion) by the truck/rail option to either evaluated facility.

The largest traffic accident risks from transporting all radioactive waste, all nonradioactive waste, and all material (backfill, equipment, and supplies) would occur under the High Impact Combination. Under the truck option, considering shipment of all radioactive and nonradioactive waste and material, the number of traffic-related fatalities is estimated to be about 1 (calculated value of 0.84). Under the truck/rail option, the number of transportation-related fatalities is estimated to be about 3 (calculated value of 2.9). The smallest risks would occur under the Low Impact Combination. The number of fatalities that estimated to result from transporting all waste and material is 0 (calculated maximum value of 0.45) under the truck option and 0 (calculated value of 0.42) under the truck/rail option.

Traffic. Under the High Impact Combination, there would be about 119,000 heavy- and medium-duty truck round trips. In addition, there would be about 68,600 round trips of cars or light-duty trucks, primarily for worker commutes. The largest increase in traffic would occur on Woolsey Canyon Road. Over 12 years, the weekly average daily traffic volume would increase by 3.4 to 7.6 percent. During most of these years, the level of service (LOS) for Woolsey Canyon Road could change from a B rating to a C rating. Motorists on Woolsey Canyon Road during weekdays when heavy-duty trucks would be traveling to or from SSFL could experience delays compared to baseline conditions; there could also be delays at the intersection of Woolsey Canyon Road with Valley Circle Boulevard. The increased traffic could be reduced on roads other than Woolsey Canyon Road by distributing traffic among multiple routes between SSFL and major highways.

Traffic associated with the High Impact Combination would impose about 210,000 equivalent single-axle loads (ESALs)[31] on the roads on the evaluated routes between SSFL and major highways. These increases were determined assuming each evaluated route received all traffic. Because some of the evaluated roads already need repair, increased vehicle traffic could further damage the surrounding roads, causing them to need repair sooner than currently anticipated.

If both groundwater remediation action alternatives were implemented, the number of heavy- and medium-duty truck round trips would increase during a 12-year period by about 42 round trips compared to the High Impact Combination estimate of 119,000 round trips. Thus, there would be no noticeable increase in traffic volumes or ESALs from those analyzed under the High Impact Combination.

Under the Low Impact Combination, there would be about 20,800 heavy- and medium-duty truck round trips. In addition, there would be about 20,800 round trips of cars or light-duty trucks, generally from worker commutes. The largest increase in traffic would occur on Woolsey Canyon Road, where the weekly average daily traffic would increase by 3.5 to 7.4 percent during the first 4 years of this action alternative combination, with a change in LOS from a B rating to a C rating, similar to that under the High Impact Combination. Traffic increases for subsequent years would be about 0.092 percent, primarily due to shipments of well monitoring purge water and environmental samples and worker commutes. Traffic delays similar to those under the High Impact Combination could occur, except that the delays would last for 4 years rather than 12. The increased traffic could be reduced on roads other than Woolsey Canyon Road by distributing traffic among multiple routes between SSFL and major highways.

Traffic associated with this combination of action alternatives would impose about 45,000 ESALs on the roads along the evaluated routes between SSFL and major highways, assuming each route received all traffic. Because some of the evaluated roads already need repair, this increase in vehicle traffic could further damage surrounding roads, causing them to need repair sooner than currently anticipated.

A safety concern is noted: heavy-duty trucks making a sharp right turn from Woolsey Canyon Road onto Valley Circle Boulevard may need to pull partially into an adjacent lane, resulting in a risk of incidents with oncoming traffic. This risk would be applicable to all action alternatives, but particularly the soil remediation action alternatives and the Building Removal Alternative, and may be mitigated by measures such as installation of a traffic signal at the intersection or posting of a flag person when shipments are made from Area IV.

[31] An ESAL is defined as the damage caused by a single 18,000-pound vehicle axle such as that found on a heavy-duty truck.

Human health. Following remediation of Area IV and the NBZ, the principal risk would be residual chemicals and radioactive material remaining in the soil. Following removal of DOE buildings under the Building Removal Alternative, there would be no remaining impact attributable to the buildings. Under the groundwater remediation action alternatives, neither near-term activities such as installing wells and removing the strontium-90 subsurface bedrock source nor the remaining activities such as monitoring or operating treatment equipment would result in chemical or radiation exposures to offsite members of the public. Consequently, the combined potential impacts would be dominated by the impacts associated with soil. The potential impacts on a hypothetical future onsite suburban resident following any of the soil action alternatives would be smaller than those under the No Action Alternative, which are very close to the potential impacts from background soil. The High Impact Combination, under which the most soil would be removed from the site, would be expected to have the lowest residual risk. The Low Impact Combination, under which soil with chemical and radionuclide concentrations meeting risk-assessment-based values would remain on site, would have a slightly higher residual risk.

Implementing different combinations of action alternatives would have little effect on the maximum number of workers on site in a year, but would have a large effect on the number of years that workers could be exposed to chemical, radiological, and industrial hazards. Under the High Impact Combination, workers would be subject to hazards over about a 12-year period, while under the Low Impact Combination, workers would be subject to hazards for about a 4-year period. In addition, there could be a combined impact on workers involved in both building demolition (decontamination and decommissioning [D&D] workers) and soil or groundwater remediation (remediation workers). However, because the potential impacts on remediation workers are estimated to be significantly less than those for D&D workers, the combined impacts would not be significantly larger than those for D&D workers alone. Regardless of the combination of action alternatives, workers would be protected in accordance with DOE regulations (e.g., 10 CFR Parts 835 and 851) and orders. Worker protection practices would be employed so that doses are ALARA below DOE occupational exposure limits.

Waste management. Over all combinations of action alternatives, the total LLW/mixed low-level radioactive waste (MLLW) volume would be up to 103,000 cubic yards, which would not impact the total waste disposal capacity at NNSS or Energy*Solutions* in Utah. There would be about 4,550 to 7,980 truck shipments from SSFL that would occur over 4 to 12 years, depending on the combination of action alternatives. Depending on the combination of action alternatives, the average daily number of offsite shipments would range from less than 1 to about 14. Under the truck option and assuming all waste was delivered to a single facility, there would be the same number of daily shipments arriving at that facility. There could be logistical concerns at a facility to ensure that personnel, equipment, and active disposal space are available for these deliveries plus deliveries from other waste generators. However, these concerns could be alleviated through careful scheduling and coordination with the disposal facility operators. Under the truck/rail option, there would be the same number of daily deliveries to NNSS, but reduced daily deliveries (all by rail) to Energy*Solutions* in Utah compared to those under the truck option.

The total hazardous waste volume (49,100 cubic yards for all action alternative combinations) would not impact the total disposal capacity at any evaluated hazardous waste facility. There would be about 3,690 to 3,930 truck shipments from SSFL that would occur over 4 to 12 years, depending on the combination of action alternatives, with an average daily number of offsite shipments ranging from less than 1 to about 8. Average daily tonnages would range from less than 1 ton to about 150 tons. Under the truck option, there would be the same number of daily deliveries at any assumed single disposal facility. The projected shipments would not impact the daily or yearly receipt limit, if applicable, at any of the evaluated facilities. Under the truck/rail option, there would be the same number of daily deliveries to the Buttonwillow or Westmorland facilities in California, because these facilities lack direct rail accessibility, but reduced daily shipments (all by rail) to US Ecology in Idaho.

The total nonhazardous waste volume would range from about 53,200 to 794,000 cubic yards. The high end of the range would occur under any combination of action alternatives that includes the Cleanup to AOC LUT Values and Building Removal Alternatives; this volume of waste would represent about 48 percent of the capacity being constructed or planned at the McKittrick Waste Treatment Site in California (assuming all nonhazardous waste was sent to this site). There would be about 4,020 to 59,600 truck shipments from SSFL over 4 to 12 years, depending on the combination of action alternatives. Over this time, the average daily number of offsite shipments would range from less than 1 to about 25, and the average daily tonnage would range from about 1 ton to about 490 tons. Under the truck option, there would be the same number of daily deliveries to any of the evaluated facilities, assuming all waste was shipped to a single facility. The projected shipments would not exceed an annual or daily receipt limit at any of the evaluated facilities, but would represent 16 percent of the daily limit at the McKittrick Waste Treatment Site. Under the truck/rail option, waste would be shipped to the Mesquite Regional Landfill in California at a rate that would represent up to 2 percent of the site's daily waste acceptance limit.

About 3,540 cubic yards of recyclable material would be delivered to offsite recycle facilities over 2 years under all combinations of action alternatives. There would be less than two average shipments per day, assuming shipments occurred each year over a 5-month period, but less than one per day if the shipments were spread over a working year. There is adequate recycle capacity in the vicinity of SSFL, so no impacts on this capacity are expected.

Therefore, no combination of action alternatives would generate waste that would lack disposal capacity. The evaluated facilities have adequate total capacities, and the shipments are not expected to exceed daily acceptance limits, where applicable. Careful coordination with some disposal facilities operators may be needed to avoid any logistical concerns regarding waste receipt scheduling. Nonetheless, any concerns regarding capacities or scheduling logistics at any single facility may be alleviated by measures such as use of multiple facilities (multiple facilities exist for all wastes evaluated in this EIS) or use of the truck/rail option for delivery of waste to rail-accessible facilities.

Cultural resources.

Archaeological and structural cultural resources. No combination of action alternatives would have an effect on architectural cultural resources because none has been identified as eligible for listing on the NRHP (i.e., no historic structures) and no impacts on this resource class have been determined under NEPA criteria.

For archaeological resources, proposed exemptions to the 2010 AOC (DTSC 2010a) requirement to remediate chemical and radioactive contaminants to LUT values would allow DOE to avoid potential impacts on archeological sites that are listed or eligible for listing on the NRHP (i.e., historic properties) or otherwise significant under NEPA or CEQA eligibility criteria. For this reason, the potential adverse effects would be similar, but would vary somewhat among the alternatives. Under all alternatives, if an unanticipated archaeological resource is encountered, DOE would comply with applicable regulations and the Section 106 agreement document currently under development, which would include a provision for unanticipated archaeological finds. However, based on the intensive survey for archaeological sites, finding a previously unrecorded archeological resource is unlikely.

The High Impact Combination would have the greatest potential to encounter unanticipated archaeological resources, primarily because this combination includes the Cleanup to AOC LUT Values Alternative which would cause the largest soil disturbance of any of the soil remediation action alternatives. The Building Removal Alternative would be unlikely to encounter unanticipated archaeological resources. Comparing the two groundwater remediation action alternatives, the Groundwater Treatment Alternative involves greater ground disturbance and construction and, thus, would have a greater potential to encounter unanticipated archaeological resources, were any to be present. If both groundwater remediation action alternatives were implemented, the potential for effects on unanticipated archaeological resources would be essentially the same as that from implementing the Groundwater Treatment Alternative alone.

The Low Impact Combination would have the least potential to encounter unanticipated archaeological resources, primarily because this combination includes the Conservation of Natural Resources Alternative which would cause the least soil disturbance of any of the soil remediation action alternatives. As discussed above, the Building Removal Alternative would be unlikely to encounter unanticipated archaeological resources, and between the two groundwater remediation action alternatives, the Groundwater Monitored Natural Attenuation Alternative would have a lesser potential to encounter unanticipated archaeological resources.

Traditional cultural resources. The 2010 AOC (DTSC 2010a) proposed an exemption from cleanup actions for "Native American artifacts that are formally recognized as Cultural Resources." For example, the proposed exemption would apply to historic properties, such as those listed on, or eligible for listing on the NRHP. However, traditional cultural resources that include properties of traditional religious and cultural importance that do not meet the NRHP criteria could also be protected under the proposed exemption. The Santa Ynez Band of Chumash Indians has designated the entire SSFL, an area that includes all archaeological sites, regardless of NRHP eligibility, as well as all isolates and the landscape, as a Native American sacred site. They believe that the site is eligible for inclusion on the NRHP as a traditional cultural property. In 2014, they filed paperwork nominating the site to be included in the State of California Native American Heritage Commission Sacred Lands Inventory (NAHC 2014). DOE is consulting with SHPO, the Santa Ynez Band of Chumash Indians, and the SSFL Sacred Sites Council to develop an agreement intended to resolve adverse impacts through avoidance, minimization, or mitigation of impacts during and subsequent to cleanup activities.

Under all action alternatives, there could be changes in setting as cleanup progresses in Area IV and the NBZ; after cleanup is complete, this impact would be removed, but the affected areas would have been re-contoured, which would change the setting of the traditional cultural resource. In addition, for traditional cultural resources, potential effects on archaeological sites are considered under all action alternative combinations because the Santa Susana Sacred Site includes all archaeological sites, regardless of NRHP eligibility, as well as all isolates and the landscape.

The High Impact Combination would have the greatest potential to impact traditional cultural resources primarily because this combination would have the longest cleanup duration and the most landscape alteration. The Building Removal Alternative would be unlikely to encounter unanticipated archaeological resources and would remove structures that could be considered intrusive. Between the two groundwater remediation action alternatives, the Groundwater Treatment Alternative involves more ground disturbance and construction, and thus has more potential to encounter unanticipated archaeological resources or alter the landscape. The Groundwater Treatment Alternative would have a greater potential to affect the Santa Susana Sacred Site, and would involve more-extensive aboveground treatment facilities that could temporarily affect its setting. This potential for impacts would be essentially the same if both groundwater remediation action alternatives were implemented.

The Low Impact Combination would have the least potential to encounter unanticipated archaeological resources, primarily because this combination includes the Conservation of Natural Resources Alternative which would have shortest cleanup duration and least landscape alternation of any of the soil remediation action alternatives. As discussed above, the Building Removal Alternative would be unlikely to encounter unanticipated archaeological resources and would remove structures that could be considered intrusive. Between the two groundwater remediation action alternatives the Groundwater Monitored Natural Attenuation Alternative would involve less ground disturbance and construction, have less potential to affect the Santa Susana Sacred Site, and create less extensive structures (well heads) that could affect its setting.

DOE is consulting with SHPO, the Santa Ynez Band of Chumash Indians, and the SSFL Sacred Sites Council to develop an agreement intended to resolve potential adverse impacts through avoidance, minimization, or mitigation of impacts during and subsequent to cleanup activities.

Socioeconomics. The socioeconomics analysis addresses employment, potential economic impacts on businesses, infrastructure and municipal services in the SSFL ROI, as well as local government revenues, and potential economic impacts on businesses near the evaluated recycle and disposal facilities.

Employment. For most years under the High Impact Combination, the number of onsite workers would range from 25 to 26 workers over 12 years of remediation. In addition, during the third year of the project, there would be a need for an additional five workers over about 6 working months to install groundwater treatment equipment and remove bedrock containing strontium-90. Under the Low Impact Combination, the number of onsite workers would be 25 to 26 for 4 years, plus 6 workers in a single year working an average of 5 days per well to install 5 groundwater monitoring wells. In addition, for all evaluated years, there would be 10 workers working an average of 1 month a year for environmental monitoring.

Under any combination of action alternatives, site activities would have a minor beneficial impact on the economy in Los Angeles and Ventura Counties by providing employment and increasing sales for industries that provide equipment, supplies, and rentals. Because workers would likely originate from Los Angeles and Ventura Counties, new spending or economic activity in the region would be minimal.

Truck traffic. The High Impact Combination would result in increased traffic in the SSFL vicinity over 12 years, with the most noticeable increase occurring on Woolsey Canyon Road. However, the additional vehicle traffic is not expected to result in socioeconomic impacts on businesses on this road, and traffic on other evaluated roads would increase by no more than 2.8 percent, assuming all traffic traversed each road, with minimal potential for socioeconomic impacts on businesses. The largest concentration of retail establishments, restaurants, and other businesses would occur on Topanga Canyon Road. The projected increase in average daily traffic (0.15 to 0.36 percent) is not expected to result in socioeconomic impacts on businesses along this road.

Traffic under the Low Impact Combination would increase in the SSFL vicinity, primarily over the first 4 years, with much smaller increases thereafter. Again, the additional vehicle traffic is not expected to result in socioeconomic impacts on businesses on Woolsey Canyon Road, and average daily traffic on other evaluated roads would increase by no more than 2.7 percent, assuming all traffic traversed each road, with minimal potential for socioeconomic impacts on businesses. The average daily traffic on Topanga Canyon Boulevard under the Low Impact Combination would increase by 0.15 to 0.35 percent during the first 4 years of site remediation, and by less than

0.01 percent thereafter, which is not expected to result in socioeconomic impacts on businesses along this road.

Under any combination of action alternatives, the increased amount of truck traffic would be insufficient to result in socioeconomic impacts in the SSFL ROI.

Infrastructure and municipal services. Under any combination of action alternatives, there could be damage to local roads from the potentially large number of trucks required for remediation of Area IV and the NBZ. Recognizing this, DOE may need to negotiate with local governments to contribute its portion of the cost for maintenance and repair of affected roads. No impacts on other municipal services are expected.

Housing. For any combination of action alternative, workers would be primarily employed from Los Angeles and Ventura Counties, with no impacts on housing availability.

Local government revenue. The High Impact Combination would have the largest potential beneficial and adverse impacts on local government revenue because increased activities, including truck traffic, would occur for 12 years. The Low Impact Combination would have the potential smallest beneficial and adverse impacts on local government revenue because increased activities, including truck traffic would primarily occur for 4 years. Beneficial impacts could result from increased revenues from fuel taxes, fees, or other project expenses, while adverse impacts could result from increased expenses for pavement repair.

Disposal facilities. Disposal facility impacts depend on the quantities of radioactive, hazardous, and nonhazardous wastes to be delivered. There is a significant difference among the combinations of action alternatives for shipment of LLW and MLLW. LLW and MLLW would be delivered to an assumed single disposal facility at average daily rates ranging from 2 to 5 deliveries for either combination of action alternatives that includes the Cleanup to AOC LUT Values Alternative, with deliveries occurring over 12 years. For combinations of action alternatives that include the Cleanup to Revised LUT or Conservation of Natural Resources Alternative, deliveries would range up to 14 per day, with deliveries occurring over slightly over 3 years to 4 years. Peak deliveries (14 per day) under these action alternative combinations would last for only 1 to 2 years. This truck traffic is not expected to cause socioeconomic impacts on businesses in the vicinities of the evaluated disposal facilities.

There is almost no difference among the combinations of action alternatives for shipment of hazardous waste. Hazardous waste would be shipped under the Building Removal Alternative and in equal quantities under all soil remediation action alternatives. The only difference among all action alternatives is that very small quantities of hazardous waste (about 26 cubic yards) might be generated under the Groundwater Treatment Alternative. The largest average daily truck delivery to a single assumed hazardous waste facility would be 8 deliveries. This frequency of truck traffic is not expected to have socioeconomic impacts on businesses in the vicinities of the evaluated disposal facilities.

The differences among the combinations of action alternatives for shipment of nonhazardous waste are primarily due to differences in soil volumes removed under the soil remediation action alternatives. Under the combination of the Cleanup to AOC LUT Values, Building Removal, and Groundwater Treatment Alternatives, waste would be shipped to disposal facilities over 12 years, and the average number of heavy-duty trucks received at a single assumed disposal facility could range up to 25 per day. Under the combination of the Cleanup to Revised LUT Values, Building Removal, and Groundwater Treatment Alternatives, waste would be shipped to disposal facilities over slightly over 4 years, and the average number of heavy-duty trucks received at a single assumed disposal facility could range up to about 8 per day. Under the combination of the Conservation of

Natural Resources, Building Removal, and Groundwater Treatment Alternatives, waste would be shipped to disposal facilities over 4 years, and the average number of heavy-duty trucks received at a single assumed disposal facility could range up to about 8 per day. Assuming all nonhazardous waste was shipped to a single nonhazardous waste facility, no or only minimal socioeconomic impacts are expected because of the locations of the facilities and/or the ease of access from major highways.

Deliveries to an assumed single recycle facility would average up to two trucks per day, assuming all deliveries were made during 2 to 5 months in each of 2 years. The daily number of delivery trucks would be reduced if waste was shipped throughout each working year. The minimal increased daily deliveries would have no impacts on traffic volumes in the vicinities of any of these recycle facilities, and, thus, no socioeconomic impacts are expected in the vicinities of any of the evaluated facilities.

Although potential socioeconomics impacts on businesses in the vicinity of any single facility accepting recyclable material or radioactive, hazardous, or nonhazardous waste for disposal are minimal (at worst), these potential impacts could be further reduced by shipping waste to multiple authorized facilities; by using multiple routes (as available) for delivery to individual facilities; or by shipping waste by rail to rail-accessible disposal facilities.

Environmental justice.

SSFL ROI. Under any combination of action alternatives, the risks to a member of the public of both the incidence of cancer and a cancer fatality would be dominated by potential impacts from background concentrations of chemical and radioactive constituents. Therefore, there would be no disproportionately high and adverse impacts on Native American tribes and minority and low-income populations.

Under the High Impact Combination, the largest increase in daily traffic would occur on Woolsey Canyon Road, where over 12 years, the average daily traffic would increase by 3.4 to 7.6 percent. If both groundwater remediation action alternatives were implemented, there would be essentially the same increase in average daily traffic as that presented above. Under the Low Impact Combination, the largest increase in daily traffic volume would occur on Woolsey Canyon Road, where the average daily traffic would increase by 3.5 to 7.4 percent over 4 years, with minor traffic increases thereafter. Under both combinations of action alternatives, there would be considerably smaller increases in traffic on the other evaluated roads between SSFL and major highways.

Although there would be increases in the traffic on the evaluated routes between SSFL and major highways, the routes would traverse minority and non-minority communities, as well as low-income and non-low-income communities, and would not pass through Native American lands. This indicates that potential impacts on Native American tribes and minority or low-income populations would be the same as those experienced by the general population. Other than Woolsey Canyon Road, traffic volumes on the evaluated roads could be reduced by using multiple routes to major highway systems. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI.

Regional ROIs. Regional environmental justice impacts depend on the quantities of radioactive, hazardous, and nonhazardous wastes that would be delivered to the disposal facilities and the schedules for these deliveries.

There is a significant difference among combinations of action alternatives regarding the shipped quantities of radioactive waste, primarily resulting from differences in soil removals under the soil remediation action alternatives. Total volumes could range from 57,600 cubic yards to 103,000 cubic yards, and the average daily deliveries to a single assumed LLW/MLLW facility could range from less than 1 to about 14. Even if all waste deliveries were made to a single LLW/MLLW disposal facility, the projected frequency of truck traffic would not result in noticeable traffic-related impacts in the ROI for that facility.

There is almost no difference among the combinations of action alternatives regarding the total quantity of hazardous waste (about 26 cubic yards), although daily deliveries to the evaluated disposal facilities would differ as would the duration of the deliveries. Even if all waste deliveries were made to a single hazardous waste disposal facility, the projected frequency of truck traffic (up to 8 truck deliveries per day) would not result in noticeable traffic-related impacts in the ROI for that facility.

There are significant differences among the combinations of action alternatives for shipped quantities of nonhazardous waste; these differences primarily result from differences in the soil volumes removed under the soil remediation action alternatives. Under the combination of the Cleanup to AOC LUT Values Alternative, Building Removal Alternative, and either groundwater remediation action alternative, about 794,000 cubic yards of nonhazardous waste (soil, debris, etc.) would be shipped to disposal facilities over 12 years. The average number of heavy-duty trucks received at nonhazardous sites could range up to 25 trucks per day. There would be no or minimal impacts from increased traffic in the vicinities of the evaluated facilities.

Under the combination of either the Cleanup to Revised LUT Values or Conservation of Natural Resources Alternative, the Building Removal Alternative, and either groundwater remediation action alternative, however, about 53,200 cubic yards of nonhazardous waste would be generated. This waste would be shipped to disposal facilities over approximately 4 years. The average number of heavy-duty trucks delivered to a single assumed nonhazardous waste facility could be up to 8 per day during 2 years; daily deliveries during other years would be smaller. This frequency of truck traffic is not expected to result in traffic-related impacts in the ROI for that facility.

Under any combination of action alternatives, about 3,540 cubic yards of recyclable material would be shipped to recycle facilities during 2 years of building demolition. As addressed in the socioeconomics section, the minimal increased daily deliveries would have no impacts on traffic volumes in the vicinities of any of these recycle facilities.

The number of truck deliveries to any single facility could be reduced if multiple disposal facilities were used, if multiple routes (as available) were used in the vicinities of individual facilities, or if waste were shipped to one or more rail-accessible facilities. Considering this and the above analysis, no combination of action alternatives would have disproportionately high and adverse impacts on Native American tribes and minority and low-income populations in the regional ROIs for the evaluated recycle and disposal facilities.

Sensitive-aged populations.

SSFL ROI. Under both the High and Low Impact Combinations, average daily traffic would increase on Woolsey Canyon Road, as discussed in the environmental justice section. There would be no noticeable additional increases if both groundwater remediation action alternatives were implemented. Under both combinations of action alternatives, but for a longer duration under the High Impact Combination than under the Low Impact Combination, this increased traffic could result in greater risks to pedestrians along or crossing Woolsey Canyon Road, although these risks would be experienced by persons of all ages. Traffic volumes on other evaluated roads are not expected to be noticeably larger than those under baseline conditions. In addition, traffic on all evaluated roads, other than Woolsey Canyon Road, that pass by or are in the vicinity of schools or recreation areas could be reduced by distributing traffic among the evaluated traffic routes. Under any combination of action alternatives, therefore, no disparate impacts (markedly distinct impacts relative to those on the general population) are expected on sensitive-aged populations in the SSFL ROI.

Regional ROIs. As discussed in the environmental justice section, even if all radioactive waste deliveries were made to a single facility and all hazardous waste deliveries were made to a single facility, the projected truck traffic would not result in noticeable traffic-related impacts. Furthermore, no schools or recreation areas have been identified in the ROIs of the evaluated radioactive and hazardous waste facilities. Therefore, no disparate impacts are expected on sensitive-aged populations in these ROIs.

The combination of the Cleanup to AOC LUT Values Alternative, the Building Removal Alternative, and either groundwater remediation action alternative would generate the most nonhazardous waste to be shipped to offsite facilities. Assuming all nonhazardous waste was shipped to a single assumed facility, traffic-related impacts are expected to be minimal at the two evaluated facilities with a school or recreation area in their vicinities (Antelope Valley Landfill and McKittrick Waste Treatment Site, both in California). The combination of either the Cleanup to Revised LUT or Conservation of Natural Resources Alternative, the Building Removal Alternative, and either groundwater action alternative combination would generate the least amount of nonhazardous waste. The average number of heavy-duty trucks delivered to a single assumed nonhazardous waste facility could be up to 8 per day during 2 years; daily deliveries during other years would be smaller. The potential impacts of this increased traffic at any single assumed facility would be minimal. Furthermore, for any combination of action alternatives, the number of truck deliveries to any single facility could be reduced if multiple disposal facilities were used or if waste were shipped to one or more rail-accessible facilities. Therefore, no disparate impacts on sensitive-aged populations are expected in the regional ROIs for the evaluated nonhazardous waste facilities under any combination of action alternatives.

S.11.3 Summary of Potential Cumulative Impacts

"Council on Environmental Quality Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act" (40 CFR Parts 1500-1508) define cumulative effects as impacts on the environment that result from the incremental impacts of the proposed action when added to the incremental impacts of other past, present, and reasonably foreseeable future actions, regardless of which agency or person undertakes such other actions (40 CFR 1508.7). Reasonably foreseeable onsite actions at SSFL included in the cumulative impact analysis of this EIS are ongoing and planned demolition, remediation, and waste transportation activities conducted by DOE, NASA, and Boeing. Activities in the SSFL ROI that could contribute to cumulative impacts could include new residential development, new industrial and commercial ventures, resource investigation and development, new utility and infrastructure development, new waste treatment and disposal facilities, and contaminated site remediation. Future actions that are speculative or are not well defined were not analyzed, including the future use of SSFL.

Potential cumulative impacts are summarized in **Table S–10** for each resource area. Chapter 5 presents the detailed cumulative impacts analysis which includes a more detailed discussion of the onsite and offsite activities considered in this cumulative impacts assessment.

Table S-10 Summary of Potential Cumulative Impacts

Resource Area	*DOE Contribution to Cumulative Impacts*	*NASA and Boeing Contribution to Cumulative Impacts*	*Other Contributions to Cumulative Impacts*	*Cumulative Impacts*
Land resources	**Land use:** 40 to 138 acres disturbed; no zoning or land use conflicts. **Recreation:** Increased traffic could discourage weekday use of Sage Ranch Park; no impacts on other recreation areas in the SSFL vicinity are expected. **Infrastructure:** 3,000 to 16,000 gallons per day water consumption for dust suppression. **Aesthetics and visual quality:** Removal of buildings and revegetation would result in beneficial long-term effects on aesthetics and visual quality.	**Land use:** 194 to 275 acres disturbed; no zoning or land use conflicts. Approximately 20 acres of additional undeveloped land in the Southern Buffer Zone could be disturbed if Boeing uses these areas as sources of clean backfill. **Recreation:** Increased traffic could discourage weekday use of Sage Ranch Park; no impacts on other recreation areas in the SSFL vicinity are expected. **Infrastructure:** 210,000 to 214,000 gallons per day water consumption for dust suppression. **Aesthetics and visual quality:** Removal of buildings and revegetation would result in beneficial long-term effects on aesthetics and visual quality.	**Land use:** acreage disturbed not available. **Recreation:** No impacts identified. **Infrastructure:** Annual water use for CMWD averages 177,644 acre feet (or approximately 159 million gallons per day). **Aesthetics and visual quality:** No impacts identified.	**Land use:** 235 to 414 acres disturbed; no zoning or land use conflicts **Recreation:** Increased traffic could discourage weekday use of Sage Ranch Park; no impacts on other recreation areas in the SSFL vicinity are expected. **Infrastructure:** SSFL water use would be approximately 0.1 percent of CMWD's combined water supply, but because of severe drought California is attempting to reduce potable water consumption state-wide by 25 percent. Therefore, cumulative SSFL water use, although small, may be controversial. **Aesthetics and visual quality:** Removal of buildings and revegetation would result in beneficial long-term effects on aesthetics and visual quality.
Geology and soils	There would be 40 to 138 acres of soil disturbance and loss of soil with mineralogical and biological composition capable of supporting unique vegetation in Area IV and the NBZ. 125,000 to 715,000 cubic yards of backfill would be needed. It is unlikely that a source of backfill meeting the DOE AOC LUT values would have the same physical and chemical properties as existing SSFL soils.	There would be 194 to 275 acres of soil disturbance and loss of soil with mineralogical and biological composition capable of supporting unique vegetation at SSFL. 315,000 to 403,000 cubic yards of backfill would be needed. It is unlikely that an offsite source of backfill meeting the NASA AOC LUT values would have the same physical and chemical properties as existing SSFL soils. Boeing has identified potential borrow areas for backfill in the Southern Buffer Zone. If soil is taken from these borrow areas, up to an additional 20 acres could be disturbed.	Other construction activities in the region could disturb soils. Although stormwater pollution prevention plan requirements and BMPs would limit soil erosion, some soil erosion is likely. If the soils are similar to those present at SSFL, cumulative impacts to these soil types could result. Other construction activities in the region could require soils for backfill, but are just as likely to result in excess soil from foundation excavation and slope cutting. Therefore, these activities are not likely to consume a large quantity of soil and contribute to a soil shortage.	There would be 235 to 414 acres of soil disturbance and loss of soil with mineralogical and biological composition capable of supporting unique vegetation at SSFL. 440,000 to 1,120,000 cubic yards of backfill would be needed. It is unlikely that a source of backfill meeting DOE and NASA AOC LUT values would have the same physical and chemical properties as existing SSFL soils.

Resource Area	*DOE Contribution to Cumulative Impacts*	*NASA and Boeing Contribution to Cumulative Impacts*	*Other Contributions to Cumulative Impacts*	*Cumulative Impacts*
Surface water resources	With implementation of control and mitigation measures, DOE's actions would generate no impacts on surface water quality or on local and regional stormwater control capacity, and would not contribute to cumulative impacts. Cleanup would result in a long-term reduction of potential sources of surface water contamination.	With implementation of control and mitigation measures, NASA's and Boeing's actions would generate no impacts on surface water quality or on local and regional stormwater control capacity and would not contribute to cumulative impacts. Cleanup would result in long-term reduction of potential sources of surface water contamination.	Offsite developments would be subject to compliance with stormwater pollution prevention plans and BMPs that would limit the potential for increased soil erosion and sediment loading in runoff during construction and operation.	With implementation of control and mitigation measures, DOE, NASA, and Boeing actions at SSFL would generate no impacts on surface water quality or local and regional stormwater control capacity and would not be expected to contribute to cumulative impacts. Cleanup would result in long-term reduction of potential sources of surface water contamination.
Groundwater resources	Impacts on the quantity of site groundwater are expected to be minimal because groundwater would not be withdrawn during soil excavation. If required, removal of 200,000 gallons of groundwater during demolition of one of the DOE buildings would have a short-term, localized impact on water levels. Because of the relatively small size of SSFL compared to the adjacent groundwater basins and the relatively small quantity of groundwater that would be withdrawn, none of the proposed groundwater remediation technologies are expected to have an appreciable impact on the quantity of groundwater available for use by populations in adjacent groundwater basins. DOE groundwater cleanup activities at SSFL would have a long-term beneficial impact on groundwater quality.	Impacts on the quantity of site groundwater are expected to be minimal because groundwater is deeper beneath the NASA- and Boeing-administered areas and is not expected to be withdrawn during soil excavation. Because of the relatively deep groundwater and because the buildings and other structures have shallow foundations, demolition of buildings is not expected to require dewatering. Because of the relative size of SSFL compared to the adjacent groundwater basins and the relatively small quantities of groundwater that are expected to be withdrawn, none of the proposed groundwater remediation technologies is expected to have an appreciable impact on the quantity of groundwater available for use by populations in adjacent groundwater basins. NASA and Boeing groundwater cleanup activities at SSFL would have a long-term beneficial impact on groundwater quality.	No other contributions to cumulative impacts in the ROI were identified.	Because of the relatively small size of SSFL compared to the adjacent groundwater basins, the depth to the aquifer, and the relatively small quantities of groundwater that would be withdrawn, none of the proposed remediation technologies are expected to have an appreciable impact on the quantity of groundwater available for use by populations in adjacent groundwater basins. Groundwater cleanup activities at SSFL would have a long-term beneficial impact on groundwater quality.

Resource Area	*DOE Contribution to Cumulative Impacts*	*NASA and Boeing Contribution to Cumulative Impacts*	*Other Contributions to Cumulative Impacts*	*Cumulative Impacts*
Biological resources	40 to 138 acres disturbed, including about 13 to 51 acres of relatively undisturbed native habitat. Removal of existing vegetation and topsoil would increase the difficulty of re-establishing native plant species and would reduce or eliminate the value of re-established habitat for most wildlife species. Remediation would require prolonged efforts to restore native vegetation and wildlife habitat. If backfill is substantially different than that originally present, it may not support native vegetation.	194 to 275 acres disturbed. Similar impacts as described for DOE. Approximately 20 acres of additional undeveloped land in the Southern Buffer Zone could be disturbed if Boeing uses these areas as sources of clean backfill.	Projects outside SSFL are generally sufficiently distant to minimize the potential for cumulative effects with the remediation projects on SSFL. However, certain proposed projects (such as Sterling Properties in Dayton Canyon) developed on land that supports threatened, endangered, or rare species or relatively undisturbed native habitat of the same type that would be affected by SSFL remediation activities (e.g., oak woodlands and habitat for Braunton's milk-vetch and Santa Susana tarplant) could have cumulative adverse impacts.	235 to 414 acres disturbed at SSFL. The combined soil excavation and building removal activities of DOE, NASA, and Boeing would cause profound disturbance (removal of vegetation and soils). The effects of vegetation and soil removal could result in long-term impacts due to the intense effort needed to restore the habitat. Simultaneous implementation of remediation activities by DOE, NASA, and Boeing would create cumulative disturbance of habitat and could interfere with regional movement of wildlife species such as mountain lion, bobcat, and ringtail.
Air quality and climate	Onsite activities would not contribute to exceedance of an ambient air quality standard at an offsite location. There would be 32 to 48 daily heavy-duty truck round trips (the maximum from SSFL between DOE, NASA, and Boeing would be 96, per the Transportation Agreement [Boeing 2015a]). These trips would extend across hundreds of miles of roadways, depending on the route taken to a disposal facility. As a result, emissions would be dispersed in the atmosphere to the point that they would produce minimal impacts in a localized area. Implementation of a green cleanup truck fleet proposed by DOE would minimize project air quality impacts. The total carbon dioxide emissions generated by the high DOE combination of alternatives would be 89,000 metric tons.	Onsite activities would not contribute to exceedance of an ambient air quality standard at an offsite location. There would be 48 to 64 daily heavy-duty truck round trips. As a result, emissions would be dispersed in the atmosphere to the point that they would produce minimal impacts in a localized area. NASA and Boeing cleanup actions would emit about 139,000 and 30,000 metric tons of carbon dioxide, respectively.	Numerous cumulative projects, such as those listed in Appendix D, Table D-7, would cause additional emissions impacts within the South Coast Air Basin.	Onsite activities would not contribute to exceedance of an ambient air quality standard at an offsite location, except possibly for occasional exceedances of particulate matter standards. For the South Coast Air Basin region, an area already in extreme nonattainment for the ambient ozone standards, emissions of ozone precursors from DOE activities, in combination with ozone precursor emissions from cumulative projects, would have the potential to contribute to exceedance of an ozone standard. Emissions generated from proposed DOE activities outside of Ventura County and the South Coast Air Basin would be diluted in the atmosphere and would produce minimal impacts in a localized area. Emissions from DOE trucks traveling within the San Joaquin Valley Air Basin (which has extreme nonattainment for ambient ozone standards), combined with cumulative emissions from other traffic has the potential to contribute to an exceedance of an ambient ozone standard within this region. Implementation of a green cleanup truck fleet proposed by DOE would minimize project air quality impacts. The total cumulative carbon dioxide emissions generated by SSFL cleanup activities would be 258,000 metric tons, a negligible contribution to future climate change.

Resource Area	*DOE Contribution to Cumulative Impacts*	*NASA and Boeing Contribution to Cumulative Impacts*	*Other Contributions to Cumulative Impacts*	*Cumulative Impacts*
Noise	The nearest potential residence is located approximately 5,000 feet from the Area IV boundary and would experience an approximate 50 dBA equivalent sound level during workday hours. Assuming the maximum authorized number of daily round trips from Area IV (96 total round trips by DOE, NASA, and Boeing), time-averaged noise levels in residential and recreation areas along potential haul routes are expected to increase by up to 3.5 dBA CNEL, where the final noise level would be below 65 dBA CNEL (the threshold for an adverse impact is an increase of 5 dBA CNEL) or, along one section of Valley Circle Boulevard where the noise level already exceeds 65 dBA CNEL, the noise level would increase by no more than 0.6 dBA CNEL (the threshold for an adverse impact when the final noise level exceeds 65 dBA CNEL is an increase of 3 dBA CNEL).	Remediation activities conducted by NASA and Boeing are expected to generate noise levels similar to those generated by DOE remediation activities.	Offsite residential, commercial, and industrial development projects typically generate temporary localized elevated noise levels at the construction site, temporary increases in construction truck traffic noise along nearby roads, and localized increases in noise levels during project operation. Construction and operations noise would be localized near the individual project sites following a similar pattern to noise levels described for construction activities on SSFL. Therefore, noise from offsite development projects would generally not be cumulative with activities on SSFL.	Projected noise levels at the closest residence to onsite remediation activities would be well below 65 dBA CNEL. Assuming 96 daily truck round trips, time-averaged noise levels in residential and recreation areas along potential haul routes are expected either to increase by no more than 5 dBA CNEL (the threshold for an adverse impact where the final noise level would be below 65 dBA CNEL) or by no more than 3 dBA CNEL (the threshold for an adverse impact where the final noise level would be above 65 dBA CNEL). Noise levels for truck transportation would not increase over levels described for DOE activities alone because the total number of DOE, NASA, and Boeing daily truck round trips would not exceed 96, in accordance with the Transportation Agreement (Boeing 2015a). Although cumulative noise levels would not be greater than the levels for DOE activities alone, these higher levels would occur for a longer period of time. In a hypothetical scenario where a development project was undertaken adjacent to existing residences, the noise of the development project would be dominant, and distant noise generated at SSFL, which is more than 5,000 feet from the closest residence, would not contribute appreciably to overall noise levels. Truck trips conducted in support of other projects in the ROI could potentially follow portions of the same routes used by SSFL trucks. Any cumulative increase in truck traffic noise would be temporary. Therefore, only minor cumulative noise impacts are expected.

Resource Area	DOE Contribution to Cumulative Impacts	NASA and Boeing Contribution to Cumulative Impacts	Other Contributions to Cumulative Impacts	Cumulative Impacts
Transportation	**Radiological impacts:** Collective transportation worker dose of 0.14 to 1.5 person-rem and collective general population dose of 0.092 to 0.39 person-rem. No LCFs would be anticipated. **Nonradiological impacts:** 0.28 to 2.9 potential accident fatalities could result from DOE transportation activities.	**Radiological impacts:** NASA remediation activities are expected to generate a collective worker dose 0.50 person-rem and a collective general population dose of 0.19 person-rem. No LCFs would be anticipated.[a] Boeing remediation activities are not expected to generate any radioactive waste. **Nonradiological impacts:** 1 (0.50 to 0.58) potential accident fatality could result from NASA and Boeing transportation activities.	**Radiological impacts:** The total number of potential LCFs (among the workers and general population) estimated to result from nationwide radioactive material transportation over the period between 1943 and 2073 is 514, or an average of 4 LCFs per year. The transportation-related LCFs represent about 0.0007 percent of the total number of cancer deaths expected over the same time period; therefore, this rate is indistinguishable from the natural fluctuation in the annual death rate from cancer. **Nonradiological impacts:** 43,000 estimated traffic fatalities in California from 2017 through 2028. 11,400 estimated traffic fatalities in the four neighboring counties (2017 through 2028).	**Radiological impacts:** Collective worker dose of 0.64 to 2 person-rem and collective general population dose of 0.28 to 0.58 person-rem. No LCFs would be anticipated. The potential doses from transport of radioactive materials associated with remediation activities at SSFL are insignificant compared to the doses from other nuclear material shipments. The majority of the cumulative risk to workers and the general population would be due to general transportation of radioactive material unrelated to remediation activities at SSFL. **Nonradiological impacts**: 1 (0.79) to 4 (3.5) potential accident fatalities could result from SSFL (DOE, NASA, and Boeing) transportation activities; representing about 0.008 percent of the total number of traffic fatalities expected in California and 0.03 percent of the total number of traffic fatalities expected in the four surrounding counties. The potential traffic fatalities from operations at SSFL are indistinguishable from the natural fluctuation in the total annual death rate from traffic fatalities.
Traffic	**Level of service:** The largest weekday, average daily traffic increase would be on Woolsey Canyon Road (3.4 to 7.6 percent). The LOS rating on Woolsey Canyon Road could degrade from LOS B to C for approximately 4 to 12 years. **Pavement deterioration:** 20,800 to 119,000 additional truck trips, depending on the alternative; ESALs would increase by 45,000 (Low Impact Combination) to 210,000 (High Impact Combination) from DOE truck trips.	**Level of service:** The largest percentage traffic increase would be on Woolsey Canyon Road (22.4 to 26.5 percent). The LOS rating on Woolsey Canyon Road could degrade from LOS B to C. **Pavement deterioration:** 86,400 to 109,000 additional truck trips, depending on the remediation option; ESALs would increase by 220,000 to 330,000 from NASA and Boeing truck trips.	**Level of service:** Current LOS ratings on routes from SSFL range from B (stable traffic flow with no delay) to F (forced traffic flow with considerable delay). **Pavement deterioration:** Estimated baseline ESALs range from 38,000 to 74,000, depending on the route.	**Level of service:** Largest percentage traffic increase would be on Woolsey Canyon Road (30 percent). The LOS on Woolsey Canyon Road could degrade from LOS B to C. **Pavement deterioration:** Estimated single axle loads associated with DOE, NASA, and Boeing remediation activities at SSFL would increase from a baseline of 38,000 to 74,000, to 260,000 to 540,000, depending on the alternative. Between 17 and 39 percent of the increase would be attributable to DOE activities. Increased truck traffic could further damage the surrounding roads, causing them to need repair sooner than currently anticipated.

Resource Area	DOE Contribution to Cumulative Impacts	NASA and Boeing Contribution to Cumulative Impacts	Other Contributions to Cumulative Impacts	Cumulative Impacts
Human health	A hypothetical onsite suburban resident or recreational user is assumed to be exposed to contaminated soil in Area IV for 24 hours a day, 350 days per year for 30 years, consistent with the SRAM. A hypothetical recreational user is assumed to be exposed 8 hours per day for 75 days per year for 30 years. Worker exposure to chemical and radioactive constituents could occur during soil remediation, building demolition, and groundwater remediation. Physical and administrative controls would be employed to ensure that workers would be protected in compliance with DOE requirements for worker safety and radiation protection. Radiation protection practices would be employed so that radiation doses are ALARA.	Because the DOE onsite suburban resident scenario already includes exposure for 24 hours a day, 350 days per year for 30 years, consistent with the SRAM, no additional time could be spent on NASA or Boeing areas of SSFL. The total exposure time for a hypothetical recreational user would not increase, regardless of which area of SSFL is being traversed. Worker exposure to chemical and radioactive constituents could occur during soil remediation, building demolition, and groundwater remediation. Physical and administrative controls would be employed to ensure that workers would be protected in compliance with regulatory requirements for worker safety and radiation protection	None identified.	Because the onsite resident scenario conservatively includes exposure for 24 hours a day, 350 days per year for 30 years, consistent with the SRAM, no additional time could be spent on NASA or Boeing areas of SSFL. A resident can only be in one area at a time and cannot be in both areas simultaneously. Therefore, the effects are not additive, and the cumulative effect cannot be greater than the greater of the individual area efforts. The impacts from adjacent areas under control of NASA or Boeing to a resident in Area IV would result in a minimal addition to cumulative impacts because these areas are separated by significant distances relative to a residential exposure scenario. Likewise, the contributions from Area IV to hypothetical onsite suburban residents in NASA or Boeing remediation areas also would be small and would make a minimal addition to cumulative impacts. It is unlikely that the same workers would perform remediation work for DOE, NASA, and/or Boeing because remediation activities are planned to occur in overlapping years. If workers do perform remediation work in more than one area, they can only be in one area at a time and would not be exposed to both simultaneously. Whatever time they spend in one area takes away from the time they could spend in another area and would be limited to applicable regulatory standards and guidelines. Because work practices during excavation or demolition would control dust, impacts would be localized to the work area. Therefore, contributions from remediation activities in one area of SSFL on remediation workers in an adjacent area would only minimally add to cumulative impacts on worker health.

Resource Area	DOE Contribution to Cumulative Impacts	NASA and Boeing Contribution to Cumulative Impacts	Other Contributions to Cumulative Impacts	Cumulative Impacts
Waste management	Considering all DOE soil remediation, building demolition, and groundwater remediation activities, DOE would generate 57,600 to 103,300 cubic yards of LLW/MLLW, about 49,100 cubic yards of hazardous waste, 53,200 to 794,000 cubic yards of nonhazardous waste, and 3,540 cubic yards of recyclable material.	Considering all soil remediation and building removal activities, NASA could generate 87,000 cubic yards of LLW/MLLW (no LLW/MLLW would be generated by Boeing). NASA and Boeing combined would generate 489,700 to 752,700 cubic yards of hazardous waste, 398,000 cubic yards of nonhazardous waste, and 37,700 cubic yards of recyclable material.	None identified.	DOE is projected to generate and ship off site about 40 to 54 percent of the SSFL cumulative volume of LLW and MLLW, 6 to 9 percent of the cumulative volume of hazardous waste, 12 to 67 percent of the cumulative volume of nonhazardous waste (primarily soil), and about 9 percent of the cumulative volume of recyclable material. Sufficient capacity exists for all types of waste generated by DOE, NASA, and Boeing, and the impact on any single facility's capacity can be reduced by sending waste to multiple disposal facilities.
Cultural resources	**Archaeological resources:** NRHP-eligible sites would be protected from impacts (i.e., adverse effects) through implementation of a Programmatic Agreement under Section 106 of the NHPA. Sites that are not individually eligible, but are contributing elements of the Santa Susana Sacred Site, could be adversely impacted. However, cultural resources that do not meet the NRHP criteria could be protected under the 2010 AOC exemption process. **Architectural resources:** No structures located in DOE-administered areas are NRHP-eligible. **Traditional cultural resources:** The character-defining traits of the Chumash-designated Santa Susana Sacred Site include all archaeological and natural resources, settings, and viewsheds. Cleanup activities would affect some archaeological resources. Plants and animals may be disturbed, dislocated, or destroyed. Beneficial impacts would be achieved through restoration of viewsheds by removal of structures. Removal of contamination would also be beneficial.	**Archaeological resources:** NRHP-eligible areas on NASA-administered lands would be protected from impacts (i.e., adverse effects) from implementation of its Programmatic Agreement under Section 106 of the NHPA. **Architectural resources:** NASA proposes to preserve one or more NRHP-eligible structures, but demolition of other structures would contribute to cumulative effects. **Traditional cultural resources:** Impacts from NASA and Boeing activities on the Chumash-designated Santa Susana Sacred Site would have similar impacts on those described for DOE. Beneficial impacts would be achieved through restoration of viewsheds by removal of structures. Removal of contamination would also be beneficial.	Of the 129 actions identified within 10 miles of SSFL, as many as 21 have the potential to contribute to cumulative impacts. **Archaeological resources:** Large-scale developments outside SSFL would contribute to cumulative adverse impacts if archaeological sites are disturbed during project construction, paved over, or disturbed at a later date due to human activity. **Architectural resources:** None specifically identified. **Traditional cultural resources:** Loss of defining characteristics of traditional cultural values at other locations within the ROI could add to cumulative impact on the viewsheds.	**Archaeological resources:** The overall trend in the region is toward a reduction in NRHP-eligible archaeological sites, both pre-contact Native American and post-contact, as these impacts accumulate. Where NHPA is applicable, adverse effects to NRHP-eligible sites would be mitigated, but mitigation could include removal of the site. Where NHPA is not applicable or where sites are not eligible, sites may be removed from the overall inventory of archaeological resources. The protection of NRHP-eligible sites at SSFL would not add to cumulative regional impacts. However, the overall complement of archaeological sites, particularly those that are not eligible for the NRHP, could continue to be reduced. **Architectural resources:** Because there are no NRHP-eligible structures within the DOE area of potential effects, DOE cleanup activities would have no cumulative effect on architectural resources. **Traditional cultural resources:** Cumulative adverse effects on traditional cultural resources are likely as cleanup occurs on the entire SSFL and as development occurs in previously undeveloped land in the ROI, including in areas with intact landscapes or remote locations where traditional resources may still retain integrity. Beneficial impacts would be achieved through restoration of viewsheds by removal of structures at SSFL. Removal of contamination at SSFL would also be beneficial.

Resource Area	DOE Contribution to Cumulative Impacts	NASA and Boeing Contribution to Cumulative Impacts	Other Contributions to Cumulative Impacts	Cumulative Impacts
Socioeconomics	**Employment:** DOE onsite activities would require 25 to 26 workers. Workers would likely originate primarily from Ventura and Los Angeles Counties. **Truck drivers and traffic:** DOE would require from 32 to 48 truck drivers. A maximum of 95 truck drivers could be required for 2-day truck trips to distant facilities. Traffic conditions near businesses would not change substantially. **Infrastructure and municipal Services:** Impacts on roads would result in impacts on local government funding and expenses. DOE may need to negotiate with local governments to contribute its portion of the cost for maintenance and repair of affected roads. **Housing availability:** Because workers would likely originate from the region, changes to housing availability are not expected. **Disposal facility impacts:** Increases in truck traffic are not expected to have a cumulative adverse economic impact on local businesses near disposal facilities because the maximum number of daily truck trips would be relatively small. The largest number of daily shipments would be to a nonhazardous waste facility (25 shipments).[b]	**Employment:** NASA and Boeing onsite activities would require 150 to 175 workers. Workers would likely originate primarily from Ventura and Los Angeles Counties. **Truck drivers and traffic:** NASA and Boeing would require an estimated 9 to 42 truck drivers. A maximum of 202 truck drivers could be required for 2-day truck trips to distant facilities. Traffic conditions near businesses would not change substantially. **Infrastructure and municipal Services:** Impacts on roads would result in impacts on local government funding and expenses. **Housing availability:** Because NASA and Boeing workers would likely originate from the region, changes to housing availability are not expected. **Disposal facility impacts:** Increases in truck traffic are not expected to have a cumulative adverse economic impact on local businesses near disposal facilities because the maximum number of daily truck trips would be relatively small. The largest number of daily shipments would be to a nonhazardous waste facility (42 shipments).[b]	The populations in Los Angeles and Ventura Counties are projected to increase by 9 percent from 2013 through 2030. **Employment:** More than 117,000 construction workers are in the region. **Truck drivers and traffic:** Approximately 7,200 workers are employed in specialized freight trucking in the region, plus approximately 26,600 employees in general truck transportation. **Infrastructure and municipal services:** Population growth could increase traffic levels, but also could increase spending by local and state government agencies on roadways and mass transit projects. **Housing availability:** Projected population growth in the ROI would increase the demand for housing. Future housing development is expected to meet the demands of population growth. **Disposal facility impacts:** None identified.	**Employment:** SSFL remediation activities would require 175 to 201 workers. SSFL site activities would have a minor beneficial impact on the economy in Los Angeles and Ventura Counties by providing employment and increasing sales for industries that provide equipment, supplies, and rentals. Because workers would likely originate from the region, new spending in the region would be minimal. **Truck drivers and traffic:** Employment of 73 to 297 SSFL truck drivers would represent 1 to 4 percent of the available truck drivers in Los Angeles and Ventura Counties and would not adversely affect the truck transportation industry. Traffic conditions near businesses would not change substantially. Business sales and revenues would not change substantially. **Infrastructure and municipal services**: DOE truck trips would represent 19 to 52 percent of the total shipments from SSFL. Impacts on roads would result in impacts on local government funding and expenses. DOE activities would not require additional services, so there would be no cumulative impacts on other municipal services. **Housing availability:** Because SSFL workers would likely originate from the region, changes to housing availability are not expected. **Disposal facility impacts:** Increases in truck traffic from SSFL waste disposal activities are not expected to have a cumulative adverse economic impact on businesses near waste disposal facilities because the maximum number of daily truck trips would be relatively small. DOE estimates that the combined maximum daily truck shipments arriving at a nonhazardous waste facility would be 43.[b] DOE estimates the maximum daily truck shipments to facilities for other types of waste would be less – 17 at LLW or MLLW facilities, 39 at hazardous waste facilities, and 4 at recycle facilities (see Appendix D).[c]

Resource Area	*DOE Contribution to Cumulative Impacts*	*NASA and Boeing Contribution to Cumulative Impacts*	*Other Contributions to Cumulative Impacts*	*Cumulative Impacts*
Environmental justice	Impacts on minority and low-income populations would be the same as those experienced by the general population. Therefore, no disproportionately high and adverse effects on minority and low-income populations are expected.	Impacts on minority and low-income populations would be the same as those experienced by the general population. Therefore, no disproportionately high and adverse effects on minority and low-income populations are expected.	None identified.	Impacts on minority and low-income populations would be the same as those experienced by the general population. Therefore, no disproportionately high and adverse cumulative effects on minority and low-income populations are expected.
Sensitive-aged populations	Impacts on sensitive-aged populations would be the same as those experienced by the general population. No disparate impacts (markedly distinct impacts relative to those on the general population) on sensitive-aged populations are expected.	Impacts on sensitive-aged populations would be the same as those experienced by the general population. No disparate impacts on sensitive-aged populations are expected.	None identified.	Cumulative impacts on sensitive-aged populations would be the same as those experienced by the general population. Because there would be no adverse cumulative impacts on members of the public, there would be no disparate cumulative impacts on sensitive-aged populations.

ALARA = as low as reasonably achievable; AOC = *Administrative Order on Consent for Remediation*; BMP = best management practice; Boeing = The Boeing Company; CMWD = Calleguas Municipal Water District; CNEL = community noise equivalent level; dBA = decibels A-weighted; ESAL = equivalent single-axle load; LCF = latent cancer fatality; LLW = low-level radioactive waste; LOS = level of service; LUT = Look-Up Table; MLLW = mixed low-level radioactive waste; NASA = National Aeronautics and Space Administration; NBZ = Northern Buffer Zone; NHPA = National Historic Preservation Act; NRHP = *National Register of Historic Places*; ROI = region of influence; SRAM = *Final Standardized Risk Assessment Methodology Revision 2 Addendum, Santa Susana Field Laboratory, Ventura County, California* (MWH 2014).

[a] NASA did not conduct radiological operations in its areas of SSFL; estimated quantities of radioactive waste from NASA remediation are due to naturally occurring isotopes and the LUT values established in accordance with the 2010 NASA *Administrative Order on Consent for Remedial Action* (DTSC 2010b).

[b] The years in which the maximum number of daily deliveries may occur for different types of waste would be different for DOE, NASA, and Boeing. For example, the maximum daily deliveries of nonhazardous waste from NASA and Boeing combined would likely occur when the number of DOE is shipments small (due to DOE's planned sequence of activities). Therefore, the combined maximum daily delivery is not the sum of the individual organizations' maximum daily deliveries.

[c] In accordance with a Transportation Agreement between DOE, NASA, and Boeing (Boeing 2015a), the maximum total number of daily heavy-duty truck round trips from SSFL would be limited to 96. The 96 heavy-duty truck round trips would be split between activities such as trips to disposal facilities or recycle facilities and shipment of backfill to SSFL. Therefore, it is highly unlikely that 96 shipments per day to any single disposal facility would occur.

Note: Sums presented in the table may differ from those calculated from table entries due to rounding.

S.12 Conclusions

S.12.1 Areas of Potential Controversy

As a result of preparing this EIS and based on public comments received during the 2008 and 2014 EIS scoping periods and other ongoing, more-recent community interactions at the site (for example, town hall meetings and DTSC update meetings), the following are areas of controversy that DOE expects will be raised by stakeholders:

- **Appropriate Cleanup Level** – DTSC established AOC LUT values consistent with the 2010 AOC, which requires cleanup to background levels or to levels based on laboratory capabilities. The Cleanup to AOC LUT Values Alternative evaluated in this EIS analyzes the potential impacts that would result from implementation of cleanup to the AOC LUT values.

  Considering that implementation of the Cleanup to AOC LUT Values Alternative poses technical challenges (for example, requiring 132 individual chemical and radioactive constituents to meet their respective LUT values and clearly distinguishing between contamination and background concentrations); would have significant environmental impacts and higher costs than other soil remediation alternatives (see Appendix J); and would result in minimal reduction in human health risk (see the comparison of background risk to that of Area IV soil in Chapter 4, Section 4.9, and location-specific examples in Appendix J); DOE evaluated two alternatives in this EIS that are based on risk. The Cleanup to Revised LUT Values Alternative uses the same LUT values for radioactive constituents as the Cleanup to AOC LUT Values Alternative, but proposes RBSLs as the revised LUT values for chemicals. These revised LUT values for chemicals were derived from the suburban resident scenario[32] evaluated in the SRAM (MWH 2014) and are based on a risk of 1 chance in 1 million for carcinogenic chemicals and a hazard index of 1 for noncarcinogenic chemicals. Under the Cleanup to Revised LUT Values Alternative, the LUT values apply individually to each chemical or radionuclide. The Conservation of Natural Resources Alternative is also based on a suburban residential scenario identified in the SRAM, but applies a risk-assessment approach that evaluates the collective impact of an area (that is, it uses the average concentration of constituents across the area and evaluates the total chemical risk or radiological dose). Under the Conservation of Natural Resources Alternative, DOE would remediate soil to reduce the concentrations of chemical and radioactive constituents to levels protective of human health.

  Inclusion of these latter alternatives in the analysis allows decision-makers to consider the potential impacts associated with cleanup to the AOC LUT values against risk-based approaches.

- **Cleanup Completed by 2017** – DOE will not be able to complete cleanup by 2017 under any of the action alternatives. DOE does not consider completion by 2017 to be a reasonable alternative based on the current status of Federal and state environmental reviews (under NEPA and CEQA) or approvals needed before remediation could commence and the amount of work required to complete remediation. After signing the 2010 AOC (DTSC 2010a) and before cleanup could begin, it was necessary to conduct offsite

[32] Multiple exposure scenarios were evaluated in the SRAM (MWH 2014). The landowner, Boeing, has stated its intent to maintain its portion of SSFL (which includes Area IV and the NBZ) as undeveloped open space (Boeing 2016b). Regardless, the revised LUT values are conservatively based on the suburban resident scenario direct pathways of inhalation, incidental ingestion, and dermal contact.

characterization to establish background values for both chemical (URS 2012) and radioactive (HGL 2011) constituents, perform and document site investigation and characterization of Area IV and the NBZ (HGL 2012a; CDM Smith 2017), and complete soil treatability studies (CDM Smith 2015b).

Before DOE can proceed with site remediation, environmental review documentation (including this EIS and the DTSC CEQA program EIR [in preparation]) must be completed. Additional plans and approvals that need to be completed include the SRAIPs for the soil remediation (DOE expects to submit the first of three planned SRAIPs to DTSC at the same time that DTSC issues the final program EIR), RCRA Closure Plans for demolition of regulated buildings (submitted by DOE in 2015 for DTSC approval), and the Corrective Measures Study for groundwater remediation to be submitted by DOE in 2017 for DTSC approval.

In addition, DOE and DTSC did not anticipate the volume of soil that would require cleanup (see Table S–3) as a result of the cleanup levels established by the AOC LUTs. An estimated 933,000 cubic yards of soil would be removed under the Cleanup to AOC LUT Values Alternative because it exceeds the AOC LUT values. Under a risk-based approach, that is, under the Cleanup to Revised LUT Values Alternative or Conservation of Natural Resources Alternative, 741,000 more cubic yards of soil (79.4 percent of the total volume of soil that does not meet the AOC LUT values) would be left on site.

- **Soil Volume Requiring Remediation** –To enable DOE to provide a basis for the analysis in this EIS and eventually plan the cleanup activities, an estimate of the volume of soil exceeding the chemical and provisional radiological AOC LUT values was needed. DOE used the analytical results from over 11,000 soil samples (3,542 soil samples taken by EPA for radiological sampling, 5,854 samples taken by DOE for chemical characterization, and 2,259 RFI samples). Based on comparison of the results for each sample with AOC LUT values, DOE estimated that the volume of soil in which one or more chemical or radioactive constituents does not meet the AOC LUT values was about 1,413,000 cubic yards, but acknowledges that due to uncertainties, the volume could range from approximately 1,000,000 to 2,500,000 cubic yards.[33]
- **Water Use During Drought Conditions** – Cleanup of SSFL Area IV and the NBZ will require a large volume of water. Based on the estimates of soil volumes to be removed, an estimated 4.0 million gallons of water would be needed annually, representing about 0.007 percent of CMWD's current imported and local water supply, principally to suppress dust generated during remediation actions in accordance with Federal, state, and local regulatory requirements. The Cleanup to AOC LUT Values Alternative would require this water use over a much longer time compared to the other soil remediation action alternatives (10 years compared to a little more than 2 years under the Cleanup to Revised LUT Values Alternative and about 2 years under the Conservation of Natural Resources Alternative).

  Water use is an important consideration in the comparison of soil remediation alternatives. Any new demand for water is likely to be controversial because of the long-term California

[33] DOE estimates the volume of soil that may not meet the AOC LUT values could range from 1,000,000 cubic yards to 2,500,000 cubic yards (see Appendix D). The estimated volume of soil (i.e., 1,413,000 cubic yards) not meeting the AOC LUT values was calculated using a geographic information system evaluation of the vertical and lateral distribution of contamination found during sampling. DOE recognizes that there is uncertainty associated with extrapolating data collected at individual points and therefore identified a range of soil volumes.

drought conditions and the need, as expressed by Governor Brown, to significantly reduce water consumption in the state.

Community Acceptance – There is a large community interested in the cleanup of SSFL, including those who live in areas near the site and through which trucks travelling to and from the site would pass. Within that community, there are diverse and divergent opinions regarding the approach to SSFL cleanup and what should be accomplished by the cleanup. As shown by the comments received during scoping, there are varying perspectives among community members regarding how "clean" the site must be upon completion of remediation efforts.

- Some members of the community live along transportation routes and will question the necessity for large numbers of trucks transporting waste from SSFL and backfill to SSFL.
- Some members of the community are concerned about the selection of a remedy consistent with the AOC LUT values and question whether it is necessary. These members support a risk-based cleanup that is protective of human health and environmentally balanced.
- Other members of the community believe SSFL currently serves as a healthy ecosystem with vegetation and wildlife similar to adjacent properties. This segment of the community does not support the Cleanup to AOC LUT Values Alternative, believing the impacts associated with that alternative would inflict unnecessary harm on portions of SSFL that have minimal contamination.
- Some members of the community remain concerned about the risk of cancer and other illnesses from hazardous pollutants at the site and support cleaning all of the contamination because that is the best way to ensure that public health is protected.

DOE believes the decisions to be supported by this EIS are important and that decision-makers will need the full range of reasonable alternatives and careful analysis on which to base decisions.

S.12.2 Issues to Be Resolved

Initiation of Area IV and NBZ remediation is contingent on completing certain regulatory requirements, such as DOE issuing a final EIS and ROD and DTSC issuing a program EIR and decision document, negotiating with DTSC any necessary changes to the 2010 AOC, and addressing the Court Order (Case 3:04-CV-04448-SC, May 2, 2007). Issuance of those documents and/or implementation of the decisions depend on resolution of several issues. The overarching issue related to soil remediation is the cleanup alternative to be selected. Other issues that affect that decision relate to the concentration of chemical and/or radioactive constituents that would be acceptable to leave on site or to be in backfill soil. Resolution of these issues influences the magnitude and feasibility of the cleanup of Area IV and the NBZ. The following issues require resolution:

- The 2010 AOC (DTSC 2010a) includes exemptions to protect sensitive biological and cultural resources. The final exemption areas for biological resources will be determined through consultation with the USFWS and CFWS, resulting in a Biological Opinion that would be issued for the proposed action. The final exemption areas for cultural resources will be determined in consultation with SHPO, Santa Ynez Band of Chumash Indians, and the SSFL Sacred Sites Council. For the purposes of this EIS, DOE estimated the proposed biological and cultural exemptions would result in an estimated 330,000 cubic yards of soil that would not be removed. DOE will not know the actual volume of soil that would not be removed until it completes federally required consultations.

- Based on completed soil treatability studies, it appears that natural processes would be able to reduce TPH and PAH concentrations adequately to meet AOC LUT values over a long period of time. To support the analysis presented in this EIS, it was assumed that soils with chemical constituents amenable for biological degradation (TPH and PAHs) would be allowed to attenuate on site. The estimated volume of soil at locations with only TPH and PAH contamination is 150,000 cubic yards. Acceptance of this approach to remediation would have to be negotiated with DTSC; if not accepted and the existing AOC LUT values are applied, an estimated 150,000 cubic yards of additional soil would require removal.
- An estimated 700,000 cubic yards of backfill would be needed to re-contour the site and restore native vegetation under the Cleanup to AOC LUT Values Alternative. Based on an initial evaluation, no source of backfill has been found that meets the AOC LUT values for concentrations of chemicals.[34] Even if an adequate source of backfill were found, DOE is uncertain that the soil would have chemical and biological properties sufficiently similar to SSFL soil for successful restoration of Area IV and NBZ native vegetation. Chances of finding acceptable backfill soil are better under the Cleanup to Revised LUT Values Alternative or Conservation of Natural Resources Alternative because the assumed requirements for concentrations of chemicals in the backfill soil would be less stringent.
- Selection of the final remedy for groundwater following this EIS also depends on completion of the RCRA Corrective Measures Study being conducted consistent with the 2007 CO (DTSC 2007). DOE expects to submit its Corrective Measures Study to DTSC in 2017, prior to the DOE ROD for this EIS.

S.12.3 Major Conclusions

- Soil remediation alternatives present a large range of potential environmental impacts, but would result in a small difference in potential human health impacts following cleanup. As presented in Chapter 4, Section 4.9, under the No Action Alternative, the risk to a hypothetical onsite suburban resident from chemicals and/or radionuclides in Area IV and the NBZ are comparable to or less than the risk determined for background soil. Because there is little difference between those risks, there would also be little difference between the risks following cleanup under any of the soil remediation alternatives—risks in all cases would be close to those from exposure to background soil. There would be large differences in other potential impacts during soil remediation, with the largest occurring under the Cleanup to AOC LUT Values Alternative; those under the Cleanup to Revised LUT Values Alternative and Conservation of Natural Resources Alternative would be less. Impacts under the Conservation of Natural Resources Alternative would be the smallest. For example, the amount of land disturbance, which is an indicator of the volume of soil that would be removed and the potential impacts on biological resources, air, traffic, and water use, would be about 130 acres under the Cleanup to AOC LUT Values Alternative; 40 acres under the Cleanup to Revised LUT Values Alternative and 32 acres under the Conservation of Natural Resources Alternative.

[34] In support of project implementation DOE would again search for and evaluate sources of backfill.

- The difference in volume estimates for soil remediation between the Cleanup to AOC LUT Values Alternative and either the Cleanup to Revised LUT Values Alternative or Conservation of Natural Resources Alternative is at least 741,000 cubic yards (that is, under the Cleanup to AOC LUT Values Alternative, an additional 741,000 cubic yards of soil would be removed from Area IV and the NBZ). The Cleanup to Revised LUT Values Alternative and the Conservation of Natural Resources Alternative are similar to a risk-based approach that typically has been applied at other DOE cleanup sites[35] (determined by an assessment of risk under the projected future land use).
- Landfill disposal of 741,000 cubic yards of additional soil under the Cleanup to AOC LUT Values Alternative would result in additional truck trips (55,575 truck round trips for soil removal and 36,245 truck round trips for backfill). Compared to the either the Cleanup to Revised LUT Values Alternative or Conservation of Natural Resources Alternative, this would entail about 8 additional years of truck traffic for hauling soil and backfill. This would be particularly noticeable on Woolsey Canyon Road, as it is the only road into SSFL that is suitable for heavy trucks.
- Implementation of the Cleanup to AOC LUT Values Alternative would result in removal of vegetation and wildlife habitat over about 130 acres outside of the proposed exemption areas and an unquantified additional acreage within the proposed exemption areas, causing mortality and disturbance of wildlife within and adjacent to the affected area. By comparison, the Cleanup to Revised LUT Values Alternative would result in removal of vegetation and wildlife habitat over 40 acres, and the Conservation of Natural Resources Alternative over 32 acres.
- The soil disturbance caused by remediation would require special measures to accomplish restoration of a self-sustaining native vegetation cover and sources of suitable clean soil for backfill where soil has been removed have not yet been identified. Based on an initial evaluation, DOE has not identified a source of backfill that would meet the AOC LUT values.[36] Even if a source of backfill were identified, it is uncertain whether the physical, chemical, and biological characteristics of that soil could support successful site restoration using native vegetation, as discussed in Chapter 4, Section 4.5.1. If backfill is substantially different than the soil originally present on site (e.g., the soil pH [acidity]), it may not support vegetation similar to that present before development of Area IV (e.g., federally and state-listed species such as Braunton's milk-vetch and Santa Susanna tarplant). With implementation of habitat restoration and revegetation measures, as well as measures to reduce or avoid impacts on wildlife as described in Chapter 6, biological impacts would be reduced, but would not be avoided given the degree of habitat loss that would occur through soil removal and the length of time required to restore vegetation, habitat function, and wildlife populations.
- A suburban resident scenario was used as a conservative means of evaluating possible future use for Area IV and the NBZ. The negative incremental risks calculated for the No Action Alternative imply that the concentrations of chemical and radionuclides in soil from site-related activities are less than the variability of background concentrations of those chemicals and radionuclides. Therefore, the risk of cancer incidence or death from chemicals and/or

[35] DOE, in conjunction with its regulators, uses risk assessments that consider the current and potential future use of the land and water resources in making cleanup decisions. The cleanup of the Rocky Flats Plant (DOE, EPA, and CDPHE 2006, DOE 2011b) and the Hanford Site 300 Area (DOE, EPA, and Ecology 2013) are examples of DOE application of risk assessments to site-specific receptors to guide remediation.

[36] In support of project implementation, DOE would again search for and evaluate sources of backfill.

radionuclides in Area IV and the NBZ are comparable to or less than the risk determined for background soils (see Chapter 4, Section 4.9). However, characterization of Area IV and the NBZ has shown that chemical and radioactive constituents are not spread evenly across Area IV and the NBZ. The areas with concentrations of chemicals exceeding revised chemical LUT values (Figure S–6) or risk-assessment-based concentrations for chemicals and radionuclides (Figure S–7) are smaller than the areas exceeding AOC LUT values (Figure S–5), indicating that these smaller areas are "hot spots." This implies that the greatest effect on reducing risk to human health would be from focusing on the removal of soil from those locations in Area IV and the NBZ with the highest concentrations of chemical and/or radioactive constituents. Additional soil removal would result in little additional reduction in risk to human health.

- An estimated 4.0 million gallons of water would be required annually to implement any of the soil remediation alternatives. Water use is an important consideration in the comparison of soil remediation alternatives, given the current drought conditions in the State of California and Governor Brown's proclamation to reduce water usage by 25 percent. The Cleanup to AOC LUT Values Alternative would last 10 years and use 40 million gallons of water, compared to the Cleanup to Revised LUT Values Alternative, which would last a little longer than 2 years and use about 8.3 million gallons, and the Conservation of Natural Resources Alternative, which would last about 2 years and use 8.0 million gallons of water.

S.13 References

ASTM (ASTM International), 2013, *Standard Guide for Greener Cleanups*, ASTM E2893-13e1, West Conshohocken, Pennsylvania, November.

Boeing (The Boeing Company), 1999, Memorandum from J. Shao, Radiation Safety, to P. Rutherford, "17th Street Drainage Area Radiation Characterization Surveys and Excavation," January 18.

Boeing (The Boeing Company), 2000, *Area 4020, MARSSIM Final Status Survey Report,* RS-00010, August 31.

Boeing (The Boeing Company), 2008, *Final Consensus Recommendation on a Site Specific Design Storm for Santa Susana Field Laboratory*, Boeing Santa Susana Field Laboratory Stormwater Expert Panel (accessed on June 2, 2015, http://www.boeing.com/assets/pdf/aboutus/environment/santa_susana/ents/ENTS_Expert_Panel_PublicMeeting_050108.pdf), April 30.

Boeing (The Boeing Company), 2015a, *Transportation Agreement for the Santa Susana Field Laboratory Ventura County, California Between the Boeing Company (Boeing) and the U.S. Government As Represented by the National Aeronautics and Space Administration (NASA) and the Department of Energy (DOE)*.

Boeing (The Boeing Company), 2015b, Personal communication (email) from D. W. Dassler to J. Wondolleck, CDM Smith, "Re: Responses to DOE EIS questions," June 11.

Boeing (The Boeing Company), 2016a, *Santa Susana Field Laboratory*, Santa Susana Backgrounder (accessed on January 7, 2016, http://www.boeing.com/resources/boeingdotcom/principles/environment/pdf/Santa_Susana_backgrounder.pdf).

Boeing (The Boeing Company), 2016b, Letter from S. L. Shestag, Director Environment, Santa Susana Site Executive, to S. Kuehl, Supervisor, Third District County of Los Angeles, M. Englander, Los Angeles City Councilman, and F. Pavley, Senator, 27th District Calabasas, "Re: Letter of December 14, 2015 from Supervisor Kuehl, Councilman Englander, and Senator Pavley to Barbara Lee, Director California Department of Toxic Substances Control," February 22.

Burgesser, T., 2015, Memorandum to K. Roberts and J. Wondolleck, *An Evaluation of Chemicals of Natural Origin on Reported Total Petroleum Hydrocarbon Concentrations at the Santa Susana Field Laboratory*, October 8.

CA EO (California Executive Order), 2015, Executive Order B-29-15, April 1.

California Energy Commission, 2012, *Our Changing Climate 2012 – Vulnerability and Adaptation to the Increasing Risks from Climate Change in California,* A Summary Report on the Third Assessment from the California Climate Center (available at http://www.climatechange.ca.gov/adaptation/third_assessment/), July.

CDC (Centers for Disease Control and Prevention), 2014, *Sources of Valley Fever (Coccidioidomycosis)*, Atlanta, Georgia (accessed on May 5, 2015, http://www.cdc.gov/fungal/diseases/coccidioidomycosis/causes.html), May 14.

CDM Smith, 2015a, *Final RCRA Facility Investigation (RFI) Groundwater Work Plan, Portions of Area IV under DOE Responsibility, Santa Susana Field Laboratory, Ventura, California*, November 9.

CDM Smith, 2015b, *Soil Treatability Studies, Area IV Santa Susana Field Laboratory, Ventura County, California,* Version 2, Denver, Colorado, September.

CDM Smith, 2017, *Chemical Data Summary Report, Santa Susana Field Laboratory, Ventura County, California,* Denver, Colorado, May.

CEQ (Council on Environmental Quality), 1981, "Memorandum to Agencies: Forty Most Asked Question's Concerning CEQ's National Environmental Policy Act Regulations," 46 FR 18026, Executive Office of the President, Washington, DC, *Federal Register*, Vol. 46, March 23, as amended.

CH2M Hill, 2008, *Group 5 – Central Portion of Areas III and IV, RCRA Facility Investigation Report*, *Santa Susana Field Laboratory, Ventura County, California,* Volume IX, *RFI Site Reports*, Appendix T, "Systems for Nuclear Auxiliary Power," Draft, November.

CH2M Hill, 2009, *Draft Group 3 Remedial Investigation Report at the Santa Susana Field Laboratory, Ventura County, California,* May.

Chumash (Santa Ynez Band of Chumash Indians), 2014, Personal communication (email) from S. Cohen, Government and Legal Specialist to S. Jennings, U.S. Department of Energy, "Santa Ynez Chumash Comment opposing restriction of EIS alternatives," March 12.

CRWQCB (California Regional Water Quality Control Board), 2007, Letter from D. Hung, Chief, Watershed Regulatory Section, to T. Gallacher, Director, SSFL Safety, Health and Environmental Affairs, The Boeing Company, "National Pollutant Discharge Elimination System Permit (NPDES) (Order No. R4-2007-0055 and Cease and Desist Order (Order No. R4-2007-0056) for the Boeing Company, Santa Susana Field Laboratory, Canoga Park, NPDES No. CA0001309, CI No. 6027," November.

DOE (U.S. Department of Energy), 2003, *Final Environmental Assessment for Cleanup and Closure of the Energy Technology Engineering Center*, DOE/EA-1345, National Nuclear Security Administration Service Center, Oakland, California (available at http://www.etec.energy.gov/Regulation/RegDocs/ETECEA.pdf), March.

DOE (U.S. Department of Energy), 2009, *Scoping Comment Responses for the Environmental Impact Statement for Remediation of Area IV of the Santa Susana Field Laboratory* (available at http://www.etec.energy.gov/EIS/Documents/SSFL%20Area%20IV%20Final%20Scoping%20CRD.pdf), September 28.

DOE (U.S. Department of Energy), 2010, *Community Involvement Plan Area IV Santa Susana Field Laboratory,* prepared by CDM Smith and Science Applications International Corporation (available at http://www.etec.energy.gov/EIS/Documents/SSFL_Area_IV_Community_ Involvement_Plan_2-26-10.pdf), February.

DOE (U.S. Department of Energy), 2011a, *Administrative Change to DOE O 458.1, Radiation Protection of the Public and the Environment*, Change 3 (January 15, 2013), Office of Health, Safety and Security, Washington, DC.

DOE (U.S. Department of Energy), 2011b, *Corrective Action Decision/Record of Decision Amendment for Rocky Flats Plant (USDOE) Central Operable Unit, Jefferson and Boulder Counties, Colorado*, September 19.

DOE (U.S. Department of Energy), 2014a, *Environmental Impact Statement for Remediation of Area IV and the Northern Buffer Zone of the Santa Susana Field Laboratory Final Scoping Summary Report* (available at http://www.etec.energy.gov/Library/Cleanup_and_Characterization/EIS/Final%20Scoping%20Summary%20Report%20SSFL%20EIS.pdf), August 6.

DOE (U.S. Department of Energy), 2014b, *DOE Handbook, Optimizing Radiation Protection of the Public and the Environment for Use with DOE O 458.1, ALARA Requirements*, DOE-HDBK-1215-2014, Washington, DC, October.

DOE (U.S. Department of Energy), 2015, *Executive Order 13693 – Planning for Federal Sustainability in the Next Decade*, Memorandum for Distribution from M. Gilbertson, Deputy Assistant Secretary for Site Restoration, Washington, DC, September 10.

DOE, EPA, and CDPHE (U.S. Department of Energy, U.S. Environmental Protection Agency, and Colorado Department of Public Health and Environment), 2006, *Corrective Action Decision/Record of Decision for Rocky Flats Plant (UDOE) Peripheral Operable Unit and Central Operable Unit, Jefferson and Boulder Counties, Colorado*, September.

DOE, EPA, and Ecology (U.S. Department of Energy, U.S. Environmental Protection Agency, and Washington State Department of Ecology), 2013, *Hanford Site 300 Area Record of Decision for 300-FF-2 and 300-FF-5, and Record of Decision Amendment for 300-FF-1*, November.

DTSC (State of California Department of Toxic Substances Control), 2007, *The State of California Environmental Protection Agency, Department of Toxic Substances Control, The Boeing Company, the National Aeronautics and Space Administration, and the United States Department of Energy, In the Matter of: Santa Susana Field Laboratory, Simi Hills, Ventura County, California, Consent Order for Corrective Action*, Docket No. P3-07/08-003, Health and Safety Code Section 25187, August 16.

DTSC (State of California Department of Toxic Substances Control), 2009, *Interim Advisory for Green Remediation* (available at http://www.dtsc.ca.gov/OMF/upload/GRT_Draft_-Advisory_-20091217_ac1.pdf), December.

DTSC (State of California State of California Department of Toxic Substances Control), 2010a, *The State of California Environmental Protection Agency, Department of Toxic Substances Control and the United States Department of Energy, In the Matter of: Santa Susana Field Laboratory, Simi Hills, Ventura County, California, Administrative Order on Consent for Remedial Action*, Docket No. HSA-CO 10/11-037, Health and Safety Code Sections 25355.5(a)(1)(B), 58009 and 58010, December 6.

DTSC (State of California Department of Toxic Substances Control), 2010b, *The State of California Environmental Protection Agency, Department of Toxic Substances Control and the United States National Aeronautics and Space Administration, In the Matter of Santa Susana Field Laboratory, Simi Hills, Ventura County, California, Administrative Order on Consent for Remedial Action*, Docket No. HSA-CO 10/11-038, Health and Safety Code Sections 25355.5(a)(1)(B), 58009 and 58010, September 3.

DTSC (State of California Department of Toxic Substances Control), 2013, *Chemical Look-Up Table Technical Memorandum, Santa Susana Field Laboratory, Ventura, California*, June 11.

EPA (U.S. Environmental Protection Agency), 2009, *Principles for Greener Cleanups*, Office of Solid Waste and Emergency Response, Washington, DC, August 27.

EPA (U.S. Environmental Protection Agency), 2015a, "Integrated Risk Information System" (available at http://www2.epa.gov/iris).

EPA (U.S. Environmental Protection Agency), 2015b, "Regional Screening Levels (RSLs) – Generic Tables (November 2015)," November.

Geosyntec, 2012, *2012 BMP Plan Addendum Santa Susana Site, Ventura County, California*, prepared with the Santa Susana Site Surface Water Expert Panel, Los Angeles, California, September 28.

Haley and Aldrich (Haley & Aldrich, Inc.), 2010, *Site-Wide Water Quality Sampling and Analysis Plan, Santa Susana Field Laboratory, Ventura County, California*, Revision 1, Tucson, Arizona, December.

HESIS (Hazard Evaluation System and Information Service), 2013, Fact sheet: *Preventing Work-Related Coccidioidomycosis (Valley Fever)*, California Department of Public Health, California Department of Industrial Relations, Richmond, California (available at https://www.cdph.ca.gov/programs/hesis/Documents/CocciFact.pdf), June.

HGL (HydroGeoLogic, Inc.), 2011, *Final Radiological Background Study Report, Santa Susana Field Laboratory, Ventura County, California*, prepared for the U.S. Environmental Protection Agency, Region 9, October.

HGL (HydroGeoLogic, Inc.), 2012a, *Final Radiological Characterization of Soils, Area IV and the Northern Buffer Zone, Area IV Radiological Study, Santa Susana Field Laboratory, Ventura County, California*, prepared for the U.S. Environmental Protection Agency, Region 9, December.

HGL (HydroGeoLogic, Inc.), 2012b, *Final Technical Memorandum Look-up Table Recommendations, Santa Susana Field Laboratory Area IV Radiological Study*, prepared for the U.S. Environmental Protection Agency, Region 9, November 27.

ICRP (International Commission on Radiological Protection), 1977, *Recommendations of the International Commission on Radiological Protection*, ICRP Publication 26, Annals of the ICRP, Vol. 1 (3).

ICRP (International Commission on Radiological Protection), 1983, *Cost-Benefit Analysis in the Optimization of Radiation Protection*, ICRP Publication 37, Annals of the ICRP, Vol. 10 No 2/3.

IPCC (Intergovernmental Panel on Climate Change), 2013, *Climate Change 2013 - The Physical Science Basis,* Working Group I Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, New York, New York (available at http://www.climatechange2013.org/images/report/WG1AR5_ALL_FINAL.pdf).

LA (City of Los Angeles), 2006, *L.A. CEQA Thresholds Guide, Your Resource for Preparing CEQA Analyses in Los Angeles.*

Matsumoto, M. R., and J. Martin, 2015, *Summary Report: Santa Susana Field Laboratory (SSFL) Soil Partitioning Treatability Study*, University of California, Riverside, California, May.

MWH (MWH Americas, Inc.), 2006, *Group 6 – Northeastern Portion of Area IV RCRA Facility Investigation Report, Santa Susana Field Laboratory, Ventura County, California*, Vol. 1, Arcadia, California, September.

MWH (MWH Americas, Inc.), 2007, *Group 8 – Western Portion of Area IV, RCRA Facility Investigation Report, Santa Susana Field Laboratory, Ventura County, California*, Arcadia, California, September.

MWH (MWH Americas, Inc.), 2009, *Group 7 – Northern Portion of Area IV RCRA Facility Investigation Report, Santa Susana Field Laboratory, Ventura County, California*, Vol. 1, Arcadia, California, June.

MWH (MWH Americas, Inc.), 2012, *Stormwater Pollution Prevention Plan for the Santa Susana Site*, Revision 7, prepared for The Boeing Company, Santa Susana Site, Arcadia, California, October.

MWH (MWH Americas, Inc.), 2014, *Final Standardized Risk Assessment Methodology Revision 2 Addendum, Santa Susana Field Laboratory, Ventura County, California*, August.

NAHC (Native American Heritage Commission), 2014, *Native American Heritage Commission Sacred Lands Inventory, Santa Susana Sacred Sites and Traditional Cultural Landscape*.

Nelson, Y. M., K. Croyle, M. Billings, and M. Poltorak, 2015a, *Natural Attenuation Study for the Santa Susana Field Laboratory: Final Report*, California Polytechnic State University, San Luis Obispo, California, April 27.

Nelson, Y. M., M. Poltorak, M. Curto, P. Waldburger, A. Koivunen, and D. Dowd, 2015b, *Phytoremediation Study for the Santa Susana Field Laboratory Final Report*, California Polytechnic State University, San Luis Obispo, California, April 16.

Nelson, Y. M., M. Billings, K. Croyle, C. Kitts, and A. Hamrick, 2015c, *Bioremediation Study for the Santa Susana Field Laboratory Final Report*, California Polytechnic State University, San Luis Obispo, California, May 7.

Nelson, Y. M., S. Cronin, K. Cochran, and A. Varni, 2015d, *Chemical Characterization of Residual Fuel Hydrocarbons in Soils at the Santa Susana Field Laboratory, Final Report*, California Polytechnic State University, San Luis Obispo, California, July 31.

New York Times, 2016, *In Sharp Reversal, California Suspends Water Restrictions*, May 18.

North Wind (North Wind Incorporated), 2014, Personal communication (email) from B. Frazee to S. Jennings U.S. Department of Energy, "ETEC D&D Waste Quantity Estimates," November 10.

P2 Solutions, 2009, *Report on Community Interviews, Community Concerns and Preferences for Public Participation in Cleanup of Area IV, Santa Susana Field Laboratory* (available at http://www.etec.energy.gov/EIS/Documents/Community_Interviews.pdf), Idaho Falls, Idaho, February.

SFWQCB (San Francisco Bay Regional Water Quality Control Board), 2013, *2013 Tier 1 ESLs,* California Environmental Protection Agency, Water Boards, Oakland, California, December.

SWRCB (State Water Resources Control Board), 2016, *California Drought*, State Water Board Adopts 'Stress Test' Approach to Water Conservation Regulation, May 18.

URS (URS Corporation), 2012, *Final Chemical Soil Background Study Report*, *Santa Susana Field Laboratory, Ventura County, California*, prepared for the California Environmental Protection Agency, Department of Toxic Substances Control, Los Angeles, California, December.

USGCRP (U.S. Global Change Research Program), 2014, *Climate Change Impacts in the United States*, U.S. National Climate Assessment, Washington, DC (available at http://www.globalchange.gov/nca3-downloads-materials), May.

Chapter 1
Introduction

1.0 INTRODUCTION

The U.S. Department of Energy (DOE) has prepared this *Draft Environmental Impact Statement for Remediation of Area IV and the Northern Buffer Zone of the Santa Susana Field Laboratory (Draft SSFL Area IV EIS)* in accordance with the National Environmental Policy Act (NEPA) and Council on Environmental Quality (CEQ) and DOE implementing regulations at Title 40, *Code of Federal Regulations*, Parts 1500-1508 (40 CFR Parts 1500-1508) and 10 CFR Part 1021, respectively. Past activities at the Santa Susana Field Laboratory (SSFL), Ventura, California, resulted in chemical and radiological releases that impacted soils, buildings, and groundwater. Information provided in this EIS on the residual chemicals and radionuclides from historical operations in Area IV is intended to inform DOE decisions about building removal, site cleanup, and disposal of waste. The Northern Buffer Zone (NBZ) is included to ensure that any soil contamination contiguous to and emanating from Area IV is analyzed in this environmental impact statement (EIS); this and other soil contamination originating in Area IV would be included as part of the cleanup. Extensive soil sampling and analysis in recent years has demonstrated that the chemical contamination is more widespread than the radiological contamination, and that contaminants are concentrated near certain facilities, rather than being evenly distributed across the site.

This EIS includes an analysis of the potential environmental impacts of alternatives for conducting cleanup activities in Area IV and the NBZ. There are separate alternatives for soil remediation, building demolition, and groundwater remediation.

This EIS also responds to an order by the U.S. District Court for the Northern District of California, which permanently enjoins DOE from transferring possession or otherwise relinquishing control over any portion of Area IV until DOE has completed an EIS and issued a Record of Decision (ROD) pursuant to NEPA. This *Order Granting Plaintiffs' Motion for Summary Judgment* (Case 3:04-CV-04448-SC, May 2, 2007) is the result of a lawsuit filed by the Natural Resources Defense Council, the Committee to Bridge the Gap, and the City of Los Angeles, which successfully challenged DOE's 2003 *Environmental Assessment for Cleanup and Closure of the Energy Technology Engineering Center* (*ETEC EA*) (DOE 2003a) and Finding of No Significant Impact (FONSI) for remediation of Area IV.

1.1 Purpose and Need for Agency Action

DOE needs to complete remediation of SSFL Area IV and the NBZ to comply with applicable requirements for cleanup of radiological and hazardous substances. These requirements include regulations, orders, and agreements. To this end, DOE needs to remove the remaining DOE structures in Area IV of SSFL and clean up the affected environment in Area IV and the NBZ in a manner that is protective of the environment and the health and safety of the public and workers.

1.2 Proposed Action

DOE proposes to remove existing DOE-owned facilities and support buildings from Area IV (Building Removal Alternative); remediate chemically and radiologically impacted soil in Area IV and the NBZ (Cleanup to AOC LUT Values Alternative); remediate groundwater in Area IV and the NBZ (elements of the Groundwater Monitored Natural Attenuation and Groundwater Treatment Alternatives); dispose of resulting waste; and restore the affected environment in accordance with applicable laws, orders, regulations, and agreements with the State of California.

1.3 History of the Site

Located in Ventura County, California, on 2,850[1] acres in the hills between Chatsworth and Simi Valley, SSFL was developed as a remote site to test rocket engines and conduct nuclear research (see **Figure 1–1**). Rockwell International's Rocketdyne Division (based in Canoga Park, California) began rocket engine testing in the Area I portion of SSFL in 1947. Rockwell created Atomics International in the early 1950s to conduct nuclear research in Area IV for the Atomic Energy Commission (AEC) (a predecessor agency of DOE) and commercial entities. In 1996, Rockwell International sold its aerospace and defense business, including Area IV of SSFL, to The Boeing Company (Boeing).

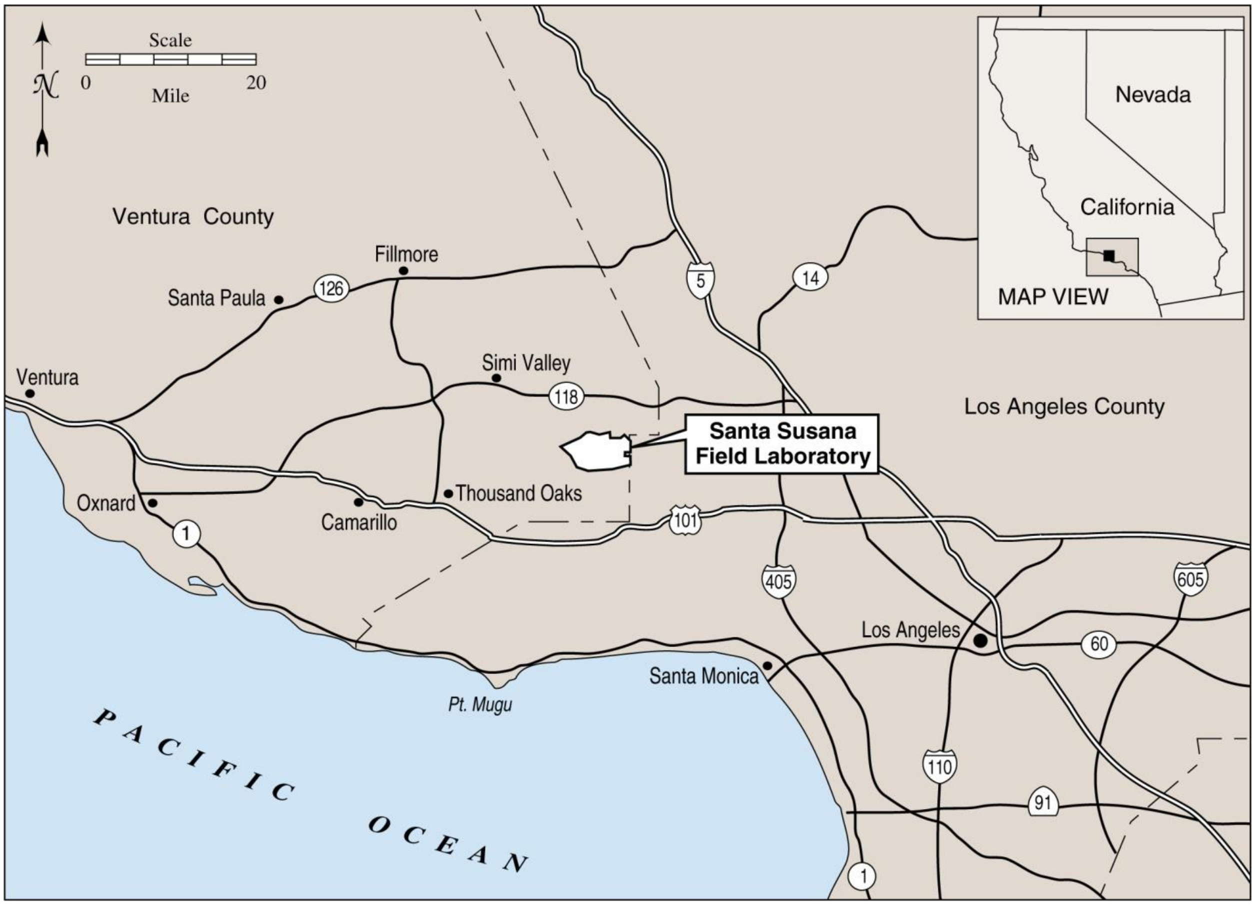

Figure 1–1 Project Location, Santa Susana Field Laboratory

SSFL is divided into four administrative areas and two contiguous buffer zones north and south of the administrative areas. **Figure 1–2** shows SSFL and the surrounding communities, as well as the layout of SSFL, including Areas I, II, III, and IV and the adjacent buffer zones. The majority of Area I is owned and operated by Boeing. Area II and a 42-acre parcel within Area I are owned by the Federal Government and administered by the National Aeronautics and Space Administration (NASA). Areas III, IV, and the contiguous buffer zone areas to the north and south are owned by Boeing. The Energy Technology Engineering Center (ETEC), once operated for DOE by Boeing and its predecessors, is located on about 90 acres within Area IV (the total area of Area IV is about 290 acres). DOE's current operating contractor is North Wind Group. DOE does not own any land at SSFL, but is the owner of 18 buildings in Area IV and is responsible for building demolition and cleanup of soils and

[1] The Amended Notice of Intent (79 *Federal Register* [FR] 7439) incorrectly reported the area of SSFL as 2,859 acres.

groundwater in the 290 acres of Area IV and the NBZ. DOE shares responsibility with NASA for cleanup of soil in the 182-acre NBZ; NASA is responsible for cleanup of contamination in the NBZ that emanates from areas that it administers (DTSC 2010b). DOE shares responsibility with Boeing for groundwater remediation in Area IV and the NBZ, as defined in the 2007 *Consent Order for Corrective Action* (2007 CO) (DTSC 2007). Not all of the energy research conducted in Area IV was performed for DOE. Some energy research was performed by Boeing and its predecessors. Boeing is responsible for decontamination and demolition of the buildings it owns in Area IV.

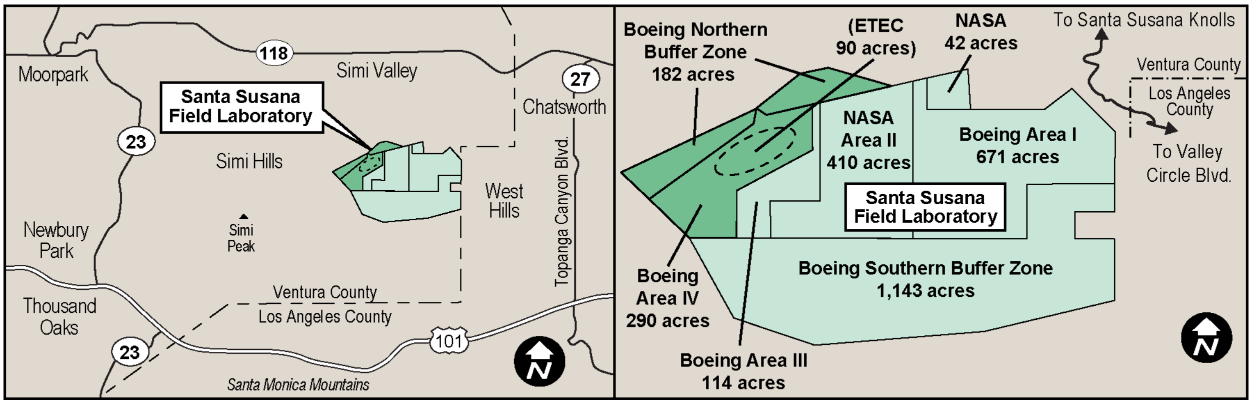

Figure 1–2 Santa Susana Field Laboratory and Surrounding Communities

Starting in the mid-1950s, AEC funded nuclear energy research on a 90-acre parcel of land in what is now SSFL Area IV, which was leased from Rocketdyne. ETEC was established by AEC on this parcel in the early 1960s as a "center of excellence" for liquid metals research (primarily sodium, potassium, and mercury) and general metals compatibility testing. DOE (or its predecessor agencies) also operated a total of 10 small nuclear reactors built for various research activities over the years of operation. As part of the operations of a research and development site, structures were constantly used, cleaned, and refurbished for a new purpose or demolished. As a result, cleanup activities have been ongoing since the 1960s. By 1980, all reactor operations had ceased, and nuclear research at ETEC was terminated in 1988. By the time non-nuclear liquid metals research ended in 1998, many facilities had been decontaminated, decommissioned, and demolished, and associated contaminated materials had been removed. As appropriate, these activities were covered by categorical exclusions in accordance with DOE's "NEPA Implementing Regulations" (10 CFR Part 1021, Appendix B to Subpart D).

Operating research reactors and conducting nuclear research resulted in some localized releases of chemicals and radionuclides to the soil, bedrock, and groundwater. The concrete containments that surrounded the reactors became radioactive. Leaks from some liquid radioactive waste holdup tanks contaminated surrounding soil. Releases of wastes into leach fields contaminated soil, bedrock, and groundwater. DOE (or its predecessor agencies) decontaminated and demolished several of its structures and facilities in Area IV to the standards established at the time decommissioning occurred (see, for example, the discussion of prior cleanup in Chapter 2, Section 2.3.3.1, under 2010 AOC Soil Cleanup Standards), in accordance with its authority under the Atomic Energy Act of 1954, as amended. The major periods of building demolition were 1975 through 1977 and 1995 through 2005. DOE has removed all nuclear materials from the site, as well as all but two of its reactor buildings, and has performed cleanup of radioactive buildings, soil, and bedrock to the standards established in the 1980s and 1990s.

In the early 2000s, DOE decided to prepare an environmental assessment (EA) in accordance with NEPA for the remaining cleanup activities. DOE issued the *ETEC EA* (DOE 2003a) in March 2003. The *ETEC EA* evaluated the potential impacts of implementing additional cleanup and closure activities, including decontaminating and decommissioning the remaining sodium facility and other support facilities. DOE issued a FONSI for the EA on March 31, 2003, and began cleanup activities by undertaking limited building demolition.

In October 2004, the Natural Resources Defense Council, the Committee to Bridge the Gap, and the City of Los Angeles challenged the *ETEC EA* and FONSI in a Federal district court (U.S. District Court for the Northern District of California), claiming DOE had violated NEPA; the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); and the Endangered Species Act. In May 2007, the U.S. District Court for the Northern District of California ruled that DOE was in violation of NEPA and issued its *Order Granting Plaintiffs' Motion for Summary Judgment* (Case 3:04-CV-04448-SC, May 2, 2007), which permanently enjoins DOE from transferring possession or otherwise relinquishing control over any portion of Area IV until DOE has completed an EIS and issued a ROD pursuant to NEPA. In response to requests from the California Department of Toxic Substances Control (DTSC) and the California congressional delegation, in 2007, DOE suspended physical demolition and removal activities for its remaining facilities at ETEC, except for those activities necessary to maintain the site in a safe and stable configuration, until completion of the final EIS and ROD.

In 2007, DTSC and DOE, NASA, and Boeing (as respondents) signed the 2007 CO (DTSC 2007), which was issued pursuant to DTSC's authority over hazardous waste under the California hazardous waste law provisions in the California Health and Safety Code, Section 25187. The 2007 CO requires the respondents to clean up all chemically contaminated soils[2] and groundwater at SSFL to risk-assessment-based levels.

DOE issued an Advance Notice of Intent to prepare an EIS and conduct public involvement activities in the October 17, 2007, *Federal Register* (FR) (72 FR 58834). Informal discussions with the public and stakeholders were held, and the information gathered, including public comments, was used in developing the *Notice of Intent to Prepare an Environmental Impact Statement for Remediation of Area IV of the Santa Susana Field Laboratory and Conduct Public Scoping Meetings*, published in May 2008 (73 FR 28437). The first round of scoping meetings for this EIS was held in July 2008. *Federal Register* notices pertinent to this EIS are provided in Appendix A of this EIS.

2007 *Consent Order for Corrective Action*

The 2007 CO (DTSC 2007), issued to DOE, NASA, and Boeing, required further characterization of the nature and extent of contamination at SSFL and identified the Resource Conservation and Recovery Act studies and work plans that would be prepared. The 2007 CO required cleanup of chemically contaminated soils by June 30, 2017, using a risk-based approach; completion of DTSC-approved groundwater and unsaturated zone cleanup remedies in the Chatsworth Formation Operable Unit by June 30, 2017, or earlier; and completion of construction of the DTSC-approved long-term soil cleanup remedy in the surficial media operable unit by June 30, 2017, or earlier. The proposed risk-assessment methodology for determining the areas that would need remediation uses a future residential land use for the evaluation of risk, although other plausible receptors (such as recreational users or workers) were also identified.

The 2010 *Administrative Order on Consent for Remedial Action* (2010 AOC) (DTSC 2010a) superseded the requirements in the 2007 CO for soils; however, the requirements for groundwater remediation under the 2007 CO are still valid and were incorporated by reference into the 2010 AOC.

[2] The 2010 AOC (DTSC 2010a) superseded the 2007 CO (DTSC 2007) with respect to cleanup of chemically and radioactively impacted soils; however, it incorporated the 2007 CO by reference for groundwater remediation. The 2010 AOC also added building demolition.

The U.S. Environmental Protection Agency (EPA) conducted a preliminary assessment/site inspection of ETEC starting in 1989 to assess potential chemical and radiological threats to human health and the environment in an effort to determine whether further action under CERCLA was warranted. The results of the assessment and inspection led EPA to conclude that referral to the National Priorities List (NPL), also known as the Superfund List, was not necessary (EPA 2003). EPA re-evaluated the entire SSFL site (rather than just Area IV) and, in December 2007, released the results of a Hazard Ranking Survey performed at SSFL. Based on the evaluation, EPA recommended further assessment of all areas of SSFL under CERCLA, particularly regarding the presence of trichloroethylene (TCE) in groundwater in Areas I and II (EPA 2007a). The score exceeded the threshold for listing SSFL on the NPL for cleanup under CERCLA (EPA 2007b). In January 2009, the State of California decided it would not support listing SSFL on the NPL (Adams 2009). EPA decided not to list SSFL on the NPL, and DTSC continued in its role as lead regulatory agency at the SSFL site.

National Environmental Policy Act Terminology Used in this *Draft SSFL Area IV EIS*

Categorical Exclusion. Categorical exclusions are classes of actions that normally do not require an EIS or EA because, individually or cumulatively, they do not have the potential for significant environmental impacts. DOE's NEPA regulations list these classes of actions. Examples are information-gathering activities, minor facility renovations, and property transfers when the use is unchanged.

Environmental Assessment. An EA is a concise public document that a Federal agency prepares under NEPA to provide sufficient evidence and analysis to determine whether a proposed agency action would require preparation of an EIS or a FONSI. The EA includes a brief discussion of the need for the proposed action, descriptions of the alternatives and the environmental impacts of the proposed action and alternatives, and a list of the agencies and persons consulted.

Environmental Impact Statement. An EIS is a detailed written statement that is required by section 102(2)(C) of NEPA for a proposed major Federal action that significantly affects the quality of the human environment. The statement includes, among other information, discussions of the environmental impacts of the proposed action and reasonable alternatives, any adverse environmental effects which cannot be avoided should the proposal be implemented, the relationship between short-term uses of the human environment and maintenance and enhancement of long-term productivity, and any irreversible and irretrievable commitment of resources.

Finding of No Significant Impact. A FONSI is a document by a Federal agency that briefly presents the reasons why an action will not significantly affect the human environment and for which an EIS will not be prepared. It is required to include the EA or a summary of it and to note any other environmental documents related to it.

National Environmental Policy Act. NEPA is the basic national charter for protection of the environment. It establishes policy, sets goals (in Section 101), and provides means (in Section 102) for carrying out policy. Section 102(2) contains "action-forcing" provisions to ensure that Federal agencies follow the letter and spirit of the Act. For major Federal actions that could significantly affect the quality of the human environment, Section 102(2) requires Federal agencies to prepare a detailed statement (an EIS) that includes the environmental impacts of the proposed action and other specific information.

Record of Decision. A ROD is a concise public document that records a Federal agency's decision(s) concerning a proposed action for which the agency has prepared an EIS. The ROD is prepared in accordance with the requirements of the Council on Environmental Quality's NEPA regulations (40 CFR 1505.2). A ROD identifies the alternatives considered in reaching the decision, the environmentally preferable alternative(s), the factors balanced by the agency in making the decision, whether all practicable means to avoid or minimize environmental harm have been adopted and, if not, why not.

In the 2008 Consolidated Appropriations Act (Energy and Water Appropriations Act, Public Law 110–161), Congress mandated that DOE use a portion of the funding for ETEC to enter into an interagency agreement with EPA to conduct a joint comprehensive radioactive site characterization of Area IV and the NBZ. DOE provided a total of $1.7 million to EPA for radiological background studies. In addition, DOE provided EPA with approximately $40 million in American Recovery and Reinvestment Act funds in 2010. EPA conducted the studies described below.

- **Radiological Background Study**. The purpose of the EPA background study was to determine the local background levels of radiation found in soils not affected by the site operations. Soil samples were collected at sites remote from SSFL to determine soil concentrations of radionuclides from natural sources or sources not related to Area IV operations. The results of the background study were used to determine concentrations of radionuclides in Area IV in soils that resulted from past operations.
- **Radiological Study at SSFL Area IV/NBZ**. EPA's characterization work within Area IV and the NBZ had multiple phases, as follows:
  - *Historical Site Assessment.* EPA conducted an independent review of documents concerning past radiological operations and releases of radiological materials at SSFL. The goal of this records review was to identify locations for soil sampling.
  - *Gamma Radiation Scan.* EPA scanned the accessible areas of Area IV and the NBZ to locate areas of elevated gamma radiation to assist in identification of locations for soil sampling.
  - *Radiological Soil Sampling.* Using site records and the gamma scans, EPA sampled and analyzed soil (3,487 soil and 55 sediment samples) for a broad range of potential radionuclides associated with nuclear research. Cesium-137 and strontium-90 were the two site-related radionuclides most frequently observed in EPA's samples (HGL 2012b, 2012c).[3]
  - *Groundwater and Surface Water Characterization.* EPA also sampled wells within Area IV and the NBZ for radionuclides, as well as surface water following rain events.

Radiological Characterization

As part of its characterization of Area IV and the NBZ, EPA collected 3,487 surface and subsurface soil and 55 sediment samples and analyzed them for radioactive contaminants. Both man-made and naturally occurring radionuclides were detected. Of these samples, man-made radioactive materials equal to or exceeding background levels were detected in 423 samples (EPA 2012; HGL 2012b). Man-made radionuclides were not detected above background levels in more than 88 percent of the total number of samples.

Characterization of chemical concentrations within soils in Area IV and the NBZ has been conducted under a series of investigations. The first formal review of potential chemical release areas was conducted in 1989 under EPA's Preliminary Assessment/Site Investigation process (Ecology and Environment 1989). DOE conducted soil sampling investigations during the years 1990 through 2010 using the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) process under the oversight of DTSC. Area IV was divided into five RFI groups (Groups 3, 5, 6, 7, and 8); soil and groundwater samples were collected; and results were presented in five group reports (CH2M Hill 2008, 2009; MWH 2006, 2007, 2009a).

[3] HydroGeoLogic, Inc., was the EPA contractor for the radiological characterization of Area IV and the NBZ.

In 2010, DOE entered into the 2010 *Administrative Order on Consent for Remedial Action* (2010 AOC) (DTSC 2010a) with DTSC. The 2010 AOC superseded the 2007 CO (DTSC 2007) with respect to soil remediation and changed the framework for the soils characterization and cleanup process for Area IV and the NBZ.[4] The 2010 AOC stipulated that the soils cleanup standard would be based on "Look-Up Table" (LUT) values, which are: (1) for chemicals, local background concentrations or method detection limits[5] for those chemicals for which the method detection limit exceeds local background concentrations, and (2) for radionuclides, local background concentrations or minimum detection limits for radionuclides whose detection limits exceed local background concentrations. The 2010 AOC defines the minimum detection limit for a radionuclide as the smallest amount of activity that can be quantified for comparison with regulatory limits.[6] The 2010 AOC indicates that the concentration in each individual soil sample (not an average of samples in an area) is to be compared to the chemical or radionuclide LUT values. Background concentrations of radionuclides in soil were determined by EPA in 2011 (HGL 2011). In 2012, DTSC conducted a soil chemical background study for all of SSFL (URS 2012).[7] As was done with the EPA radionuclide background study, the DTSC chemical background study results were used to identify site-related chemical concentrations resulting from operations in Area IV. Appendix D presents chemical LUT values and provisional radionuclide LUT values incorporating DTSC's and EPA's background study findings.

2010 *Administrative Order on Consent for Remedial Action*

The 2010 AOC (DTSC 2010a) superseded the 2007 CO (DTSC 2007) for soils; however, it incorporated the 2007 CO by reference for groundwater remediation and added building demolition. The end state after soil cleanup is based on "Look-Up Table" (LUT) values for chemical and radioactive constituents in Area IV and the NBZ. DTSC and EPA are responsible for developing LUT values for the chemical and radiological cleanup levels, respectively, that reflect local background concentrations or minimum detection limits for contaminants whose detection limits exceed local background concentrations. Chemicals and radionuclides in the backfill soil must meet the same LUT values. Verification of cleanup levels and the acceptability of the backfill soil are required by DTSC for chemicals and by EPA for radioactive contaminants. No "leave-in-place" alternative (onsite burial or landfill) is allowed. The 2010 AOC provides exemptions to cleanup for species and habitat protected under the Endangered Species Act and Native American artifacts that are formally recognized as cultural resources. An additional exemption (not to exceed 5 percent of the total soil volume) is allowed for other unforeseen circumstances, but only to the extent that the cleanup cannot be achieved through technologically feasible measures. The 2010 AOC calls for DOE to develop a Soils Remedial Action Implementation Plan that clearly describes a schedule for implementation of the planned remedial actions. Per the 2010 AOC, the schedule shall ensure that the identified activities can be accomplished by 2017 or sooner.

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4 The 2007 CO (DTSC 2007) remains in effect for groundwater remediation.

5 Per the 2010 AOC (DTSC 2010a), "Detection Limit" means the method reporting limit (or MRL) that is the lowest concentration at which an analyte can be confidently detected in a sample and its concentration can be reported with a reasonable degree of accuracy and precision.

6 In its *Final Technical Memorandum, Look-Up Table Recommendations, Santa Susana Field Laboratory Area IV Radiological Study* (HGL 2012c), EPA stated: "In exercising independent technical judgment, as identified in Section 5.2 of the AOC, EPA recommends an adjustment to the BTVs [background threshold values] and minimum detectable concentrations [limits] (MDC) to include appropriate consideration for [method uncertainty] to ensure an acceptably low decision error rate of approximately 5 percent. This adjustment is not believed by EPA to be contrary to the AOC requirement that LUT values incorporate BTVs and laboratory MDCs." The memorandum also stated: "For purposes of this technical memorandum, and for the appropriate use of BTVs, it is important to note that the MDC is <u>not</u> used as a <u>detection</u> decision criterion. Rather, the MDC is understood to represent a level of activity at which the associated uncertainty becomes predictably constrained to a level that is useful for defining a substitute cleanup value when the BTV is not practically or technologically supported by the laboratory data. The use of the MDC in this case, defined as "the smallest amount of activity that can be quantified for comparison with regulatory limits," is consistent with the AOC requirements and definitions."

7 URS Corporation was the DTSC contractor for the chemical characterization of off-SSFL reference areas. The characterization data provide background soil concentrations to which samples collected at SSFL can be compared.

To take advantage of EPA's soil sampling efforts in Area IV and the NBZ, collocated soil samples were collected for radionuclide analyses by EPA and chemical analysis by DOE. Working with DTSC staff, DOE completed a data gap analysis, a process involving a review of site operations and chemical releases, and an assessment of the adequacy of existing data to determine what additional data would be needed to complete site characterization, resulting in additional soil sampling work. In all, DOE scientists collected 5,854 soil samples for chemical analysis as part of the 2010 AOC (DTSC 2010a) activities. The most frequently observed chemicals in soils were polychlorinated biphenyls (from electrical components), polycyclic aromatic hydrocarbons (from fuels and burning of wastes), dioxins (from burning of wastes and brush fires), petroleum chemicals (mostly from diesel fuel), mercury (from electrical components and as heat transfer medium), and metals (antimony, cadmium, chromium VI, mercury, selenium, and silver wastes) (CDM Smith 2017).

The results of the soil chemical investigation conducted under the direction of DTSC and the radionuclide investigation conducted by EPA were used to estimate that as much as 1,413,000 cubic yards of soil may need to be remediated (see Appendix D). For purposes of analysis in this EIS, and after accounting for proposed exemptions for sensitive biological or cultural resources (see the text box regarding the 2010 AOC on the preceding page) and onsite treatment, the total volume of soil that does not meet the AOC LUT values is approximately 933,000 cubic yards (see Appendix D).

In addition, during this time, DOE contracted with Sandia National Laboratories, California Polytechnic State University, San Luis Obispo, and the University of California, Riverside to conduct soil treatability studies of possible soil cleanup technologies.

The terms of the 2010 AOC also call for EPA to provide technical assistance to DTSC on radiological issues during cleanup in Area IV and the NBZ. Per the 2010 AOC, EPA will conduct post-cleanup confirmation sampling and analysis for radionuclides in remediation areas to verify cleanup completion. In addition, EPA will verify that backfill/replacement soils are consistent with LUT values for radionuclides. DTSC will perform the same verification sampling and analysis of soils in remediation areas and of backfill/replacement soils for chemical constituents.

The 2010 AOC incorporated the requirements for investigation and cleanup of groundwater in the 2007 CO (DTSC 2007) by reference. Groundwater characterization requirements were evaluated during development of the RCRA Facility Investigation Work Plan (CDM Smith 2015a). The feasibility of groundwater treatment technologies (e.g., pump and treat, soil vapor extraction, thermal treatment) is being evaluated in a RCRA groundwater Corrective Measures Study (under development), and the potential environmental impacts of the groundwater treatment options are included in this EIS.

1.4 Future of Area IV and the Northern Buffer Zone

Boeing is the landowner of Area IV and the NBZ; therefore, Boeing will decide the potential future land use of these areas. Boeing has stated that its intent is to maintain its portion of SSFL (including Area IV and the NBZ) as undeveloped open space. Further, Boeing states that it would restrict future land use to prevent development for any commercial, industrial, agricultural, or residential purpose. Boeing also states that it would restrict future land use to ensure the property would be protected as undeveloped open space, regardless of zoning changes beyond its control (Boeing 2016b).

Boeing has indicated that it is committed to cleanup to a standard that is equivalent to a suburban residential standard that is more protective of human health than that applicable to open space uses (Boeing 2016b).

1.5 Cooperating Agencies

CEQ NEPA regulations (40 CFR 1501.6) establish the requirements for cooperating agencies (see text box). For this EIS, there are three cooperating agencies: NASA, the U.S. Army Corps of Engineers, and the Santa Ynez Band of Chumash Indians (a federally recognized Native American tribe with historical ties to the SSFL land). EPA and DTSC were also invited to be cooperating agencies, but declined.

> **Cooperating Agencies**
> **(from 40 CFR 1508.5)**
>
> "*Cooperating agency* means any Federal agency other than a lead agency that has jurisdiction by law or special expertise with respect to any environmental impact involved in a proposal (or a reasonable alternative) for legislation or other major Federal action significantly affecting the quality of the human environment. The selection and responsibilities of a cooperating agency are described in 40 CFR 1501.6. A State or local agency of similar qualifications or, when the effects are on a reservation, an Indian Tribe, may by agreement with the lead agency become a cooperating agency."

1.6 Decisions to Be Supported

DOE proposes to remove existing DOE-owned facilities and support buildings from Area IV, remediate chemically and radiologically impacted soil and groundwater in Area IV and the NBZ, dispose of resulting waste, and restore the affected environment. The 2007 CO (DTSC 2007), which is applicable to groundwater, requires a risk-based cleanup approach based upon the methodology in the *Final Standardized Risk Assessment Methodology Revision 2 Addendum, Santa Susana Field Laboratory, Ventura County, California* (SRAM) (MWH 2014) approved by DTSC.[8] The 2010 AOC (DTSC 2010a) requires soil cleanup to levels provided in the LUT values. The 2010 AOC and 2007 CO specify how the cleanup standards are to be developed for SSFL Area IV soil and groundwater remediation, respectively.

This EIS evaluates reasonable alternatives for how DOE can conduct the cleanup of Area IV and the NBZ. DOE has developed separate reasonable alternatives for the three components that make up its remediation project: soil remediation, building demolition, and groundwater remediation. As required by CEQ NEPA regulations (40 CFR 1508.25), DOE is also evaluating no action alternatives for soil remediation, building demolition, and groundwater remediation. For each component of its remediation project, DOE may select one of the alternatives described in this EIS, or DOE may combine different aspects of the alternatives and create a "hybrid" alternative.

The potential environmental impacts presented in this EIS, along with public input, cost, policy, and other factors, will be considered by DOE decision-makers in selecting alternatives for soil remediation, building demolition, and groundwater remediation for implementation. DOE's decision resulting from the analysis in this *SSFL Area IV EIS* will be announced in a ROD that will be issued no sooner than 30 days after the EPA Notice of Availability of the Final EIS is published in the *Federal Register*.

[8] The 2007 CO cited a 2005 version of the SRAM Work Plan. The currently applicable version of the SRAM (MWH 2014) was issued in 2014.

1.7 Organization of this EIS

This EIS consists of 14 chapters and their supporting appendices. The chapters and appendices are organized as follows:

- Chapter 1, "Introduction," describes DOE's purpose and need for action, background history for SSFL Area IV, decisions to be supported, related NEPA documents, and public involvement through the NEPA process.
- Chapter 2, "Alternatives," describes the range of reasonable alternatives for remediation of Area IV and the NBZ, as well as the alternatives that were considered but eliminated from detailed study in this EIS. It also presents a summary of the potential environmental impacts by alternative.
- Chapter 3, "Affected Environment," describes the potentially affected environments at Area IV and the NBZ, including land resources, geology and soils, surface water and groundwater resources, biological resources, air quality and climate, noise, transportation and traffic, human health, waste management, and cultural resources, as well as socioeconomics, environmental justice, and sensitive-aged populations. These data are provided as the baseline against which the potential impacts of each of the alternatives can be compared.
- Chapter 4, "Environmental Consequences," describes the potential impacts of the alternatives. Environmental consequences are evaluated for each alternative for the same resources areas described in Chapter 3.
- Chapter 5, "Cumulative Impacts," describes the potential cumulative impacts of the action alternatives in combination with other past, present, and reasonably foreseeable future actions. The chapter presents information regarding the impacts of DOE, NASA, and Boeing activities, as well as the impacts from other relevant activities in the region.
- Chapter 6, "Measures to Minimize Impacts and Mitigation Measures," provides information on planned measures to minimize potential impacts, as well as potential methods of mitigating impacts under the action alternatives.
- Chapter 7, "Resource Commitments," addresses green and sustainable remediation, potential unavoidable adverse impacts to the environment, irreversible and irretrievable commitments of resources, and short-term impacts versus long-term productivity of Area IV and the NBZ from implementing the action alternatives.
- Chapter 8, "Laws, Regulations, and Other Requirements," describes the environmental and health and safety compliance requirements governing implementation of the alternatives.
- Chapter 9, "Native American Histories and Perspectives," describes the significance of SSFL to the native peoples who inhabited the site before it began operations as a field laboratory.
- Chapters 10, 11, 12, 13, and 14 are the "References," "Glossary," "Index," "List of Preparers," and "Distribution List" chapters, respectively.

- Appendices are included to provide more-detailed information to support this EIS:
  - Appendix A, "*Federal Register* Notices"
  - Appendix B, "Environmental Consequences Methodologies"
  - Appendix C, "Alternatives Development"
  - Appendix D, "Detailed Project Information"
  - Appendix E, "Consultations"
  - Appendix F, "Cultural Resources"
  - Appendix G, "Human Health"
  - Appendix H, "Evaluation of Transportation and Traffic Impacts"
  - Appendix I, "Wetlands Assessment"
  - Appendix J, "Cost-Benefit Analysis Report"
  - Appendix K, "Contractor Disclosure Statements"

1.8 Related NEPA and Other Documents

Four existing NEPA documents have been identified as having a direct relationship to this EIS. In addition, a program environmental impact report (EIR) for the entire SSFL that is being prepared by DTSC under the California Environmental Quality Act (CEQA), as well as a Soils Remedial Action Implementation Plan (SRAIP) required under the 2010 AOC and RCRA documents for ETEC, are discussed in this section.

The NEPA documents include the 1997 *Final Environmental Assessment of Off-Site Transportation of Low Level Waste from Four California Sites* (DOE 1997a); the 2003 *ETEC EA* (DOE 2003a); the 2014 *NASA Final Environmental Impact Statement for Proposed Demolition and Environmental Cleanup Activities at Santa Susana Field Laboratory* (NASA 2014a); and the *National Park Service Rim of the Valley Corridor Draft Special Resource Study and Environmental Assessment* (NPS 2015e). In a separate action related to SSFL Area II and a portion of Area I, the U.S. General Services Administration may conduct NEPA and National Historic Preservation Act analyses to evaluate the potential impacts of transferring property ownership of NASA's land. The level of NEPA analysis is expected to depend on whether the property is transferred outside the Federal Government, and the timing will be based on when such a transfer will take place.

DOE has prepared and submitted to DTSC RCRA closure plans for the Hazardous Waste Management Facility (HWMF) (North Wind 2015b) and the Radioactive Materials Handling Facility (RMHF) (North Wind 2015c). In addition, DOE has prepared a *Final RCRA Facility Investigation (RFI) Groundwater Work Plan, Portions of Area IV under DOE Responsibility, Santa Susana Field Laboratory, Ventura, California* (CDM Smith 2015a) addressing groundwater conditions in Area IV and the NBZ.

The documents described in this chapter, along with the environmental evaluations in this EIS and other considerations such as feasibility, costs, and stakeholder comments, will be used to inform DOE decision-makers in selecting alternatives for the ROD. The identified related NEPA documents, CEQA program EIR document, 2010 AOC (DTSC 2010a) documents, and RCRA documents are summarized in Sections 1.8.1, 1.8.2, 1.8.3, and 1.8.4, respectively. Other studies prepared for input into this EIS, such as cultural and biological resources surveys, are discussed in the respective affected environment sections in Chapter 3.

1.8.1 Related NEPA Documents

***Final Environmental Assessment of Off-Site Transportation of Low Level Waste from Four California Sites (LLW Transportation EA)* (DOE/EA-1214) (DOE 1997a).** The *LLW Transportation EA* assessed transport of low-level radioactive waste (LLW) from four DOE sites in California to federally owned and DOE-operated radioactive waste disposal facilities or to U.S. Nuclear Regulatory Commission (NRC)-licensed commercial radioactive waste disposal facilities. The assessment focused on transport of LLW from the gate of the generating site to the gate of the receiving disposal site. Based on the *LLW Transportation EA* evaluation, DOE decided to send LLW generated at ETEC to DOE disposal sites (the Nevada National Security Site near Las Vegas, Nevada, and the Hanford Site in Richland, Washington) or to Envirocare (now called Energy*Solutions*), a licensed commercial radioactive disposal facility in Clive, Utah (DOE 1997a). Since this EA was issued, DOE has placed a moratorium on the receipt of offsite waste at the Hanford Site at least until the Waste Treatment Plant currently under construction at Hanford is operational (78 FR 75913).

***Environmental Assessment for Cleanup and Closure of the Energy Technology Engineering Center (ETEC EA)* (DOE/EA-1345) (DOE 2003a).** The *ETEC EA* analyzed potential cleanup and closure procedures for radiological contaminants remaining at ETEC. Chemical contamination in soil and groundwater was not addressed in the *ETEC EA;* it was covered under the RCRA Facility Investigation process. This EA included evaluation of two alternatives for decontamination of radiological facilities and surrounding soils: (1) cleanup to a standard of 15 millirem per year additional radiation dose to the maximally exposed individual (plus DOE's as low as reasonably achievable [ALARA] principle) (see Chapter 2, Section 2.4.2, for a discussion of ALARA), resulting in a theoretical risk of an additional cancer of about 3×10^{-4} (1 chance in 3,300) from 40 years of exposure and (2) cleanup to a standard of 0.05 millirem per year to the maximally exposed individual, resulting in a theoretical risk of an additional cancer of about 1×10^{-6} (1 chance in 1 million) from 40 years of exposure.

Based on the analysis in the *ETEC EA*, DOE decided to implement the Preferred Alternative, which was cleanup of decontaminated radiological facilities and surrounding soils using a 15 millirem per year standard and the ALARA principle. A FONSI issued in March 2003 was successfully challenged in the U.S. District Court for the Northern District of California in 2007 and, as a result, DOE is preparing this EIS.

***Final Environmental Impact Statement for Proposed Demolition and Environmental Cleanup Activities at Santa Susana Field Laboratory (NASA FEIS)* (NASA 2014a).** The *NASA FEIS* included an evaluation of the potential environmental consequences of NASA's Proposed Action of demolishing existing structures and remediating groundwater and soil on the NASA-administered property of SSFL (Areas I and II) to meet the 2007 CO (DTSC 2007) and the 2010 NASA *Administrative Order on Consent for Remedial Action* (2010 NASA AOC) (DTSC 2010b). The proposed activities are to help NASA meet its commitments under both orders and NASA's missions. A No Action Alternative and the Proposed Action were evaluated. NASA signed a ROD in April 2014 (NASA 2014b) related to building demolition and initiated removal of its remaining structures. In consideration of technical, environmental, and economic factors, NASA deferred its decision on the specific techniques that will be used to accomplish the environmental (soil and groundwater) cleanup required to meet the 2007 CO and the 2010 NASA AOC. NASA deferred the decision on soil and groundwater to allow the agency to complete soil and groundwater fieldwork, additional archeology surveys, and cleanup technology feasibility studies. NASA will use the results of the additional soil and archaeological studies to further understand the areas requiring cleanup and the technical cleanup options available. NASA plans to perform additional NEPA analysis and issue a second ROD based on these results.

National Park Service Rim of the Valley Corridor Draft Special Resource Study and Environmental Assessment (Draft ROTV EA) **(NPS 2015e)**. The "Rim of the Valley" encompasses the mountains encircling the San Fernando, La Crescenta, Santa Clarita, Simi, and Conejo Valleys of Los Angeles and Ventura Counties. SSFL is within the center portion of the study area of the National Park Service's *Draft ROTV EA* (see Chapter 3, Figure 3–3). The *Draft ROTV EA* was issued in April 2015. As stated in the EA, the purpose is to determine:

- the suitability and feasibility of designating all or a portion of the corridor (which includes SSFL) as a unit of Santa Monica Mountains National Recreation Area; and
- the methods and means for protection and interpretation of the corridor by the National Park Service, other Federal, state, or local government entities, or private or non-governmental organizations.

The *Draft ROTV EA* includes alternatives for determining whether the area would be suitable as an addition to the Santa Monica Mountains National Recreation Area. Alternatives range from building a collaborative partnership to explore means of establishing an interconnected system of parks, habitats, and open space connecting urban neighborhoods and the surrounding mountains, to expanding the boundaries and providing new authoritative management to improve recreation and habitat connectivity for the Santa Monica Mountains National Recreation Area. Additional lands would only be acquired and incorporated from willing landowners.

1.8.2 Related CEQA Document

As required by the California Health and Safety Code, DTSC is preparing a program EIR under CEQA to evaluate the potential impacts of proposed remedial actions at SSFL from the combined actions of DOE, NASA, and Boeing. The program EIR is being developed concurrently with this EIS. Impacts from DOE's proposed actions are being evaluated in the program EIR as part of a larger proposed action of cleaning up the entire SSFL. DTSC is also evaluating alternatives for transportation of soil and debris that would apply to DOE, NASA and Boeing.

1.8.3 Related 2010 AOC Documents

The 2010 AOC (DTSC 2010a) requires the development of a SRAIP to describe how DOE will clean up the Area IV and NBZ soils. DOE may prepare multiple SRAIPs: (1) one for cleanup of radionuclides above LUT values and chemicals that represent the greatest risk to human health and the environment, (2) another for cleanup of the remaining chemicals above LUT values that will not naturally degrade, and (3) and a final one addressing remaining chemicals that will naturally degrade. DOE anticipates submitting the first of these plans (each of which would include a schedule for completing the corresponding phase) to DTSC at the same time that DTSC issues the final program EIR.

1.8.4 Related RCRA Documents

***Closure Plan, Hazardous Waste Management Facility: Buildings T029 and T133, ETEC, Santa Susana Field Laboratory, Area IV, Ventura County, California* (North Wind 2015b).** This RCRA closure plan for HWMF describes the closure tasks for decontamination, demolition, verification sampling, and remediation of nonradiological chemicals associated with HWMF. The closure plan includes Buildings T029 and T133 (now Buildings 4029 and 4133).

***RCRA Closure Plan, Radioactive Materials Handling Facility, Buildings 4021, 4022, and 4621, ETEC, Santa Susana Field Laboratory, Area IV, Ventura County, California* (North Wind 2015c).** This RCRA closure plan describes the closure tasks for decontamination, demolition, verification sampling, and remediation of radiological and chemical constituents associated with RMHF. The closure plan addresses Buildings 4021, 4022, and 4621.

***Final RCRA Facility Investigation (RFI) Groundwater Work Plan, Portions of Area IV under DOE Responsibility, Santa Susana Field Laboratory, Ventura, California* (CDM Smith 2015a).** This plan divided Area IV and the NBZ into 19 groundwater investigation areas based on history of land use and operations. As a result of the initial evaluation, areas were identified as needing additional investigation to determine the extent of contamination. The groundwater investigation has shown three areas of groundwater with historically higher TCE concentrations in Area IV: the Former Sodium Disposal Facility TCE plume, Hazardous Materials Storage Area perched groundwater plume, and Building 4100/56 landfill TCE plume. There are another three areas with historically lower concentrations of groundwater contamination (mainly solvents) that are also being evaluated for potential cleanup methodologies: the RMHF TCE plume, Metals Clarifier TCE plume, and Building 4057 Warehouse perchloroethylene plume. Additionally, there is a tritium plume near the location of the former Building 4010 and a strontium-90 source near RMHF. These areas are being assessed for groundwater cleanup considerations. The feasibility of groundwater treatment technologies (e.g., pump and treat, soil vapor extraction, monitored natural attenuation) will be evaluated in a RCRA Corrective Measures Study, currently under development and scheduled for completion in 2017, prior to the ROD for this EIS. The potential environmental impacts of the proposed technologies are evaluated in this EIS. DOE may issue a ROD for groundwater remediation prior to a DTSC decision on the Corrective Measures Study. If DOE or DTSC identifies a remediation technology that is not included in the alternatives evaluated in this EIS, DOE would perform additional NEPA analysis as necessary.

1.9 Public Involvement

DOE considers public involvement to be a critical element in the cleanup and closure of SSFL and has incorporated extensive public involvement opportunities for the planning activities it is conducting related to cleanup of Area IV and the NBZ. DOE has complied with the spirit and intent of NEPA public involvement requirements and implemented public involvement efforts that seek to include all SSFL stakeholders. SSFL stakeholders have expressed varying and sometimes conflicting and competing points of view.

DOE's efforts to enhance its interactions with the community began in earnest in 2008 when it commissioned interviews of SSFL stakeholders representing the range of perspectives among community members. These interviews revealed, among other issues, concerns about the completeness of the historical information available about the site. These observations and concerns are documented in *Report on Community Interviews: Community Concerns and Preferences for Public Participation in the Cleanup of Area IV Santa Susana Field Laboratory* (P2 Solutions 2009).

Using the community interviews as a foundation, DOE prepared the *Community Involvement Plan Area IV Santa Susana Field Laboratory* in 2010 (DOE 2010c). The plan describes how DOE provides timely, accurate, and credible information and/or access to information to the public, agencies, and organizations that are interested in and may be affected by the SSFL remediation and closure process. It also describes DOE plans to continue to provide opportunities for public contributions to selected project issues, reports, plans, and other project documents that DOE will use in its decision-making process. In addition, the plan describes the overarching objectives of building and improving relationships with regulators, elected officials, and the affected public; fostering a coordinated approach to address cleanup; and evaluating DOE activities to modify and enhance public participation (DOE 2010c).

The following sections provide information on the public involvement activities required by NEPA as part of the EIS process (Section 1.9.1); summarize the scoping activities conducted for this EIS (Section 1.9.2); describe DOE's additional public involvement activities (Section 1.9.3); and provide an overview of SSFL-related public involvement activities conducted by other agencies (Section 1.9.4).

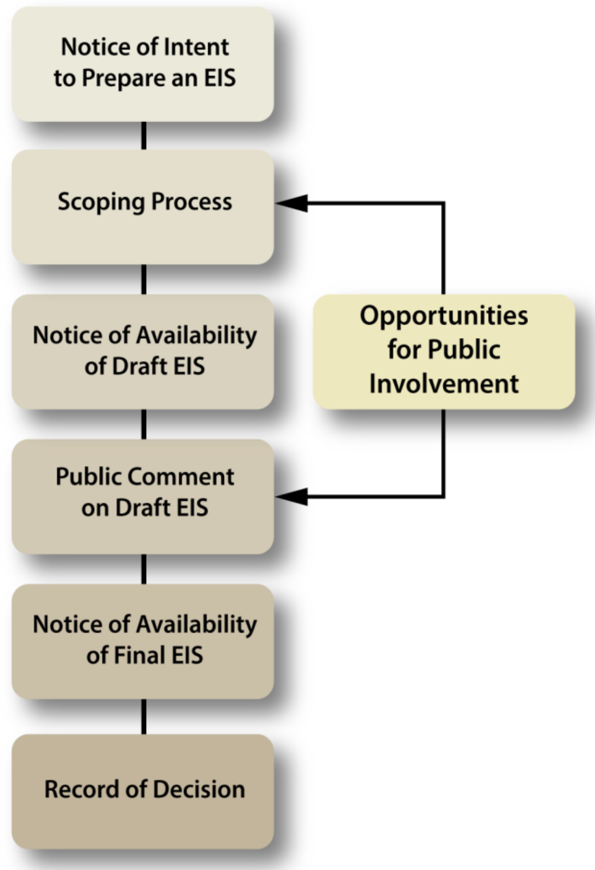

Figure 1–3 EIS Public Involvement Opportunities

1.9.1 NEPA-Required EIS Public Involvement

A principal component of the NEPA process is active public participation (see **Figure 1–3**). DOE conducted a number of activities to encourage public input in the NEPA process. DOE's NEPA regulations require a public meeting for scoping and a public hearing for a draft EIS. The regulations also require a minimum 30-day scoping comment period and a minimum 45-day public comment period on this draft EIS. These NEPA public involvement opportunities are described below.

1.9.2 EIS Scoping Public Involvement

The purpose of scoping-related public involvement activities is to inform the public about this EIS early in the process and obtain public input on issues of concern and development of alternatives. DOE issued an Advance Notice of Intent to prepare an EIS in October 2007. Scoping was initially conducted in 2008; however, because of changed cleanup requirements resulting from the 2010 AOC (DTSC 2010a) and the availability of more-recent site characterization data, DOE conducted another public scoping period in 2014. Summary documents of comments received during these scoping efforts, along with information on additional EIS-related public involvement activities, are available on the ETEC website at: http://etec.energy.gov/Char_Cleanup/EIS.html.

During the 2008 *SSFL Area IV EIS* scoping period from May to August, DOE held six scoping meetings in July to present the proposed alternatives and receive comments from agencies, organizations, and the public. The scoping meetings were held in Simi Valley, Northridge, and Sacramento, California.

DOE received 750 individual comments from 74 commenters, including individuals; elected officials; special interest groups; and Federal, state, and local agencies during the 2008 scoping period. The comments are documented in the *Scoping Comment Responses for the Environmental Impact Statement for Remediation of Area IV of the Santa Susana Field Laboratory* (DOE 2009). These comments and the subsequent comments received during the scoping from February to April 2014 were used in the development of this EIS.

The 2014 scoping period was initiated with an amended NOI. The *Amended Notice of Intent to Prepare an Environmental Impact Statement for Remediation of Area IV of the Santa Susana Field Laboratory and Conduct Public Scoping Meetings* (79 FR 7439) was published in the February 7, 2014, *Federal Register*. DOE held two scoping meetings in February and March. The scoping period was initially scheduled to close on March 10, 2014, but DOE extended it until April 2, 2014. Over the 55-day scoping period, DOE received a total of 1,272 comments from 309 commenters, including individuals, an elected official, organizations, Government agencies, a Native American organization, and a Native American tribe. **Table 1–1** contains a summary of key scoping comments from the 2014 scoping period. Additional information on scoping and comments received is included in the 2014 *Environmental Impact Statement for Remediation of Area IV and the Northern Buffer Zone of the Santa Susana Field Laboratory Final Scoping Summary Report* (DOE 2014b).

DOE reviewed the comments provided during the 2008 and 2014 scoping periods and the Community Alternatives Development Workshops that were held in 2012. DOE developed alternatives based, in part, on input from the stakeholders. For example, stakeholders requested incorporation of "green" concepts and design features, and DOE added green cleanup principles to its action alternatives. Some stakeholders requested DOE to consider putting all soil in sealed containers prior to transporting the waste by truck through neighborhoods. DOE is including in its soil remediation alternatives both metal boxes and roll-off bins for removed soil, as well as liners (such as bladder bags) that would contain soil within dump trucks. Other stakeholders asked DOE to include an alternative that looks at one or more risk-based alternatives and, as a result, DOE included a risk-based alternative (the Conservation of Natural Resources Alternative) that accounts for potential future residential land use. Appendix C includes more information on how alternative concepts proposed by stakeholders were considered by DOE in developing the alternatives.

As with the alternatives, requests for specific environmental analyses were incorporated as much as practicable. For example, some community members were concerned about environmental justice concerns for communities with waste disposal facilities. This EIS analyzes potential environmental justice concerns with respect to potential disposal facilities for Area IV waste. Native Americans expressed concerns about cultural and biological resources at SSFL and have declared SSFL to be a traditional cultural property and a sacred site. In response to the Native American concerns, DOE invited Native American participation in development of this EIS. Native Americans contributed material concerning their histories, and that information was compiled into a Native American histories and perspectives chapter (Chapter 9). The request that DOE look at multiple waste disposal facilities was incorporated into the alternatives. Concerns about potential health impacts, such as Valley Fever, or the risk of no action were incorporated into the human health analysis. The biological resources evaluation includes a qualitative discussion of how imported soil with physical and chemical properties differing from soil at SSFL could impact the biological resources of Area IV.

Table 1–1 Summary of Key Scoping Comments

Category	*Issues*
Alternatives/Alternative Development	Comments on alternatives and alternative development focused on the content and timing, as well as whether or not alternatives would adhere to the guidelines and restrictions set out in the 2010 AOC (DTSC 2010a). Some commenters expressed support for strict 2010 AOC compliance (with the added provision of not including any alternative that could be considered in violation of the AOC), including adherence to the 2017 deadline and a cleanup to background levels. A number of commenters said that DOE appears to be "backtracking" from its earlier commitment not to analyze additional EIS alternatives that are a violation of the 2010 AOC requirements. Several commenters further stated that the numerous alternatives and "concepts" included in the Amended Notice of Intent would violate the 2010 AOC and result in much of the contamination that was promised to be cleaned up continuing to remain on SSFL. Another approach to cleanup proposed by commenters is for DOE to develop and analyze a full range of alternatives for SSFL Area IV cleanup. Excluding other possible cleanup alternatives, except the 2010 AOC-mandated approach, would violate NEPA, they said. Some commenters supported a full-range analysis of alternatives and indicated their belief that the 2010 AOC is illegal, violates NEPA, is predecisional, and would eventually be challenged in court and thrown out. Some commenters advocated for additional alternative considerations, including the option of improving existing fire roads, building new roads, or utilizing railcars and railroad tunnels to transport soil from SSFL.
Comments on the 2010 AOC (DTSC 2010a)	Comments on the 2010 AOC focused largely on how the AOC would/should affect the proposed action and on the content of the AOC itself. Commenters indicated that, as the 2010 AOC gives the California DTSC oversight authority for the cleanup, DTSC should provide a binding, authoritative interpretation of the requirements in the AOC. Other commenters indicated that the requirements of the 2010 AOC were not clear and, in some instances, were ambiguous. Some commenters suggested the 2010 AOC cleanup deadline needs to be extended, while still others stated the AOC standard is unsustainable and should be repealed or, at the very least, renegotiated. Other commenters indicated that the 2010 AOC subverts public health concerns by imposing a standard of cleanup to background concentrations without considering health risks either from the contamination itself or from the efforts to clean it up, which contradicts the purpose of NEPA.
Cumulative Impacts	Comments on cumulative impacts asked for a detailed, specific review of the combined impacts of all concurrently operating SSFL projects, including projects led by DOE, NASA, and Boeing. Other commenters indicated that the EIS should quantify cumulative impacts across resources areas, as well as describe and evaluate feasible mitigation measures to avoid and minimize any identified adverse cumulative impacts. In addition to other projects on the SSFL, commenters provided examples of regional projects that could have an effect on or be affected by the proposed action.
Health Impacts of Previous Operations	Commenters expressed general concerns about the health of residents in communities surrounding SSFL, indicating that contaminants identified on SSFL are known to cause adverse health impacts. Other commenters stated the EIS must include a thorough discussion of the radioactive and hazardous substances at SSFL, the types of toxicity associated with each substance, and what communities have been affected by past site activities. Commenters also requested that the EIS include maps that show all of the chemical contamination based on the risk-based scenarios. Still other commenters suggested the EIS should include chemical and radiological contaminants ranked by their toxicity.
NEPA	NEPA comments focused on the EIS process, format, and adherence to NEPA guidelines/regulations. General comments were: the process lacks transparency; DOE does not seem to be interested in the concerns of the people and will not listen to public input; the EIS is moving along a predetermined path; the EIS is politically influenced; and information being put out to the public by DOE, especially about the alternatives, is deliberately confusing.
Public Involvement	Public involvement comments addressed the scoping process and, in particular, the scoping meetings. Some commenters suggested the scoping process failed to keep the promises made by CEQ and assurances made by DOE to follow CEQ directives. Others were concerned regarding the structure and format of the meetings; lack of a question and answer period; meetings held in inappropriate or inconvenient locations or in places least likely to be impacted; presentation materials at the meetings that the commenters thought were inadequate; information presented that the commenters believed was not consistent with information presented at other locations; and material the commenters believed was public relations fabrication and/or propaganda. Some commenters requested that all materials presented at scoping meetings be made publicly available.

Category	*Issues*
Specific Resource Area Comments	
Air Quality	Air quality comments centered on the standards and requirements to be considered in the EIS analysis, including a detailed discussion of ambient air conditions; National Ambient Air Quality Standards; criteria pollutant nonattainment areas; potential air quality impacts of the proposed project; and emission sources by pollutant from mobile sources, stationary sources, and ground disturbance. Commenters also noted that the EIS should address the applicability of the Clean Air Act and EPA's general conformity regulations. Other commenters suggested that DOE should work with air quality management districts to develop a Draft General Conformity Determination.
Biological Resources	Comments on biological resources expressed concerns about compliance with the Endangered Species Act, coordination/consultation with the U.S. Fish and Wildlife Service and California Department of Fish and Game, and threatened and endangered species, in particular Braunton's milk-vetch (*Astragalus brauntonii*) and the Santa Susana tarplant (*Hemizonia minthornii*).
Climate Change	Comments on climate change requested that the EIS consider the potential influence of climate change on the proposed project, specifically within sensitive areas, and assess how the projected impacts could be exacerbated by climate change.
Cultural Resources	Comments on cultural resources expressed general concern about the potential disturbance of cultural resources related to the proposed action. Commenters requested that the EIS address all Federal regulations, laws, and Executive Orders related to the protection and preservation of cultural resources. Other commenters pointed to what they considered to be vague language in the 2010 AOC (DTSC 2010a) related to "artifacts" and stated that this definition needs to be clarified, especially as there are identified sites on Area IV. Commenters further requested that the EIS explain how sites found on the DOE property would be assessed to determine the need for protection. The Santa Ynez Band of Chumash Indians expressed concern about cultural resources and requested that specific environmental and cultural factors be considered when assessing the overall cultural sensitivity of SSFL. They further indicated that Area IV should be considered a traditional cultural property and be eligible for protection on the *National Register of Historic Places*. The tribe requested consultation with the State Historic Preservation Office if new archaeological sites are discovered. Burro Flats was also identified as a specific area of concern. The Santa Ynez Band of Chumash Indians indicated the EIS needs to officially recognize SSFL as a traditional cultural property and a Native American sacred site.
Environmental Justice	Environmental justice comments expressed concern about impacts to Native American tribes and lower income and minority populations and school-age children. Commenters also said the EIS should address environmental justice in the communities that could receive soils from SSFL, and DOE should provide outreach materials to all potentially affected areas with environmental justice considerations.
Geologic/Soil Resources	Geologic resources comments expressed concerns about the potential effects of removal or blasting of rock outcrops or other geologic features. Comments received regarding soil resources requested that the EIS consider adverse impacts on soils under various cleanup scenarios, including topsoil removal, which would eliminate microbes necessary to degrade contaminants naturally, and erosion of unstable, potentially contaminated soil in stormwater flows to the communities in the area. Commenters also expressed concern over whether sufficient backfill soil of the quality required exists.
Groundwater	Comments on groundwater focused on the need to evaluate existing levels of contamination and the disclosure of whether or not there is evidence that hazardous substances in groundwater have migrated beyond SSFL Area IV. Other commenters indicated that groundwater cleanup should be considered as a component of the proposed action.
Human Health	Human health comments suggested the EIS should consider the likelihood of accidents under various cleanup scenarios, including accidents involving onsite workers, accidents during material transport, and accidents at landfills. Comments also expressed a concern about a possible increase in Valley Fever from disturbing large volumes of soil. In addition, commenters mentioned that emergency response measures should be addressed.
Infrastructure	Comments on infrastructure indicated the EIS should address the potential need for infrastructure (electrical, sewer, and water supply lines) during and after the proposed action, as well as any impacts of the associated construction.
Land Use	The majority of comments on land use focused on the potential future uses of Area IV and the NBZ once the cleanup has concluded. Some commenters suggested that the entire SSFL should be preserved as part of the Santa Monica Mountains National Recreation Area.

Category	*Issues*
Noise	Noise comments asked that the EIS consider the impacts of noise under various cleanup scenarios and suggested a reduction of noise impacts with specific vehicle choices (e.g., electric vehicles, noise-reducing tires, and vehicle adjustments to optimize performance).
Socioeconomics	Socioeconomic comments focused on the potential impacts of various cleanup scenarios on the long-term economic viability of surrounding communities and suggested that truck traffic could have economic impacts resulting from increased traffic and the negative perception of trucks moving soil from SSFL through communities, including reduced property values, reduction of area per capita income levels, and increased crime.
Surface Water	Surface water comments focused on the need for compliance with Federal regulations (e.g., the Clean Water Act) and the need for coordination with EPA and the U.S. Army Corps of Engineers. Several commenters expressed concern about potential impacts to area waterways, including the Los Angeles River and the Arroyo Simi.
Transportation/Traffic	Many transportation/traffic comments expressed concern about the transport of contaminated materials, including how materials will be transported and on which routes, and what steps will be taken to protect the citizens who live along these routes. They requested that analysis include the potential impacts of truck traffic on schoolchildren, including childcare centers, preschools, parks, and recreation centers. Some commenters suggested that transportation of soils and all other materials should take place only before or after—not during—rush hours or school openings and closings. Commenters suggested that the EIS provide specific details about vehicle routes and the vehicles to be used for the proposed action, including schedules, truck types, containers used, and numbers of truckloads per day. Other commenters expressed concerns about potential damage to roads, traffic congestion, and delayed emergency responses.
Visual Resources	Several commenters noted visual resources of the area would be impacted by cleanup activities and that the visual appeal of the area could be lost.
Waste Management	Waste management comments indicated that there should be as much transparency in the matter of waste composition and management as possible. Other commenters suggested DOE should consider shipments to multiple facilities to reduce impacts at the receiving facilities and should coordinate with NASA and Boeing on their remediation projects (e.g., scheduling, disposal facilities, and changes in soil volumes).

AOC = *Administrative Order on Consent for Remedial Action*; Boeing = The Boeing Company; CEQ = Council on Environmental Quality; DTSC = Department of Toxic Substances Control; EIS = environmental impact statement; EPA = U.S. Environmental Protection Agency; NASA = National Aeronautics and Space Administration; NBZ = Northern Buffer Zone; NEPA = National Environmental Policy Act.

1.9.3 Additional Public Involvement Activities

In conjunction with required public involvement activities for this EIS, DOE sponsored and supported numerous outreach activities and opportunities to encourage active community involvement as various studies and reports were prepared for use in the EIS analyses.

In addition to public meetings, tours, reports, and newsletter and fact sheet publication, DOE's efforts included inviting the public to attend and participate in technical meetings and field sampling observation opportunities with regulators and Government agencies. These meetings with agencies such as EPA and DTSC included discussions of technical issues and ongoing studies involving the following:

- Area IV radiological and chemical site characterization and determination of background concentrations or levels of ambient radiation and chemicals in the environment surrounding Area IV
- Groundwater contamination studies
- Soil treatment technologies
- Onsite chemical and radiological sampling observations
- Cultural resource survey observations

DOE representatives met with focused study groups, including the cultural and biological resources stakeholder groups, and hosted site visits and bus tours for groups such as Fernandeño Tataviam Tribe members and Teens Against Toxins. To better understand SSFL Area IV's history, DOE held site tours in 2009 that were specifically geared toward former workers and interviewed 132 former SSFL workers because stakeholders suggested to DOE that former workers would help inform the investigation. The results of the interviews are documented in *Santa Susana Field Laboratory Former Worker Interviews* (P2 Solutions 2011).

Additional public involvement activities included the following:

- Providing information on DOE activities, copies of pertinent reports, historical documents, and documents pertaining to the Area IV cleanup activities on the ETEC Closure Project website: http://www.etec.energy.gov. Examples of reports available on the website include cultural resources surveys, such as the *Final Report, Cultural Resource Compliance and Monitoring Results for USEPA's Radiological Study of the Santa Susana Field Laboratory Area IV and Northern Buffer Zone* (Minch 2012), as well as the results of assessments of biological reviews of sensitive species potential habitat, including the red-legged frog (*Rana aurora draytonii*) and the Quino Checkerspot butterfly (*Euphydryas editha quino*).

- Sponsoring two public meetings in connection with issuance of the June 2008 *Area IV Santa Susana Field Laboratory Environmental Impact Statement Draft Data Gap Analysis Report* (DOE 2008). The report included a compilation and review of existing chemical and radiological data for SSFL Area IV and determined the additional data that would be needed to complete this EIS and prepare a human health risk assessment and an ecological risk assessment.

- Providing opportunities for public comments and responses to those comments on the many project documents, such as the *Community Involvement Plan Area IV Santa Susana Field Laboratory* (DOE 2010c), as well as sampling and analysis plans and biological and cultural resources survey plans.

- Establishing a newsletter, the *CleanUpdate*, which is issued approximately twice yearly to a distribution list of approximately 4,300 stakeholders. This newsletter provides updates on this EIS and EIS-related studies, as well as on all activities related to the cleanup of SSFL Area IV, including annual community involvement reports.

- Hosting a daylong meeting and workshop in 2009, "Diverse Perspectives on the July 1959 Sodium Reactor Experiment Accident," during which three independent technical experts offered their perspectives on the accident. Because of the controversy regarding the 1959 accident, the meeting was held as an open forum with experts to review the causes and outcome.

- Co-sponsoring Groundwater U, a series of six educational sessions to help interested stakeholders review the *Draft Site-Wide Groundwater Remedial Investigation Report, Santa Susana Field Laboratory, Ventura County, California* (MWH 2009b) and understand the technical concepts.

- Establishing a Soil Treatability Investigative Group in 2011, composed of interested stakeholders, to regularly review study progress and provide suggestions for soil treatment technologies that should be considered.

- Hosting a series of three meetings in 2012 with interested stakeholders concerning the development of alternatives for this EIS. DOE presented information on the alternatives development process and the criteria the alternatives need to meet. Stakeholders then broke into groups and developed alternatives to be considered by DOE. Four groups and three individuals developed alternatives and submitted them to DOE for consideration. Additional information on this activity is included in Appendix C.

1.9.4 Other Agencies' Public Involvement Activities Related to the Santa Susana Field Laboratory

Agencies and organizations other than DOE also provide SSFL stakeholders with public involvement opportunities. Along with elected officials and community members, DOE participates in meetings sponsored by NASA, EPA, DTSC, Boeing, and the Los Angeles Regional Water Quality Control Board (LARWQCB). Upon requests, DOE representatives deliver presentations, briefings, and updates at organization and agency meetings, including those hosted by the West Hills, Warner Center, and Woodland Hills/Canoga Park Neighborhood Councils. DOE participates in DTSC-sponsored meetings, such as those held by the Public Participation Group (since disbanded) and the SSFL Community Advisory Group. DOE has provided briefings in support of this EIS, including presenting information on technical milestones and addressing community concerns. The SSFL Inter-Agency Workgroup meets several times per year and invites representatives from regulatory oversight agencies such as EPA, DTSC, and LARWQCB, along with DOE, NASA, and Boeing, and other involved and interested parties, to update members of the community on cleanup progress. During EPA's SSFL Area IV activities, EPA conducted public involvement opportunities in conjunction with its development of the radiological background study and comprehensive radiological study of SSFL Area IV and the adjacent NBZ.

DOE, NASA, Boeing, and DTSC maintain separate websites that provide access to project technical documents, groundwater, surface water, and soil sampling information, and data on regulatory compliance.

Chapter 2
Alternatives

2.0 ALTERNATIVES

2.1 Introduction

This chapter of this *Draft Environmental Impact Statement for Remediation of Area IV and the Northern Buffer Zone of the Santa Susana Field Laboratory (Draft SSFL Area IV EIS)* describes the reasonable alternatives for remediation of Santa Susana Field Laboratory (SSFL) Area IV and the Northern Buffer Zone (NBZ). (SSFL and the surrounding communities are shown in Chapter 1, Figures 1–1 and 1–2.) The U.S. Department of Energy (DOE) is evaluating separate alternatives for soil remediation, building demolition, and groundwater remediation.

For soil remediation, DOE's proposed action is to implement the technical requirements of the 2010 *Administrative Order on Consent for Remedial Action* (2010 AOC) (DTSC 2010a) between DOE and the California Department of Toxic Substances Control (DTSC)—that is, cleanup to meet the Look-Up Table (LUT) values for residual concentrations of chemicals and radionuclides in soil established in accordance with the 2010 AOC (Cleanup to AOC LUT Values Alternative). In preparing this environmental impact statement (EIS), DOE identified challenges to implementing this alternative, including difficulty determining when the AOC LUT values have been met and difficulty finding replacement soil that meets the AOC LUT values. Consistent with NEPA requirements, this EIS also analyzes a no action alternative (no soil treatment or removal), as well as two additional action alternatives (Cleanup to Revised LUT Values Alternative and Conservation of Natural Resources Alternative). The additional action alternatives would meet the cleanup objectives to be protective of the environment and the health and safety of the public and workers while avoiding some of the technical challenges and potential adverse environmental impacts associated with cleanup to the 2010 AOC LUT values.

For buildings, DOE's proposed action is to demolish the 18 structures it owns in Area IV and dispose of or recycle the materials off site (Building Removal Alternative); the EIS also analyzes a no action alternative of leaving the structures in place. To address groundwater contamination, this EIS analyzes current levels of monitoring (no action), additional monitoring to better support natural attenuation (Groundwater Monitored Natural Attenuation Alternative), and active treatment of contaminated groundwater (Groundwater Treatment Alternative).

DOE proposes to complete remediation of Area IV and the NBZ to comply with applicable requirements for cleanup of chemical and radioactive constituents. Orders, regulations, and agreements affecting the development of this EIS include, but are not limited to, the *Order Granting Plaintiffs' Motion for Summary Judgment* (Case 3:04-CV-04448-SC, May 2, 2007) from the lawsuit challenging DOE's 2003 *Environmental Assessment for Cleanup and Closure of the Energy Technology Engineering Center* (*ETEC EA*) (DOE 2003a) and the Finding of No Significant Impact (see Chapter 1); the Council on Environmental Quality's (CEQ) National Environmental Policy Act (NEPA) implementing regulations in Title 40, *Code of Federal Regulations*, Parts 1500-1508 (40 CFR Parts 1500-1508); DOE NEPA regulations in 10 CFR Part 1021; the 2010 AOC (DTSC 2010a); and the 2007 *Consent Order for Corrective Action* (2007 CO) (DTSC 2007). This chapter further discusses these requirements and explains how they informed the development of the action alternatives analyzed in this EIS.

Whereas the development of alternatives for building demolition and groundwater remediation was reasonably straightforward, the alternatives for soil remediation evolved as DOE considered comments from the public and cooperating agencies (Chumash 2014) and evaluated the complexities of implementing soil cleanup in accordance with the 2010 AOC. It is important for decision-makers, people living near SSFL, and other stakeholders to understand the process DOE employed in identifying the soil remediation alternatives evaluated in this EIS.

DOE considered a number of soil remediation alternatives, informed by public input. After entering into the 2010 AOC, DOE developed an action alternative for soil remediation that implemented the technical requirements of that consent order—that is, cleanup to meet LUT values for residual concentrations of chemicals and radionuclides in soil established in accordance with the 2010 AOC. DTSC published LUT values for more than 116 chemicals and provisional LUT values for 16 radionuclides in 2013 (see Appendix D, Section D.2). In accordance with the 2010 AOC, these LUT values are generally meant to limit contaminants remaining in soil after cleanup to local background levels, considering technical limitations in the measurement of these constituents in soil.

As data on levels of chemical and radioactive constituents in soil at Area IV, the NBZ, and background locations[1] became available and the AOC LUT values were established, DOE recognized that there would be technical issues associated with implementing a cleanup that meets the 2010 AOC requirements (see Section 2.3.3, Evaluation of Implementation of 2010 AOC Cleanup Requirements). DOE also determined that implementing the 2010 AOC requirements and remediating soil to meet the AOC LUT values would have the potential for adverse environmental impacts due to the large area of land that would be disturbed and the large volume of soil that would be removed. The CEQ NEPA regulations state that an EIS "shall provide full and fair discussion of significant environmental impacts and shall inform [decision-makers] and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment" (40 CFR 1502.1). The Santa Ynez Band of Chumash Indians, a cooperating agency on this EIS, also expressed their expectation that DOE would include "a robust analysis of alternatives" (Chumash 2014). DOE therefore determined that it was necessary to develop additional action alternatives for soil remediation that were protective of human health and the environment to be analyzed in this EIS. Evaluation of additional soil remediation alternatives allows decision-makers and the public to compare the potential impacts from implementing the alternatives with those from implementing a cleanup that meets the 2010 AOC requirements.

For purposes of comparison, the soil remediation action alternatives evaluated in this EIS address remediation of the soil in Area IV and the NBZ to AOC LUT values for chemicals and radionuclides, revised LUT values for chemicals (that is, LUT values that are based on individual chemical risk), or risk-assessment-based values for chemicals and radionuclides (expressed as a radiation dose for radionuclides). The building demolition action alternative (i.e., the Building Removal Alternative) addresses removal of the remaining DOE-owned buildings in Area IV and disposal of the debris off site. The groundwater remediation action alternatives address implementation of management practices to clean up groundwater in accordance with the requirements of the 2007 CO (DTSC 2007).

Each of the three sets of alternatives allows independent evaluation and comparison of the potential impacts of implementing each component of DOE's cleanup action. In addition, DOE evaluated the potential combined impacts of implementing each of the three cleanup components: soil remediation, building demolition, and groundwater remediation.

Under all alternatives, steps would be taken to protect biological and cultural resources, including limiting the amount of soil disturbance in biologically or culturally sensitive areas as provided for in the 2010 AOC. To the extent practicable, and as approved by DTSC, DOE would use onsite

[1] Background reference areas located 3 to 6 miles from SSFL were identified to be representative of SSFL onsite soil conditions. Soils and sediments in these areas were sampled and analyzed to establish chemical and radiological background levels (HGL 2011; URS 2012).

treatment and natural attenuation to reduce the volume of soil that would be transported and disposed of off site. Soil in which chemical constituents would not attenuate (degrade) naturally on site to levels meeting cleanup criteria would be transported off site to permitted disposal facilities based on the type of waste. Locations where soil is excavated would be backfilled, re-contoured, and stabilized with new vegetation. To the extent practicable, DOE would implement green remediation technologies and revegetate with native species.

A no action alternative is included for each of the three sets of alternatives. Evaluation of a no action alternative is required in accordance with CEQ NEPA regulations (40 CFR 1502.14(d)) because it establishes the baseline against which the potential environmental impacts of the action alternatives can be compared.

This chapter is organized as follows:

Section 2.1, Introduction – This section describes the purpose and intent of this chapter, as well as its organization.

Section 2.2, Alternatives Development – This section presents the alternatives development process and discusses regulatory drivers, community involvement, and alternative concepts that were considered, but dismissed from detailed analysis.

Section 2.3, Initial Soil Remediation Alternatives – This section presents the Soil No Action Alternative and the Cleanup to AOC LUT Values Alternative, as well as a discussion of concerns associated with implementing cleanup to meet the AOC LUT values.

Section 2.4, Additional Soil Remediation Action Alternatives – This section describes alternatives other than the Cleanup to AOC LUT Values Alternative to accomplish soil cleanup in a manner protective of public health and the environment. They consist of the Cleanup to Revised LUT Values Alternative and the Conservation of Natural Resources Alternative.

Section 2.5, Building Demolition Alternatives – This section describes the building demolition alternatives, consisting of the Building No Action and the Building Removal Alternatives.

Section 2.6, Groundwater Remediation Alternatives – This section describes the groundwater remediation alternatives, consisting of the Groundwater No Action, Groundwater Monitored Natural Attenuation, and Groundwater Treatment Alternatives.

Section 2.7, Preferred Alternative – This section discusses DOE's preferred alternative.

Section 2.8, Summary of Environmental Consequences – This section summarizes and compares the potential environmental consequences of the alternatives, as well as the cumulative impacts.

2.2 Alternatives Development

This section presents the alternatives development process, as well as a discussion of regulatory drivers, community involvement, and the alternative concepts that were considered, but dismissed from detailed analysis.

2.2.1 Applicable Laws, Regulations, Orders, and Agreements

Removal of existing DOE-owned facilities and support buildings from Area IV, remediation of chemically and radiologically impacted soil and groundwater in Area IV and the NBZ, disposal of resulting waste, and restoration of the affected environment would be conducted in accordance with requirements of applicable laws, regulations, and orders and agreements with the State of California. The 2007 CO (DTSC 2007), which applies to groundwater in Area IV and the NBZ, calls for a risk-based cleanup approach for groundwater based on the methodology in the *Final Standardized Risk*

Assessment Methodology Revision 2 Addendum, Santa Susana Field Laboratory, Ventura County, California (SRAM) (MWH 2014)[2] that was approved by DTSC. The 2010 AOC (DTSC 2010a) requires soil cleanup to the AOC LUT values, which are based on soil background levels or method/minimum detection limits.[3] DOE expects that, in order for the implementation of any alternative to be consistent with the 2010 AOC, changes to the AOC would be required. In addition, DOE would conduct its remediation activities in compliance with other applicable regulations and orders (see Chapter 8). These include other environmental regulations such as those implementing the Endangered Species Act and the National Historic Preservation Act, safety regulations such as those addressing worker and public safety, and applicable Executive Orders and DOE Orders.

2.2.2 Process and Criteria

Community input has been a major driver in the development of the alternatives for analysis in this EIS, and DOE has provided many opportunities over a number of years for the public to provide input. Appendix C describes in detail the process DOE used to develop the alternatives, including extensive community outreach and participation, concepts from the 2012 Community Alternatives Development Workshops, and input submitted by community members during the EIS scoping periods.

As discussed in Chapter 1, Section 1.3, preparation of this EIS began with an Advance Notice of Intent (NOI) published in the *Federal Register* (FR) (72 FR 58834) in October 2007. Informal discussions with the public and other stakeholders were held, and the resulting information was used in developing the May 16, 2008, NOI (73 FR 28437). The 2008 NOI presented DOE's proposed alternatives and, in accordance with NEPA, the public was invited to comment on the proposed alternatives or suggest other alternatives or alternative concepts. A summary of the public comments received during the 2008 scoping period (as well as those from the 2014 scoping period) are available on the Energy Technology Engineering Center (ETEC) website (http://etec.energy.gov/Char_Cleanup/EIS.html).

Preparation of this EIS was delayed to allow the U.S. Environmental Protection Agency (EPA) to conduct radiological characterization of Area IV and the NBZ; DOE to conduct chemical characterization; and DTSC to develop LUT values identifying the cleanup levels for chemicals and radionuclides. EPA's radiological characterization effort entailed a historical site assessment of past operations and radiological releases to identify locations for soil sampling; a gamma radiation scan, also to identify areas for soil sampling; collection and radiological analysis of 3,487 soil and 55 sediment samples; and radiological characterization of groundwater and surface water (HGL 2012b).[4] DOE's chemical characterization effort entailed collection and chemical analysis of 5,854 samples and conducting a data gap analysis that reviewed site operations and chemical releases and assessed the adequacy of existing data to guide soil sampling. DTSC published the provisional AOC LUT values for radionuclides in January 2013 and the AOC LUT values for chemicals in June 2013.[5] These AOC LUT values are listed in Appendix D, Tables D–2 and D–3.

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[2] The 2007 CO (DTSC 2007) originally also applied to soil remediation in Area IV and the NBZ; the 2010 AOC (DTSC 2010a) superseded the 2007 CO for soil remediation. The 2014 SRAM (MWH 2014) supersedes the 2005 version that was cited in the 2007 CO.

[3] See Chapter 1, Section 1.3, for further discussion on the development of AOC LUT values (HGL 2012c; DTSC 2013a, 2013b).

[4] HydroGeoLogic, Inc., was the EPA contractor for the radiological characterization of Area IV and the NBZ.

[5] The radionuclide LUT values are provisional. EPA recommended not selecting final LUT values until a single laboratory is selected to conduct the radionuclide analysis for the cleanup confirmation sampling and the selected laboratory can demonstrate its ability to meet EPA's defined measurement quality objectives. The chemical AOC LUT values are not provisional because they provide analytical standards for multiple laboratories to report and use when establishing data quality objectives (see Appendix D, Section D.2).

To meet revised regulatory requirements and commitments and to accommodate, to the extent practicable, the preferences of the communities surrounding SSFL and other stakeholders, the alternatives evaluated in this EIS have evolved from those identified in the 2008 NOI (73 FR 28437). As a result, with the exception of a No Action Alternative, the alternatives proposed in 2008 are not among the alternatives evaluated in this EIS. This EIS, however, includes alternatives based on risk and dose for a hypothetical suburban resident scenario, similar to some of the alternatives identified in 2008 that also considered risk, based on future land use scenarios (for example, agricultural, residential, and open space). The alternatives proposed in the 2008 NOI are discussed in Section 2.2.3, Alternative Concepts Considered but Dismissed from Detailed Study.

Since initial efforts to prepare this EIS began, DOE has engaged the public about cleanup of Area IV and the NBZ through interviews, workshops, and informational meetings, as described in Chapter 1, Section 1.9. In spring 2012, DOE sponsored a series of three Community Alternatives Development Workshops in which community members were asked to articulate their preferences for alternatives they would like to see analyzed in this EIS. The workshops resulted in four cleanup concepts that reflect the diverse preferences in the community. Appendix C provides details about the workshop process and the alternative cleanup concepts proposed by the community.

Despite the differences in their approaches to cleanup, the four community-developed concepts were similar in their focus on cleaning up and restoring Area IV and the NBZ to a level that allows use of the site as open space for wildlife or human enjoyment, as well as use of "green" and sustainable methods whenever possible to minimize the impact of cleanup on the site and the surrounding communities. All four of the alternative concepts recommended that DOE should take actions to minimize damage to the natural environment during cleanup. DOE has referred to one of the submitted concepts as the Green Cleanup Alternative Concept (see Appendix C). While DOE did not retain this concept as a separate alternative, it designed all of the action alternatives to incorporate green cleanup methodologies. A summary of green cleanup principles adopted by DOE to guide the development of alternatives is included in the following Green Cleanup text box and a more detailed discussion is provided in Chapter 7.

Green Cleanup

DOE is committed to integrating sustainability in its projects consistent with the requirements of Executive Order 13693, *Planning for Federal Sustainability in the Next Decade*. Impacts on the natural environment would be expected to result from the cleanup of Area IV and the NBZ, regardless of which action alternative is selected. DOE is committed to minimizing impacts by using the principles of "green cleanup." This approach is consistent with the DOE Office of Environmental Management's recognition of sustainability as an organizational goal at the highest levels of management (DOE 2015b). To the extent practical, green and sustainable remediation and innovative technology practices will be integrated into all phases of remediation. Chapter 7 of this EIS provides additional detail on implementation of greener cleanup principles.

For this project, cleanup decisions for all action alternatives would be guided to the extent possible by the EPA *Principles for Greener Cleanups* (EPA 2009b), the ASTM International *Standard Guide for Greener Cleanups* (ASTM 2013), and the California Department of Toxic Substances Control's (DTSC) *Interim Advisory for Green Remediation* (DTSC 2009). The purpose of EPA's principles, ASTM's standard guide, and DTSC's Advisory is to improve the decision-making process involved with site cleanup, while assuring the protection of human health and the environment by minimizing the environmental "footprint" of cleanup activities. Principal elements of green sustainable remediation are:

- **Minimize total energy and maximize use of renewable energy**
- **Minimize air pollutants and greenhouse gas emissions**
- **Minimize water use and impacts on water resources**
- **Reduce, reuse, and recycle materials and waste**
- **Protect land and ecosystems**

In addition, community concepts called for minimizing transportation impacts, preferential use of native plants for restoration of the site, and implementation of measures to prevent the spread of invasive, non-native plants. DOE considered all of these community concepts in preparing this EIS; these concepts informed the development of alternatives for this EIS (see Chapter 7).

Many community members who expressed concerns about transportation, biological, and cultural resources impacts also requested that DOE evaluate a risk-based cleanup alternative that might minimize these impacts. In response, in addition to evaluating an alternative for soil cleanup that meets AOC LUT values, DOE evaluated alternatives that use a risk-based methodology to determine areas and soil volumes that require remediation, based on cleanup to risk levels, similar to concepts considered in the 2008 NOI (73 FR 28437) (see Section 2.4).

As input to its 2014 Amended NOI (79 FR 7439), DOE reviewed and evaluated in detail the 2008 scoping comments and concepts developed during the 2012 Community Alternatives Development Workshops. In the Amended NOI, DOE summarized the history of the SSFL Area IV cleanup project, changes in regulatory requirements, and NEPA efforts to that date; presented the 2012 Community Alternatives Development Workshops concepts; announced scoping meetings and its intention to prepare this EIS; and provided the public with further opportunities to provide comments on the scope of this EIS and the alternatives to be evaluated.

After receiving stakeholder input from the 2014 scoping comments and the 2012 Community Alternatives Development Workshops, DOE developed screening and balancing criteria to identify alternatives to be evaluated in this EIS. The screening criteria were developed to ensure the proposed alternatives would meet the purpose and need for agency action as described in Chapter 1, Section 1.1. The balancing criterion included principles for cleanup in a manner that is as environmentally sensitive as possible. Descriptions of the criteria, including their development and selection process, are provided in Appendix C.

The main screening criteria selected were:

- Regulatory Compliance,
- Protect Public and Worker Health and Safety,
- Effectiveness, and
- Ease of Implementation.

The balancing criteria included:

- Protect the Environment,
- Protect Native American Interests,
- Cost,
- Community Acceptance,
- Return to Natural State,
- Minimize Transportation Impacts, and
- Preference for Onsite Treatment of Soils.

The concepts proposed by members of the community and DOE were first evaluated against the main screening criteria. These criteria were considered the most important criteria in developing the alternatives. The Regulatory Compliance criterion included compliance with applicable requirements of regulations, orders, and agreements. The Protect Public and Worker Health and Safety criterion considered the overall safety of the public and workers. The Effectiveness criterion was based on cleanup methods that could be implemented quickly enough to address any short-term risks and provide reliable protection over time. Under the Ease of Implementation criterion, consideration was given to the various components of the proposed alternatives and the ease or difficulty with each could be implemented. If a concept was proposed that was not feasible or effective because it did not meet the purpose and need (such as some of the soil treatment concepts discussed in Section 2.2.3), it was eliminated from further consideration in DOE's NEPA review. Those concepts posing too great a safety risk were also eliminated as not being reasonable. Alternative concepts were also screened against regulations, orders, and agreements governing hazardous and radiological materials cleanup and disposal, including the 2007 CO (DTSC 2007) and the 2010 AOC (DTSC 2010a). This screening process resulted in an initial selection of concepts that were then further refined using the balancing criteria and used to build the alternatives for soil remediation, building demolition, and groundwater remediation (see Sections 2.3 through 2.6).

The balancing criterion, Protect the Environment, included principles for cleanup in a manner that is as environmentally sensitive as possible. This included protecting biological and cultural resources, disturbing or removing as little soil as possible for offsite disposal, incorporating green cleanup principles, and minimizing consumption of resources such as water. Southern California has been under drought conditions for several years, and on April 1, 2015, Governor Brown issued Executive Order B-29-15, which directed the State Water Resources Control Board to impose restrictions that would achieve a statewide 25 percent reduction in potable water usage through February 28, 2016 (CA EO 2015). As a result, Californians reduced their potable urban water use by 24 percent compared to 2013 usage (New York Times 2016). In May 2016, California suspended the mandatory 25 percent reduction and directed local communities to set their own conservation standards (SWRCB 2016). Southern California remains in a severe drought condition.

DOE also included a separate Protect Native American Interests criterion. The Santa Ynez Band of Chumash Indians has designated the entire SSFL as a Native American sacred site (referred to herein as the Santa Susana Sacred Site) and believes that the site is eligible for inclusion on the *National Register of Historic Places* (NRHP) as a traditional cultural property. In 2014, the tribe filed paperwork with the State of California nominating the site to be included in the State of California Native American Heritage Commission Sacred Lands Inventory (NAHC 2014). Executive Order 13007, *Indian Sacred Sites*, requires Federal agencies that manage Federal lands and activities to "accommodate access to and ceremonial use of Indian sacred sites" and avoid adversely affecting the physical integrity of sacred sites. DOE is consulting with the State Historic Preservation Officer (SHPO), the Santa Ynez Band of Chumash Indians, and the Santa Susana Field Laboratory Sacred Sites Council (SSFL Sacred Sites Council), an organization of Native Americans with historical ties to SSFL land, to develop an agreement intended to resolve adverse impacts through avoidance, minimization, or mitigation of impacts during and subsequent to cleanup activities.

The Cost criterion was included to consider the estimated capital, operational, and maintenance costs of implementing each of the alternatives relative to the degree of environmental and human health protection afforded. Cost is often a factor in the decision-making process or in determining whether a proposed alternative is feasible. A cost-benefit analysis of the soil remediation alternatives is included as Appendix J of this EIS.

The Community Acceptance criterion was included to consider whether the community would find an alternative acceptable, based on whether there was general public support, general opposition, or a mixture of support and opposition expressed for an alternative concept.

The objective of the Return to Natural State criterion was to leave Area IV and the NBZ in as near a natural state as possible to be conducive to their use as open space, parkland, or a wildlife corridor.

Notwithstanding this goal, DOE does not own the land and cannot legally determine the ultimate land use.

The Minimize Transportation Impacts criterion focused on minimizing, as much as possible, both the onsite and offsite impacts from transporting materials and equipment onto the site for remediation activities and waste and recyclable materials off the site for disposition. Considerations under this criterion included total distance traveled to disposal sites, traffic congestion and safety on local roads and long-haul routes, air emissions, and transfer of non-native or nuisance species onto or off the site.

The final balancing criterion, Preference for Onsite Treatment of Soils, was included to give preference to alternatives and treatment methodologies that would treat soil to cleanup standards and leave it on the site rather than remove it for treatment or disposal.

The evaluation of the alternative concepts pursuant to the main screening and balancing criteria is summarized in Appendix C, Tables C–1 and C–2.

2.2.3 Alternative Concepts Considered but Dismissed from Detailed Study

A number of alternative concepts were proposed by the public during the EIS scoping period in 2008, the Community Alternatives Development Workshops in 2012, and the EIS scoping period in 2014. Not all of these concepts are evaluated in detail as alternatives in this EIS. However, DOE incorporated most of these concepts into the alternatives described in this chapter. **Table 2–1** briefly describes the alternative concepts that were considered but dismissed from detailed analysis and the reasons why these concepts were not carried forward as alternatives evaluated in this EIS. More-detailed descriptions of these concepts, as well as a discussion of the analysis undertaken to evaluate each concept and inform DOE's dismissal of the concept from detailed study, are provided in the following subsections in the same order they are presented in Table 2–1.

Table 2–1 Matrix of Alternative Concepts Considered but Dismissed from Detailed Study

Alternative Concept	*Alternative Description*	*Reason(s) for Dismissal*
Cleanup by 2017, consistent with the 2010 AOC or any other action alternative	Soil cleanup by 2017 would involve remediation of up to 130 acres and transport of up to 933,000 cubic yards of soil in less than 1 year, resulting in up to 470 daily and 118,200 annual truck trips.	There is insufficient time to complete regulatory actions (e.g., this EIS and the DOE ROD and the DTSC program EIR and decision) and to load and move the necessary number of trucks from SSFL to complete any action alternative by the 2017 deadline.
Transportation-Related Alternative Concepts	Proposed concepts ranged from minimizing the amount of transported soil to evaluating alternative transportation routes and methods.	Some of these concepts (e.g., minimizing the amount of transported soil) were incorporated into the alternatives evaluated in this EIS. DTSC is conducting a transportation study that will be issued in conjunction with its program EIR that evaluates alternative means of transporting debris and soil from SSFL. DOE will evaluate, when available, the study and determine the need for additional NEPA analysis.
Ultimate Land Use of Area IV after Cleanup	Potential future land uses include museums and parks, a land grant to Native Americans, open space, a wildlife corridor, and a wildlife preserve.	DOE does not own the land in Area IV or the NBZ and cannot make decisions about its ultimate use. DOE's cleanup would be compatible with Boeing's intended future land use of undeveloped open space (Boeing 2016a, 2016b).
Other Soil Cleanup Concepts	Installation and use of catch basins downstream of relatively inaccessible areas of the northern drainages that contain chemicals or radionuclides exceeding AOC LUT values to capture water flushed down drainages (clean water would be introduced upstream to flush contaminants to the catch basins, where the then-contaminated water would be collected and treated for offsite disposal); helicopters/mules for difficult-to-access locations; dilution through soil	These concepts raised regulatory or safety concerns: - Flushing contaminants from drainages does not meet DOE's purpose and need (e.g., is not protective of human health and the environment). - The safety risks associated with the use of helicopters or mules in steep terrain are greater than the expected benefits. - Dilution through soil mixing is not allowed for hazardous waste under RCRA regulations (40 CFR 268.3). For nonhazardous soils, this approach may not be effective in meeting cleanup goals because the concentrations of chemical and radioactive constituents in background soil are not significantly different than those in Area IV and NBZ soils.

Alternative Concept	Alternative Description	Reason(s) for Dismissal
	mixing; and soil compaction into trucks.	- Compacting soil in trucks would increase the need for water, present industrial hazards, and add to the timeline to complete the proposed action (e.g., time for loading and unloading each truck).
Cleanup Based on Different Land Use Scenarios	Cleanup based on a range of land uses.	The landowner's (Boeing's) intended future land use for their portion of SSFL, including Area IV and the NBZ, is undeveloped open space. Consistent with Boeing's basis for analysis, DOE assumed cleanup levels based on a hypothetical suburban residential land use scenario.[a] This scenario is more protective than an open land use scenario (Boeing 2016b).
No Action (Abandon Area IV)	Proposed in the 2008 NOI. Cessation of all DOE management and oversight of SSFL Area IV.	DOE determined that the No Action Alternative of continued maintenance is adequate to provide a baseline for evaluating the action alternatives.
Onsite Containment at SSFL Area IV	Proposed in the 2008 NOI. Onsite containment (which would include burial) of buildings, wastes, and radiological and chemical contaminants, aligned with potential future land use scenarios including, but not limited to, agricultural, residential, and open space.	This concept was eliminated because the 2010 AOC does not allow onsite burial or landfilling (excavating and burying) of contaminated debris or soil, and it would entail a decision affecting future land use for land that DOE does not own. DOE's non-AOC alternatives (see Section 2.4) include leaving in place constituents determined to meet risk-based standards, but do not include excavating soil and burying it elsewhere in Area IV.
Offsite Disposal of SSFL Area IV Materials (cleanup based on agricultural or open space risk assessment scenarios)	Proposed in the 2008 NOI. This alternative consisted of demolition of buildings and removal of contaminated media, aligned with potential future land use scenarios including, but not limited to, agricultural, residential, and open space. Nonradiological wastes would be transported to approved disposal or treatment facilities and radiological wastes to approved out-of-state disposal facilities.	This concept was partially considered in the development of the alternatives discussed in Sections 2.4.1 and 2.4.2 for soil remediation, in that the Cleanup to Revised LUT Values Alternative addresses soil cleanup based on chemical risk and soil cleanup under the Conservation of Natural Resources Alternative is based on risk for both chemicals and radionuclides (using radiation dose as a surrogate when evaluating radionuclides). To be consistent with the SRAM (MWH 2014), DOE used the hypothetical suburban residential scenario [a] as the potential future land use.
Combination Onsite/Offsite Disposal Alternative for SSFL Area IV	Proposed in the 2008 NOI. Demolition of buildings and onsite containment (which would include burial) of contaminated media, aligned with potential future land use scenarios including, but not limited to, agricultural, residential, and open space. Nonradiological wastes would be transported to approved disposal or treatment facilities and radiological wastes to an approved out-of-state disposal facility.	The onsite disposal portion of this concept was eliminated because the 2010 AOC does not allow onsite burial or landfilling (excavating and burying) of contaminated debris or soil, and it would entail a decision affecting future land use for land that DOE does not own. DOE's non-AOC alternatives (see Section 2.4) include leaving in place constituents determined to meet risk-based standards, but do not include excavating soil and burying it elsewhere in Area IV.
Alternate Use of Area IV Buildings	Possible use of the ETEC Office Building (Building 4038) as an interpretive center and the former Sodium Pump Test Facility (Buildings 4462 and 4463) for commercial purposes.	At this time, none of these concepts is sufficiently developed to be considered in this EIS. If any of these concepts develop into actual proposals, additional NEPA analysis would be required.
Particle Size Separation/Soil Washing	Particle size separation: Use size separation to separate the contaminated size fractions from the non- or less-contaminated size fractions (typically sand and larger soil particles). Soil washing: Place contaminated soil into treatment units (similar to washing machines) in which mechanical agitation and a washing solution are used to remove contaminants from the soil.	Soil treatability studies conducted on Area IV soil demonstrated that particle size separation was not effective in producing soil fractions that met the AOC LUT values and, thus, would require additional treatment (Matsumoto and Martin 2015). Soil washing is not considered a viable option because of the estimated large volume of water and length of time required to complete the effort: approximately 36 years and between 80,000 and 160,000 gallons per day of water would be required to treat all 933,000 cubic yards of soil (see Appendix D). Soil washing is normally performed as a volume reduction process to reduce the amount of material being disposed of as hazardous waste, not to remove all of the soil contaminants to background levels. In addition, either an onsite water treatment capability for reuse or offsite disposal of the wash water would be required, and it is uncertain whether soil washing could meet AOC LUT values or other applicable cleanup requirements.

Alternative Concept	Alternative Description	Reason(s) for Dismissal
Phytoremediation and bioremediation	Use plants and/or soil organisms to remove or breakdown contaminants in the soil.	Studies determined that these processes were ineffective in removing or breaking down most of the constituents; however, natural attenuation may be useful for low concentrations of certain hydrocarbons (Nelson et al. 2015b, 2015c).

AOC = *Administrative Order on Consent for Remedial Action*; Boeing = The Boeing Company; CFR = *Code of Federal Regulations*; DTSC = Department of Toxic Substances Control; EIR = environmental impact report; EIS = environmental impact statement; ETEC = Energy Technology Engineering Center; LUT = Look-Up Table; NBZ = Northern Buffer Zone; NEPA = National Environmental Policy Act; NOI = Notice of Intent; RCRA = Resource Conservation and Recovery Act; ROD = Record of Decision; SRAM = *Final Standardized Risk Assessment Methodology Revision 2 Addendum, Santa Susana Field Laboratory, Ventura County, California.*

[a] Although Boeing's intended future land use is undeveloped open space (Boeing 2015c, 2016b), the human health impacts analysis in this EIS includes a hypothetical onsite suburban residential scenario that includes the direct exposure pathways of dermal chemical exposure, direct radiation exposure, inhalation of chemical and radioactive constituents, and incidental ingestion of chemical and radioactive constituents (MWH 2014). The hypothetical onsite suburban residential scenario is a more conservative scenario than that of open space; that is, it would yield higher potential human health impacts. Because Boeing has stated that it will restrict future land use and prohibit residential houses and backyard gardens (Boeing 2016b), DOE did not include the indirect garden pathway of ingestion of homegrown fruits and vegetables.

Cleanup by 2017 per the 2010 AOC

The 2010 AOC (DTSC 2010a), signed by DOE and DTSC, requires soil cleanup to be completed by 2017. Since the 2010 AOC was signed, significant efforts to characterize Area IV, the NBZ, and background soils were undertaken by DOE, EPA, and DTSC. Soil characterization and background studies were necessary precursors to developing the AOC LUT values, developing preliminary remediation designs, and preparing required environmental documents, including this EIS. Before cleanup can begin, DOE needs to issue the final EIS and a Record of Decision (ROD) and complete and obtain regulatory approval of the documents described in the following paragraphs, as required by the 2010 AOC or the Resources Conservation and Recovery Act (RCRA), as amended. These documents and decisions apply to all of the action alternatives DOE evaluated in this EIS. Considering the current project status, completion of soil remediation by 2017 under any of the action alternatives is not feasible.

DOE must prepare a 2010 AOC (DTSC 2010a)-required Soils Remedial Action Implementation Plan (SRAIP) that addresses all soil contamination across Area IV and the NBZ.[6] The SRAIPs will need to be reviewed by DTSC, and all actions to be undertaken will require analysis in DTSC's California Environmental Quality Act (CEQA) program environmental impact report (EIR).[7] At this time, the DTSC program EIR has not been issued. DTSC will issue its findings regarding remediation of the entire SSFL following finalization of the program EIR. With those findings and the completion of the NEPA process through DOE's issuance of its ROD for cleanup of Area IV and the NBZ, DOE would be able to initiate soil remediation.

Two sets of buildings, including three associated with the Radioactive Materials Handling Facility (RMHF) and two associated with the Hazardous Waste Management Facility (HWMF), are regulated under RCRA permits. DOE submitted RCRA closure plans for RMHF (North Wind 2015c) and HWMF (North Wind 2015b) in 2015. DTSC needs to review both plans, consider public comments on the plans, approve the plans, and incorporate them as projects in its program EIR analysis (in preparation) prior to building demolition. DOE could initiate building removal following issuance of the ROD for this EIS; removal of the two RCRA-regulated facilities (RMHF and HWMF) would also require issuance of DTSC's program EIR decision.

[6] As described in Chapter 1, Section 1.8.3, of this EIS, DOE has chosen to prepare three SRAIPs to separately address the different types or levels of radionuclides and chemicals present in the soils rather than preparing a single SRAIP for cleanup of all the soil.

[7] DTSC is preparing a program EIR for the entire SSFL (Areas I through IV, the NBZ, and the Southern Buffer Zone). The program EIR will evaluate the remediation activities of DOE, NASA, and Boeing. The draft program EIR is currently in preparation.

DOE also remains under a Federal court order that enjoins the Department from transferring possession, or otherwise relinquishing control over, any portion of Area IV until DOE issues a final EIS and a ROD. Following public review of this draft EIS, DOE will address the comments received and prepare a final EIS. DOE will then issue a ROD no sooner than 30 days following issuance of EPA's Notice of Availability of the final EIS in the *Federal Register*.

For DOE to demolish all of the buildings and remove all of the soil exceeding the AOC LUT values by the end of calendar year 2017 (assuming work started in January 2017), approximately 200 truck round trips per day, 365 days a year would be required. To bring back clean backfill, another 125 truck round trips per day would be needed, making a total of 325 truck round trips per day. Working 250 days per year (50 weeks per year, 5 days per week), soil remediation would require up to 470 truck round trips per day (including building removal, soil removal, and backfill) (see Appendix D). Because these are truck round trips, the indicated number of trucks would be coming down Woolsey Canyon Road, the winding two-lane road from the hilltop on which SSFL sits, at the same time the same number of trucks are driving up the road. Working 12 hours per day at the above rates (325 or 470 truck round trips per day) would result in a truck leaving the site every 1.5 to 2 minutes; loading and traffic management of trucks at this rate is not feasible. The National Aeronautics and Space Administration (NASA) and The Boeing Company (Boeing) would also be transporting soil and building debris during this time. The result would be a constant stream of truck traffic up and down Woolsey Canyon Road (currently the only truck access road to SSFL) over the course of 1 year. Although DOE's other action alternatives would require a lower level of activity (e.g., loading trucks, truck traffic up and down Woolsey Canyon Road), DOE concluded that by the time regulatory actions are completed (discussed above), it is not feasible to complete remediation by 2017.

As a result of these concerns and analysis, completion by 2017 under any of the soil remediation action alternatives was not considered to be a reasonable and was eliminated from detailed evaluation in this EIS.

Transportation-Related Alternative Concepts

A number of transportation-related alternative concepts were submitted to DOE during the 2012 Community Alternatives Development Workshops and the 2014 scoping period. The community-proposed transportation alternative concepts ranged from examining ways to minimize the amount of soil to be transported to evaluating alternative transportation routes and methods. These concepts included:

- developing fire roads extending from SSFL;
- improving Black Canyon Road (a narrow road extending north of SSFL into Simi Valley);
- using variable truck routes to minimize impacts to any one neighborhood;
- building a conveyor or other transport system (including tunneling) to a railroad siding;
- developing intermodal transport strategies, such as truck to train or truck to ship, followed by shipment through the Panama Canal to Texas, then truck transport to a disposal facility in Texas for waste containing radioactive constituents above LUT values;
- sealing the trucks to minimize exposure to dust; and
- using alternative energy vehicles.

Concepts involving constructing new roads, making major improvements to existing currently unsuitable roads, or developing alternate transport systems such as conveyors or tunnels were not evaluated in detail. The time required to study, design, secure rights-of-way, and finally construct such large infrastructure projects would unreasonably delay initiation of the project relative to the availability of other options. Concepts such as containerizing the waste, covering the trucks to minimize dust, and using variable routes to reduce impacts on one neighborhood are included in the soil remediation alternatives evaluated in this EIS. Concepts such as ship transport to a waste disposal facility in Texas do not appear to represent any advantage over the truck-only or truck-rail transport evaluated in this EIS.

As part of its activities associated with preparing a program EIR for the entire SSFL, DTSC is conducting a transportation study that evaluates alternative means of transporting debris and soil from SSFL. In support of DTSC's 2014 scoping meetings for its program EIR, DOE provided DTSC with the stakeholder comments it received concerning transportation and the community-proposed alternative transportation concepts. DTSC is using this information in the development of its transportation study for its program EIR. If DTSC finds other disposal routes or transportation methods that are potentially viable, the feasibility (including needed permits, land purchases, costs, resource studies, and impacts to schedule) and potential environmental impacts (as necessary to comply with NEPA) would be evaluated by DOE at that time.

Ultimate Land Use of Area IV after Cleanup

Many suggestions for the ultimate use of Area IV were provided by members of the public. These included museums and parks, a land grant to Native Americans, open space, a wildlife corridor, and a wildlife preserve. DOE does not own the land in Area IV or the NBZ and does not have the authority to make decisions about its ultimate use. Therefore, community concepts concerning the ultimate use of the land are not included as part of the alternatives. Boeing, the landowner, publicly has expressed an interest in preserving the land as undeveloped open space for public benefit (Boeing 2016a, 2016b). Although future land use would not be a DOE decision, the soil cleanup alternatives evaluated in this EIS would reduce the risk associated with chemical and radioactive constituents in soil and groundwater and be compatible with use of the land as undeveloped open space. In fact, the risk-based alternatives evaluated in this EIS are based on analysis of direct exposure pathways for a hypothetical onsite suburban resident consistent with the SRAM (MWH 2014). (Impacts from an indirect pathway of a garden from which the hypothetical suburban resident derives all of his or her fruits and vegetables were not evaluated.) The onsite suburban residential scenario is a more protective land use scenario than open space.

Other Soil Cleanup Concepts

As described below, several soil cleanup concepts were proposed and considered, but were eliminated from further evaluation in this EIS because they posed regulatory or safety concerns.

Alternative concepts were proposed for relatively inaccessible areas of the northern drainages. Under one of the concepts, catch basins would be installed downstream from relatively inaccessible areas of the northern drainages that contain chemicals or radionuclides exceeding AOC LUT values. Clean water (obtained from offsite sources) would be introduced upstream of the identified areas containing chemicals or radionuclides to flush the contaminants to the catch basins, where the then-contaminated water would be collected and treated or removed using vacuum trucks for remote disposal. This alternative concept was eliminated from further evaluation in this EIS because flushing contaminants from drainages does not meet DOE's purpose and need (e.g., is not protective of human health and the environment). DOE also considered using helicopters or mules to reach inaccessible areas of the northern drainages, but eliminated that concept because the safety risks associated with the use of helicopters or mules in steep terrain are greater than the expected benefits. If an area with chemicals or radionuclides exceeding AOC LUT values is inaccessible for safety reasons, the 2010 AOC (DTSC 2010a) allows exemptions of up to 5 percent of the total volume of soil above AOC LUT values.

The concept of mixing clean soil with soil containing low levels of chemicals or radionuclides to meet the AOC LUT values was eliminated from further evaluation because dilution of contaminated material is not allowed for hazardous waste under RCRA (40 CFR 268.3) and for nonhazardous soil, constituent levels in Area IV and the NBZ soils are not significantly different than background levels. Because they are not significantly different, mixing onsite soil containing background levels of constituents with soil that exceeds AOC LUT or Revised LUT values may not be effective in reducing the concentrations to levels that meet the AOC LUT or Revised LUT values.

Compacting excavated soil into trucks was suggested as a way to minimize the number of trucks needed for transporting the large volumes of soil. Compaction of soil in trucks is not practical for the 933,000 cubic yards of soil proposed to be removed from SSFL. Compacting soil into the trucks would present logistical difficulties and additional industrial hazards and require additional time, both when loading the soil into the trucks and removing the compacted soil at the disposal site. This alternative concept was therefore eliminated from detailed analysis in this EIS.

Cleanup Based on Different Land Use Scenarios

Members of the public requested that DOE evaluate a full range of alternatives (NEPA and CEQA requirements were cited), including alternatives other than those meeting the 2010 AOC (DTSC 2010a) requirement of cleanup to background levels. DOE is evaluating alternatives that establish cleanup levels based on an assessment of risk, using a suburban residential land use scenario. The suburban residential scenario was identified in the SRAM (MWH 2014) as a potential future land use that would provide conservative results. Although other scenarios could be developed, for its Cleanup to Revised LUT Values and Conservation of Natural Resources Alternatives, DOE determined that it would be consistent with the landowner's (Boeing's) proposed cleanup to the suburban residential land use scenario (Boeing 2016b, MWH 2014). Boeing has indicated that it intends the future land use of its portion of SSFL (including Area IV and the NBZ) be undeveloped open space (Boeing 2015c, 2016a, 2016b). The suburban residential land use scenario considers the direct exposure pathways of dermal chemical exposure, direct radiation exposure, inhalation of chemical and radioactive constituents, and incident ingestion of chemical and radioactive constituents. (Impacts from an indirect pathway of a garden from which the hypothetical suburban resident derives all of his or her fruits and vegetables were not evaluated.) Based on a comparison of the exposure parameter values, the suburban residential land use scenario provides a conservative evaluation because suburban residential receptors (both adult and child) have substantially greater maximum exposure frequency and duration (24 hours per day, 350 days per year, for 30 years) when compared to a receptor under an open space land use (such as recreational users).

Alternatives Proposed in the 2008 Notice of Intent

In the 2008 NOI (73 FR 28437), DOE proposed five alternatives for the cleanup of Area IV (listed below). Then, in 2010, DOE entered into an agreement with the State of California (the 2010 AOC [DTSC 2010a]) to clean up the soil at SSFL Area IV and the NBZ to the AOC LUT values by 2017. Additionally, DOE agreed to propose no "leave-in-place" alternative or onsite burial or landfilling of contaminated soil. As a result of the 2010 AOC requirements, DOE determined that the 2008 NOI alternatives are not infeasible and eliminated them from detailed study in this EIS (with the exception of a No Action Alternative with continued monitoring and security). The eliminated 2008 NOI alternatives are presented below, along with the reasons they were dismissed from detailed study in this EIS.

No Action (Abandon Area IV). In the 2008 NOI, DOE considered two No Action Alternatives. DOE is retaining a No Action Alternative in which no cleanup would occur, but security of the site would continue (for soil remediation, building demolition, and groundwater remediation, as presented in Sections 2.3.1, 2.5.1, and 2.6.1, respectively). A second No Action Alternative (abandonment) involving the cessation of all DOE management and oversight of SSFL Area IV was also considered in the 2008 NOI. Under this alternative, buildings would remain and would not be monitored or maintained. Unmitigated natural processes, including erosion, groundwater transport of chemical and radioactive constituents, and concrete degradation were assumed to occur. DOE eliminated this No Action (Abandon Area IV) Alternative after determining that the No Action Alternative of continued maintenance is adequate to provide a baseline for evaluating the action alternatives.

Onsite Containment at SSFL Area IV. This alternative included onsite containment (including burial) of buildings, wastes, and chemical and radioactive constituents, aligned with potential future land use scenarios including, but not limited to, agricultural, residential, and open space. The 2010 AOC (DTSC 2010a) does not allow onsite burial or landfilling (excavating and burying) of contaminated debris or soil. Additionally, DOE recognized that burying soil on site would be making a future land use decision for land that DOE does not own. For these reasons, concepts of this alternative involving onsite burial in Area IV of soils excavated from Area IV or the NBZ were not evaluated in detail. However, as discussed in Section 2.4, DOE has included concepts that would leave in place constituents determined to meet risk-based standards.

Offsite Disposal of SSFL Area IV Materials. This alternative consisted of demolition of buildings and removal of contaminated media, aligned with potential future land use scenarios including, but not limited to, agricultural, residential, and open space. Nonradiological wastes would be transported to approved disposal or treatment facilities and radiological wastes to an approved out-of-state disposal facility. This concept was partially considered in the development of the alternatives discussed in Sections 2.4.1 and 2.4.2 for soil remediation, in that the Cleanup to Revised LUT Values Alternative addresses soils based on chemical risk, and the Conservation of Natural Resources Alternative is based on chemical and radiological risk (using radiological dose as a surrogate when evaluating radionuclides). To be consistent with the DTSC-approved SRAM (MWH 2014), DOE is using the onsite suburban residential[8] scenario as the potential future land use.

Combination Onsite/Offsite Disposal Alternative for SSFL Area IV. This alternative involved demolition of buildings and onsite containment (including burial) of contaminated media, aligned with potential future land use scenarios including, but not limited to, agricultural, residential, and open space. Nonradiological wastes would be transported to approved disposal or treatment facilities and radiological wastes to an approved out-of-state disposal facility. The 2010 AOC (DTSC 2010a) does not allow onsite burial or landfilling (excavating and burying) of contaminated soil. Additionally, DOE recognized that burying soil on site would be making a future land use decision for land that DOE does not own. For these reasons, concepts of this alternative involving onsite burial in Area IV of soils excavated from Area IV or the NBZ were not evaluated in detail. However, as discussed in Section 2.4, DOE has included concepts that would leave in place constituents determined to meet risk-based standards.

[8] The human health scenario evaluated in this EIS consisted of a hypothetical onsite suburban residential scenario considering the direct exposure pathways of dermal chemical exposure, direct radiation exposure, inhalation of chemical and radioactive constituents, and incidental ingestion of chemical and radioactive constituents (MWH 2014). Impacts from an indirect pathway of a garden from which the hypothetical suburban resident derives all of his or her fruits and vegetables were not evaluated.

Alternate Use of Area IV Buildings. During scoping, interest was expressed in possible use of the ETEC Office Building (Building 4038) as an interpretive center and the former Sodium Pump Test Facility (Buildings 4462 and 4463) for commercial purposes. At this time, neither of these proposals is sufficiently developed to be considered in this EIS. If any of these concepts develop into actual proposals, additional NEPA analysis would be performed.

Soil Treatment Concepts

Concepts for treatment of soil containing constituents above the AOC LUT values were proposed by Sandia National Laboratories for further study, with input from local stakeholders. The treatment concepts included phytoremediation or bioremediation[9] and natural and enhanced attenuation.[10] In addition, Sandia National Laboratories suggested that particle size separation (soil partitioning) and soil washing be evaluated. DOE contracted with two local universities, California Polytechnic State University, San Luis Obispo, and the University of California, Riverside to conduct the studies. The California Polytechnic State University conducted phytoremediation, bioremediation, and natural attenuation studies. The University of California, Riverside conducted soil partitioning, soil washing, and mercury chemical state (which affects treatability by the above technologies) studies.

The results of the studies (Nelson et al. 2015a, 2015b, 2015c) found that the constituents of interest adhered strongly to the soil, such that they were essentially immobile and could not be removed through phytoremediation or bioremediation. However, the studies found evidence that natural attenuation (degradation) of chemicals has been occurring at SSFL since they were first released and predicted that natural processes will continue (Nelson et al. 2015a). DOE therefore concluded that natural attenuation could be effective for managing certain low-concentration, petroleum-contaminated (total petroleum hydrocarbons [TPH] and polycyclic aromatic hydrocarbons [PAHs]) soils. This onsite treatment option, which would have to be approved by DTSC, was thus considered to be feasible and was assumed to occur under all soil remediation alternatives in this EIS.

Particle Size Separation/Soil Washing. Particle size separation and soil washing were evaluated as part of the soil partitioning treatability investigation. When contaminants preferentially adsorb (adhere) to certain soil size fractions, particle size separation can be used to separate size fractions with contamination from size fractions with no or less contamination (typically sand and larger soil particles) through the use of screens (sieves) of gradually decreasing mesh opening size. Typically, contaminants adhere to the smaller soil particles (silts and clays). At SSFL, less than 10 percent of the soil mass is composed of small silt and clay particles (Matsumoto and Martin 2015), creating an opportunity for reducing the mass of soil requiring offsite disposal if the larger-sized soil particles could meet the AOC LUT values. Soil treatability studies conducted on Area IV soil demonstrated that particle size separation was not effective in producing soil fractions that met AOC LUT values; even the larger-sized particles (expected to be the least contaminated) did not meet the AOC LUT values and, thus, would require additional treatment, such as soil washing (Matsumoto and Martin 2015). These findings are consistent with the findings of the phytoremediation and bioremediation studies that the constituents are strongly adhered to the soil particles.

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[9] Phytoremediation is the use of plants to remove, transfer, stabilize, or destroy contaminants in soil and sediment. Bioremediation is the use of living organisms to recover or clean a contaminated medium (soil, sediment, air, water). The process of bioremediation might involve introduction of new organisms to a site or adjustment of environmental conditions to enhance the ability or rate of indigenous fauna to clean contaminated media.

[10] Natural attenuation is the reduction of contaminants through natural processes. This reduction may occur through biological processes, such as biodegradation, and/or abiotic processes, such as volatilization and photo-oxidation. Enhanced natural attenuation involves the addition of materials to the soil to stimulate the natural processes.

Particle size separation could also be used as an initial step in the soil washing process to address remediation of the easier-to-clean sand particles separately from the silts and clays. Soil washing involves placing contaminated soil into a treatment unit (similar to a washing machine), in which mechanical agitation and a washing solution are used to remove contaminants from the soil. The composition of the washing solution may vary from plain water to a solution with extractants designed to desorb (remove) contaminants from the soil particles. The washing solution is agitated with the soil, and the mixture is discharged from the treatment unit for further processing, after which the soil is rinsed of residual treatment solution. Following use, the contaminant-laden washing solution would then be treated in a permitted wastewater treatment system.

Washing solutions can include water, water mixed with detergents, surfactants that remove insoluble contaminants, or strong acids that are needed to dissolve metals and radionuclides. Given the variety of contaminants in the soil within Area IV, a sequence of washing solutions would be necessary to remove all contaminants. Potential washing solutions may contain magnesium chloride, sodium acetate, sodium acetate with acetic acid, hydroxylamine hydrochloride with acetic acid, or nitric acid with hydrogen peroxide. On a larger scale, either organic or inorganic acids would be the most likely candidates for washing of soils contaminated with metals (for example, antimony, chromium, mercury, and silver) or radionuclides. Surfactants used to remove organic contaminants could be methanol and water; hydroxypropyl-β-cyclodextrin (a non-toxic, glucose-based surfactant for PAHs, polychlorinated biphenyls [PCBs], TPH, and dioxins); organic acids; alcohols; or vegetable oils.

After the washing process, the cleaned soil would be dried and stockpiled for replacement at the site. The washing process would generate large quantities of liquids and finer soil particles that would retain the contaminants. Because the contaminants may be concentrated with the finer soil particles, this soil could exhibit hazardous characteristics and need to be disposed of as hazardous waste.

Soil washing would require between 80,000 and 160,000 gallons of water per day and remove all organic matter from the soil along with the finer soil particles; the chemicals used would sterilize the soil (kill all bacteria, fungi, soil organisms), making the soil inhospitable for growing plants. Soil amendments (e.g., organic material, fertilizer) would be required to make the soil suitable for supporting plant life. Soil washing is typically a batch process, and would involve approximately 13 cubic yards of soil per batch. Each batch of soil would be agitated and flushed several times with treatment solutions; the entire process would require at least 3 hours. If the entirety of the 933,000 cubic yards were subject to soil washing, assuming three treatment systems were working continuously, it would take approximately 36 years of normal workweeks to wash the chemically contaminated soil (see Appendix D). Particle size separation and soil washing are not considered a viable soil treatment option for Area IV and NBZ soils because the treatment concept would use such large quantities of clean water (contrary to Governor Brown's proclamation to reduce water usage by 25 percent [CA EO 2015]); require establishment of a water treatment capability on site or the offsite transport of wash water; take at least three times as long as the longest alternative considered in this EIS (i.e., 10 years for the Cleanup to AOC LUT Values Alternative); and result in sterile, large-grained soil (like sand) that would not be conducive to re-establishing plant communities in Area IV. This technology may not meet DOE's purpose and need because it is uncertain whether the washed soils would meet the AOC LUT or other cleanup levels (see Appendix D). Therefore, particle size separation and soil washing were eliminated from detailed analysis in this EIS.

Phytoremediation and Bioremediation. Phytoremediation was evaluated for treatment of constituents in soil that are not amenable to biological degradation (metals, PCBs, dioxins). The results of a phytoremediation study performed for SSFL indicated that the method would not be effective at removing chemical constituents in soil to AOC LUT values. Phytoremediation studies showed little or no uptake of the chemical constituents of interest at SSFL (Nelson et al. 2015b). The bioremediation studies concluded that, although biological destruction of chemical constituents is an ongoing natural process, the readily degradable chemicals have already degraded, and what remains today are chemicals that would require many more years (decades) to degrade to the AOC LUT values (Nelson et al. 2015a, 2015c; CDM Smith 2015b). Therefore, phytoremediation and bioremediation were eliminated from further evaluation in this EIS.

2.3 Initial Soil Remediation Alternatives

This section presents the alternatives that DOE initially identified for evaluation after issuance of the 2010 AOC (DTSC 2010a). These include the Cleanup to AOC LUT Values Alternative, as well as the Soil No Action Alternative required by CEQ NEPA regulations. Following the description of these two alternatives, it presents an evaluation of the implementation of the 2010 AOC requirements.

2.3.1 Soil No Action Alternative

Under the Soil No Action Alternative, no soil would be treated to reduce constituent concentrations to levels that would meet cleanup criteria or be removed for offsite disposal. Soil would be left in place in perpetuity. Over time, radioactive constituents would continue to decay, and some chemicals would be reduced through natural chemical decomposition processes. Boeing is currently providing site security for the entire SSFL site. If that were to change, then DOE, in accordance with its Atomic Energy Act of 1954, as amended (AEA) responsibilities, would provide security at SSFL Area IV and the NBZ.

2.3.2 Cleanup to AOC Look-Up Table Values Alternative

Under this alternative, DOE would remediate soil in Area IV and the NBZ to meet the chemical and radionuclide cleanup LUT values established in accordance with the 2010 AOC (DTSC 2010a). DOE's planning assumption for cleanup of Area IV and the NBZ is that building removal would be conducted during the first 2 years of the project, followed by soil remediation. Soil removal would be the primary method for cleanup to the AOC LUT values, with onsite treatment (monitored natural attenuation) used where feasible for selected, low-concentration chemicals. Soil would be removed on a systematic basis until all of the soil removal required to meet AOC LUT values is accomplished. Approximately 933,000 cubic yards of soil would be removed and disposed of off site (see Table 2–4 in Section 2.4.3). Fifteen to 25 workers would be involved with soil removal activities at any one time, not including truck drivers hauling soil off site. Approximately 69,975 truck round trips over 10 years would be required to remove the soil for disposal under this alternative, although additional time could be necessary to allow for partially full trucks and weather delays, as well as to ensure restoration activities and/or onsite treatment methods are effective. As many as 45,636 truck round trips would be needed to bring backfill to the site (see Table 2–5 in Section 2.4.3).

Soil treatment studies found evidence that natural attenuation (degradation) of chemicals has been occurring at SSFL since they were first released and predicted that natural processes will continue (Nelson et al. 2015a). DOE therefore concluded that natural attenuation could be effective for management of certain low-concentration, petroleum-contaminated (TPH and PAHs) soils. DOE has estimated that implementing onsite treatment in the form of monitored natural attenuation for these hydrocarbons could reduce the amount of soil to be considered for removal from Area IV and the NBZ by 150,000 cubic yards (see Appendix D). Such onsite treatment would have to be approved by DTSC. This onsite treatment was assumed to occur regardless of the soil remediation alternative considered (that is, the 150,000 cubic yards were not included in the total volume of soil considered for removal and offsite disposal under the soil remediation action alternatives).

Overview of Soil Remediation

DOE would begin soil remediation following completion of building demolition. **Figure 2–1** shows the extent of the chemical and radioactive constituents above the AOC LUT values in the soil in Area IV and the NBZ. DOE's remediation responsibilities include the NBZ. However, a portion of the NBZ was impacted by chemicals carried from NASA facilities in Area II; these areas, shown in Figure 2–1, would be cleaned up by NASA. Based on analysis of more than 11,000 soil samples, for this EIS, DOE has estimated that a volume of 1,413,000 cubic yards of soil does not meet the chemical or radiological AOC LUT values (see Table 2–2) (see Appendix D).[11] The most frequently observed chemical constituents include PCBs, PAHs, TPH, dioxins, and metals (antimony, cadmium, chromium, mercury, selenium, and silver) (CDM Smith 2017). The most frequently observed radionuclide constituents are cesium-137 and strontium-90 (HGL 2012c). The estimated volume of soil requiring remediation was adjusted, as described below, to account for proposed exemptions to protect biological and cultural resources and soil with low concentrations of TPH and PAHs that would be treated on site by monitored natural attenuation.

The 2010 AOC (DTSC 2010a) includes exemptions to protect biological resources in accordance with the Endangered Species Act and cultural resources that are eligible for inclusion in the NRHP in accordance with the National Historic Preservation Act (NHPA) or the *California Register of Historical Resources*. DOE is currently consulting with the U.S. Fish and Wildlife Service (USFWS) and the California Fish and Wildlife Service regarding biological resources. DOE is also consulting with the California SHPO, the Santa Ynez Band of Chumash Indians, and the SSFL Sacred Sites Council to support DOE's determination of the eligibility of cultural resources at SSFL for listing in the NRHP or the *California Register of Historical Resources*. Cultural resources identified by SHPO as eligible for the NRHP or the *California Register of Historic Places* would be protected in accordance with the consultation findings. Locations proposed for protection of biological and cultural resources are identified in this EIS (see Figure 2–2). These areas would be protected under any of the soil remediation alternatives. DOE would not take action in any of these areas unless it is demonstrated that levels of chemical or radioactive constituents in the soil pose a risk to human health or the environment, as determined using risk-based screening levels (RBSLs) from the SRAM (MWH 2014). The preliminary estimated volume of soil within areas subject to the proposed biological/cultural exemptions under the 2010 AOC is 330,000 cubic yards (see Appendix D). These areas would be avoided under any of the soil remediation alternatives.

Based on soil treatability studies, it appears that natural attenuation will be able to reduce TPH and PAH concentrations adequately to meet the AOC LUT values given sufficient time (due to the low existing concentrations, it would take an estimated 70 years for concentrations to degrade below the AOC LUT values) (CDM Smith 2015b). DOE assumes that DTSC would approve use of natural attenuation processes for low-concentration, petroleum-contaminated (TPH and PAH) soil. The estimated volume of soil at locations with only TPH and PAH contamination is 150,000 cubic yards (see Appendix D). Natural attenuation for this soil was assumed under all soil remediation alternatives.

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[11] DOE estimates the volume of soil that may not meet the AOC LUT values could range from 1,000,000 cubic yards to 2,500,000 cubic yards (see Appendix D). The estimated volume of soil (i.e., 1,413,000 cubic yards) not meeting the AOC LUT values was calculated using a geographic information system evaluation of the vertical and lateral distribution of contamination found during sampling. DOE recognizes that there is uncertainty that associated with extrapolating data collected at individual points and therefore identified a range of soil volumes.

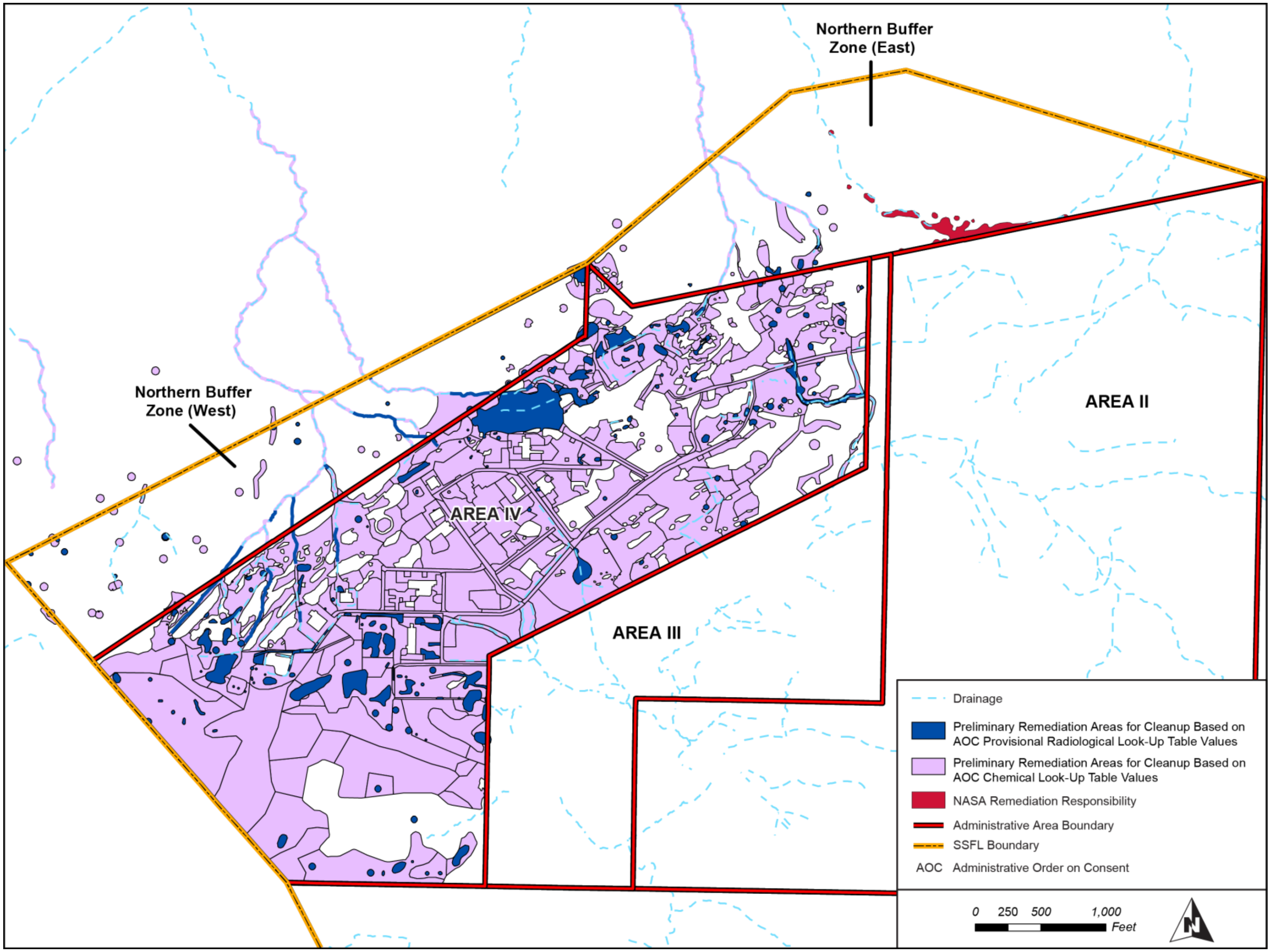

Figure 2–1 Extent of Radiological and Chemical Constituents Above AOC Look-Up Table Values

As a result of these adjustments to the soil volume, 933,000 cubic yards of soil exceeding the AOC LUT values is considered in the Cleanup to AOC LUT Values Alternative in this EIS (see Appendix D). **Table 2–2** summarizes the preliminary estimated soil volumes by 2010 AOC (DTSC 2010a) considerations.

Table 2–2 Preliminary Estimated Soil Volumes for Remedial Actions per 2010 AOC Considerations

Soil Category Description	*Soil Volumes (cubic yards)*
Estimated volume of soil exceeding the chemical AOC LUT values only (radionuclides below the AOC LUT values)	1,320,000
Estimated volume of soil exceeding the chemical AOC LUT values with radionuclides above the AOC LUT values	88,000
Estimated volume of soil exceeding the radionuclide AOC LUT values only (chemicals below the AOC LUT values)	3,000
Total volume of soil exceeding the chemical or radionuclide AOC LUT values	**1,413,000**
Volume of soil potentially subject to proposed biological and cultural exemptions per the 2010 AOC	330,000
Volume of TPH/PAH-contaminated soil potentially subject to natural attenuation	150,000
Total volume of soil potentially subject to removal	**933,000**

AOC = *Administrative Order on Consent for Remedial Action*; LUT = Look-Up Table; TPH = total petroleum hydrocarbons; PAH = polycyclic aromatic hydrocarbon.
Note: Sums presented in the table may differ from those calculated from table entries due to rounding.

The 2010 AOC (DTSC 2010a) also allows exemptions from soil remediation (up to 5 percent by volume) for unforeseen circumstances. DOE would propose use of these exemptions as necessary to prevent damage in remote locations and avoid areas that are too risky for workers to access. DOE may also propose use of the exemptions for soil with constituents that are above the AOC LUT values, are deeper than 5 feet below ground surface, and do not threaten groundwater. Exemptions proposed for these purposes will be described in the forthcoming SRAIPs and were not used in developing the above adjustments to estimated soil volumes analyzed in this EIS.

The 2010 AOC stipulates that soils be cleaned up to LUT values that are local background concentrations or method/minimum detection limits for contaminants for which the method/minimum detection limits exceed background concentrations. Based on the chemical concentrations relative to hazardous waste criteria, risk-based concentrations, and the AOC LUT values, as well as the radionuclide concentrations relative to risk-based concentrations and the AOC LUT values, the following six categories of soil are expected to be removed during remediation efforts:

1. *Soil containing chemical constituent concentrations below both hazardous waste standards and risk-based levels, but above the chemical AOC LUT values, and radionuclides at or below the radiological AOC LUT values.* This soil does not meet the definition of hazardous or radioactive waste and would be transported to a permitted California Class II or Class III[12] disposal facility, based on the acceptance criteria of the facility. At most sites in the United States, including California, this soil would be left in place (see Appendix D, Section D.3 for comparison with other cleanup projects in California).

[12] Siting and construction requirements for California Class I landfills are similar to those for hazardous waste permitted under Subtitle C of RCRA (e.g., double composite liners and leachate collection systems). Siting and construction requirements for California Class II and Class III landfills are similar to those for nonhazardous waste permitted under Subtitle D of RCRA (e.g., liners and leachate collection systems), except additional requirements exist for Class II landfills compared to those for Class III landfills.

2. *Soil containing chemical constituent concentrations below hazardous waste standards and above risk-based levels and radionuclide concentrations at or below the radiological AOC LUT values.* This soil does not meet the definition of hazardous or radioactive waste and would be transported to a permitted Class II or Class III disposal facility, based on the acceptance criteria of the facility.
3. *Soil containing chemical constituent concentrations exceeding hazardous waste standards and radionuclide concentrations at or below the radiological AOC LUT values.* This soil would be transported to a permitted California Class I or out-of-state hazardous waste disposal facility, based on the acceptance criteria of the facility.
4. *Soil containing chemical constituent concentrations above the AOC LUT values, but below risk-based levels and hazardous waste standards, and radionuclide concentrations above the radiological AOC LUT values, but below risk-based levels.* This soil would be transported to a licensed or authorized low-level radioactive waste (LLW) disposal facility, based on the acceptance criteria of the facility.
5. *Soil containing chemical constituent concentrations above risk-based levels that may be a hazardous waste and radionuclide concentrations above the radiological AOC LUT values.* This soil would be transported to a facility permitted to receive hazardous waste and licensed or authorized to receive radioactive waste, based on the acceptance criteria of the facility.
6. *Soil containing chemical constituent concentrations at or below the AOC LUT values and radionuclide concentrations above risk-based levels.* This soil would be transported to a licensed or authorized LLW disposal facility, based on the acceptance criteria of the facility.

Table 2–3 presents the preliminary estimates of soil volumes based on the soil categories for transportation and disposal considerations.

Table 2–3 Preliminary Estimated Soil Volumes for Transportation

Soil Category	*Soil Chemical/Radionuclide Classifications*	*Soil Volumes (cubic yards)*
1	Chemicals above AOC LUT values, but below risk-based levels and hazardous waste standards. Radionuclides at or below AOC LUT values.	741,000
2	Chemicals above risk-based levels, but below hazardous waste standards. Radionuclides at or below AOC LUT values.	52,000
3	Chemicals above hazardous waste standards. Radionuclides at or below AOC LUT values.[a]	49,000
4	Chemicals above AOC LUT values, but below risk-based levels and hazardous waste standards. Radionuclides above AOC LUT values, but below risk-based levels.	44,000
5	Chemicals above risk-based levels that may be a hazardous waste. Radionuclides above AOC LUT values.[a]	44,000
6	Chemicals at or below AOC LUT values. Radionuclides above risk-based levels.	3,000
Total		**933,000**

AOC = *Administrative Order on Consent for Remedial Action*; LUT = Look-Up Table.

[a] A total of 93,000 cubic yards of soil, with and without radionuclides, is estimated to exceed chemical hazardous waste standards.

Note: The total does not equal the sum of the individual entries due to rounding.

Vegetation would need to be cleared before soil could be excavated. Clearing and grubbing (removing belowground components such as roots) would be performed as necessary. The material would be shredded and used for mulch to the extent possible. However, much of the vegetation in these areas is non-native or invasive, so using it for mulch would not be appropriate. Such material would be carefully handled to minimize the potential for propagation and disposed of off site. Fifteen to 25 workers would be involved with soil removal activities at any one time, not including the truck drivers hauling the debris off site.

Figure 2–2 is a composite map of Area IV and the NBZ showing areas with chemical and radioactive constituents above the AOC LUT values overlain by the proposed exemption areas for sensitive biological and cultural resources, as allowed under the 2010 AOC (DTSC 2010a). The final exemption areas for biological resources will be determined through consultation with the USFWS and California Fish and Wildlife Service as part of the USFWS Biological Opinion. The final exemptions for cultural resources will be determined through consultation with the California SHPO, the Santa Ynez Band of Chumash Indians, and the SSFL Sacred Sites Council. The exemptions are ultimately subject to other agency approval. If levels of constituents in these areas pose a risk to human health and the environment, as determined using RBSLs from the SRAM (MWH 2014), DOE would remove them through carefully planned, focused removals that would result in minimum disturbance. In this EIS, it was assumed that the potential impacts from these focused removals would be a fraction of those associated with the balance of the soil remediation efforts and within the uncertainty associated with the analysis of impacts.

Minimization measures to reduce environmental impacts, as described in Chapter 6, Section 6.1, of this EIS, would be used to ensure that impacts on the environment from cleanup activities are minimized. Dust and runoff controls would be applied to excavated locations awaiting backfill and restoration. In accordance with the 2010 AOC, following soil removal, soil cleanup would be verified by DTSC for chemicals and EPA for radionuclides before backfilling of excavated areas would start. The verification process would involve collection of confirmatory samples following soil removal, analysis of the samples for constituents of concern, and transmission of the data to the agencies for their review. This verification process could take up to 6 weeks following soil removal.

Following confirmation by DTSC and EPA that cleanup standards have been met, excavated areas would be backfilled and graded, slopes would be stabilized, and disturbed areas would be revegetated using native plant species. It was assumed that approximately 75 percent of the soil volume removed would be backfilled to accomplish slope stabilization (see Appendix D). This would require transporting up to 700,000 cubic yards of backfill (if 933,000 cubic yards of soil were removed) to the site. DOE conducted an initial evaluation of three off-SSFL sources of soil for backfill and found none that meets the requirements of the 2010 AOC (that the backfill meets the AOC LUT values) (see Appendix D).[13] In addition, DOE has had bags of soil from two home improvement stores analyzed and found that both samples failed to meet the AOC LUT values (see Appendix D). Because the AOC LUT values are very low, finding soil of this purity, especially soil that is comparable to the existing local soil (i.e., that would support the native plant communities), is expected to remain a challenge. If a source of backfill that meets all of the AOC LUT values cannot be reasonably found, then DTSC, DOE, and EPA would enter into a consultation process, and DTSC would determine the best available source of backfill (DTSC 2010a).

[13] In support of project implementation, DOE would again search for and evaluate sources of backfill.

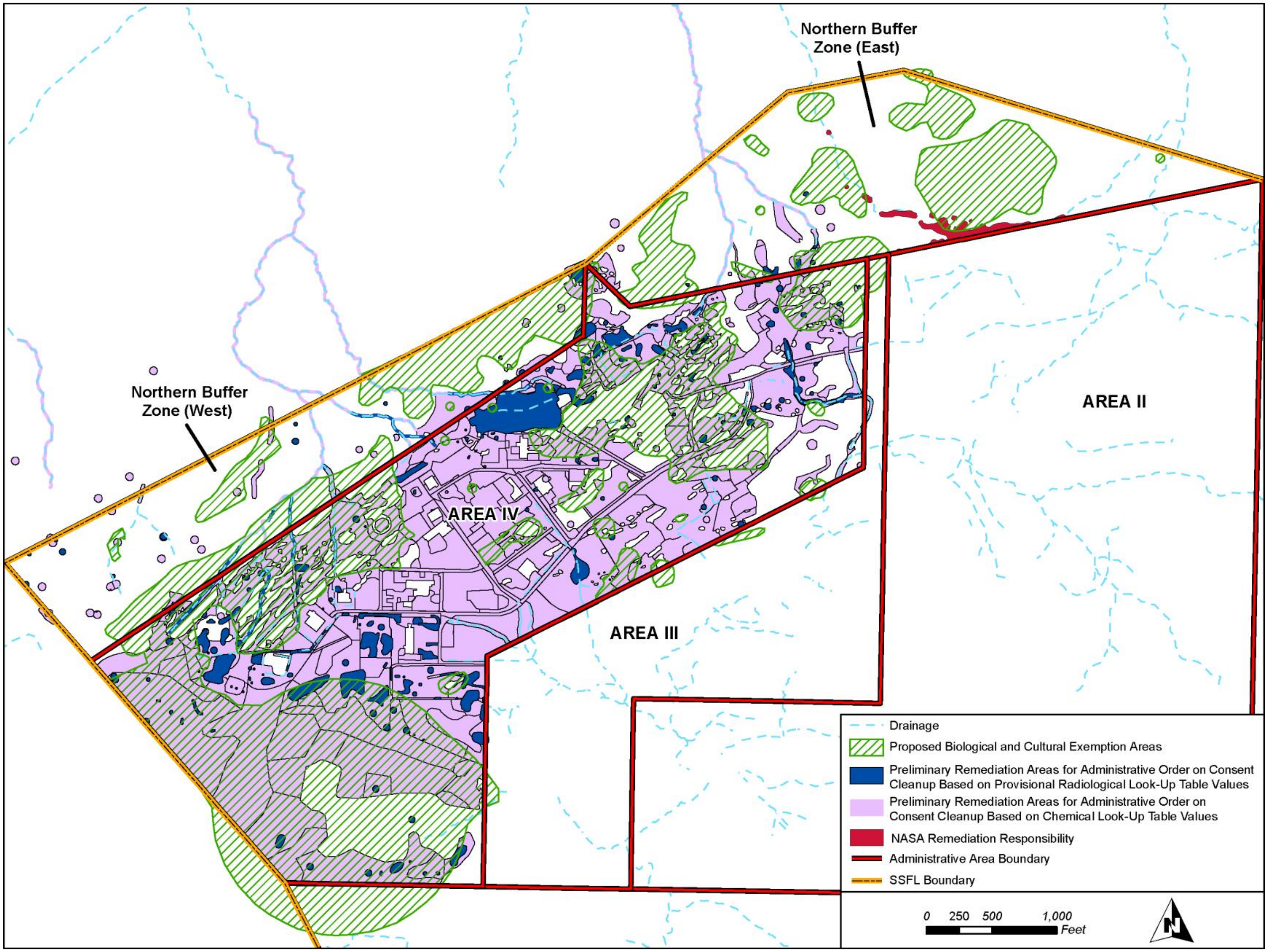

Figure 2–2 Extent of Radiological and Chemical Constituents Above AOC Look-Up Table Values with Proposed Exemption Areas

Stormwater discharges from the entire SSFL site are regulated by a site-specific National Pollutant Discharge Elimination System (NPDES) permit and a California Regional Water Quality Control Board, Los Angeles Region, order issued to Boeing, the landowner (CRWQCB 2007). To maintain compliance, Boeing has implemented a comprehensive, site-wide best management practices (BMP) program that utilizes both structural and nonstructural BMPs (MWH 2012; Geosyntec 2012). The existing NPDES stormwater control and monitoring system would remain in place during soil remediation and restoration. This stormwater control and monitoring system was designed to provide for the full treatment of runoff from 95 percent of the storms that could occur on site and partial treatment for the remaining 5 percent of the storms (Boeing 2008b). DOE would coordinate with Boeing and schedule and perform its soil-disturbing work to minimize the potential to cause perturbations and permit exceedances.

Figure 2–3 Wattle

DOE would apply a surfactant or soil binder to exposed areas to control dust and deploy wattles (long tubes of inert, usually natural materials such as straw that filter water and retain sediments) to control runoff. **Figure 2–3** shows a wattle deployed across a ditch. Foot and vehicle traffic in exposed areas would be restricted to maintain the surfactant crust. Following concurrence from DTSC and EPA that backfill soil is acceptable, DOE would place the backfill on the excavated areas and re-grade and re-contour as necessary. The area would then be seeded with a native plant seed mixture. DOE would conduct vegetation monitoring per the Revegetation and Habitat Restoration Plan discussed in Chapter 6 of this EIS.

2.3.3 Evaluation of Implementation of 2010 AOC Cleanup Requirements

This section addresses the technical aspects of implementing the "cleanup to background" approach described in the 2010 AOC (DTSC 2010a) that compelled DOE to look at other soil cleanup alternatives beyond those described in Sections 2.3.1 and 2.3.2. In this section, DOE also considers its legal and regulatory responsibilities for considering alternative for soil cleanup actions.

2.3.3.1 Implementability of the 2010 AOC Requirements

2010 AOC Soil Cleanup Standards

The soil cleanup standards specified in the 2010 AOC (DTSC 2010a) are based on "cleanup to background" for soil contaminants. The 2010 AOC stipulated that the soils cleanup standard would be based on LUT values, which are local background concentrations or minimum detection limits for constituents whose minimum detection limits exceed local background concentrations (see Chapter 1, Section 1.3). The cleanup standard definition applies to chemical as well as radionuclide constituents found in Area IV and the NBZ. DTSC has established AOC LUT values for chemicals and provisional AOC LUT values for radionuclides based on either background concentrations or detection limits (see Appendix D).

Background concentrations and minimum detection limits are lower than what is typically used as a standard for soil cleanup. Most cleanups are based on a risk assessment that follows EPA guidance. For example, the risk-based standard (based on the SRAM [MWH 2014]) for mercury is 16.8 parts per million, while the AOC LUT value is 0.13 parts per million. For silver, the risk-based standard is 230 parts per million, but the AOC LUT value is 0.2 parts per million. PCBs do not naturally occur, so they do not have a background concentration; therefore, the detection limit is used for the AOC LUT value. For Aroclor 1254, one of the PCBs found in Area IV, the SRAM risk-based standard is

232 parts per billion, and the AOC LUT cleanup standard is 17 parts per billion. For petroleum hydrocarbons, the AOC LUT value is 5 parts per million; environmental screening levels normally used at other locations in California (SFWQCB 2013) and applicable to other cleanups (EPA 2015b) range from 100 to 500 parts per million. This 1 to 2 orders of magnitude (that is, multiples of 10) difference between what is normally used in soil cleanup and the AOC LUT value occurs for most of the chemicals detected within Area IV and the NBZ.[14]

For cesium-137, the cleanup standard applied to Area IV soil removal actions (prior to establishment of the provisional radionuclide AOC LUT values per the 2010 AOC) was 9.2 picocuries per gram (Boeing 1999, 2000). The current DOE cleanup standard for cesium-137 in soil using a suburban residential land use scenario (consistent with the SRAM [MWH 2014]) corresponds to a soil concentration of 10.3 picocuries per gram. The provisional AOC LUT value for cesium-137 is 0.225 picocuries per gram (see Appendix D, Table D–2).

The 2010 AOC confirmation protocol addresses and compares every soil sample with the AOC LUT values for 116 chemicals and 16 radionuclides (see Appendix D). Should any chemical or radionuclide exceed its respective AOC LUT value, then the soil must be cleaned up. This EIS refers to this approach as a point-by-point cleanup process.

To understand how a point-by-point process would be implemented, DOE reviewed similar cleanup actions at other sites. While there are sites where point-by-point cleanups have been applied, these sites contained only a few chemicals or radionuclides of concern and not the large number of constituents (132) included in the AOC LUTs. DOE reviewed two large remediation projects in California—Hunters Point near San Francisco and McClellan Air Force Base near Sacramento because they dealt with multiple contaminants. However, both of these cleanups were risk-assessment-based (not point-by-point decisions), were focused on about 30 constituents (not 132), and allowed leaving contamination in place. When there are only a few constituents and/or a risk assessment approach is used, a small number of constituents need to meet the established standard. Moreover, the AOC LUT values do not account for the natural occurrence of many constituents in the soil, meaning that they could lead to decisions to remove soil that has not been contaminated by Area IV operations. Therefore, meeting the 2010 AOC LUT values would require an unprecedented approach and effort.

High Level of Uncertainty in Cleanup Decisions

To be certain that what DOE is cleaning up is contamination resulting from ETEC operations, there must be confidence in the analytical result that the contaminants are actually present and their concentrations exceed the cleanup standard. The 2010 AOC specifies that the detection limits for the chemical AOC LUT values should be based on the "lowest concentrations at which an analyte can be confidently detected in a sample and its concentration can be reported with a reasonable degree of accuracy and precision" (DTSC 2010a). For many of the chemicals (e.g., PCBs) and radionuclides (e.g., strontium-90), however, the AOC LUT values are set at the lower end of the analytical instruments' abilities to accurately report the presence of the constituent. Exceeding such values does not necessarily indicate that contamination is present because some constituents may be at background levels. As a result, DOE may perform soil cleanup at locations where contamination does not exist.

EPA provided guidance and recommendations on how AOC LUT values for radionuclides should be developed (HGL 2012c). EPA states that, "BTVs [Background Threshold Values] alone are

[14] See Appendix D, Table D–3, for a list of AOC LUT values for chemical constituents and the corresponding revised LUT values that were determined on a risk basis.

neither appropriate nor recommended for use as the LUT values." EPA also stated that their field action levels (FALs), which they renamed "radiological trigger levels" (RTLs) after adding uncertainty factors to the FALs, should not be used for radionuclide LUT values. EPA stated that the RTLs were developed for EPA's radiological investigation of Area IV and, "USEPA does not [EPA emphasis] recommend the use of those [RTLs] for future phases of the project," (i.e., cleanup). EPA recommends consideration of uncertainty in the decision-making process. EPA states, "For any given sample, a laboratory result that is equal to the BTV represents a range of possible true values for that sample; some of which are less than the BTV and some of which are greater than the BTV. Whether that result represents a true sample value that actually exceeds the BTV is purely a matter of chance; a decision that the BTV has been exceeded would be incorrect 50 percent of the time," (meaning a 50 percent false positive rate or that one-half the time, DOE could be remediating clean soil). EPA further states, "[e]stablishing a decision criterion, without considering the impact [of uncertainty], would result in a potential situation in which the release of uncontaminated background-level material would not be assured, but would instead be randomly determined, similar to a coin toss." EPA goes on to caution DTSC's selection of AOC LUT values: "While DTSC may select LUT values that are equal to cleanup levels, it is USEPA's understanding that the extraordinarily high decision error rate for laboratory results at or near those cleanup levels [that is, background] is believed to be unacceptable." EPA states that it "recommends an adjustment to the BTVs and minimum detectable concentrations to include appropriate consideration [for uncertainty] to ensure an acceptably low decision error rate of approximately 5 percent" (HGL 2012c). The FALs used by EPA in presenting potential radionuclide contamination did not include an uncertainty factor and, thus per EPA, should not be used to determine the presence of radionuclide contamination. The issue of decision rate errors for radionuclides also applies to chemicals.

The 2010 AOC (DTSC 2010a) (paragraph 1.8.3.1) specifies that the detection limits for the chemical AOC LUT values should be based on the "lowest concentrations at which an analyte can be confidently detected in a sample and its concentration can be reported with a reasonable degree of accuracy and precision." During the development of the chemical AOC LUT values, DTSC chemists were critical of the process. In a memorandum to DTSC management, the chemists stated, "[t]he Environmental Chemistry Laboratory does not recommend the process outlined in the current Draft Technical Memorandum to serve as the foundation for site characterizations and for the development of the [method reporting limit] lookup table values" (DTSC 2012).

Acceptable Error Rate

DTSC has set an acceptable error rate in sample analysis of 5 percent. This means that, for 100 soil samples analyzed for one chemical near the minimum detection limit, five sample analyses could falsely report the chemical's presence when it is not actually in the sample. A 5 percent error rate may be acceptable when the project involves only one chemical, but consistent with the 2010 AOC (DTSC 2010a), DOE must consider 116 chemicals and 16 radionuclides. Compounding a 5 percent error rate over 132 different potential constituents in each sample means a much greater chance that DOE would be remediating clean soil, not contaminated soil.

Background Data AOC LUT Failures

DTSC conducted a soil background study that involved collecting soil samples from two sites approximately 3 to 4 miles west of SSFL (URS 2012).[15] DTSC analyzed 148 soil samples for

[15] URS Corporation was the DTSC contractor for the chemical characterization of off-SSFL reference areas. The characterization data provide background soil concentrations to which samples collected at SSFL can be compared.

110 different chemicals[16] and used this data set for development of the chemical AOC LUT values. Comparing the background soil results with the AOC LUT values, 46 of the 110 chemicals analyzed (42 percent) exceeded their respective AOC LUT values in at least one sample. This implies that, if the point-by-point, chemical-by-chemical process described in the 2010 AOC were applied to the background study locations, they would be declared contaminated and subject to soil remediation. It also demonstrates that it is difficult to differentiate background concentrations from contamination from ETEC operations based on the low AOC LUT values; thus, where to stop soil remediation cannot be clearly defined.

Total Petroleum Hydrocarbon AOC LUT Value

The AOC LUT value for TPH was set at 5 parts per million without considering its natural presence. The analytical method (EPA Method 8015) is not specific to TPH, but detects any chemical molecule, many of which naturally occur, within the carbon ranges of TPH. Therefore, for any soil sample analyzed for TPH, there is a high level of uncertainty regarding whether the result is actually TPH. In addition, environmental screening levels normally used at other locations in California (SFWQCB 2013) and applicable to other cleanups (EPA 2015b) range from 100 to 500 parts per million; for this reason, analytical laboratories are not set up to analyze for TPH at 5 parts per million. DOE provided soil samples to two laboratories, and they could not reproduce TPH results below 100 parts per million (Nelson et al. 2015d). California Polytechnic State University, San Luis Obispo, evaluated the types of organic molecules in soil to demonstrate that the results being reported were not TPH. The study demonstrated that there are technical problems with measuring TPH concentrations at such low levels (Nelson et al. 2015d). A review of the TPH data produced for Area IV indicates that as much as 300 parts per million of the reported TPH in any given sample actually results from normally occurring organic materials and are not petroleum-related (Burgesser 2015).

Changes in Site Knowledge Since the Signing of the 2010 AOC

When the 2010 AOC was signed, there was a general belief that there was widespread radioactive contamination in Area IV. However, EPA's radiological study did not show that Area IV was highly contaminated. EPA concluded, "[a] majority of the Radiological Areas of Interest are congregated within specific areas or are associated with key facilities;" and, "Approximately 70 percent of soil samples with radionuclide concentrations greater than the FALs [field action levels][17] are located within five Area IV Radiological Areas of Interest: RMHF complex, SRE [Sodium Reactor Experiment] complex, 17th Street Drainage, Former Fuel Element Storage Facility, and New Conservation Yard Drainage" (HGL 2012b). Each of these areas were known to be impacted by radionuclides prior to EPA's study and had been subject to prior soil removal actions by DOE to an approximate 9.2 picocurie per gram cleanup standard (see, for example, Boeing 1999 and Boeing 2000). Review of data in the *Final Radiological Characterization of Soils, Area IV and the Northern Buffer Zone, Area IV Radiological Study, Santa Susana Field Laboratory, Ventura County, California* (HGL 2012a) showed that, of the over 3,500 soil samples analyzed by EPA, only about 12 percent of the samples exhibited radionuclide concentrations exceeding EPA's FALs. Cesium-137 and strontium-90 constituted 94 percent of the reported radionuclides, consistent with site knowledge prior to the EPA study. As a result, the EPA findings disproved the general belief that Area IV is highly contaminated by radionuclides throughout.

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[16] DTSC also analyzed samples for pH, but soil pH is not a parameter in the chemical AOC LUT.

[17] EPA notes in its final soils report (HGL 2012b) that FALs do not consider EPA's recommended uncertainty factors and locations with results exceeding the FALs "do not represent areas of contamination or areas of remediation." Nonetheless, the FALs were used during site characterization to identify areas of potential radiological contamination.

What was not clearly known at the time of the signing of the 2010 AOC was the extent of soil contamination by chemicals. The RCRA Facility Investigation (RFI) studies completed during the years 2000 through 2009 focused on chemical contamination associated with Solid Waste Management Units and Areas of Concern (CH2MHill 2008, 2009; MWH 2006; 2007, 2009a). The RFI studies were based on risk assessment standards, and the need to conduct extensive soil sampling away from the investigation areas was not warranted.

The AOC LUT values became the basis for soil investigations under the 2010 AOC. DOE concluded that low AOC LUT values, coupled with the false positive issues and the inability to accurately distinguish TPH from a range of other organic molecules (described above), resulted in data showing almost the entirety of Area IV to exceed an AOC LUT value for at least one chemical. In accordance with the 2010 AOC, soil exceeding the AOC LUT for even one chemical would require remediation. As a result, cleanup planning for Area IV and the NBZ was transformed from a radionuclide-based cleanup (approximately 91,000 cubic yards) to a chemically impacted soil cleanup (approximately 1,410,000 cubic yards), based on the chemical AOC LUT values (DTSC 2013b).

2010 AOC Backfill Soil Requirements

Attachment B (Final Agreement in Principle) of the 2010 AOC (DTSC 2010a) states the following with regard to use of backfill soil:

> "Backfill/replacement soils must not exceed local background levels.
>
> - Onsite soils that do not exceed local background levels may be used as backfill/replacement soils.
> - Offsite soils that have been verified to not exceed local background levels may be used as backfill/replacement soils."

Attachment C (Confirmation Protocol "Not to Exceed" Background Cleanup Standard) of the 2010 AOC states:

> "Backfill/replacement soils may be from onsite or offsite locations, with a preference for onsite locations. For purposes of this protocol, "onsite" locations are those within the geographic boundaries of the SSFL site."
>
> "For backfill soils obtained from outside the Santa Susana Field Lab, the relevant Look-up Table shall be for the formation to which the backfill soils are to be placed."

There are no onsite borrow sources for DOE's use at SSFL. Developing onsite borrow sources would significantly add to potential biological impacts at SSFL. In February 2015, DOE conducted an initial evaluation of off-SSFL borrow sites for soil meeting the chemical AOC LUT values.[18] The three evaluated sites failed to meet 2010 AOC requirements because multiple chemicals of concern exceeded the AOC LUT values (see Appendix D). In addition, DOE tested packaged soil products sold by home improvement stores. All products tested exceeded the AOC LUT values for multiple chemicals (see Appendix D). Based on this initial evaluation and given the low AOC LUT values, it appears unlikely that replacement soil meeting the AOC requirements can be found. If a soil were found that could meet the AOC LUT values, there is also concern that the soil would not be comparable to the physical, chemical, and microbial characteristics of existing soil, making it difficult to re-establish native vegetation in Area IV and the NBZ.

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[18] In support of project implementation, DOE would again search for and evaluate sources of backfill. If a source of backfill soil that meets all of the AOC LUT values cannot be reasonably found, then DTSC, DOE, and EPA would enter into a consultation process, and DTSC would determine the best available source of backfill (DTSC 2010a).

NEPA Requirements for Impact Assessments in an EIS

Based on the uncertainty regarding whether cleanup based on the 2010 AOC (DTSC 2010a) could be implemented, DOE evaluated potential alternatives that, when completed, would leave Area IV and the NBZ in a state that was protective of human health and the environment. DOE consulted applicable CEQ and DOE NEPA regulations and guidance in determining reasonable alternatives to the AOC cleanup to background requirement for analysis in this EIS. Section 2.4 presents viable cleanup alternatives to the Cleanup to AOC LUT Values Alternative.

NEPA Guidance and Regulations for Addressing Alternatives in EIS Documents

As noted above, the CEQ NEPA regulations state that an EIS "shall inform [decision-makers] and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment" (40 CFR 1502.1). In discussing the contents of an EIS, the regulations further indicate the importance of the analysis of alternatives:

> §1502.14 Alternatives including the proposed action. This section is the heart of the environmental impact statement…. In this section agencies shall:
>
> (a) Rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated.
>
> (b) Devote substantial treatment to each alternative considered in detail including the proposed action so that reviewers may evaluate their comparative merits.

CEQ's "Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations" (46 FR 18026) (CEQ 1981) provides the following guidance:

- Range of Alternatives – "The phrase 'range of alternatives' refers to the alternatives discussed in environmental documents. It includes all reasonable alternatives, which must be rigorously explored and objectively evaluated. . ."
- Alternatives Outside of the Capability of Applicant or Jurisdiction of Agency – "Section 1502.14 [NEPA Regulations 40 CFR Parts 1500–1508] requires the EIS to examine all reasonable alternatives to the proposal. In determining the scope of alternatives to be considered, the emphasis is on what is 'reasonable' rather than on whether the proponent or applicant likes or is itself capable of carrying out a particular alternative. Reasonable alternatives include those that are practical or feasible from the technical and economic standpoint and using common sense, rather than simply desirable from the standpoint of the applicant."

2003 Litigation Involving ETEC

In addition to the 2010 AOC (DTSC 2010a), this EIS responds to the outcome of a lawsuit filed by the Natural Resources Defense Council, the Committee to Bridge the Gap, and the City of Los Angeles, which successfully challenged DOE's 2003 *ETEC EA* (DOE 2003a) and Finding of No Significant Impact for remediation of Area IV in the U.S. District Court for the Northern District of California (see Chapter 1, Section 1.3).

2.3.3.2 Potential Environmental Consequences of Cleanup to AOC LUT Values

As described in Chapter 4, the Cleanup to AOC LUT Values Alternative would result in appreciable resource use and waste generation. Characteristics of this alternative include:

- 130 acres of land disturbed in Area IV and the NBZ;
- 933,000 cubic yards of soil removed and 700,000 cubic yards of backfill emplaced, resulting in 116,000 truck round trips (up to 39,000,000 million truck miles);
- 62,500 round trips of cars or light-duty trucks primarily due to worker commutes;
- substantial increase in the wear on local roadways;
- About 40 million gallons of water used;
- 2.8 to 8.2 million gallons of fuel used for trucks and heavy equipment;[19] and
- 28,000 to 84,000 metric tons (total) of greenhouse gases (as carbon dioxide [CO_2]) generated.[20]

Disturbing 130 acres of land in order to remove 933,000 cubic yards of soil would kill plants and animals, destroy portions of their habitats, and require a substantial, focused, and prolonged effort to achieve revegetation and restoration. Habitat could also be affected by incompatible backfill and invasive species brought to SSFL in the 700,000 cubic yards of backfill or on vehicles. In addition, land disturbance would produce fugitive dust that could impact downwind onsite and offsite areas.

Transportation for disposal of 933,000 cubic yards of soil would result in 116,000 truck trips (39,000,000 million truck miles) over 10 years and 62,500 round trips of cars or light-duty trucks would result in increases in traffic and noise on local roads. In addition, the increased traffic, in particular the heavy haul trucks, would accelerate road deterioration, requiring repair sooner than currently anticipated.

The 40 million gallons of water (used primarily for dust suppression) would further deplete the already stressed Southern California water supply. In addition, the irreversible consumption of 2.8 to 8.2 million gallons of fuel for truck transportation and heavy equipment use would contribute to the generation of a total of 28,000 to 84,000 metric tons of greenhouse gases.

2.4 Additional Soil Remediation Action Alternatives

This EIS includes two alternatives in addition to the Soil No Action Alternative and the Cleanup to AOC LUT Values Alternative discussed in the previous section. Under the Cleanup to Revised LUT Values Alternative, DOE would continue to apply cleanup criteria on a point-by-point basis, but would implement revised chemical constituent LUT values for making cleanup decisions (the radionuclide LUT values would be the same as under the Cleanup to AOC LUT Values Alternative). Under the Conservation of Natural Resources Alternative, DOE would apply a traditional risk-assessment approach to making cleanup decisions, including using area averaging to determine concentrations and developing risk and dose criteria as described below. DOE expects that, in order for the implementation of any alternative to be consistent with the 2010 AOC, changes to the AOC would be required.

[19] The large range in results from the analysis considering disposal in facilities near SSFL, as well as in facilities long distances from SSFL (for example, a hazardous waste disposal facility in Idaho).
[20] See preceding footnote.

2.4.1 Cleanup to Revised LUT Values Alternative

Under this alternative, a revised set of LUT values would be established for chemical constituents, and the LUT values for radioactive constituents would be the same as those under the Cleanup to AOC LUT Values Alternative. The revised chemical LUT values would be based on RBSLs. The RBSLs would be calculated for the direct pathways[21] of the hypothetical suburban residential land use scenario established for SSFL (MWH 2014), in which it is assumed that a receptor would be present on the remediated site 24 hours per day, 350 days per year, for 30 years. The revised LUT values for chemical constituents would be concentrations that correspond to a 1×10^{-6} (1 chance in 1 million) risk of developing a cancer and/or a toxicity hazard quotient[22] of 1.

Soil would first be removed in the Sodium Reactor Experiment and RMHF areas, where hazardous chemicals and radioactive constituents above the revised LUT values are most prevalent. Remediation would then expand outward from those areas to remove the remaining soil with chemical and/or radioactive constituents present above revised LUT values. As under the Cleanup to AOC LUT Values Alternative, cleanup decisions would be made on a point-by-point basis. That is, if the soil in a particular area exceeded the revised LUT value for any chemical or radioactive constituent, the soil would be removed.

Approximately 192,000 cubic yards of soil would be removed under this alternative (see Table 2–4 in Section 2.4.3). **Figure 2–4** shows the total extent of chemical and radioactive constituents above the revised LUT values and those areas from which soil would be removed. Approximately 14,400 truck round trips over a little more than 2 years would be required to remove the soil for disposal under this alternative, although additional time could be necessary to allow for partially full trucks and weather delays, as well as to ensure restoration activities are effective. Approximately 9,400 truck round trips (rounded value) would be needed to bring 144,000 cubic yards of backfill to the site.

Some, but not all, of the issues associated with implementing the Cleanup to AOC LUT Values Alternative would also affect the Cleanup to Revised LUT Values Alternative. Like the Cleanup to AOC LUT Values Alternative, this alternative would require point-by-point decisions on individual constituents. However, each sample would have to meet the revised LUT values for 34 constituents (18 chemicals that exceed risk-based screening levels from the SRAM [MWH 2014] and 16 radionuclides). If any one of the constituents were to exceed its respective revised LUT value, DOE would make a decision to remediate the area represented by the sample. Although fewer constituents would need to be evaluated under the Cleanup to Revised LUT Values Alternative, the point-by-point cleanup decisions would be subject to issues similar to those under the Cleanup to AOC LUT Values Alternative. Specifically, if any one constituent fails to meet its revised LUT value, a cleanup decision would be required. Although the decision thresholds would be higher, the potential for false positives introduces uncertainty in determining whether a detection actually represents contamination from ETEC operations (see Section 2.3.3.1). Under this alternative, a smaller volume of backfill would be needed (144,000 cubic yards), and the chemical LUT values

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[21] Direct exposure pathways include inhalation, incidental ingestion, and dermal contact with the chemicals in the soil. The indirect pathway of a garden from which the hypothetical suburban resident derives all of his or her fruits and vegetables is not included in the direct impacts analysis.

[22] A hazard index is the sum of the hazard quotients of noncarcinogenic chemicals. A hazard index below 1.0 will likely not result in adverse health effects over a lifetime of exposure. A hazard quotient is a unitless value determined by (1) dividing the exposure concentration by the EPA reference concentration for inhalation exposures or (2) dividing the average daily dose by the EPA reference dose for oral exposures. The reference concentration (for inhalation) or dose (for ingestion) (reported in EPA's Integrated Risk Information System [EPA 2015e]) is an estimate of a continuous exposure to the human population (including sensitive subgroups) that will likely not result in adverse health over a lifetime of exposure.

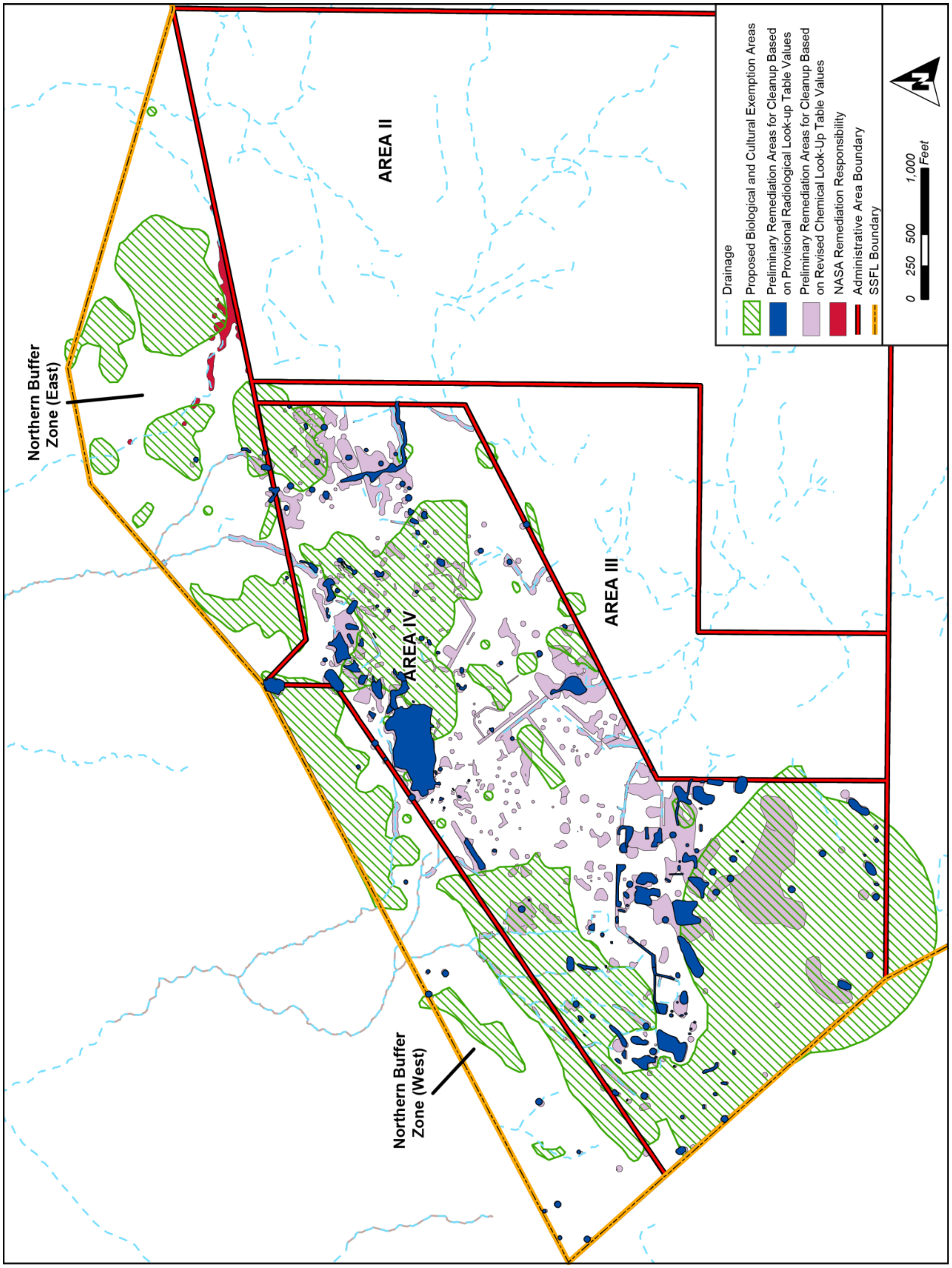


Figure 2–4 Soil Remediation Cleanup to Revised LUT Values Alternative

applicable to the backfill would be less restrictive than those under the Cleanup to AOC LUT Values Alternative. As with the Cleanup to AOC LUT Values Alternative, finding a source of backfill that has the physical, chemical, and microbial characteristics that would support establishment of native vegetation may be a challenge. A search for such soil would be conducted in support of project implementation.

2.4.2 Conservation of Natural Resources Alternative

Under this alternative, DOE would remediate Area IV and the NBZ to reduce the concentrations of chemical and radioactive constituents in the soil to levels necessary to protect human health. This alternative reduces risk to the public and the environment, yet conserves natural resources, including biological, cultural, and water resources. The hypothetical onsite suburban residential exposure scenario (using the direct pathways) as identified in the SRAM (MWH 2014) was selected as the basis for the risk assessment. Cleanup would be targeted at locations posing risk based on the outcome of a risk assessment and dose analysis. Area IV and the NBZ would be subdivided into smaller areas or units for which concentrations would be averaged for purposes of evaluating risk or radiation exposure. For each unit, risk assessment calculations would be performed individually for each chemical, and then the results summed to determine the risk value. The risk results for each unit would be compared with the risk limit of 1×10^{-6} (1 chance in 1 million) for cancer-causing chemicals and/or to a hazard index of 1 for noncarcinogenic chemicals to make decisions regarding cleanup of the contaminated soil. DOE would cleanup chemicals in accordance with applicable requirements. For each unit, a dose assessment would also be performed to determine the level of radionuclide cleanup needed. Cleanup would be performed to levels as low as reasonably achievable (ALARA)[23] below the DOE standard of 25 millirem per year (DOE Order 458.1) to the hypothetical suburban resident.

In applying the ALARA principle to soil remediation, DOE would clean up soil to limit public and worker radiation exposures to the lowest levels practical, commensurate with sound economic and social considerations (DOE 2014c). Soil would be cleaned up to reduce potential doses to a hypothetical member of the public to below 25 millirem per year, with the specific level determined through the ALARA analysis. The DOE standard of 25 millirem per year serves as an upper limit to the range of doses that may be acceptable and is evaluated as a starting place for ALARA analysis. If this alternative is chosen, DOE would evaluate different cleanup options (that is, levels corresponding to doses below 25 millirem per year) to determine whether additional cleanup would provide the optimal balance of the benefits from exposure reduction (e.g., health protection, regulator and public goodwill) with the costs (e.g. economic, schedule, social), considering doses that may be received by hypothetical members of the public and by workers performing cleanup.

[23] ALARA is based on the system of dose limitation recommended in International Commission on Radiological Protection (ICRP) Publication 26: "all exposures shall be kept as low as reasonably achievable, economic and social factors taken into account" (ICRP 1977). In ICRP Publication 37 (ICRP 1983), this component was referred to as "the optimization of radiation protection." ALARA is an approach to radiation protection to manage and control releases of radioactive material to the environment, and exposure to members of the public and the work force so that the levels are as low as reasonable, taking into account societal, environmental, technical, economic, and public policy considerations. As used in DOE Order 458.1, *Radiation Protection of the Public and the Environment* (DOE 2011b), ALARA is not a specific release or dose limit, but a process whose goal is to optimize control and management of releases of radioactive material to the environment and doses so that they are as far below the applicable limits of the order as reasonably achievable.

If the ALARA analysis resulted in implementation of a cleanup level less than 25 millirem per year, some or all of the additional 44,000 cubic yards of soil containing radionuclides above the AOC LUT values would be remediated (see soil volumes on Table S–4). The potential impacts of removing additional soil would fall between those presented for this alternative and those for the Cleanup to Revised LUT Values Alternative.

Cleanup based on risk assessments for individual units accounts for the receptor's exposure to an average concentration in the unit in contrast to the point-by-point evaluation of the Cleanup to AOC LUT Values Alternative and the Cleanup to Revised LUT Values Alternative, where each sample must meet the LUT values for each constituent.

This alternative would result in the least amount of ground disturbance and soil that would be removed for offsite disposal: 148,000 cubic yards (see Table 2–4 in Section 2.4.3). The volume of soil containing chemicals above risk-based levels that would be removed would be approximately the same as that under the Cleanup to Revised LUT Values Alternative (approximately 145,000 cubic yards), as would the volume of soil removed that only exceeds risk-based levels for radionuclides (3,000 cubic yards). This alternative would avoid the excavation and offsite transport of soil with concentrations that are less than risk-based levels. **Figure 2–5** shows the extent of soil removal that would be required under this alternative. As shown in Table 2–5 (see Section 2.4.3), approximately 11,100 truck round trips over 2 years would be required to remove the soil for disposal under this alternative, although additional time could be necessary to allow for partially full trucks and weather delays, as well as to ensure restoration activities are effective. As many as 7,200 truck round trips (rounded value) would be needed to bring 111,000 cubic yards of backfill to the site.

Implementation of the Conservation of Natural Resources Alternative would entail different issues than implementation of either the Cleanup to AOC LUT Values Alternative or Cleanup to Revised LUT Values Alternative. DOE would divide Area IV and the NBZ into risk assessment units and evaluate those units against risk and dose criteria. An assessment of each area would be required to determine the relative quantities of chemicals and/or radionuclides that would trigger a cleanup decision. Rather than a single number for a given constituent across the entire Area IV and NBZ, the value that would result in cleanup has to be considered in concert with other constituents in an area to determine whether soil meets the cleanup targets (i.e., a chemical risk of 1×10^{-6} [a lifetime chance of 1 in 1 million of developing a cancer], a hazard index of 1 [the level below which no toxic effects would be expected], and an annual dose of 25 millirem [plus ALARA]). The approach of averaging the concentrations of constituents across assessment units has the potential of leaving localized areas of contamination that would be removed under a point-by-point cleanup like the Cleanup to AOC LUT Values Alternative or Cleanup to Revised LUT Values Alternative. Although a smaller volume of backfill would be required (111,000 cubic yards), and the allowable concentrations of chemical and radionuclides would be less restrictive than those for the Cleanup to AOC LUT Values Alternative and similar to those for the Cleanup to Revised LUT Values Alternative, finding a backfill source that has the physical, chemical, and microbial characteristics that would support establishment of native vegetation may be a challenge. A search for such soil would be conducted in support of project implementation.

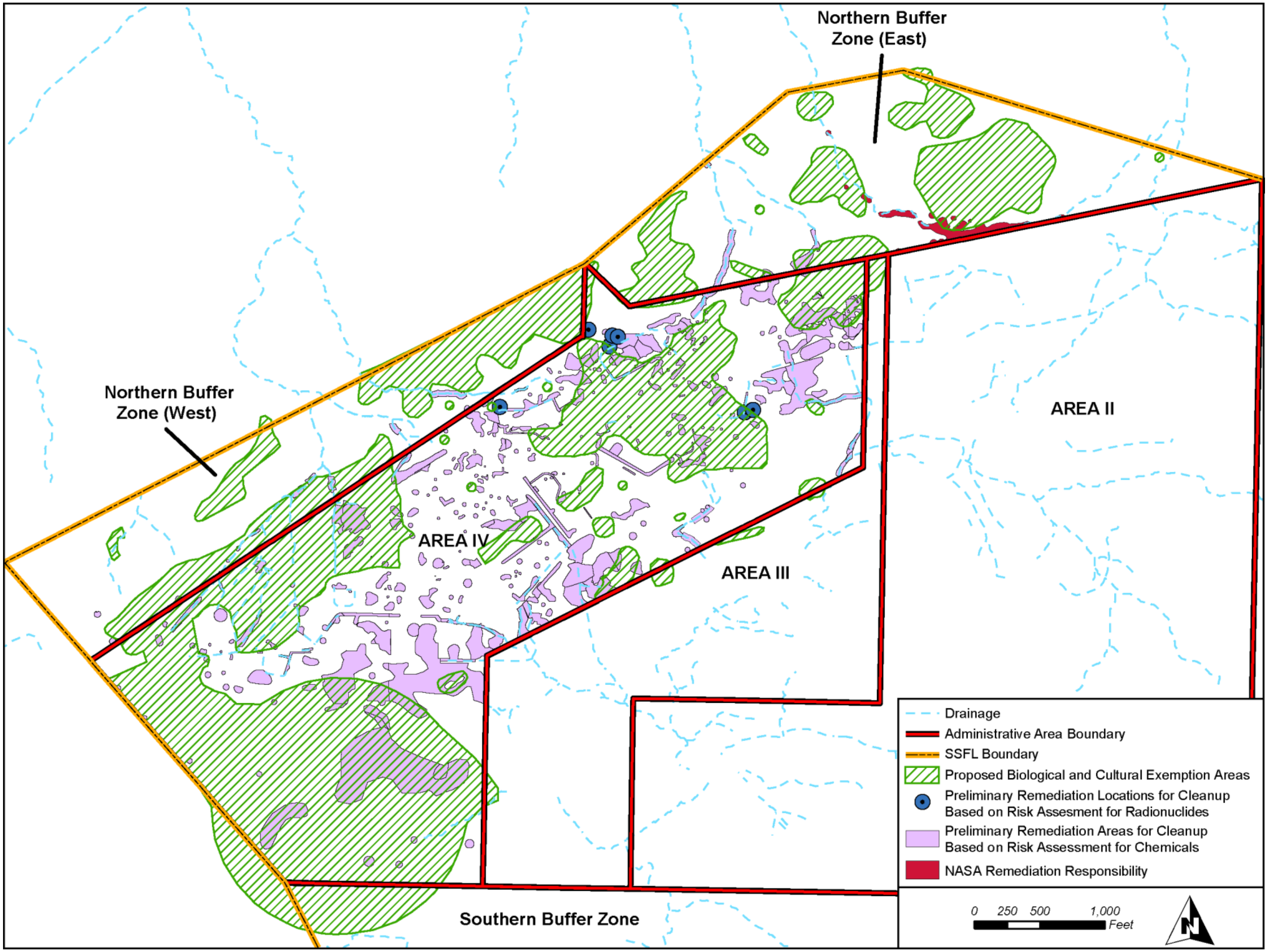


Figure 2–5 Soil Remediation Conservation of Natural Resources Alternative

2.4.3 Summary of Soil Remediation Alternatives

It is DOE's policy that work be conducted safely and efficiently and in a manner that ensures protection of workers, the public, and the environment. To achieve this policy for SSFL remediation, effective safety requirements and goals would be established through the adoption of applicable national and international consensus standards and where necessary to address unique conditions, through development and implementation of additional standards. DOE would implement Integrated Safety Management in accordance with DOE directives and include related requirements in remediation contractor contracts.

DOE's ultimate goal is zero accidents, work-related injuries and illnesses, regulatory violations, and reportable environmental releases. DOE would ensure that for all activities and phases in the remediation of SSFL, appropriate mechanisms are in place to ensure that exposures to workers, the public, and the environment to radiological and nonradiological hazards are maintained below regulatory limits. Furthermore, DOE would ensure that deliberate efforts are taken to keep exposures to radiation ALARA, consistent with DOE Order 458.1 and 10 CFR 835.

As described in the preceding sections, DOE evaluated the No Action Alternative and three action alternatives for soil cleanup within Area IV and the NBZ. Under each of the action alternatives, DOE assumes that DTSC will approve the use of monitored natural attenuation for the onsite treatment of 150,000 cubic yards of soil containing low levels of TPH and PAHs.

- No Action Alternative – DOE would continue monitoring and maintenance activities and ensure that site security is maintained. There would be no treatment of soil to reduce constituent concentrations or removal of soil for disposal off site. Soil would be left in place in perpetuity.
- Cleanup to AOC LUT Values Alternative – DOE would start at one side of the site and proceed across Area IV and the NBZ, removing soil exceeding the AOC LUT values, based on a point-by-point determination. An estimated 933,000 cubic yards of soil would be removed from the site over a 10-year time frame. The number of truck round trips (rounded values) would be about 70,000 for removing soil from the site and 46,000 for transporting backfill to the site.
- Cleanup to Revised LUT Values Alternative – DOE would remove soil exceeding the revised LUT values. Chemical cleanup levels would be based on the direct exposure pathways for the hypothetical onsite suburban residential scenario, as outlined in the SRAM (MWH 2014). Levels would be based on a cancer incidence risk of 1 chance in 1 million and a hazard quotient of 1. The radionuclide LUT values would be the same as those for the Cleanup to AOC LUT Values Alternative. DOE would remove all soil in Area IV and the NBZ exceeding the revised LUT values. As with the prior alternative, DOE would make soil remediation decisions on a point-by-point basis. An estimated 192,000 cubic yards of soil would be removed from the site over a little more than 2-year time frame. The number of truck round trips (rounded values) would be about 14,400 for removing soil from the site and 9,400 for transporting backfill to the site.

- Conservation of Natural Resources Alternative – DOE would clean up soil to a level that would protect human health by removing soil with concentrations of chemical or radioactive constituents that exceed criteria established using a risk assessment process. This alternative would reduce risk to the public and the environment, yet conserve natural resources by disturbing less land than the other alternatives, thereby reducing the potential of impacting visual, biological, cultural, and water resources. Cleanup levels would be based on a hypothetical onsite suburban residential scenario, as outlined in the SRAM (MWH 2014), and averaging the concentrations over a risk assessment area or unit. Chemically impacted soil would be removed to achieve a cancer incidence risk of 1 chance in 1 million and a hazard index of 1; radiologically impacted soil would be removed to ALARA levels below the dose rate of 25 millirem per year. An estimated 148,000 cubic yards of soil would be removed from the site within a 2-year time frame. The number of truck round trips (rounded values) would be about 11,100 for removing soil from the site and 7,200 for transporting backfill to the site.

Each of the action alternatives would require approximately 4.0 million gallons of water each year for dust suppression during soil excavation and loading of trucks. Although the annual need is within the Calleguas Municipal Water District's (CMWD) current capacity, water use is an important consideration in the comparison of soil remediation alternatives, given the current drought conditions in the State of California and Governor Brown's Executive Order requiring a statewide 25 percent reduction in potable water use (CA EO 2015).

Similarly, regardless of the action alternatives that DOE may select, transportation of material to and from SSFL is a key issue. Each of the action alternatives would include transportation of large quantities of building debris and soil to offsite disposal facilities. Whereas there are major highways north and south of SSFL, access to and from those highways requires travel on local roadways through commercial and residential areas. The section of roadway nearest SSFL over which all traffic to and from SSFL would pass is a 2.5-mile-long, two-lane road (Woolsey Canyon Road). Woolsey Canyon Road[24] would be used by all large vehicles and most personal vehicles accessing SSFL in support of DOE, NASA, and Boeing, as each is responsible for implementing its respective SSFL remediation activities.

Contaminated soil and building demolition debris would be transported off site for disposal in haul trucks with a 23-ton payload or in containers placed on trucks with a 20-ton payload. Trucks would be covered or other appropriate methods would be used to minimize dust and contain the contents while in transit to disposal destinations. DOE would consider use of alternative-energy-fueled vehicles, if available and practicable, to minimize transportation impacts.

DOE, NASA, and Boeing have responsibility for cleaning up their respective portions of SSFL and may do so simultaneously until each has completed its effort. Because of the large number of trucks that would be required and concern regarding how many trucks could reasonably and safely be accommodated on the main access road to SSFL, DOE, NASA, and Boeing have entered into an agreement that establishes the total number of truck round trips that would be allowed daily and how those trucks trips would be apportioned among them (Boeing 2015a).

[24] Woolsey Canyon Road is the only serviceable road for heavy truck traffic to and from SSFL. The pavement on Woolsey Canyon Road shows few signs of structural failure, but is showing signs of age and brittleness, indicating that the pavement is near the end of its useful life. Portions of the roadway have recently been repaired.

The agreement allows a maximum of 96 truck round trips at SSFL each workday (Monday through Friday), equally divided among the entities engaged in cleanup activities. The number of trucks that would transport materials each day would depend on a number of factors: the building demolition rate, the soil excavation rate, and the truck staging and loading rate; the distance to the disposal sites; the availability of trucks; and project funding. Under the agreement, as the number of entities involved in cleanup decreases, the number of truck round trips available to the remaining entities would increase. In this EIS, DOE assumes that it would be allotted 32 truck round trips daily for the first 2 years of the project and an average of 48 round trips daily thereafter. Even if DOE were allotted as many as 96 round trips daily, the average rate would be 48 round trips, with occasional surges to accommodate periods of higher activity (e.g., to expedite cleanup).

Table 2–4 provides the soil volumes that would be removed under each action alternative. As shown in Table 2–4, within the accuracy of the estimates of soil volume and weight, the same quantities of soil in Categories 2, 3, 5, and 6 would be remediated under all of the action alternatives. Under the Cleanup to Revised LUT Values Alternative, soil in Category 4 (soil with radionuclide concentrations above AOC LUT values that would not cause a dose in excess of 25 millirem per year via the direct exposure pathways for the hypothetical onsite suburban residential scenario) would also be removed. Under the Cleanup to AOC LUT Value Alternative, in addition to the Category 4 soil, Category 1 soil (soil that does not meet the definition of either hazardous or radioactive waste and does not contain chemical constituents that exceed risk-based levels, contains chemical constituents above the AOC LUT values) would be removed. **Table 2–5** shows the number and timing of truck round trips that would be required to transport the soil for disposal and backfill for site restoration. Costs of the alternatives correlate to the quantity of soil removed; that is, the larger the quantity of soil removed, the higher the costs. Although there would be some reduction in the risk remaining following remediation with each increment of soil removed, proceeding from the alternative with the least soil removed (Conservation of Natural Resources Alternative) to that with the most soil removed (Cleanup to AOC LUT Values Alternative), the largest reduction in risk would occur between the No Action and Conservation of Natural Resources Alternatives. A smaller reduction in risk would be realized between the Conservation of Natural Resources and Cleanup to Revised LUT Values Alternatives. Even though the largest increment of soil would be removed between the Cleanup to Revised LUT Values and Cleanup to AOC LUT Values Alternatives, there would be minimal change in the risk remaining following cleanup. (See the text box, Comparison of Risk Management and Cost Among Soil Remediation Alternatives following Table 2–5.)

Under all action alternatives, the amount of soil removed and the areal extent of the cleanup would incorporate the proposed 2010 AOC (DTSC 2010a) exemption areas for sensitive biological and cultural resources per USFWS, California Fish and Wildlife Service, SHPO, Santa Ynez Band of Chumash Indians, and SSFL Sacred Sites Council consultation (see Figures 2–2, 2–4, and 2–5). DOE would use exemptions provided for in the 2010 AOC that are approved by DTSC and would not take action in any of these areas unless it is demonstrated that levels of constituents in the soil pose a risk to human health or the environment (as determined using RBSLs from the SRAM [MWH 2014]) and soil removal is necessary. DOE would implement these exemptions on a case-by-case basis in consultation with DTSC, only remove the quantity of soil necessary to reduce the risk, and take all precautions to protect the environment as part of the action.

Table 2–4 Remediation Soil Quantities by Alternative

	Cleanup to AOC LUT Values Alternative	*Cleanup to Revised LUT Values Alternative*	*Conservation of Natural Resources Alternative*
Soil Category 1 Chemicals above AOC LUT values, but below risk-based levels and hazardous waste standards. Radionuclides at or below AOC LUT values.	741,000 cubic yards 1,112,000 tons 55,600 truckloads		
Soil Category 2 Chemicals above risk-based levels, but below hazardous standards. Radionuclides at or below AOC LUT values.	52,000 cubic yards 78,000 tons 3,900 truckloads	52,000 cubic yards 78,000 tons 3,900 truckloads	52,000 cubic yards 78,000 tons 3,900 truckloads
Soil Category 3 Chemicals above hazardous waste standards. Radionuclides at or below AOC LUT values.	49,000 cubic yards 73,500 tons 3,700 truckloads	49,000 cubic yards 73,500 tons 3,700 truckloads	49,000 cubic yards 73,500 tons 3,700 truckloads
Soil Category 4 Chemicals above AOC LUT values, but below risk-based levels and hazardous waste standards. Radionuclides above AOC LUT values, but below risk-based levels.	44,000 cubic yards 66,000 tons 3,300 truckloads	44,000 cubic yards 66,000 tons 3,300 truckloads	
Soil Category 5 Chemicals above risk-based levels and may be a hazardous waste. Radionuclides above AOC LUT values.	44,000 cubic yards 66,000 tons 3,300 truckloads	44,000 cubic yards 66,000 tons 3,300 truckloads	44,000 cubic yards 66,000 tons 3,300 truckloads
Soil Category 6 Chemicals at or below AOC LUT values. Radionuclides above risk-based levels.	3,000 cubic yards 4,500 tons 230 truckloads	3,000 cubic yards 4,500 tons 230 truckloads	3,000 cubic yards 4,500 tons 230 truckloads
Affected Area	130 acres	40 acres	32 acres
Total Volume	933,000 cubic yards	192,000 cubic yards	148,000 cubic yards
Total Weight	1,399,500 tons	288,000 tons	222,000 tons
Total Truck Round Trips [a]	70,000 truckloads	14,400 truckloads	11,100 truckloads

AOC = *Administrative Order on Consent for Remedial Action*; LUT = Look-Up Table.

[a] Truck round trips were conservatively estimated based on transporting 20 tons of containerized waste per truck. If 23-ton trucks were used for nonradioactive waste, truck trips would be reduced by 11 percent under the Cleanup to AOC LUT Values Alternative and the Cleanup to Revised LUT Values Alternative, and 9 percent under the Conservation of Natural Resources Alternative.

Notes:

– Sums and products may not equal those calculated from table entries due to rounding.

– Cubic yards are converted to tons using a conversion factor of 1.5 tons per cubic yard (see Appendix D).

Table 2–5 DOE Truck Round Trips by Year for Remediation by Alternative [a]

	Number of Truck Round Trips per Year												
	Year 1	***Year 2***	***Year 3***	***Year 4***	***Year 5***	***Year 6***	***Year 7***	***Year 8***	***Year 9***	***Year 10***	***Year 11***	***Year 12***	***Totals***
Soil Remediation Alternatives													
Cleanup to AOC LUT Values Alternative													
Radionuclides above background concentrations; with and without chemicals above AOC LUT values (LLW and MLLW).	0	0	695	708	708	708	708	708	708	708	708	463	6,825
Chemicals exceeding AOC LUT values; includes hazardous wastes.	0	0	6,433	6,554	6,554	6,554	6,554	6,554	6,554	6,554	6,554	4283	63,150
Backfill soil	0	0	4,649	4,736	4,736	4,736	4,736	4,736	4,736	4,736	4,736	3,097	45,636
Totals	0	0	11,778	11,999	11,999	11,999	11,999	11,999	11,999	11,999	11,999	7,841	115,611
Cleanup to Revised LUT Values Alternative													
Radionuclides above background concentrations; with and without chemicals above Revised LUT values (LLW and MLLW).	0	0	3,413	3,412									6,825
Chemicals exceeding Revised LUT values; includes hazardous wastes.	0	0	3,716	3,851	9								7,575
Backfill soil	0	0	4,649	4,736	5								9,391
Totals	0	0	11,778	11,999	14								23,791
Conservation of Natural Resources Alternative													
Radionuclides above background concentrations; includes chemically contaminated soil.	0	0	3,413	112									3,525
Chemicals exceeding risk assessment levels; includes hazardous waste.	0	0	3,716	3,859									7,575
Backfill soil	0	0	4,649	2,590									7,239
Totals	0	0	11,778	6,561									18,339
Building Removal Alternative													
Building removal	750	750											1,500
Backfill soil	63	815											878
Totals	813	1,565											2,378

	Number of Truck Round Trips per Year												
	Year 1	***Year 2***	***Year 3***	***Year 4***	***Year 5***	***Year 6***	***Year 7***	***Year 8***	***Year 9***	***Year 10***	***Year 11***	***Year 12***	***Totals***
Groundwater Remediation Alternatives													
Groundwater Monitored Natural Attenuation Alternative													
Well installation and monitoring	1	1	6	1	1	1	1	1	1	1	1	1	17
Groundwater Treatment Alternative													
Sr-90 Source Removal – Bedrock	0	0	128 [b]										128
Backfill soil	0	0	83										83
Totals	0	0	211										211

AOC = *Administrative Order on Consent for Remedial Action*; LLW = low-level radioactive waste; LUT = Look-Up Table; MLLW = mixed low-level radioactive waste; Sr = strontium.

[a] This table shows round trips for heavy-duty trucks hauling waste from the site and backfill to the site. A few additional heavy-duty truck shipments would also be required for delivery of equipment, and light- and medium-duty truck shipments would be required for supplies, sample delivery, groundwater treatment medium exchange, and similar activities. Those miscellaneous shipments are not reflected in this table, but have been accounted for in the analysis. Trucks would operate 250 days per year in accordance with the agreement with NASA and Boeing (Boeing 2015a). Backfill soil round trips would go from the backfill source to Area IV and return for additional backfill. Soil removal trucks would go from Area IV to the disposal facility or an intermodal facility, where the soil containers would be loaded on a train; the trucks would then return to Area IV for an additional soil removal load. DOE's cleanup schedule is based on an average of up to 32 truck round trips per workday for the first 2 years, then 48 truck round trips per workday for the remainder of the project.

[b] In-ground volume of solid rock would be approximately 1,050 cubic yards; the removed rock is assumed to have an expanded volume of 1,700 cubic yards (see Appendix D). Using a conversion of 1.5 tons per cubic yard and 20 tons per truck would result in 128 truckloads for strontium-90 source removal from the bedrock.

Note: Annual truck round trips are rounded values. As a consequence, sums presented in the table may differ from those calculated from table entries.

Comparison of Risk Management and Cost Among Soil Remediation Alternatives

Appendix J of this EIS presents an analysis of the costs and benefits of the soil remediation alternatives. The costs are presented in terms of present worth, that is, the cost in current dollars, taking into account the duration of the alternative and the future value of money. The benefits are presented as risks to human health as measured by the risk of cancer or the hazard index (for non-cancer-causing chemicals) remaining after implementation of an alternative. The analysis is based on evaluation of four locations; the representative locations were selected because they were identified by EPA as having radionuclide contamination, had been subject to prior cleanup actions, and provided a range of chemical constituents characteristic of Area IV operations. The range of risks in these four exposure areas is expected to represent the upper boundary across Area IV and the NBZ for cancer risk and for noncancer hazard. Results of these analyses as applied to Area IV and the NBZ are summarized below. The figures show that risk or hazard (the peach-colored region) is reduced as alternatives are compared from left to right. This same comparison shows that costs (green line) increase, with a large cost increase with little risk reduction between the Cleanup to Revised LUT Values Alternative and the Cleanup to AOC LUT Values Alternative.

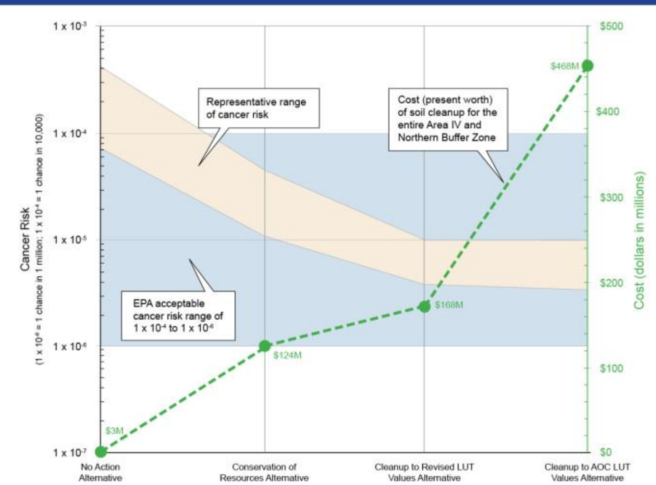
No Action Alternative:
Cost: $3 million
Cancer risk: 6.3×10^{-5} to 3.5×10^{-4} or 1 chance in 3,000 to 16,000
Hazard index: 0.8 to 30

Conservation of Resources Alternative:
Cost: $124 million
Cancer risk: 1.1×10^{-5} to 4.0×10^{-5} or 1 chance in 25,000 to 91,000
Hazard index: 0.6 to 1

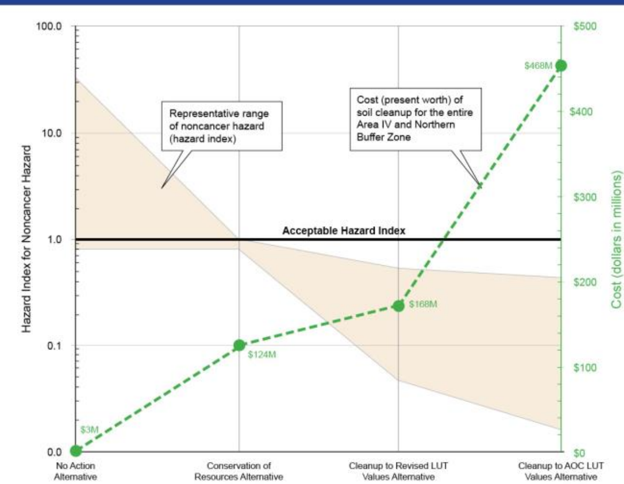
Cleanup to Revised LUT Values Alternative:
Cost: $168 million
Cancer risk: 3.7×10^{-6} to 9.8×10^{-6} or 1 chance in 100,000 to 270,000
Hazard index: 0.04 to 0.5

Cleanup to AOC LUT Values Alternative:
Cost: $468 million
Cancer risk: 3.2×10^{-6} to 9.6×10^{-6} or 1 chance in 100,000 to 310,000
Hazard index: 0.02 to 0.4

Remaining Cancer Risk and Remedial Action Costs of Soil Remediation Alternatives



Remaining Noncancer Hazard and Remedial Action Cost of Soil Remediation Alternatives



Note: Consistent with normal practices at this stage of project development, rough order of magnitude costs for implementing the alternatives were estimated. Actual costs would be expected to fall within a range from 20 percent less to 40 percent more than the rough order of magnitude estimate.

2.5 Building Demolition Alternatives

A total of 22 structures remain in Area IV; 18 are owned by DOE and 4 by Boeing, as shown in **Figure 2–6**. In this EIS, DOE is evaluating disposition of its 18 structures in Area IV. DOE has never had buildings in the NBZ. Seven of the 18 structures are metal sheds used for material storage; the other 11 are more-substantial structures, consisting of prefabricated metal upper buildings constructed on grade-level concrete platforms or with formed concrete basements or buildings with cinder block/concrete walls and metal roofs. The more substantial structures (building numbers are shown in parentheses) are the Sodium Pump Test Facility (Buildings 4462 and 4463); ETEC Office Building (Building 4038); Building 4057 Warehouse; HWMF (Buildings 4029 and 4133); RMHF (Buildings 4021, 4022, and 4034); and former reactor complex buildings (Buildings 4019 and 4024). The seven metal sheds are part of the RMHF (Buildings 4044, 4075, 4563, 4621, 4658, 4665, and 4688). HWMF no longer manages hazardous waste and the RMHF no longer manages radioactive waste. The Building 4057 Warehouse is used for field equipment storage, but the remaining buildings are unoccupied and unused. In addition to the structures, the associated parking lots are included as part of the building demolition activity.

Two alternatives are being evaluated for building demolition, the No Action Alternative and the Building Removal Alternative.

2.5.1 Building No Action Alternative

Under the No Action Alternative for building demolition, the 18 DOE-owned structures in Area IV would remain in place. DOE would conduct surveillance and maintenance as needed for safety (e.g., preventing access). Because radiological materials would remain in some buildings, DOE would continue its responsibilities in accordance with AEA and ensure continuation of security that restricts access to Area IV and the structures.

2.5.2 Building Removal Alternative

Under this alternative, DOE would demolish the 18 structures it owns in Area IV, shown in Figure 2–6, and dispose of or recycle the materials off site. Building demolition would start following the DOE ROD for this EIS and a decision following completion of the DTSC CEQA program EIR, and would take approximately 2 years to complete, contingent on funding. Building removal activities are estimated to disturb about 8.4 acres. Approximately 1,500 truck round trips would be required to haul debris from Area IV for either disposal or recycle (see Table 2–5). Boeing also plans to begin removal of its remaining buildings (four structures) in Area IV, following the DTSC CEQA program EIR decision (Boeing 2015b). DOE does not have responsibility for the Boeing-owned buildings in Area IV.

Building demolition plans would be prepared for each structure by DOE's demolition contractor to ensure worker safety is maintained throughout the demolition process and regulatory requirements and DOE guidelines are met for each facility. These plans would include identifying potential hazards for each structure, such as the presence of radiological or chemical materials or building structural issues, and specifying protective equipment and procedures to protect workers from specific hazards.

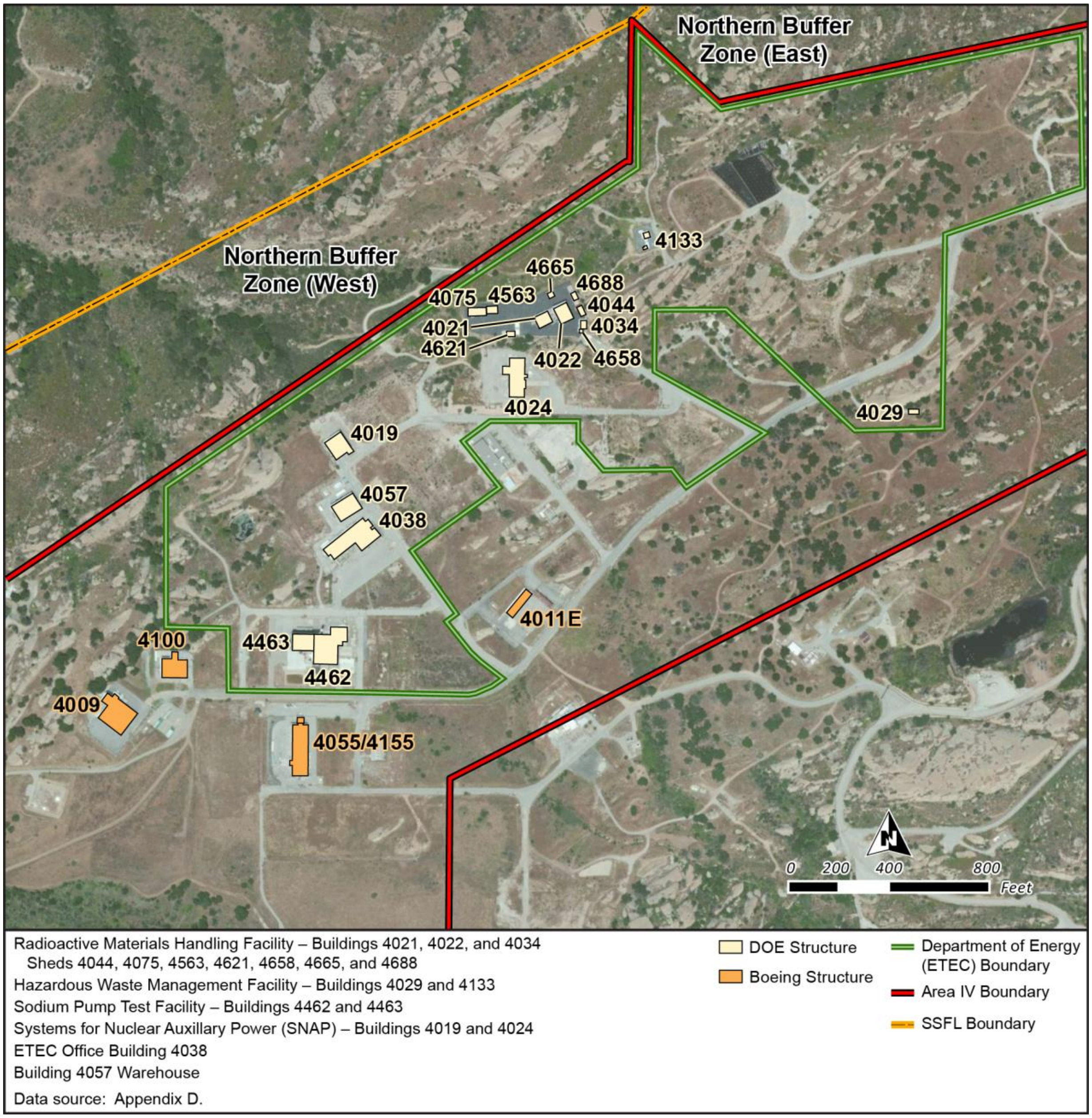


Figure 2–6 Remaining Structures in Area IV

At least two staging areas would be established to support building demolition and soil remediation work. The first would be the main staging area within the north-central portion of Area IV, near Building 4024. This staging area may be supplemented by an additional area south of Building 4038 (see Figure 2–6) that would include a contractor trailer, worker parking, portable restrooms, heavy equipment parking, and a decontamination pad. The main staging area would be situated on level ground where buildings previously stood to take advantage of existing cement foundations. A second staging area would be set up in the eastern portion of Area IV. This staging area, which would be located on level ground where buildings previously stood west of Building 4133, would be used to support soil remediation work in this area. Facilities would be similar to those described for the main staging area. Neither grading nor major vegetation clearance would be required to prepare the staging areas. Other, more-temporary staging and stockpiling areas would be set up within 300 feet of facilities undergoing demolition. These areas would be located on asphalt, concrete, or previously disturbed ground. As necessary, RCRA storage areas would be established to store wastes while awaiting shipment off site for disposal. The storage areas would consist of areas approximately 20 feet square, with berms around the perimeter and liners to capture any potential spills.

In preparation for demolition activities, surveys of building structural materials for the presence of radioactivity would be conducted. Building materials, particularly metal structures that do not have a radioactive history, have been determined to be free of radioactive contamination and do not contain hazardous materials would be transported to a recycle facility or a permitted general or industrial waste facility. Materials from buildings that cannot be shown to be suitable for free release[25] would be managed as radioactive waste and would be transported to a Federal or commercial LLW or mixed low-level radioactive waste (MLLW) facility such as the Nevada National Security Site (NNSS) in Nevada or Energy*Solutions* in Utah.[26]

Building materials from structures associated with hazardous waste management or chemical usage permits would be transported, as needed, to a permitted California Class I out-of-state hazardous waste disposal facility. Disposal facilities being considered by DOE as representative are presented in Chapter 3, Section 3.10, and Appendix D.

Conventional heavy equipment consistent with construction and demolition projects would be used for building demolition. Excavators (i.e., backhoes), cranes, and loaders with various tooling and a variety of conventional equipment for sorting and loading debris would be used. Agreements and contracts with disposal and recycle facilities would be in place prior to initiating demolition activities. Demolished materials would be characterized to determine the appropriate disposition option and location and removed from the site as soon possible.

Table 2–6 shows the estimated quantities of building demolition waste and debris that would be disposed of or recycled by type. A larger quantity of radioactive waste than other types of waste is identified because materials from buildings with a radiological history would be managed as radioactive waste for disposal purposes unless they can be demonstrated to be suitable for free release. As shown in Table 2–6, approximately 65 percent of the debris from buildings with a radiological history does not exhibit radiological characteristics above background levels. Approximately 1,500 truckloads would be required to move all of the DOE building demolition debris (all waste categories) from Area IV. As many as 26 workers would be involved with DOE building demolition activities at any one time, not including the truck drivers hauling the debris off site.

Following removal of the slabs and subgrade structures, radiological surveys of building footprints would be conducted. Soil sampling for chemicals and radionuclides would be conducted in accordance with DTSC-approved plans. Any soil encountered above the soil remediation level selected for implementation would be remediated or removed and disposed of during the soil remediation effort. Soil would be replaced to the extent necessary to ensure safe working conditions. Dust and erosion control measures, such as spraying with water, surfactant, or soil binder and/or covering exposed soil with mulch or straw wattles, would be used to minimize dust and erosion issues until the area is re-contoured and revegetated.

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[25] Materials are suitable for free release if they do not exhibit radioactivity above background levels.

[26] See Appendix D, Section D.4 for a discussion of the sites that were considered reasonable disposal locations for the different waste types and those that were selected as representative and analyzed in detail in this EIS. Representative LLW and MLLW disposal facilities evaluated in this EIS include Nevada National Security Site and Energy*Solutions*.

Table 2–6 Estimated Parameters for DOE Area IV Building Demolition

Land Area Disturbance	
Buildings	***Acres***
SNAP (Buildings 4019 and 4024)	1.9
HWMF (Buildings 4029 and 4133)	0.2
ETEC Office Building (Building 4038) and Building 4057 Warehouse	2.2
SPTF (Buildings 4462 and 4463)	2.6
RMHF (Buildings 4021, 4022, and 4034 and Sheds 4044, 4075, 4563, 4621, 4658, 4665, and 4688)	1.6
Total	**8.4**
Waste and Recyclable Materials	
Type	***Volume (cubic yards)*** [a]
From Buildings with a Radioactive History [b]	
Low-level radioactive waste	3,280
Mixed low-level radioactive waste	18
Free-released debris [c]	7,220
Free-released hazardous debris [c]	110
From Buildings with No Radioactive History [b]	
Hazardous waste	120
Recyclable steel, concrete, and asphalt	3,540
Nonhazardous debris	1,220

ETEC = Energy Technology Engineering Center; HWMF = Hazardous Waste Management Facility; RMHF = Radioactive Materials Handling Facility; SNAP = Systems for Nuclear Auxiliary Power; SPTF = Sodium Pump Test Facility.

[a] Volumes estimated from North Wind 2014. Demolition materials would be transported offsite in approximately 1,500 heavy-duty truck loads.

[b] For purposes of estimating waste volumes, buildings with no radioactive history include 4038, 4057 Warehouse, 4462, and 4463; all other building were considered to have a radioactive history.

[c] Materials from buildings with a radiological history would be managed as radioactive waste for disposal purposes unless they can be demonstrated to be suitable for free release. Free-released debris and free-released hazardous debris do not exhibit radioactivity above background levels.

Currently, water, sewer, and gas services to all Area IV buildings have been severed. The buildings are connected to electrical service, which would be deactivated prior to building removal. Buried utilities would be severed at the building footprint during building demolition. All roadways would remain in place following building demolition to provide access to stormwater control systems and monitoring wells.

2.6 Groundwater Remediation Alternatives

DOE would clean up groundwater in accordance with the requirements of the 2007 CO (DTSC 2007) and, as such, technologies are being identified and evaluated through the RCRA process. Although groundwater remediation at SSFL is being jointly addressed by DOE, NASA, and Boeing, DOE would implement its own remedial activities for its responsibilities within Area IV and the NBZ. Groundwater remediation would be an integrated effort with Boeing in those portions of Area IV where Boeing is addressing groundwater plumes for which it is responsible.

Investigation of the bedrock groundwater in Area IV was initiated in 1986 with the installation of a well at the Building 4056 landfill site. Since then, 61 additional bedrock wells, ranging from 100 to 400 feet deep, have been installed throughout Area IV (two wells were abandoned when Building 4059 was removed). Investigation of the near-surface groundwater at SSFL was initiated in March 2001. As part of the investigation of near-surface groundwater, DOE has installed 45 wells to depths of less than 100 feet (one of which has since been closed and sealed). The Area IV groundwater monitoring well network currently consists of 104 wells. Approximately 40 wells are sampled each year. The wells to be sampled and the analyses performed are described in the *Site-Wide Water Quality Sampling and Analysis Plan, Revision 1, Santa Susana Field Laboratory, Ventura County, California* (Haley and Aldrich 2010).

There are six primary areas within Area IV that require remediation measures to protect the groundwater: the Former Sodium Disposal Facility (FSDF) trichloroethylene (TCE) plume; the Building 4100/4056 landfill TCE plume; the Building 4057 Warehouse perchloroethylene (PCE) plume; the Hazardous Materials Storage Area (HMSA) TCE plume; the tritium plume (in the area of the former Building 4010); and the RMHF leach field strontium-90 source (see **Figure 2–7**). Additionally, two other areas with lower concentrations of groundwater contamination, mainly solvents, are being evaluated: the RMHF TCE plume and the Metals Clarifier TCE plume. As shown in Figure 2–7, the tritium plume extends into the NBZ and the boundaries of the FSDF and RMHF TCE plumes are uncertain and may extend into the NBZ.

The 2010 AOC (DTSC 2010a) incorporated by reference the requirements for investigation and cleanup of groundwater contained in the 2007 CO (DTSC 2007). In accordance with the 2007 CO (DTSC 2007) and RCRA requirements, the groundwater cleanup standards are risk-based, meaning the concentrations of any contaminants remaining in groundwater following remediation will pose an acceptable risk to future groundwater users. Groundwater characterization requirements were evaluated during development of the RCRA Facility Investigation Work Plan (CDM Smith 2015a). A RCRA Corrective Measures Study is currently being developed independently from this EIS; the study is to evaluate and select groundwater treatment technologies (e.g., pumping and treatment (commonly called pump and treat), soil vapor extraction, monitored natural attenuation) to be applied as remedial actions. In support of the Corrective Measures Study, DOE has completed collecting hydrogeological data that will support the transport and fate modeling needed for remedy selection. All groundwater remedies would involve monitoring to assess remedy effectiveness.

Potential environmental impacts of implementing the groundwater treatment technologies are evaluated in this EIS. DOE may select any or all of these technologies for action depending on the contaminant, source, and location of the impacted groundwater. Because the results of the Corrective Measures Study are yet to be determined, this EIS evaluates the potential impacts that could occur during groundwater remediation activities, assuming implementation of those technologies that would result in the largest potential impacts. DOE anticipates submitting the Corrective Measures Study to DTSC in 2017, prior to the DOE ROD for this EIS. Descriptions of the groundwater actions are described in the following paragraphs. For the purpose of impact assessment in this EIS, the proposed locations and footprints for groundwater treatment facilities and support structures are shown in **Figure 2–8**.

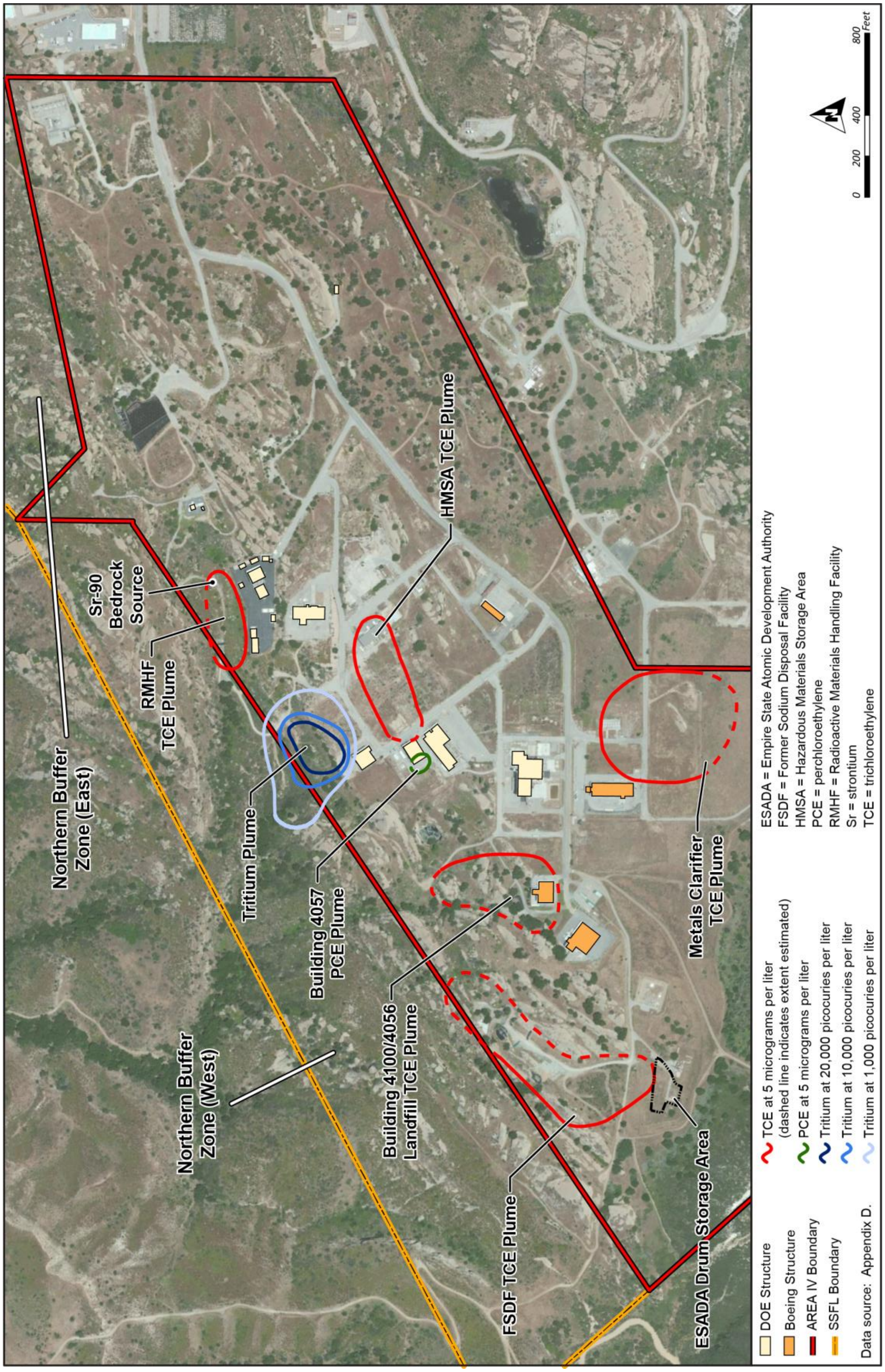

Figure 2–7 Groundwater Plumes and Strontium-90 Source

Figure 2–8 Proposed Groundwater Treatment Areas

2.6.1 Groundwater No Action Alternative

Under the No Action Alternative for groundwater, current groundwater monitoring would continue. DOE would not implement additional monitoring. As part of the SSFL-wide groundwater interim measures, the currently planned FSDF Groundwater Interim Measure would be initiated to extract TCE-contaminated groundwater. Over time, concentrations of radiological and chemical constituents would be reduced through natural attenuation (decay, degradation, dispersion, and dilution).

Annual sampling would take approximately 20 days. Two teams of three (or a total of six) staff members would collect samples on the site. Approximately 250 gallons of purge water would be annually generated during this effort. Consistent with current practice, purge water would be collected during the sampling process, then transported to a permitted wastewater treatment plant in tanker trucks for disposal.

2.6.2 Groundwater Monitored Natural Attenuation Alternative

Under this alternative, DOE would take advantage of natural processes to reduce the concentrations of chemicals and radionuclides impacting groundwater.

Monitored Natural Attenuation. Natural attenuation is the use of natural processes to contain or reduce the concentrations of constituents at a cleanup site. Monitored natural attenuation integrates monitoring, through sampling and analysis of groundwater, with natural attenuation to confirm that the concentrations of chemicals of interest are in fact decreasing. Mechanisms include biodegradation (degradation caused by naturally occurring microbes), as well as physical processes such as volatilization, dispersion, dilution, and radioactive decay (Nelson et al. 2014). Under favorable geochemical and microbial conditions, chlorinated solvents like TCE and PCE have been shown to break down; that is, in chemically reducing environments and in the presence of certain naturally occurring microbes, concentrations of these chemicals would be reduced through biodegradation.

Radioactive decay is also an effective natural attenuation process. The half-life (the time required for the radioactivity of a specified isotope to decrease to half its original value) of tritium is 12.3 years, which is short enough for natural attenuation to be effective in reducing tritium concentrations relatively quickly.

When implemented as a remedy, natural attenuation requires yearly monitoring to confirm that concentrations are decreasing and, in the case of reductive biodegradation, that the TCE or PCE breaks down completely. Groundwater monitoring would continue until constituent concentrations are demonstrated to be below their respective cleanup levels.

Under this alternative, no active remediation of any DOE groundwater plumes would occur. The plumes would be sampled (i.e., monitored) on an established schedule to confirm that reduction of the contaminant concentrations continues as anticipated. Monitoring periods would be based on the expected natural chemical decomposition or radionuclide decay over time. Most monitoring would be completed in 10 to 50 years. Monitoring time frames would be adjusted based on sampling results. The DOE groundwater plumes, the contaminants and their concentrations, and the expected time frames for monitoring are listed below (CDM Smith 2015a):

- For the FSDF TCE plume, TCE is currently above 1,000 parts per billion, and there are low levels (below the maximum contaminant level [MCL]) of perchlorate present (CDM Smith 2015a). The remaining TCE would be monitored for approximately 30 to 50 years until it reached the MCL of 5 parts per billion.

- For the HMSA perched groundwater plume with TCE at 90 parts per billion (CDM Smith 2015a), monitoring would continue for approximately 20 years.
- For the Building 4100/4056 Landfill TCE plume, TCE is currently approximately 48 parts per billion (CDM Smith 2015a). The TCE would be monitored for approximately 20 years.
- For the Building 4057 Warehouse PCE plume (currently at 48 parts per billion) (CDM Smith 2015a), monitoring would be needed for approximately 20 years until it reached the MCL of 5 parts per billion.
- For the Metals Clarifier TCE plume (currently at 9.3 parts per billion and decreasing) (CDM Smith 2015a), monitoring would be needed for approximately 10 years.
- For the RMHF leach field, both strontium-90 and TCE would be monitored. Strontium-90 has a 28.8-year half-life (the period of time required for half of the strontium-90 to decay to a nonradioactive isotope). With an MCL of 8 picocuries per liter and maximum activity concentrations of 183 picocuries per liter in 2010 and 29.5 picocuries per liter in 2015, monitoring would need to continue for 50 to 150 years. For the TCE plume (currently at about 6 parts per billion), monitoring would continue until the 5 parts per billion MCL is reached. The time frame for monitoring is uncertain because TCE in this plume has been approximately 6 parts per billion for about 15 years. This constant concentration is consistent with the conceptual model that assumes that TCE in the bedrock fractures has been removed and the current source is slow, continuous diffusion of TCE from the bedrock matrix.
- For the tritium plume, data (CDM Smith 2015a) indicate that radioactive decay would reduce tritium (with a 12.3-year half-life) to its 20,000 picocuries per liter drinking water MCL by 2025. Tritium in the plume was measured at 40,000 picocuries per liter in February 2014.

This alternative may require the installation of new monitoring wells to provide the data necessary to track the progress of attenuation processes.

Well Installation. For the purposes of this EIS, it was assumed that DOE would propose to DTSC the installation and monitoring of additional wells (five new monitoring wells). Each well would consist of a drilled borehole. Shallow wells would have polyvinylchloride or stainless steel well pipe inside the borehole, with a screen (slotted open portion) to allow water to enter the well. The size, length, material, and other details of the pipe would depend on the intended use of the well. Deep wells installed into the bedrock would have a metal casing installed through the alluvium to keep the upper part of the well from collapsing, but the bedrock portion typically would remain open (no well pipe would be used).

Wells are "developed" following installation to make sure that fine rock and soil particles are removed from the hole and to create a good connection for water, air, or chemicals to flow into or out of the wells. Well development usually involves pumping potable water into and out of the wells. Well installation generates wastes, including the soil and rock cuttings and development and other well installation water. The wastes would be collected in tanks and drums at the surface and taken to the Area IV staging area. Solid wastes would be disposed of at offsite landfills; liquid wastes would be disposed of at permitted wastewater treatment plants.

Shallow, hollow-stem auger wells can be installed and developed in 2 days; bedrock wells would take 3 to 5 days, depending on the depth of the well. Materials for well construction and support buildings would be brought to the site on trucks. One supply truck would be needed for a shallow well, and three to five trucks would be needed for a deep well. Water to develop the well would be brought to the site by a tanker truck.

Drilling would take place along and off existing roads. Staffing for well construction would require six workers.

2.6.3 Groundwater Treatment Alternative

Under the Groundwater Treatment Alternative, treatment would be selected following the completion of a RCRA Corrective Measures Study. The following treatment methods are being considered for groundwater remediation:

- The plumes with chlorinated solvents (e.g., FSDF, HMSA, Building 4100/4056 Landfill, and Building 4057 Warehouse) could be treated using:
  - pump and treat, followed by local re-injection of treated water;
  - enhanced groundwater treatment, consisting of *in situ* treatment, chemical injection, and biological enhancement;
  - soil vapor extraction (SVE); and,
  - for the HMSA plume only, perched zone dewatering.
- The RMHF leach field strontium-90 source could be remediated by removing the bedrock (source removal) that is contaminated with strontium-90 or lowering the groundwater table through active pumping.

The Metals Clarifier TCE plume and the RMHF TCE plume concentrations are less than 10 parts per million and would not be amenable to treatment. Because the tritium plume would meet its MCL by 2025 through radioactive decay, it would not be addressed by any active treatment. Remediation of these three plumes would be addressed by monitored natural attenuation, as under the Groundwater Monitored Natural Attenuation Alternative.

Pump and Treat. Groundwater pump and treat involves the use of a well and pump to extract impacted groundwater, a treatment system to remove constituents present in groundwater, and a system to discharge the treated water at the site. Groundwater would be extracted (pumped) to the surface and treated to remove the constituents of concern prior to local release of the treated water. Water would be withdrawn from existing extraction wells, so no new wells would need to be installed. Treatment would be performed by filtration to remove particulates and running the water through granulated activated carbon to capture the volatile organic compounds (VOCs) and resins to remove perchlorate and metals. The treatment system would be installed and operated in accordance with a permit issued by the Los Angeles Regional Water Quality Control Board.

The treated groundwater would be piped aboveground from a storage tank to an underground infiltration system. This system would consist of gravel-filled ditches with perforated pipe installed in the gravel for release of the treated water. Alternatively, the cleaned water could be returned through an injection well. The location of the water release would be upgradient of the plumes, so treated water would help flush impacted groundwater toward the extraction well.

The footprint of the treatment system and treated water storage tank would be approximately 880 square feet, based on a continuous extractable groundwater rate of 0.5 gallons per minute. A portion of the treatment system would be located on areas currently paved or covered by gravel. A portable 10-foot-by-10-foot shed would be used for storage. Installation of the treatment facility and piping would take five workers 1 week to accomplish. No new staff would be needed to operate the extraction and treatment systems. Spent activated carbon and resins would be replaced monthly. Used filter materials would be taken off site for regeneration and replaced with new materials on a monthly basis. Based on experience gained from three prior pump and treat projects in Area IV, DOE estimates that 5 years is sufficient time to remove the extractable mass of contaminants to their respective cleanup targets (see Appendix D). In practice, pump and treat would continue until the cleanup goal is met, as demonstrated by groundwater monitoring.

Enhanced Groundwater Treatment. Enhanced groundwater treatment, coupled with pump and treat, could be used to reduce the TCE concentration in the Area IV groundwater. This technology involves injection of a chemical, typically an oxidizing agent, or a nutrient to enhance chemical and/or biological degradation. The chemical or nutrient would be injected into the groundwater through a well to facilitate destruction of a target chemical. For Area IV, injection of ozone, peroxide, or permanganate (oxidizers) could be used for chemical enhancement. Enhanced groundwater treatment could also involve injecting nutrients into the groundwater to facilitate biological (microbial) destruction of the TCE.

If identified as a feasible treatment option in the Corrective Measures Study (currently under development), chemical injection would occur on a regular basis, likely every 3 months for approximately 3 years until the cleanup standard is met. For each injection event, a staff of three would be on site for 5 days to inject chemicals. The oxidizing agent would be delivered to the site in powder form and mixed with water on site in a truck-mounted polyethylene tank. Chemicals would be physically pumped into the subsurface over the 5-day period. Wells in the vicinity of the injection spot would be periodically sampled for the presence of the injected chemical and changes in water quality. Re-injection would occur periodically until the cleanup standard is met. One truck trip per injection event would be required to bring the tank with treatment chemicals on site. The truck and tank would be in a temporary lined, bermed, containment area during each injection event.

Soil Vapor Extraction. VOCs such as TCE present in bedrock, fractured bedrock, and alluvium above groundwater can be removed through SVE. With this technology, air is pulled through the subsurface into wells using a vacuum pump placed at the top of the well. The SVE system works by pulling air from the surface down into the area being remediated. The volatile constituents move with the air stream and are pulled to the surface through the extraction well. At the surface, the extracted air is treated using granulated activated carbon prior to release to the atmosphere. Liquid condensate created in the treatment unit would be captured for offsite disposal. Typically, the activated carbon would be contained in a 55-gallon drum and would be replaced periodically with fresh material. Use of SVE would require a treatability study to test the technology in the site geology. The results of the study would determine whether SVE is feasible and, if so, the number of wells that would be needed.

The system would be automatically operated and periodically visited by an onsite technician. A study to determine whether SVE is feasible in SSFL geology has been drafted and is undergoing review and revision. Results of the study will be considered in development of the Corrective Measures Study (anticipated to be submitted to DTSC in 2017). Based on the lateral extent and concentration of contaminants in the vadose zone (the unsaturated zone above the groundwater table), DOE estimated an SVE system would operate for approximately 5 years to reduce the threat of volatile chemicals in the soil above the aquifer from migrating into the aquifer (see Appendix D). The footprint of the operation would be a 40-foot-by-40-foot area, including a 20-foot-by-20-foot utility shed. Piping for the air injection and extracted vapors would run on the surface.

Source Isolation. Bedrock in the vicinity of the former RMHF leach field is a continuing source of strontium-90 in the groundwater. A prior removal action (Carroll, Marzec, and Stelle 1982) involved removal of strontium-90 in bedrock fractures to a depth of 10 feet into the fractures. The zone containing strontium-90 is assumed to extend from 10 feet into bedrock (10 feet below the bedrock surface) to 35 feet into bedrock, based on increases in the concentration of strontium-90 in groundwater when the groundwater elevation reaches 45 feet below ground surface (CDM Smith 2015a).

Source isolation could involve injection of grout around the contaminated bedrock to seal the contamination and prevent groundwater contact. A drill rig would be used to drill shallow holes around the contaminated bedrock, and then a cement grout would be pressure-pumped into the holes to fill bedrock cracks.

Source isolation could also involve pumping groundwater to maintain water levels below the contaminated bedrock. Pumping would be similar to the pump and treat method described earlier.

Removal of Bedrock. The bedrock at the former RMHF leach field is covered with about 10 feet of backfill soil that was put in place following a prior removal action. This backfill would be excavated and stockpiled, and the portion meeting soil cleanup values would be replaced after the bedrock has been removed. The footprint of the bedrock excavation would be approximately 20 feet by 40 feet, but the soil excavation footprint would be larger (approximately 40 feet by 100 feet) in order to build a ramp for the excavator to reach the top of the bedrock and provide room to maneuver around the rock excavation. There is an existing road to the excavation location, so no additional road construction would be required.

The bedrock source would be removed using a hydraulic breaker attached to an excavator. The hydraulic breaker would be capable of breaking the rock into removable pieces, and the excavator would be used to dig out the broken rock and place it into a sealed box to be taken off site. The depth of the bedrock excavation would be about 35 feet; the elevation of the floor of the excavation would be about 1,765 feet above mean sea level. The source removal activity would occur after RMHF is removed (in the second year of building removal) and would take approximately 20 days and require five workers.

A total of 1,050 cubic yards of rock would be removed. The volume of rock that would be disposed of off site would be larger (approximately 1,700 cubic yards) because broken rock is not as compact as rock in the ground (see Appendix D). An excavator, an operator, a support vehicle, and a helper would be on site each day of excavation.

The hydraulic breaker would be fitted with a dust suppression system that sprays a mist of water on the breaker bit and rock surface to control the dust generated when the rock is broken. More dust would be generated when the rock is loaded into boxes for removal. Additional water would be sprayed on the rock during loading to decrease the dust. A water truck and operator would be on site during the bedrock removal activities.

Figure 2–8 shows the location of the bedrock removal area. The excavated soil would be stockpiled in this area as well. A staging area to store equipment and supplies would be set up immediately adjacent to the south of the excavation or along the access road to the west. The staging area would have a truck wash to remove dust and dirt from vehicles leaving the area. The wash water would be collected, stored in a holding tank, sampled for radiation, and sent off site for disposal if necessary. While the rock removal is taking place, the air would be monitored for dust and radiation. An environmental specialist and a radiation technician would be on site every day to set up and calibrate monitors and to monitor the excavated material.

2.7 Preferred Alternative

DOE has no preferred alternative at this time.

2.8 Summary of Potential Environmental Consequences

This section summarizes the consequence analyses for the alternatives evaluated in this EIS. Section 2.8.1 summarizes the potential consequences of each alternative by resource area. Section 2.8.2 summarizes the potential cumulative impacts analysis that considers the consequences of the alternatives in the context of other past, present, and reasonably foreseeable future actions.

2.8.1 Comparison of Potential Environmental Consequences of Alternatives

Sections 2.8.1.1 through 2.8.1.3 summarize the potential consequences of the three groups of alternatives addressed in this EIS: respectively, the soil remediation alternatives, building demolition alternatives, and groundwater remediation alternatives. A summary table is provided at the end of each subsection. Section 2.8.1.4 addresses the range of potential impacts for each resource area, assuming implementation of the different combinations of action alternatives.

2.8.1.1 Potential Environmental Consequences of the Soil Remediation Alternatives

Potential environmental consequences for each resource area are summarized in **Table 2–7** and evaluated for the Soil No Action, Cleanup to AOC LUT Values, Cleanup to Revised LUT Values, and Conservation of Natural Resources Alternatives.

Land resources. Under the Soil No Action Alternative, the land use designation for Area IV and the NBZ would be consistent with Ventura County requirements. Under all soil remediation action alternatives, remediation would be consistent with the landowner's (Boeing's) intent to maintain its land as undeveloped open space (Boeing 2016b).

Compared to the Soil No Action Alternative, traffic from DOE activities would increase under all soil remediation action alternatives. While soil removal occurs, the average daily traffic on Woolsey Canyon Road would increase by up to 7.3 percent, which could result in weekday motorist delays on Woolsey Canyon Road and at the intersection of Woolsey Canyon Road with Valley Circle Boulevard during the hours when heavy-duty trucks would be traveling to and from SSFL. This increased traffic could discourage weekday use of Sage Ranch Park. (Note, however, that Sage Ranch Park can be accessed using other routes than Woolsey Canyon Road.) Increased traffic due to soil removal would last for 10 years under the Cleanup to AOC LUT Values Alternative, slightly more than 2 years under the Cleanup to Revised LUT Values Alternative, or 2 years under the Conservation of Natural Resources Alternative. Weekday use of other recreation areas in the SSFL vicinity would likely not be affected because the average daily traffic on any evaluated road other than Woolsey Canyon Road would increase by no more than 2.7 percent. Other than Woolsey Canyon Road, traffic along all evaluated roads past recreation areas may be reduced by routing truck traffic among multiple routes between SSFL and major highways.

Annual electrical requirements would be minimal under all alternatives. Water use would be minimal under the Soil No Action Alternative, but the soil remediation action alternatives would each annually require about 4.0 million gallons of water, primarily for dust control. The total water use would be about 40 million gallons under the Cleanup to AOC LUT Values Alternative, 8.3 million gallons under the Cleanup to Revised LUT Values Alternative, or 8.0 million gallons under the Conservation of Natural Resources Alternative. Because only limited quantities of water may be obtained from onsite groundwater wells, DOE expects that this water would be primarily obtained from CMWD. Although the projected annual water use would represent about 0.007 percent of CMWD's combined imported and local water supply, water use is an important consideration because of California's current drought conditions and Governor Brown's Executive Order requiring a statewide 25 percent reduction in potable water use (CA EO 2015). Water use may be reduced by measures such as use of surfactants.

Under the Soil No Action Alternative, the aesthetics and quality of current views of the areas addressed under the soil remediation alternatives would remain. Under all soil remediation action alternatives, there would be impacts on onsite visual quality during soil remediation activities, but after remediation is complete the views of the areas addressed would only slightly change compared to those under the Soil No Action Alternative. Small improvements in aesthetics and visual quality could occur because of new vegetation resulting in additional surface texture and color in areas that were previously barren. Nonetheless, the terrain would retain the appearance of open space crossed by roads.

Geology and soils. Minimal or no adverse impacts are expected on bedrock geologic resources under any of the soil remediation alternatives. Under the Soil No Action Alternative, although there would be restrictions on access to potential sources of aggregate at Area IV and the NBZ, impacts on bedrock geologic resources are minimal because the potential for minable aggregate resources is low. Under all soil remediation action alternatives, no adverse impacts on bedrock geologic resources are expected.

No impacts on paleontological resources (i.e., loss of fossils) would occur under the Soil No Action Alternative, but under all soil remediation action alternatives, potential impacts on paleontological resources could occur at portions of Area IV that are underlain by the Santa Susana Formation because of the presence of fossiliferous siltstone beds. (The Santa Susana Formation exists in the southern portions of Area IV and southwestern-most portion of Area III and does not extend into the NBZ.) The majority of the Santa Susana Formation is located in exemption areas that would be proposed under the 2010 AOC (DTSC 2010a). As noted in Section 2.3.2, DOE would not take action in any of these proposed exemption areas unless it is demonstrated that levels of chemical or radioactive constituents in the soil pose a risk to human health or the environment. In this event, soil removal operations in the proposed exemption areas would occur via focused removal actions that would minimize soil disturbance,[27] so that paleontological resources in these areas would likely be largely protected. Outside of the proposed exemption areas, the potential for impacts would be greater under the Cleanup to AOC LUT Values Alternative than under the Cleanup to Revised LUT Values Alternative, which in turn would have a greater potential for impacts than under the Conservation of Natural Resources Alternative. This is because about 1 acre of land overlying the Santa Susana Formation and outside the proposed exemption areas contains chemical or radioactive constituents exceeding AOC LUT values; about 0.2 acre contains chemical constituents exceeding revised LUT values or radioactive constituents exceeding AOC LUT values; and less than 0.1 acre contains chemical (but no radioactive) constituents exceeding risk-assessment-based values.

Unlike the Soil No Action Alternative, under all soil remediation action alternatives some activities could take place in zones where earthquake-induced landslides could present risks to workers. The potential for these risks would be greatest under the Cleanup to AOC LUT Values Alternative. Risks would be comparatively smaller under the Cleanup to Revised LUT Values Alternative because the areas of the seismic hazard zones where remediation would occur would be about 8 acres smaller. Compared to the Cleanup to Revised LUT Values Alternative, risks would be slightly smaller under the Conservation of Natural Resources Alternative because the areas of the seismic hazard zones where remediation would occur would be about 0.3 acre smaller. DOE would minimize risks to workers by proposing to implement the exemption process stipulated in the

[27] Focused removal actions include measures intended to minimize disturbance of vegetation and soils in sensitive areas. In some areas, this may include the limited use of earthmoving equipment and, in others, the use of all-terrain vehicles with large underinflated tires and soil removal using hand tools and portable mechanized equipment to remove only as much soil as necessary.

2010 AOC (DTSC 2010a) for certain areas if, during the planning and design of soil remediation activities, it was determined that excavating soil in these areas would present unacceptable risks.

Under the soil remediation action alternatives, soil erosion is possible in disturbed areas. Soil erosion would be minimized using BMPs, as summarized in Chapter 6. However, in the periods before completion of stabilization activities, precipitation runoff may erode soil, leading to a reduction of soil quality and functional capability within eroded areas. The greatest potential for erosion would occur under the Cleanup to AOC LUT Values Alternative because of the projected disturbance of about 130 acres of land outside the proposed exemption areas. There would be less potential for erosion under the Cleanup to Revised LUT Values Alternative because about 40 acres would be disturbed outside the proposed exemption areas. There would be even less potential for erosion under the Conservation of Natural Resources Alternative because about 32 acres would be disturbed outside the proposed exemption areas.

All of the soil remediation action alternatives would include placement of backfill in excavated areas. The biological activity, filtration, and vegetation support quality of the backfill received from offsite sources may be less than that of current soil at Area IV and the NBZ.[28] The potential for loss of soil function would be largest under the Cleanup to AOC LUT Values Alternative, but smaller under the Cleanup to Revised LUT Values Alternative because of the smaller need for backfill, and still smaller under the Conservation of Natural Resources Alternative. In addition, although sources of soil for construction or other industrial applications are readily available regionally, backfill to be used under the Cleanup to AOC LUT Values Alternative would need to contain concentrations of chemicals and radionuclides meeting AOC LUT values. If used at Area IV and the NBZ, backfill with these characteristics would represent a resource that would be less available to other users in Ventura County or other counties.

A source of 700,000 cubic yards of backfill meeting AOC LUT values under the Cleanup to AOC LUT Values Alternative has not been identified, and it appears unlikely that backfill meeting these values can be found. As noted in Section 2.3.3.1, DOE conducted initial evaluations of three potential borrow sites for backfill and soil from all three evaluated sites exceeded AOC LUT values for multiple chemicals of concern. Tested packages of soil products sold by home improvement stores also exceeded AOC LUT values for multiple chemicals of concern. As noted in Section 2.3.2, if a source of backfill that meets all of the AOC LUT values cannot be reasonably found, then DTSC, DOE, and EPA would enter into a consultation process, and DTSC would determine the best available source of backfill (DTSC 2010a).

Under the Cleanup to Revised LUT Values Alternative, 144,000 cubic yards of backfill would be required that meet revised LUT values for chemicals and AOC LUT values for radionuclides. Under the Conservation of Natural Resources Alternative, 111,000 cubic yards of backfill would be required that contain concentrations of chemicals and radionuclides meeting risk-assessment-based values. DOE has not identified and evaluated potential sources of backfill to determine whether the backfill would meet constituent concentration values consistent with these two alternatives. Because the allowable concentrations of chemical constituents in backfill under these two alternatives would generally be higher than AOC LUT values, DOE expects that finding acceptable sources of backfill would be more likely.

[28] For this EIS, it was assumed that the areas disturbed by remediation would be restored to native plant communities including chaparral, oak woodland, and Venturan coastal scrub. For this reason, the backfill should have similar texture, pH, and nutrient status compared to native soils on site. Agricultural soil would not be preferred due to the propensity of such soil to support invasive weeds. Also see the Biological resources subsection.

Surface water. Under the Soil No Action Alternative, no changes would occur to the onsite NPDES stormwater control and outfall monitoring system. Chemical and radioactive constituents would remain in soil, representing a source of potential surface water contamination in the event of an unusually large rainstorm that exceeds the current design of the NPDES system.

Under all soil remediation action alternatives, no adverse short-term impacts would be normally expected on surface water quality, and runoff quantity and velocity. However, if an unusually large rainstorm were to occur, the design capacity of the existing site NPDES stormwater control and outfall monitoring system could be exceeded, leading to soil runoff, although the mitigation measures implemented to protect surface water resources would likely forestall this risk, as well as any risk to regional stormwater control capacity. This risk would be larger under the Cleanup to AOC LUT Values Alternative than that under the other two soil remediation action alternatives because more land would be disturbed. Potential sources of surface water contamination would be removed under all action alternatives.

Groundwater. The Soil No Action Alternative would leave chemical and radioactive constituents in soil that would represent a potential source of groundwater contamination. No adverse impacts on groundwater quality are expected under any of the soil remediation action alternatives; positive impacts would result from removal of a potential source of groundwater contamination. Under all soil remediation alternatives, including the Soil No Action Alternative, there would be no requirement to withdraw site groundwater.

Biological resources. No adverse impacts are expected under the Soil No Action Alternative on vegetation and wildlife habitat and biota; aquatic and wetland habitats and biota; or threatened, endangered, or rare species.

Under the Cleanup to AOC LUT Values Alternative, vegetation and soil would be removed from about 130 acres of land in Area IV and the NBZ that are outside the proposed exemption areas. Removal of existing vegetation and topsoil would increase the difficulty of re-establishing native plant species and would reduce or eliminate the value of re-established habitat for most wildlife species. Due to the profound disturbance to and loss of soil, remediation would require prolonged, focused efforts to restore native vegetation and wildlife habitat. If backfill is substantially different from the original topsoil, it may not support vegetation similar to that present before development of Area IV. About 51 acres of relatively undisturbed native habitat (including coast live oak woodland, northern mixed chaparral, and Venturan coastal scrub) would be affected by remediation activities outside the proposed exemption areas. As discussed in Section 2.3.2, DOE would not take action in the proposed exemption areas unless it is demonstrated that levels of chemical or radioactive constituents in the soil pose a risk to human health or the environment. In this event, remediation within the proposed exemption areas would occur via focused removal actions. Potential impacts within the proposed exemption areas would thus be less severe and extensive and restoration would be more feasible than in areas outside proposed exemption areas that are remediated to AOC LUT values.

Potential impacts on vegetation and wildlife habitat and biota would be substantially reduced under the Cleanup to Revised LUT Alternative because the disturbed acreage (about 40 acres outside the proposed exemption areas) would be much less than the 130 acres affected under the Cleanup to AOC LUT Values Alternative. Impacts would be further reduced under the Conservation of Natural Resources Alternative because even less acreage would be disturbed (about 32 acres outside the proposed exemption areas). The less acreage disturbed, the greater the feasibility of restoration, with increased undisturbed habitat between remediated portions of the site, which would facilitate recolonization by native plant and wildlife species and beneficial soil organisms. About 17 acres of relatively undisturbed native habitat (including coast live oak woodland and northern mixed chaparral) outside of the proposed exemption areas would be affected under the Cleanup to Revised LUT Values Alternative, while about 13 acres would be affected under the Conservation of Natural Resources Alternative. Under both of these alternatives, potential impacts in the proposed exemption areas would be generally similar to those under the Cleanup to AOC LUT Values Alternative.

Under the Cleanup to AOC LUT Values Alternative, less than 1 total acre of wetlands, ephemeral drainages, and drainage ditches in upland habitats would be directly affected. Under the Cleanup to Revised LUT Values or Conservation of Natural Resources Alternative, potential impacts on aquatic and wetland habitats and biota would be similar to those under the Cleanup to AOC LUT Values Alternative, but the area of ephemeral drainages affected would be less. The area of ephemeral drainages affected under the Cleanup to Revised LUT Values and Conservative of Resources Alternatives would be about 55 percent and 48 percent, respectively, of that under the Cleanup to AOC LUT Values Alternative. Potential indirect impacts on aquatic and wetland habitats and associated biota, including jurisdictional waters of the U.S., from erosion and movement of sediment or soil would be minimized by use of BMPs and mitigation measures.

The potential for impacts on threatened, endangered, or rare species would be greatest under the Cleanup to AOC LUT Values Alternative, because there would be extensive remediation in Area IV and some remediation in the NBZ. Within the proposed exemption areas, where most threatened, endangered, or rare species in Area IV and the NBZ are located, as well as critical habitat for two federally listed species, the remediation footprint would be minimized by use of focused removal actions. Under the Cleanup to Revised LUT Values or Conservation of Natural Resources Alternative, the potential for impacts on threatened, endangered, or rare species would be similar to those under the Cleanup to AOC LUT Values Alternative, but much less habitat outside the proposed exemption areas would be affected (40 acres and 32 acres, respectively, compared to 130 acres under the Cleanup to AOC LUT Values Alternative).

Air quality and climate. Compared to the Soil No Action Alternative, under the soil remediation action alternatives, emissions from Area IV of pollutants such as VOCs, carbon monoxide, nitrogen oxides (NOx), sulfur dioxide (SO_2), and particulates would increase, with nearly all particulate emissions arising from fugitive dust. Additional emissions would occur from on-road vehicles. Total emissions of CO_2 (a greenhouse gas) would range from 28,000 to 84,000 metric tons under the Cleanup to AOC LUT Values Alternative, 12,000 to 33,000 metric tons under the Cleanup to Revised LUT Values Alternative, or 7,700 to 24,000 metric tons under the Conservation of Natural Resources Alternative. These emissions would be primarily from vehicles. The large range of potential emissions occurs because the analysis addresses truck transport to nearby disposal sites as well as to distant disposal sites. See Section 2.8.1.4 for a discussion of the potential impacts of emissions from DOE activities including compliance with air quality standards. (Emissions from action alternative combinations are more suitable than individual alternatives for assessments of potential impacts because action alternative combinations represent simultaneous activities with resulting total air quality impacts.)

Noise. Consistent with the *L.A. CEQA Thresholds Guide, Your Resource for Preparing CEQA Analyses in Los Angeles* (*L.A. CEQA Thresholds Guide*) (LA 2006), noise levels were determined using the community noise equivalent level (CNEL) to quantify noise, where CNEL is the average noise level over a 24-hour period with noise "penalties" applied during evening and night hours. Noise levels were determined to result in an adverse impact if the time-averaged noise level at the nearest residence to Area IV or in the vicinity of a truck route were to increase by 5 decibels A-weighted (dBA) CNEL, and the resulting noise was 65 dBA or less or were to increase by 3 dBA CNEL, and the resulting noise level exceeded 65 dBA CNEL.

Compared to the Soil No Action Alternative, noise emanating from Area IV would increase under all soil remediation action alternatives. This increased noise is not expected to cause adverse impacts at the nearest residence. Traffic would also increase under all soil remediation action alternatives compared to baseline conditions. The increased traffic noise would occur for 10 years under the Cleanup to AOC LUT Values Alternative, a little more than 2 years under the Cleanup to Revised LUT Values Alternative, and about 2 years under the Conservation of Natural Resources Alternative. The noise from this increased traffic is not expected to result in adverse noise impacts along the evaluated routes between SSFL and major highways because the increased noise is not expected to rise to unacceptable levels in accordance with the *L.A. CEQA Thresholds Guide* (LA 2006). Other than Woolsey Canyon Road, traffic noise along the roads evaluated in this EIS may be reduced by routing truck traffic among multiple routes between SSFL and major highways.

Transportation. Under the Soil No Action Alternative, very small quantities of waste may be annually generated as part of site maintenance activities, which in past years has included LLW and nonradioactive wastes, such as miscellaneous groundwater well equipment, debris, purge water from sampling monitoring wells, and rinse water. No transportation impacts above baseline conditions are expected from incident-free shipment of radioactive waste. No additional impacts are expected from potential accidents involving shipments of radioactive and nonradioactive wastes and other materials.

Potential impacts under all soil remediation action alternatives were evaluated, assuming an option whereby radioactive soils would be shipped to offsite facilities totally by truck (truck option) and an option whereby the same soils would be shipped to an offsite intermodal facility and then transferred to trains for delivery to the disposal facilities (truck/rail option). (Waste would be transferred at a second intermodal facility from trains onto trucks for delivery to NNSS.)

Under both the truck and truck/rail options for shipment of radioactive waste, no latent cancer fatalities (LCFs) are expected among the transport crews or the population along the routes to the disposal facilities. Assuming a hypothetical accident during transport to the disposal facilities, no LCFs are expected among the population along the transport route considering the risks from all possible accidents. The calculated risk of a fatality from a traffic accident involving radioactive waste shipments would be much larger than the calculated risk of an LCF; still, no traffic fatalities among the population along the transport routes are expected.

In addition, potential impacts were evaluated for shipment of nonradioactive (hazardous and nonhazardous) waste, backfill, equipment, and supplies to or from SSFL. Shipment of this material was evaluated under the truck option (all nonradioactive waste, backfill, equipment, and supplies would be shipped by truck) and the truck/rail option (nonradioactive waste would be shipped by truck from SSFL to an intermodal facility, then by rail to a disposal facility; all backfill, recyclable material, equipment, and supplies would be shipped by truck). Under the Cleanup to AOC LUT Values Alternative, traffic fatalities could occur among the population along the transport route. The risk of a traffic fatality was calculated to be 0.52 under the truck option or 3 (2.6) under the truck/rail option. Under both the Cleanup to Revised LUT Values and Conservation of Natural Resources Alternatives, no traffic fatalities are expected among the population along the transport routes under either the truck or truck/rail option.

Traffic. Any of the soil remediation action alternatives would result in increased traffic in the SSFL vicinity compared to the Soil No Action Alternative. This EIS evaluated four routes in the SSFL vicinity using various roads between SSFL and major highways, such as State Route 118 and U.S. Highway 101, which would be used to access other highways such as Interstate 5. For comparative analysis purposes, it was assumed that all traffic would be routed through each evaluated route.

Under the Cleanup to AOC LUT Values Alternatives, the weekday average daily traffic on Woolsey Canyon Road would increase by 7.2 to 7.3 percent during 9 years of soil removal and 5.6 percent during the final year of soil removal. Under the Cleanup to Revised LUT Values Alternative, the weekday average daily traffic on Woolsey Canyon Road would increase by 7.2 to 7.3 percent during 2 years of soil removal and 0.23 percent during the final partial year of soil removal. Under the Conservation of Natural Resources Alternative, the weekday average daily traffic on Woolsey Canyon Road would increase by 7.2 percent during the first year of soil removal and 5.1 percent during the final year of soil removal. Traffic increases on all other evaluated roads would be much smaller than those on Woolsey Canyon Road.

During the years of soil removal under each soil remediation action alternative, the level of service (LOS)[29] for Woolsey Canyon Road could change from a B to a C rating, and motorists could experience weekday delays on Woolsey Canyon Road and at its intersection with Valley Circle Boulevard during the hours when truck shipments occur. These weekday delays could persist for multiple years, particularly under the Cleanup to AOC LUT Values Alternative. Other than Woolsey Canyon Road, traffic volumes on the evaluated roads may be reduced by directing traffic to or from SSFL through multiple routes between SSFL and major highways.

Truck traffic under all soil remediation action alternatives would likely damage road pavement on some evaluated routes to major highways; this damage may require repair of affected roads sooner than currently anticipated. To compare the potential for pavement damage under the alternatives, the number of equivalent single-axle loads (ESALs) on the evaluated roads was determined for each alternative, where one ESAL is defined as the damage caused by a single 18,000-pound vehicle axle such as that found on a heavy-duty truck. For each action alternative, the number of ESALs for the roads in the SSFL vicinity were determined by multiplying the ESALS for a particular type of vehicle by the annual number of vehicles of that type traversing the roads, and then summing the results over all vehicle types and the total number of years of truck traffic required to implement the alternative. The total number of ESALs was determined to be about 200,000 under the Cleanup to AOC LUT Values Alternative, 51,000 under the Cleanup to Revised AOC LUT Values Alternative, or 40,000 under the Conservation of Natural Resources Alternative. Thus, the potential for pavement damage would be greatest under the Cleanup to AOC LUT Values Alternative and least under the Conservation of Natural Resources Alternative.

Human health

Members of the public. As described in Section 2.4, a no action and three action alternatives were defined with respect to remediating soils containing chemicals and radionuclides in Area IV and the NBZ. The Soil No Action Alternative could result in exposure of people who work on the site or intrude onto the site, whether the intrusion is temporary and occasional or more permanent. Under the Soil No Action Alternative, members of the public would be restricted from accessing the site through fencing, signage, and routine patrols by site security personnel. Although DOE's intent would be to prevent public access to the site, two scenarios involving hypothetical public receptors were analyzed: an onsite suburban resident and a recreational user. The onsite suburban resident was considered under the Soil No Action Alternative, after an assumed loss of institutional control 100 years in the future, and the soil remediation action alternatives after remediation. A hypothetical onsite suburban resident scenario representing exposure to current conditions was also evaluated as a baseline. The onsite recreational user was considered under both the Soil No Action Alternative and the soil remediation action alternatives after remediation. Site access was assumed to occur in

[29] The LOS is a qualitative measurement of operating conditions on roads that ranges from LOS ratings of A (highest quality of service) to F (forced traffic flow, with speed and traffic flow possibly dropping to zero).

spite of institutional control, and a hypothetical recreational user was also evaluated for current conditions, as well as following 100 years of institutional control.

To provide a comparison for the potential human health impacts of site-related chemical and radioactive constituents, the potential impacts from concentrations of chemicals and radionuclides in background soil were evaluated. Potential impacts were reported as excess lifetime cancer incidence for cancer-causing constituents (carcinogenic chemicals and radionuclides) and a hazard index for noncarcinogenic chemicals. Concentrations in background soil were calculated from sample data collected at locations about 3 to 6 miles from SSFL (HGL 2011; URS 2012). Potential impacts were then calculated for the No Action Alternative for a hypothetical future onsite suburban resident and a hypothetical onsite recreational user. Potential impacts were evaluated by comparing the cancer risk and calculated hazard index from exposure to background soil with those from exposure to Area IV and NBZ soil. Because uranium and thorium and their daughter products are naturally occurring and their concentrations cover a wide range, radiological potential impacts were determined with and without uranium and thorium decay chain radionuclides.

The analysis shows that there is very little difference between the risks from chemicals and radionuclides in Area IV and NBZ soils and those in background soil. The cancer risks to the future onsite suburban resident and recreational user from exposure to chemicals in Area IV and NBZ soil were lower than those from background soil. The calculated hazard index for onsite soil was slightly higher (an incremental increase of 0.1) for the future onsite suburban resident and somewhat higher (an incremental increase of 0.42) for the onsite recreational user.

The cancer risk from radionuclides in soil is the same as or slightly lower than the risk from chemicals in soil for both onsite and background soil. The difference in radiological cancer risk from exposure to Area IV or NBZ soil as compared to background soil depends on whether the uranium and thorium decay chain radionuclides are included. With the uranium and thorium decay chain radionuclides included, the cancer risk to the hypothetical future onsite suburban resident from exposure to Area IV and NBZ soils is lower than that for background soil. Without the uranium and thorium decay chain radionuclides, the cancer risk from exposure to onsite soils is higher than that for background soil. For the hypothetical onsite recreational user, there is no difference in risk between onsite and background soil with the uranium and thorium decay chain radionuclides and a higher risk from onsite soil without the uranium and thorium decay chain radionuclides.

The analysis also included a comparison of the annual radiation dose due to radionuclides in the soil. Regardless of the receptor evaluated (a hypothetical onsite suburban resident today or in the future or a hypothetical onsite recreational user), the difference in annual radiation dose between exposure to onsite and background soil is less than 2 millirem. With the uranium and thorium decay chain radionuclides included, the onsite doses are lower than those for background soil. Without the uranium and thorium decay chain radionuclides, the onsite doses are higher. To put this dose in perspective, the average annual radiation dose to a person living in the United States from natural background sources is about 311 millirem (NCRP 2009).

Notwithstanding the above analysis comparing potential impacts from onsite and background soil, under the soil remediation action alternatives it was assumed that removal of soil containing chemical and radioactive constituents and replacing it with backfill meeting the cleanup standard of the alternative would result in a reduction in potential impacts.

Under the Cleanup to AOC LUT Values Alternative, following cleanup, the average concentrations of residual chemicals and radionuclides would be less than current average concentrations and would meet AOC LUT values. Therefore, the potential impacts on a hypothetical onsite suburban resident and a hypothetical onsite recreational user would be less than impacts under the No Action Alternative. As shown by the comparison to risks from average background concentrations of chemicals and radionuclides, a large reduction in risk is not expected.

Under the Cleanup to Revised LUT Values Alternative, concentrations in soil remaining on the site and any backfill soil brought to the site would be less than the revised LUT values[30] (revised LUT values for chemicals are larger than those for the AOC LUT values and for radionuclides are the same as the AOC LUT values). Therefore, the average concentrations of residual chemicals and radionuclides would be less than current average concentrations and less than the revised LUT values. Therefore, potential impacts on a hypothetical onsite suburban resident and a hypothetical onsite recreational user would be between the potential impacts under the No Action Alternative and those of the Cleanup to AOC LUT Values Alternative.

Under the Conservation of Natural Resources Alternative, soil containing average chemical concentrations that are above a concentration equal to a 1.0×10^{-6} risk (1 chance in 1 million) of cancer incidence or a cumulative hazard index of 1 (whichever is less) and soil containing average radionuclide concentrations above a concentration equal to a dose of 25 millirem (or less) would be excavated and removed from the site. Soil remaining on site and any backfill soil would have average chemical concentrations below risk or toxicity-based values and average radionuclide concentrations below prescribed dose-based values. Therefore, the potential impacts on a hypothetical onsite suburban resident and a hypothetical onsite recreational user would be less than potential impacts under the No Action Alternative, but somewhat higher than the potential impacts under either the Cleanup to AOC LUT Values or Cleanup to Revised LUT Values Alternative.

Valley fever. Valley fever is the initial form of coccidioidomycosis infection, a fungal infection caused by inhalation of airborne *Coccidioides spp*. spores that are present in certain arid soils. In California, valley fever is caused by the fungus *Coccidioides immitis*, which lives in the top 2 to 12 inches of soil in many parts of the state. Activities under the soil remediation action alternatives would increase the potential for exposure to the fungus spores that cause valley fever.

Under the Soil No Action Alternative, there would be no change in the potential for exposure of the offsite public. The Cleanup to AOC LUT Values Alternative would have the largest potential for causing worker or public exposure to fungus spores. The potential for exposure to these fungus spores under the Conservation of Natural Resources Alternative would be about one-fifth of that under the Cleanup to AOC LUT Values Alternative because about one-fifth of the volume of soil would be removed. The potential for exposure under the Cleanup to Revised LUT Values Alternative would be somewhat greater than that under the Conservation of Natural Resources Alternative.

Project design features to control fugitive dust in accordance with Ventura County Air Pollution Control District Rule 55 would also reduce the potential for exposure to fungus spores. Features include treating surfaces with soil binders or dust control agents, limiting speed on unpaved roads, placing solid barriers around stockpiled soils and covering or wetting them, and loading materials carefully and not loading during high winds or storms. In addition to wetting soils during loading, wetting or binding agents would be applied at the points of excavation to minimize the amount of dust raised. In addition, the remediation contractor would employ measures to preclude emissions

[30] If a revised LUT value is less than the AOC LUT value, the AOC LUT value would be used.

of dust from transport trucks to the extent practical, and would pass outbound trucks through a decontamination and inspection station to be cleaned of visible soil before leaving the staging and loading areas.

Workers. Workers may be exposed to chemicals and radionuclides during monitoring, maintenance, and soil removal activities at Area IV and the NBZ. Under all alternatives, workers would be protected in accordance with DOE regulations (e.g., 10 CFR Parts 835 and 851) and DOE Orders. Radiation protection practices would be employed to ensure doses are ALARA. Workers could be exposed to higher levels of chemicals and radionuclides during soil remediation than when performing monitoring and maintenance. These exposures would be higher under the Cleanup to AOC LUT Values Alternative (a duration of 10 years) than under the Cleanup to Revised LUT Values Alternative (slightly longer than 2 years) or the Conservation of Natural Resources Alternative (about 2 years). Personal protective equipment would be used as dictated by the potential level of chemical and radiological impacts. Breathing protection equipment would be used when necessary and as-needed precautions to protect workers could include filter masks, respirators, or heavy equipment with enclosed cabs supplied with filtered air. Physical controls, including use of tools that allow workers to perform their jobs at a distance from contaminated or activated materials and use of surfactants or water sprays to control the generation of dust, may be applied as appropriate. Additionally, administrative controls, such as limiting the time of exposure, would be employed to ensure workers do not exceed DOE annual dose limits.

Remediation activities would pose an industrial safety risk to workers, who would be protected from injury in accordance with DOE regulations and guidance and operating procedures. The greatest risk would occur under the Cleanup to AOC LUT Values Alternative. Less risk would occur under the Cleanup to Revised LUT Values Alternative and still less under the Conservation of Natural Resources Alternative. Most soil removal work would occur in previously developed areas that are safely accessible to workers and heavy equipment that would be used for soil removal. There are, however, portions of the site where the topography presents challenges to worker safely, such as steep hillsides where heavy machinery could rollover. Additionally, portions of the site in the NBZ and along the southern edge of Area IV are within zones where earthquake-induced landslides could occur. DOE would use the AOC exception process if, during the planning and design of the soil removal project, it was determined that excavating soil in certain areas presented an unacceptable risk to workers.

Waste management. Very small quantities of waste from site maintenance activities would be annually generated under the Soil No Action Alternative; this waste would be transported to offsite waste management facilities with no impacts on the disposal capacities of these facilities.

Under either the Cleanup to AOC LUT Values or Cleanup to Revised LUT Values Alternative, about 91,000 cubic yards of soil would be removed that would exceed provisional radiological AOC LUT values and be classified as LLW or MLLW. Under the Conservation of Natural Resources Alternative, about 47,000 cubic yards would exceed risk-assessment-based values for radionuclides and be classified as LLW or MLLW. Under all soil remediation action alternatives, about 49,000 cubic yards of soil would be removed that would be classified as hazardous waste. Under the Cleanup to AOC LUT Values Alternative, about 793,000 cubic yards of soil would be removed that would exceed chemical AOC LUT values and would be classified as nonhazardous waste. Under either the Cleanup to Revised LUT Values or Conservation of Natural Resources Alternative, about 52,000 cubic yards of soil would be removed that would exceed risk-based values for chemicals and would be classified as nonhazardous waste.

All waste under all alternatives would be sent to authorized or permitted offsite facilities for disposal, consistent with facility authorizations and waste acceptance criteria. No exceedance of total waste capacity is expected at any evaluated facility potentially receiving waste from Area IV and the NBZ. Assuming all waste of each waste type would be sent to a single facility authorized to receive that waste type, only the McKittrick Waste Treatment Site would receive waste from Area IV and the NBZ, representing a significant fraction (about 16 percent) of the daily permitted tonnage limit for that facility. Any concerns about the total or daily quantities of waste received at any single facility could be alleviated by shipping waste to multiple facilities. Thus, no waste under any of the soil remediation alternatives would lack disposal capacity.

Cultural resources. No known archaeological or architectural cultural resources would be affected under any alternative. No adverse impacts are expected on traditional cultural resources under the Soil No Action Alternative. Under the soil remediation action alternatives, there could be adverse impacts on the integrity of traditional cultural resources from changes in setting during remediation activities, augmented site access by workers, disturbance of landscape, and potential discovery of unanticipated archaeological sites. Based on the land area that could be disturbed under the alternatives, the potential for impacts would be greatest under the Cleanup to AOC LUT Values Alternative (130 acres disturbed), less under the Cleanup to Revised LUT Values Alternative (40 acres disturbed), and smallest under the Conservation of Natural Resources Alternative (32 acres disturbed).

Socioeconomics. Under the Soil No Action Alternative, no socioeconomic impacts on employment, regional truck traffic, infrastructure and municipal services, housing, and local government revenue are expected in Los Angeles and Ventura Counties. No traffic-related socioeconomic impacts are expected at offsite disposal facilities.

The soil remediation action alternatives would annually employ about 25 workers, assumed to originate primarily from Los Angeles and Ventura Counties. Due to the large local labor force in these counties, there would be only minor potential beneficial socioeconomic impacts from this employment in these two counties and no impacts on housing availability. The increased heavy-duty truck traffic under the soil remediation action alternatives is not expected to cause socioeconomic impacts on businesses (e.g., reductions in sales) on the evaluated routes between SSFL and major highways. This increased traffic, however, could damage pavement on the routes used by trucks, resulting in increased expenses for local governments. Increased tax revenues from purchases of materials and fuel and rental of equipment, as well as permitting fees for project activities, could potentially offset these increased expenses. No other impacts are expected on municipal services, such as police or fire services.

Because of the small number of daily deliveries of soil to the evaluated radioactive and hazardous waste facilities, no socioeconomic impacts are expected on businesses near these facilities. For deliveries of nonhazardous soil to the evaluated facilities, no or minimal socioeconomic impacts are expected on businesses near the facilities. Disposal fees could increase revenues for public or private entities. Although potential socioeconomics impacts on businesses in the vicinity of any single facility accepting radioactive, hazardous, or nonhazardous waste for disposal are minimal (at worst), any potential impacts may be further reduced by shipping waste to multiple authorized facilities; by using multiple routes (as available) for delivery to individual facilities; or by shipping waste by rail to rail-accessible disposal facilities.

Environmental justice. For persons in the SSFL region of influence (ROI), the environmental justice analysis evaluated potential human health impacts as well as the potential impacts of increased traffic associated with remediation activities. For persons in the ROIs of the evaluated disposal facilities, the environmental justice analysis evaluated the potential impacts of increased traffic within the facility vicinities. Increased traffic was used as an indicator of several potentially detrimental traffic-related conditions, including traffic congestion; more noise; a higher risk of traffic accidents; and increased emissions of pollutants.[31]

Under the Soil No Action Alternative, potential risks to a hypothetical future (after 100 years) onsite suburban resident or hypothetical onsite recreational user would be very low (see the Human Health subsection), with no disproportionately high and adverse impacts expected on minority or low-income populations in the SSFL ROI. There would be no increases in traffic to or from SSFL above baseline conditions or increases in traffic in the vicinity of any disposal facility receiving waste from Area IV. Therefore, no disproportionately high and adverse traffic-related impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI and the regional ROIs.

Under all soil remediation action alternatives, after remediation, potential risks to an onsite suburban resident or onsite recreational user would be smaller than the already low risks associated with the Soil No Action Alternative. There would be no disproportionately high and adverse impacts expected on Native American tribes and minority and low-populations in the SSFL ROI.

Under all soil remediation action alternatives, increased traffic could change the LOS rating for Woolsey Canyon Road, causing weekday motorist delays on this road and at its intersection with Valley Circle Boulevard. No change in LOS is expected on other evaluated roads between SSFL and major highways. The evaluated routes traverse minority and non-minority communities, as well as low-income and non-low-income communities, and would not pass through Native American lands. This indicates that potential traffic impacts on Native American, minority, or low-income populations would be the same as those experienced by the general population. Nonetheless, the duration of traffic increase would be much longer under the Cleanup to AOC LUT Values Alternative (10 years) than that under the Cleanup to Revised LUT Values Alternative (slightly over 2 years), which in turn would be somewhat longer than that under the Conservation of Natural Resources Alternative (2 years). Except for Woolsey Canyon Road, traffic volume on the evaluated roads may be reduced by use of multiple routes between SSFL and major highways. Therefore, no disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI.

Under all soil remediation action alternatives, there would be no noticeable increase in traffic in the vicinities of the disposal facilities evaluated for receipt of radioactive or hazardous soil; therefore, there would be no disproportionately high and adverse impacts on Native American tribes and minority and low-income populations in the ROIs of these facilities. For deliveries of nonhazardous soil to the evaluated disposal facilities, there would be no or minimal impacts due to increased heavy-duty truck traffic in the vicinities of these facilities. By using multiple disposal facilities or rail transport to rail-accessible facilities, traffic may be reduced on roads through all communities in the regional ROIs. Considering this and the above analysis, no disproportionately high and adverse

[31] The SSFL ROI for the environmental justice analysis comprises the census tracks and block groups encompassing and adjacent to the SSFL property and the roads between SSFL and major highways. It includes census tracts and block groups within approximately 1 mile of the SSFL boundary. The regional ROIs include the census tracts near the evaluated recycle or waste disposal facilities, particularly the routes in the vicinities of the recycle and waste disposal facilities that may be traversed by heavy-duty trucks delivering material or waste to these facilities.

impacts are expected on Native American tribes and minority and low-income populations in the regional ROIs.

Sensitive-aged populations. The alternatives in this EIS were evaluated to determine whether sensitive-aged populations could experience disparate levels of impacts (that is, markedly distinct impacts relative to those on the general population) resulting from increased traffic in the SSFL ROI or in the ROIs of the evaluated recycle and disposal facilities (regional ROIs). Sensitive-aged populations were assumed to consist of children (persons under the age of 18) and persons aged 65 years or older. Of particular interest was whether schools or recreation areas exist in the vicinities of the expected routes for heavy-duty trucks transporting waste, backfill, equipment, or supplies to or from SSFL or heavy-duty trucks delivering recyclable material or waste to the evaluated facilities.

Under the Soil No Action Alternative, there would be no increases in traffic to or from SSFL above baseline conditions or increases in traffic in the vicinity of any disposal facility receiving waste from Area IV and the NBZ. Therefore, no disparate impacts are expected on sensitive-aged populations in the SSFL ROI and the regional ROIs.

Under all soil remediation action alternatives, there could be an increased risk to pedestrians along or crossing Woolsey Canyon Road, with the duration of this increased risk lasting for 10 years under the Cleanup to AOC LUT Values Alternative and about a fifth this long under the other two soil remediation action alternatives. However, this risk would be experienced by persons of all ages. There is not expected to be a significantly larger population of sensitive-aged persons in the group that could experience this risk compared to groups of persons living elsewhere in the SSFL ROI. Traffic volumes on other evaluated roads are not expected to be noticeably larger than those under baseline conditions. Nonetheless, except for Woolsey Canyon Road, traffic volume on the evaluated roads could be reduced by use of multiple routes between SSFL and major highways. No disparate traffic-related impacts are expected on sensitive-aged populations in the SSFL ROI.

Under all soil remediation action alternatives, no noticeable increase in traffic is expected in the vicinities of the disposal facilities evaluated for receipt of radioactive or hazardous soil; therefore, no disparate impacts are expected on sensitive-aged populations in the ROIs of these facilities. For deliveries of nonhazardous soil to the evaluated disposal facilities, there would be no or minimal impacts due to increased heavy-duty truck traffic in their vicinities. Nonetheless, by using multiple disposal facilities or rail transport to rail-accessible facilities, traffic may be reduced on the roads in the vicinities of the evaluated facilities. Therefore, no disparate impacts would be expected on sensitive-aged populations in the regional ROIs.

Table 2–7 Summary of Potential Environmental Consequences under the Soil Remediation Alternatives

	Alternatives			
Resource Area	***Soil No Action***	***Cleanup to AOC LUT Values***	***Cleanup to Revised LUT Values***	***Conservation of Natural Resources***
Land resources	- The land use designation for Area IV and the NBZ would be consistent with Ventura County requirements. - No impacts are expected on use of Sage Ranch Park or other recreation areas in the SSFL vicinity. - Electricity and water use would be minimal. - No change in aesthetics and visual quality from baseline conditions.	- Remediation would be consistent with the landowner's (Boeing's) intent to maintain its land as undeveloped open space (Boeing 2016b). - During 10 years of soil removal, the average daily traffic on Woolsey Canyon Road would increase by up to 7.3 percent, which could discourage weekday use of Sage Ranch Park. Traffic on evaluated roads other than Woolsey Canyon Road is expected to increase by no more than 2.7 percent, with no expected impacts on use of other recreation areas in the SSFL vicinity. - Electricity use would be minimal. Annual water use would be about 4.0 million gallons; total water use would be about 40 million gallons. Annual use would represent about 0.007 percent of CMWD's annual supply. Water use is an important consideration because of California's current drought conditions and Governor Brown's call to reduce water use (CA EO 2015). - There would be onsite impacts on aesthetics and visual quality during the 10 years of soil removal, but long-term improvements to aesthetics and visual quality resulting from returning Area IV to a stabilized, revegetated state. The terrain would retain the appearance of an open space crossed by roads.	- Remediation would be consistent with the landowner's (Boeing's) intent to maintain its land as undeveloped open space (Boeing 2016b). - Impacts on recreation areas would be similar to those under the Cleanup to AOC LUT Values Alternative, except that increased traffic would last for slightly more than 2 years. - Electricity use would be minimal. Annual impacts on water would be the same as those under the Cleanup to AOC LUT Values Alternative; total water use would be about 8.3 million gallons. Water use is an important consideration for the same reasons as those under the Cleanup to AOC LUT Values Alternative. - Impacts on aesthetics and visual quality would be similar to those under the Cleanup to AOC LUT Values Alternative, but the impact duration would be less because soil removal would last for slightly more than 2 rather than 10 years.	- Remediation would be consistent with the landowner's (Boeing's) intent to maintain its land as undeveloped open space (Boeing 2016b). - Impacts on recreation areas would be similar to those under the Cleanup to AOC LUT Values Alternative, except that increased traffic would last for about 2 years. - Electricity use would be minimal. Annual impacts on water would be the same as those under the Cleanup to AOC LUT Values Alternative; total water use would be about 8.0 million gallons. Water use is an important consideration for the same reasons as those under the Cleanup to AOC LUT Values Alternative. - Impacts on aesthetics and visual quality would be similar to those under the Cleanup to AOC LUT Values Alternative, but the impact duration would be less because soil removal would last for 2 rather than 10 years.
Geology and soils	- No impacts are expected on geologic (bedrock) and paleontological resources (i.e., loss of fossils) or onsite soil function. - No activities would take place in zones where earthquake-induced landslides could occur. - Minimal soil erosion is expected from site maintenance activities, and there would be no need for backfill obtained from offsite sources.	- No adverse impacts are expected on geologic (bedrock) resources. - Potential impacts on paleontological resources (i.e., loss of fossils) would be minimal because the Santa Susana Formation containing these resources is largely located within the proposed exemption areas.[a] Outside of the proposed exemption areas, about 1 acre of land overlying the Santa Susana Formation would be remediated.	- Impacts on geologic resources would be the same as those under the Cleanup to AOC LUT Values Alternative. - Potential impacts on paleontological resources would be similar to those under the Cleanup to AOC LUT Values Alternative, except that only 0.2 acres of land overlying the Santa Susana Formation (and not within the proposed exemption area) would be remediated.	- Impacts on bedrock geologic resources would be the same as those under the Cleanup to AOC LUT Values Alternative. - Potential impacts on paleontological resources would be similar to those under the Cleanup to AOC LUT Values Alternative, except less than 0.1 acre of land overlying the Santa Susana Formation (and not within the proposed exemption area) would be remediated.

Resource Area	Alternatives			
	Soil No Action	***Cleanup to AOC LUT Values***	***Cleanup to Revised LUT Values***	***Conservation of Natural Resources***
Geology and soils (cont'd)		- Some activities could take place in zones where earthquake-induced landslides could occur, leading to worker risks that DOE would minimize as needed using the 2010 AOC exemption process. - Soil erosion is possible because of the disturbance of about 130 acres of land, but would be minimized using BMPs, as summarized in Chapter 6. In the periods before completion of stabilization activities, precipitation runoff may erode soil, leading to a reduction of soil quality and functional capability within eroded areas. - About 700,000 cubic yards of backfill would be required, with chemical and radioactive constituents in concentrations meeting AOC LUT values. Loss of soil function is possible if the backfill is not of equal soil quality (including regenerative structures, organic carbon, seed bank, and beneficial soil organisms) as that of current soil at Area IV and the NBZ.	- Potential impacts associated with earthquake-induced landslides and management of worker risks would be similar to those under the Cleanup to AOC LUT Values Alternative, but the areas of the seismic hazard zones would be about 8 acres smaller. - Potential soil erosion impacts would be reduced compared to those under the Cleanup to AOC LUT Values Alternative because less acreage would be disturbed (about 40 acres). - About 144,000 cubic yards of backfill would be required, with concentrations of chemicals meeting revised LUT values and radionuclides meeting AOC LUT values. The Area IV-wide potential for loss of soil function would be reduced compared to that under the Cleanup to AOC LUT Values Alternative.	- Potential impacts associated with earthquake-induced landslides and management of worker risks would be similar to those under the Cleanup to Revised LUT Values Alternative, but the areas of the seismic hazard zones would be about 0.3 acres smaller. - Potential soil erosion impacts would be reduced compared to those under the Cleanup to Revised LUT Values Alternative because less acreage would be disturbed (about 32 acres). - About 111,000 cubic yards of backfill would be required, with concentrations of chemicals and radionuclides meeting risk-assessment-based values. The Area IV-wide potential for loss of soil function would be reduced compared to under the Cleanup to Revised LUT Values Alternative.
Surface water resources	No changes would occur to the onsite NPDES stormwater control and outfall monitoring system. Radioactive and chemical constituents would remain in soil, representing a source of potential surface water contamination if an unusually large rainstorm that exceeds the design of the NPDES system were to occur.	No adverse short-term impacts on surface water quality and runoff quantity and velocity are normally expected. During soil remediation, 130 acres would be disturbed. If an unusually large rainstorm were to occur, the design capacity of the existing onsite NPDES stormwater control and outfall monitoring system could be exceeded, resulting in offsite transport of soil and possible overwhelming of regional stormwater control capacity. However, the measures to minimize impacts, as summarized in Chapter 6, would likely forestall this risk. There would be a long-term reduction of potential sources of surface water contamination.	Same as under the Cleanup to AOC LUT Values Alternative, except the potential for impacts would be much less because much less acreage (40 acres) would be disturbed.	Same as under the Cleanup to Revised LUT Values Alternative, except the potential for impacts would be less because less acreage (32 acres) would be disturbed.
Groundwater resources	A source of potential groundwater contamination would remain. There would be no requirement to withdraw site groundwater.	No adverse impacts are expected; positive impacts would result from removal of a potential source of groundwater contamination. There would be no requirement to withdraw site groundwater.	Same as under the Cleanup to AOC LUT Values Alternative.	Same as under the Cleanup to AOC LUT Values Alternative.

	Alternatives			
Resource Area	***Soil No Action***	***Cleanup to AOC LUT Values***	***Cleanup to Revised LUT Values***	***Conservation of Natural Resources***
Biological resources	No adverse impacts on vegetation and wildlife habitat and biota; aquatic and wetland habitats and biota; and threatened, endangered, or rare species are expected.	- Removal of existing vegetation and topsoil from about 130 acres would increase the difficulty of re-establishing native plant species and would reduce or eliminate the value of re-established habitat for most wildlife species. Remediation would require prolonged focused efforts to restore native vegetation and wildlife habitat. If backfill is substantially different from the original topsoil, it may not support re-establishment of native vegetation. About 51 acres of relatively undisturbed native habitat (including coast live oak woodland, northern mixed chaparral, and Venturan coastal scrub) would be affected. There would be fewer impacts within the proposed exemption areas because remediation within these areas would occur via focused removal actions that would minimize soil and habitat disturbance. - Less than 1 total acre of wetlands, ephemeral drainages, and drainage ditches in upland habitats would be directly affected. Potential indirect impacts on aquatic and wetland habitats and associated biota, including jurisdictional waters of the U.S., from erosion and movement of sediment or soil would be minimized by use of BMPs and mitigation measures. - Within the proposed exemption areas, where most threatened, endangered, or rare species in Area IV and the NBZ are located, as well as critical habitat for two federally listed species, impacts would be minimized through use of focused removal actions.	- Impacts on vegetation and wildlife habitat and biota would be reduced because the remediated acreage (40 acres) would be less than that under the Cleanup to AOC LUT Values Alternative. The smaller area affected by remediation would increase the feasibility of restoration, and there would be more undisturbed habitat between remediated portions of the site, facilitating recolonization by native plant and wildlife species and beneficial soil organisms. About 17 acres of relatively undisturbed native habitat (including coast live oak woodland and northern mixed chaparral) would be affected by remediation activities outside the proposed exemption areas. Impacts within the proposed exemption areas would be generally as described under the Cleanup to AOC LUT Values Alternative. - Impacts on aquatic and wetland habitats and biota would be similar to those under the Cleanup to AOC LUT Values Alternative, but the area of ephemeral drainages directly affected would be about 0.4 acres. - Impacts on threatened, endangered, or rare species and critical habitat would be similar to those under the Cleanup to AOC LUT Values Alternative	- Impacts on vegetation and wildlife habitat and biota would be reduced because the remediated acreage (32 acres) would be less than that under the Cleanup to AOC LUT Values Alternative. Impacts would be slightly less than those under the Cleanup to Revised LUT Values Alternative (32 acres vs. 40 acres). The smaller area affected by remediation would increase the feasibility of restoration, and there would be more undisturbed habitat between remediated portions of the site, facilitating recolonization by native plant and wildlife species and beneficial soil organisms. About 13 acres of relatively undisturbed native habitat (including coast live oak woodland and northern mixed chaparral) would be affected by remediation activities outside the proposed exemption areas. Impacts within the proposed exemption areas would be generally as described under the Cleanup to AOC LUT Values Alternative. - Impacts on aquatic and wetland habitats and biota would be similar to those under the Cleanup to AOC LUT Values Alternative, but the area of ephemeral drainages directly affected would be about 0.4 acres. - Impacts on threatened, endangered, or rare species and critical habitat would be similar to those under the Cleanup to AOC LUT Table Values Alternative.
Air Quality and climate	No emissions of pollutants, including CO_2, above baseline conditions are expected.	Pollutants such as VOCs, CO, NOx, SO_2, and particulates would be emitted from onsite activities, with nearly all particulate emissions arising from fugitive dust. Additional emissions would occur from on-road vehicles. A total of 28,000 to 84,000 metric tons of CO_2 would be emitted, primarily from vehicles.	The same types of pollutants would be emitted as those under the Cleanup to AOC LUT Values Alternative, but in smaller total quantities. A total of 12,000 to 33,000 metric tons of CO_2 would be emitted, primarily from vehicles.	The same types of pollutants would be emitted as those under the Cleanup to AOC LUT Values Alternative, but in smaller total quantities. A total of 7,700 to 24,000 metric tons of CO_2 would be emitted, primarily from vehicles.

	Alternatives			
Resource Area	***Soil No Action***	***Cleanup to AOC LUT Values***	***Cleanup to Revised LUT Values***	***Conservation of Natural Resources***
Noise	No noise impacts above baseline conditions are expected.	- Noise levels from onsite remediation are expected to increase at the closest residence during the 10 years of soil removal, but would be well below 65 dBA CNEL and a 5 dBA CNEL increase, a threshold for potential adverse noise impacts established per the *L.A. CEQA Thresholds Guide, Your Resource for Preparing CEQA Analyses in Los Angeles* (LA 2006). - No adverse noise impacts from traffic noise are expected during the 10 years of soil removal, although traffic noise would increase compared to baseline conditions. Time-averaged daily noise levels at a distance of 100 feet from the evaluated roads could increase by up to 3.5 dBA CNEL, where the final noise level would be below 65 dBA CNEL (the threshold for an adverse impact is an increase of 5 dBA CNEL). Along one section of Valley Circle Boulevard, where the noise level already exceeds 65 dBA CNEL, the increase would be no more 0.6 dBA (the threshold for an adverse impact when the final noise level exceeds 65 dBA CNEL is an increase of 3 dBA CNEL).	Similar to the Cleanup to AOC LUT Values Alternative, except the duration of increased noise due to site activities or traffic would be slightly more than 2 years.	Similar to the Cleanup to AOC LUT Values Alternative, except the duration of increased noise due to site activities or traffic would be 2 years.
Transportation [a]	No impacts above baseline conditions are expected.	**Shipment of radioactive waste – truck option** [b] Shipments – 6,830 truck shipments *Incident-free risks:* - Crew LCFs: 0 (3×10^{-4} to 8×10^{-4}) - Population LCFs: 0 (8×10^{-5} to 2×10^{-4}) *Accident risks:* - Population LCFs: 0 (4×10^{-10} to 4×10^{-9}) - Traffic fatalities: 0 (0.04 to 0.3) **Shipment of radioactive waste – truck/rail option** [b] Shipments – 6,830 truck shipments from SSFL to an intermodal facility and then 430 rail shipments *Incident-free risks:* - Crew LCFs: 0 (1×10^{-4} to 2×10^{-4}) - Population LCFs: 0 (1×10^{-4}) *Accident risks:* - Population LCFs: 0 (3×10^{-10}) - Traffic fatalities: 0 (0.2)	**Shipment of radioactive waste – truck option** Same as the Cleanup to AOC LUT Values Alternative. **Shipment of radioactive waste – truck/ rail option** Same as the Cleanup to AOC LUT Values Alternative.	**Shipment of radioactive waste – truck option** [b] Shipments – 3,530 truck shipments *Incident-free risks:* - Crew LCFs: 0 (2×10^{-4} to 4×10^{-4}) - Population LCFs: 0 (4×10^{-5} to 1×10^{-4}) *Accident risks:* - Population LCFs: 0 (2×10^{-10} to 2×10^{-9}) - Traffic fatalities: 0 (0.02 to 0.1) **Shipment of radioactive waste – truck/rail option** [b] Shipments – 3,530 truck shipments from SSFL to a an intermodal facility, then 220 rail shipments *Incident-free risks:* - Crew LCFs: 0 (6×10^{-5} to 1×10^{-4}) - Population LCFs: 0 (5×10^{-5} to 7×10^{-5}) *Accident risks:* - Population LCFs: 0 (1×10^{-10}) - Traffic fatalities: 0 (0.1)

Resource Area	Alternatives: Soil No Action	Cleanup to AOC LUT Values	Cleanup to Revised LUT Values	Conservation of Natural Resources
Transportation [a] (cont'd)		**Shipment of nonradioactive waste, backfill, equipment, and supplies [b]** *Truck option:* - 110,000 truck shipments - Traffic fatality risks: 1 (0.52) *Truck/rail option:* - 63,000 truck shipments of waste from SSFL to an intermodal facility, then 3,900 rail shipments; 45,700 truck shipments of backfill, equipment, and supplies Traffic fatality risks: 3 (2.6)	**Shipment of nonradioactive waste, backfill, equipment, and supplies [b]** *Truck option:* - 17,000 truck shipments - Traffic fatality risks: 0 (0.25) *Truck/rail option:* - 7,580 truck shipments of waste from SSFL to an intermodal facility and then 470 rail shipments; 9,440 truck shipments of backfill, equipment, and supplies Traffic fatality risks: 0 (0.32)	**Shipment of nonradioactive waste, backfill, equipment, and supplies [b]** *Truck option:* - 14,900 truck shipments - Traffic fatality risks: 0 (0.25) *Truck/rail option:* - 7,580 truck shipments of waste from SSFL to an intermodal facility and then 470 rail shipments; 7,290 truck shipments of backfill, equipment, and supplies Traffic fatality risks: 0 (0.31)
Traffic	No increases in average daily traffic or LOS are expected on roads in the SSFL vicinity, with no traffic-induced damage to road pavement.	The weekday average daily traffic on Woolsey Canyon Road would increase by 7.2 to 7.3 percent during 9 years of soil removal and 5.6 percent during the final year. Traffic increases on other evaluated roads would be much smaller. Weekday motorist delays could occur on Woolsey Canyon Road and at its intersection with Valley Circle Boulevard. The LOS for Woolsey Canyon Road could change from a B rating to a C rating (see Appendix H, Table H–19). Other than Woolsey Canyon Road, traffic volumes on the evaluated roads may be reduced by use of multiple routes between SSFL and major highways. Traffic would impose about 200,000 ESALs on the evaluated roads, which would cause damage to the pavement and lead to roads needing repairs sooner than currently anticipated.	Impacts would be similar to those under the Cleanup to AOC LUT Values Alternative, except the increased level of traffic would last for a little more than 2 years. Traffic would impose about 51,000 ESALs on the evaluated roads, which would cause less damage than that under the Cleanup to AOC LUT Values Alternative, but would still lead to roads needing repairs sooner than currently anticipated.	Impacts would be similar to those under the Cleanup to AOC LUT Values Alternative, except the increased level of traffic would last for about 2 years. Traffic would impose about 40,000 ESALs on the evaluated roads, which would likely cause less damage than that under the Cleanup to Revised LUT Values Alternative, but would still lead to roads needing repairs sooner than currently anticipated.
Human health	**Workers** Minimal exposures from monitoring and maintenance activities; maintenance workers would be protected from chemical and radiation exposure and industrial hazards through compliance with DOE requirements for worker safety and radiation protection.	**Workers** Exposures would be higher than those under the Soil No Action Alternative during 10 years of soil remediation. Remediation workers would be protected from chemical and radiation exposure through compliance with DOE requirements for worker safety and radiation protection. Radiation protection practices would be employed so that doses are ALARA.	**Workers** The duration of higher exposures would be slightly more than 2 years. Workers would have less exposure to chemically impacted soil than under the Cleanup to AOC LUT Values Alternative; exposure to radioactive constituents would be the same. Remediation worker protection would be the same as that under the Cleanup to AOC LUT Values Alternative.	**Workers** The duration of higher exposures would be 2 years. Workers would have less exposure to chemical and radioactive constituents than under the Cleanup to AOC LUT Values Alternative. Remediation worker protection would be the same as that under the Cleanup to AOC LUT Values Alternative.

Resource Area	*Alternatives* Soil No Action	Cleanup to AOC LUT Values	Cleanup to Revised LUT Values	Conservation of Natural Resources
Human health (cont'd)	**Valley fever** [c] There would be no change in the risk of exposure to the fungus spores that cause valley fever.	**Valley fever** The potential for exposure of workers and the public to fungus spores would be managed through control of fugitive dust, but would be largest among the action alternatives because of the volume of soil that would be disturbed (933,000 cubic yards).	**Valley fever** The potential for exposure of workers and the public to fungus spores would be managed through control of fugitive dust and would be smaller than that under the Cleanup to AOC LUT Values Alternative because the volume of soil that would be disturbed would be less (192,000 cubic yards).	**Valley fever** The potential for exposure of workers and the public to fungus spores would be the lowest among the action alternatives because the smallest volume of soil would be disturbed (148,000 cubic yards).
	Members of the public [d] *Hypothetical Onsite Suburban Resident* – Cancer risk and toxicity impacts from chemicals and/or radionuclides [d] in Area IV and the NBZ comparable to or less than those determined for background soil. *Hypothetical Onsite Recreational User* – Cancer risk and toxicity impacts from chemical and/or radionuclides [e] in Area IV and the NBZ are comparable to or less than those determined for background soil.	**Members of the public** Chemically and radioactively impacted soil exceeding AOC LUT values would be removed. Thereafter, risks to a hypothetical onsite suburban resident or recreational user would be less than those under the No Action Alternative.	**Members of the public** Chemically impacted soil exceeding revised LUT values would be removed, as would radioactively contaminated soil exceeding AOC LUT values. Thereafter, risks to a hypothetical onsite suburban resident or recreational user would be less than those under the Soil No Action Alternative, but more than those under the Cleanup to AOC LUT Values Alternative.	**Members of the public** Chemically and radioactively impacted soil exceeding risk assessment-based values would be removed. Thereafter, risks to a hypothetical onsite suburban resident or recreational user would be less than those under the Soil No Action Alternative, but more than those under the Cleanup to AOC LUT Values or Cleanup to Revised LUT Values Alternative.
Waste management	Very small quantities of waste from site maintenance activities may be annually generated, which would be transported to offsite waste management facilities with no impacts on the disposal capacities of these facilities.	LLW/MLLW – 91,000 cubic yards Hazardous waste – 49,000 cubic yards Nonhazardous waste – 793,000 cubic yards No exceedance of total waste capacity or a daily or annual waste acceptance limit is expected at any evaluated facility.	LLW/MLLW – 91,000 cubic yards Hazardous waste – 49,000 cubic yards Nonhazardous waste – 52,000 cubic yards No exceedance of total waste capacity or a daily or annual waste acceptance limit is expected at any evaluated facility.	LLW/MLLW – 47,000 cubic yards Hazardous waste – 49,000 cubic yards Nonhazardous waste – 52,000 cubic yards No exceedance of total waste capacity or a daily or annual waste acceptance limit is expected at any evaluated facility.
Cultural resources	No archaeological or architectural cultural resources would be affected. No adverse impacts are expected on traditional cultural resources.	Archaeological and architectural cultural resources would not be affected. During 10 years of soil removal, adverse impacts on the integrity of traditional cultural resources are possible from changes in setting, augmented site access during remediation, disturbance of landscape (130 acres), and potential discovery of unanticipated archaeological sites.	Archaeological and architectural cultural resources would not be affected. Adverse impacts on the integrity of traditional cultural resources are possible, similar to those under the Cleanup to AOC LUT Values Alternative, but of reduced likelihood. There would be reduced changes in setting because soil removal and site access would occur for slightly more than 2 years, with less disturbance of landscape (40 acres) and less soil removed, which would reduce the potential for discovery of unanticipated archaeological sites.	Archaeological and architectural cultural resources would not be affected. Adverse impacts on the integrity of traditional cultural resources are possible, similar to those under the Cleanup to Revised LUT Values Alternatives, but of reduced likelihood. There would be slightly reduced changes in setting because soil removal and site access would occur for 2 years, with less disturbance of landscape (32 acres) and less soil removed, which would further reduce the potential for discovery of unanticipated archaeological sites.

	Alternatives			
Resource Area	***Soil No Action***	***Cleanup to AOC LUT Values***	***Cleanup to Revised LUT Values***	***Conservation of Natural Resources***
Socioeconomics	No socioeconomic impacts on employment, businesses, infrastructure and municipal services, housing, or local government revenue are expected in Los Angeles and Ventura Counties. No traffic-related impacts are expected at offsite disposal facilities.	- Employment would increase by 25 workers for 10 years, with minor beneficial socioeconomic impacts. - Truck traffic in the SSFL vicinity would last for 10 years, but is not expected to have socioeconomic impacts on businesses on the evaluated routes between SSFL and major highways. - Traffic could damage road pavement along segments of the routes to major highways, which could affect government finances. DOE may need to negotiate with local governments to contribute its portion of the cost for maintenance and repair of affected roads. No other impacts on municipal services are expected. - Workers would be primarily employed from the SSFL ROI, with no impacts on housing availability. - Revenue from taxes from purchases of materials and fuel and rental of equipment, as well as permitting fees for project activities, could increase revenues for local governments during the 10 years of remediation. - Because of the small numbers of daily deliveries of soil to the evaluated radioactive and hazardous waste facilities, no socioeconomic impacts are expected on businesses near these facilities. For deliveries of nonhazardous soil to the evaluated facilities, no or minimal socioeconomic impacts are expected on businesses near these facilities. Disposal fees could increase revenues for public or private entities. Any adverse impacts may be reduced by shipping soil waste to multiple authorized disposal facilities, using multiple local routes (as available) to a disposal facility, or shipping waste by rail to rail-accessible facilities.	- Employment would increase by 25 workers for slightly more than 2 years, with minor beneficial socioeconomic impacts. - Truck traffic in the SSFL vicinity would last for slightly more than 2 years, but is not expected to have socioeconomic impacts on businesses on the evaluated routes between SSFL and major highways. - Same as the Cleanup to AOC LUT Values Alternative, except there would be fewer truck round trips, which would have a smaller potential for damage of road pavement. - Impacts on housing availability would be the same as those under the Cleanup to AOC LUT Values Alternative. - Potential funding impacts and benefits would be reduced compared to those under the Cleanup to AOC LUT Values Alternative because of the shorter operational duration of slightly more than 2 years. - Similar disposal facility impacts as those under the Cleanup to AOC LUT Values Alternative, except that there would be increased daily deliveries to evaluated radioactive and hazardous waste facilities, and significantly reduced daily and total deliveries to the evaluated nonhazardous waste facilities. There would be reduced disposal fees at the evaluated hazardous waste facilities. No socioeconomic impacts on businesses are expected from delivery of waste to any evaluated facility.	- Employment would increase by 25 workers for 2 years, with minor beneficial socioeconomic impacts. - Truck traffic in the SSFL vicinity would last for 2 years, but is not expected to have socioeconomic impacts on businesses on the evaluated routes between SSFL and major highways. - Same as under the Cleanup to Revised LUT Values Alternative, except there would be fewer truck round trips which would have a smaller potential for damage of road pavement. - Impacts on housing availability would be the same as those under the Cleanup to AOC LUT Values Alternative. - Potential funding impacts and benefits would be reduced compared to those under the Cleanup to Revised LUT Values Alternative because of the slightly shorter operational duration of 2 years. - Similar disposal facility impacts as those under the Cleanup to Revised LUT Values Alternative, except that shipments to radioactive waste facilities would be reduced, meaning that disposal fees that could provide revenues for public or private entities also would be reduced. No socioeconomic impacts on businesses are expected from delivery of waste to any evaluated facility.

	Alternatives			
Resource Area	***Soil No Action***	***Cleanup to AOC LUT Values***	***Cleanup to Revised LUT Values***	***Conservation of Natural Resources***
Environmental justice	- Potential risks to a hypothetical (after 100 years) onsite suburban resident or recreational user would be extremely low (see Human Health). No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI. - No traffic impacts above baseline conditions are expected in the SSFL ROI. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI. - No traffic impacts above baseline conditions are expected in the regional ROIs. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the regional ROIs.	- After remediation, potential risks to a hypothetical onsite suburban resident or recreational user would be extremely low. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI. - During the 10 years of soil removal, weekday traffic in the SSFL ROI would increase, but the evaluated routes would traverse minority and non-minority communities, as well as low-income and non-low-income communities, and would not pass through Native American lands. This indicates that traffic impacts on Native America, minority, or low-income populations would be the same as those experienced by the general population. No disproportionately high and adverse impacts are expected in the SSFL ROI. - There would be no noticeable increase in traffic in the vicinities of the disposal facilities evaluated for receipt of radiologically contaminated or hazardous soil, and no or minimal impacts in the vicinities of the facilities evaluated for receipt of nonhazardous soil. By using multiple disposal facilities or rail transport to rail-accessible facilities, traffic in the vicinities of the evaluated disposal facilities could be reduced. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the regional ROIs.	- Impacts on Native American tribes and minority and low-income populations in the SSFL ROI and in the vicinities of the disposal facilities would be similar to those under the Cleanup to AOC LUT Values Alternative, except that they would last for slightly more than 2 years. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations.	- Impacts on Native American tribes and minority and low-income populations in the SSFL ROI and in the vicinities of disposal facilities would be similar to those under the Cleanup to AOC LUT Values Alternative, except that they would last for 2 years. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations.

	Alternatives			
Resource Area	***Soil No Action***	***Cleanup to AOC LUT Values***	***Cleanup to Revised LUT Values***	***Conservation of Natural Resources***
Sensitive-aged populations	- No traffic impacts above baseline conditions are expected in the SSFL ROI, with no disparate impacts (markedly distinct impacts relative to those on the general population) on sensitive-aged populations. - No traffic impacts above baseline conditions are expected in the regional ROIs, with no disparate impacts on sensitive-aged populations.	- During the 10-year duration of soil removal, there could be an increased risk to pedestrians along or crossing Woolsey Canyon Road, but this risk would be experienced by persons of all ages. There is not expected to be a significantly larger population of sensitive-aged persons in the group that could experience this risk compared to groups of persons living elsewhere in the SSFL ROI. Traffic volumes, and therefore risks to pedestrians, along other evaluated routes are not expected to be noticeably larger than those under baseline conditions. No disparate impacts on sensitive-aged populations are expected in the SSFL ROI. - There would be no or minimal impacts due to increased traffic in the regional ROIs. Using multiple facilities or rail transport to rail-accessible facilities, traffic may be reduced along any route that may pass near a school or recreation area. No disparate impacts are expected on sensitive-aged populations in the regional ROIs.	- Impacts in the SSFL ROI would be similar to those under the Cleanup to AOC LUT Values Alternative, except that increased traffic would occur for slightly more than 2 rather than 10 years. - Compared to the Cleanup to AOC LUT Values Alternative, there would be larger traffic increases in the regional ROIs of radioactive and hazardous waste disposal facilities and smaller traffic increases in the regional ROIs of nonhazardous waste facilities. Increased traffic would occur for slightly more than 2 years. No disparate impacts are expected on sensitive-aged populations in the regional ROIs.	Impacts in the SSFL ROI would be similar to those under the Cleanup to AOC LUT Values Alternative, except that increased traffic would occur for 2 rather than 10 years. - Similar traffic increases in the regional ROIs for radioactive, hazardous, and nonhazardous waste disposal facilities as those under the Cleanup to Revised LUT Values Alternative, except that the increased traffic to each type of facility would be of shorter duration, with the longest duration being 2 years. No disparate impacts are expected on sensitive-aged populations in the regional ROIs.

ALARA = as low as reasonably achievable; AOC = *Administrative Order on Consent for Remediation*; BMP = best management practice; Boeing = The Boeing Company; CO = carbon monoxide; CO_2 = carbon dioxide; CMWD = Calleguas Municipal Water District; CNEL = community noise equivalent level; dBA = decibels A-weighted; ESAL = equivalent single axle load; LCF = latent cancer fatality; LLW = low-level radioactive waste; LOS = level of service; LUT = Look-Up Table; MLLW = mixed low-level radioactive waste; NBZ = Northern Buffer Zone; NO_X = nitrogen oxides; NPDES = National Pollutant Discharge Elimination System; ROI = region of influence; SO_2 = sulfur dioxide; VOC = volatile organic compound.

[a] "Proposed exemption areas" refers to areas that are identified for the protection of biological and cultural resources in accordance with the 2010 AOC (DTSC 2010a). DOE would not take action in the proposed exemption areas unless it is demonstrated that levels of chemical or radioactive constituents in the soil would pose a risk to human health or the environment, as determined using risk-based screening levels from the *Final Standardized Risk Assessment Methodology Revision 2 Addendum, Santa Susana Field Laboratory, Ventura County, California* (MWH 2014).

[b] Transportation risks are presented as whole numbers with the actual calculated values presented in parentheses. Values in parentheses that have a negative power of 10 are less than 1. The larger the negative value of 10, the smaller the number.

[c] Valley fever is the initial form of coccidioidomycosis infection, a fungal infection caused by inhalation of airborne *Coccidioides* spp. spores that are present in certain arid soils. Spores from the fungus are found in the top 2 to 12 inches of soil in many parts of arid United States southwest. When soil containing this fungus is disturbed by activities such as digging or by the wind, the fungal spores can get into the air (CDC 2014; HESIS 2013).

[d] Because members of the public would be restricted from accessing the site through fencing, signage, and routine patrols by site security personnel, and DOE's intent would be to prevent public access to the site, impacts calculated for the onsite suburban resident and recreational user under the Soil No Action Alternative are hypothetical.

[e] All impacts for soil constituents are based on the mean (for chemicals) or median (for radionuclides) concentration for all constituents that had one or more exceedances of the LUT values.

2.8.1.2 Potential Environmental Consequences of the Building Demolition Alternatives

Environmental consequences for each resource area are summarized in **Table 2–8** and evaluated for the Building No Action and Building Removal Alternatives.

Land resources. Under the Building No Action Alternative, the land use designation for Area IV and the NBZ would be consistent with Ventura County requirements. After removal of DOE-owned buildings, the remediated area would be consistent with the landowner's (Boeing's) intent to maintain its land as undeveloped open space (Boeing 2016b).

Under the Building Removal Alternative, if shipment of waste and backfill occurred over a 2- to 5-month period in each working year, the increased traffic could discourage weekday use of Sage Ranch Park. But if waste and backfill were instead shipped over a working year, the average daily traffic on Woolsey Canyon Road would increase by less than 1 percent, which would be unlikely to discourage weekday use of Sage Ranch Park. Traffic on roads (other than Woolsey Canyon Road) past other recreation areas in the SSFL vicinity may be reduced by routing traffic among multiple routes to major highways.

Electrical services to DOE-owned buildings would be severed under both the Building No Action and the Building Removal Alternatives, although electrical service to Area IV would remain. Electrical requirements for both alternatives would be minimal.

Although water use would be minimal under the Building No Action Alternative, about 315,000 gallons of water would be annually used (about 630,000 gallons total) under the Building Removal Alternative, primarily for dust control. As with the soil remediation action alternatives (see Section 2.8.1.1), DOE expects that the primary source of this water would be CMWD. Although the projected annual water use would represent about 0.0005 percent of CMWD's combined imported and local water supply, water use is an important consideration because of California's current drought conditions and Governor Brown's Executive Order requiring a statewide 25 percent reduction in potable water use (CA EO 2015).Water use may be reduced using measures such as surfactants.

Under the Building No Action Alternative, DOE-owned buildings could dilapidate over time, decreasing aesthetics and onsite visual quality but likely not resulting in substantial additional adverse impacts compared to baseline conditions. Under the Building Removal Alternative, there would be potential impacts on onsite visual quality during the 2 years of building demolition, but long-term improvements to visual quality due to removal of existing buildings and restoration and revegetation of affected areas.

Geology and soils. No or minimal impacts are expected on bedrock geologic resources. Under the Building No Action Alternative, although there would be restrictions on access to potential sources of aggregate at Area IV, impacts on bedrock geologic resources are minimal because the potential for minable aggregate resources is low. No impacts are expected on paleontological resources, and no activities would take place in zones where earthquake-induced landslides could occur that could cause a risk to workers. No impacts are expected from soil erosion.

Under the Building Removal Alternative, no adverse impacts are expected on bedrock geologic resources. Minimal potential impacts on paleontological resources are expected during building removal because the buildings are located in the Upper Chatsworth Formation, which has a low potential for paleontological resources (see Section 2.8.1.1).

Soil erosion during building removal activities would be minimized using BMPs as summarized in Chapter 6. However, in the periods between building removal and completion of site stabilization, disturbed soil could erode, leading to reductions in soil quality and functional capability within eroded areas. Because most of the area to be disturbed is currently occupied by buildings or asphalt, soil quality and functional capability within potentially eroded areas would likely be already reduced compared to that before development of Area IV.

Up to 13,500 cubic yards of backfill would be required with chemical and radioactive constituents in concentrations meeting prescribed values (e.g., AOC LUT, revised LUT, or risk-assessment-based values). Loss of soil function is possible if the backfill is not of equal soil quality, including regenerative structures, organic carbon, seed bank, and beneficial soil organisms, as that for current soil at Area IV. As noted above, some degradation of soil quality and functional capability within the area to be disturbed has probably already occurred. In addition, although sources of soil for construction or other industrial applications are readily available regionally, backfill to be used at Area IV would need to contain very low concentrations of chemicals and radionuclides (e.g., meet AOC LUT, revised LUT, or risk-assessment-based values). As discussed in Section 2.8.1.1, a source of backfill with these characteristics has not been identified, and it appears unlikely that a source of backfill meeting chemical AOC LUT values can be found.

Surface water. Under the Building No Action Alternative, no changes are expected in surface water quality and velocity from baseline conditions, although sources of potential surface water contamination would remain. Under the Building Removal Alternative, no adverse short-term impacts are expected on water quality from stormwater runoff. This alternative would remove a potential source of surface water contamination. No increases in runoff quantity and velocity are expected that could impact SSFL or regional stormwater control capacity.

Groundwater. Under either the Building No Action or the Building Removal Alternative, no adverse impacts are expected on groundwater quality, and no substantial impacts are expected on groundwater quantity. The Building Removal Alternative may require dewatering of the basement of Building 4024 to enable safe demolition. If this occurs, up to 200,000 gallons of groundwater could be withdrawn from Area IV that would be managed by methods such as treatment (as needed) and onsite discharge.

Biological resources. Under the Building No Action Alternative, no adverse impacts are expected on vegetation and wildlife habitat and biota; aquatic and wetland habitats and biota; or threatened, endangered, or rare species. Removal of buildings under the Building Removal Alternative would not be expected to cause measurable loss of native plant and wildlife communities, although habitat would be lost for native wildlife species using the buildings for roosting or nesting, potentially disturbing species protected under the Migratory Bird Treaty Act. There would be offsetting potential beneficial impacts on native wildlife from elimination of habitat for nuisance species and creation of restored habitat after buildings are removed. If backfill meeting prescribed values (e.g., AOC LUT, revised LUT, or risk-assessment-based values) is substantially different than soil present before development of Area IV, it may not support restoration of vegetation similar to that previously present.

Wetlands or jurisdictional waters of the U.S. would not be directly impacted under the Building Removal Alternative. Existing drainage structures and impervious surfaces may be removed, but would be replaced by more natural drainage patterns. Indirect impacts from runoff would be minimized by use of BMPs and mitigation measures. Potential impacts on special-status animal species or their habitats would be short term, may be mitigated or avoided, and would be unlikely to result in take[32] of listed wildlife species. Adverse impacts on individuals of the Santa Susana tarplant could occur if they are established next to buildings at the time of demolition.

Air quality and climate. Compared to the Building No Action Alternative, under the Building Removal Alternative, emissions from Area IV of pollutants (such as VOCs, carbon monoxide, NO_X SO_2, and particulates) would increase, with nearly all particulate emissions arising from fugitive dust. Additional emissions would occur from on-road vehicles. A total of 1,800 to 3,900 metric tons of CO_2 would be emitted, primarily from vehicles. See Section 2.8.1.4 for an evaluation of the potential impacts of emissions from DOE activities, including compliance with air quality standards.

Noise. Under the Building Removal Alternative, noise emanating from Area IV would increase compared to that under the Building No Action Alternative. This increased noise is not expected to cause adverse impacts at the nearest residence to Area IV. Traffic would increase under the Building Removal Alternative compared to baseline conditions, but this increased traffic is not expected to result in adverse noise impacts along the evaluated routes between SSFL and major highways (see Section 2.8.1.1). Nonetheless, other than on Woolsey Canyon Road, traffic noise along roads affected by DOE activities may be reduced by routing truck traffic among multiple routes between SSFL and major highways.

Transportation. Under the Building No Action Alternative, very small quantities of radioactive and nonradioactive wastes may be annually generated as part of site maintenance activities. No impacts above baseline conditions are expected from incident-free transportation of this waste. No impacts above baseline conditions are expected from potential accidents involving shipments of waste, backfill, equipment, and supplies.

Under the Building Removal Alternative, potential impacts were evaluated as described in Section 2.8.1.1 for shipment of radioactive waste via a truck option and a truck/rail option. Under either option, no LCFs are expected among the transport crews or the population along the routes to the disposal facilities. In the event of a hypothetical accident during transport to the disposal facilities, no LCFs are expected among the population along the transport route after considering the risks from all possible accidents, ranging from minor fender-benders to severe accidents resulting in fires and/or release of radioactive material. The calculated risk of a fatality from a traffic accident due totally to the mechanical forces attendant to that accident (and independent of the cargo) would be much larger than the calculated risk of an LCF; still, no traffic fatalities among the population along the transport routes are expected.

In addition, potential impacts were evaluated for shipment of nonradioactive (hazardous and nonhazardous) waste, recyclable material, backfill, equipment, and supplies to or from SSFL. Shipment of this material was evaluated under the truck option (all nonradioactive waste, backfill, equipment, and supplies would be shipped by truck) and the truck/rail option (nonradioactive wastes would be shipped by truck from SSFL to an intermodal facility, and then by rail to disposal facilities; all backfill, recyclable material, equipment, and supplies would be shipped by truck). No traffic fatalities are expected among the population along the transport routes under either the truck or truck/rail option.

[32] Under the Endangered Species Act, "take" has a broad definition that includes "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct." Harassment is defined as actions that create the likelihood of injury to listed species to such an extent that significant disruption of normal behavior patterns could occur, including but not limited to, breeding, feeding, or sheltering. Harm is defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering.

Traffic. The Building Removal Alternative would result in increased traffic in the SSFL vicinity compared to the Building No Action Alternative. As with the soil remediation action alternatives (see Section 2.8.1.1), this EIS evaluated four potential routes between SSFL and major highways. (For comparative analysis purposes, it was assumed that each evaluated route would receive all traffic.)

The average daily traffic on Woolsey Canyon Road would increase by about 3.4 percent in 2017 and 5.3 percent in 2018, leading to possible weekday motorist delays on this road, assuming waste and backfill shipments occurred during a 2- to 5-month period in each year. Traffic increases on other evaluated roads would be smaller. Weekday average daily traffic increases on Woolsey Canyon Road would be reduced to less than 1 percent, with corresponding reductions on other roads, assuming waste and backfill were shipped throughout each working year. Except for Woolsey Canyon Road, traffic on the evaluated roads may be further reduced by distributing traffic among multiple routes between SSFL and major highways. Assuming waste and backfill shipments are made during a 2- to 5-month period in each year, the LOS for Woolsey Canyon Road could be reduced from a B rating to a C rating. No change in LOS rating would be expected if waste and backfill were shipped throughout each working year. LOS ratings for other roads are not expected to change.

Truck traffic under the Building Removal Alternative would impose about 5,200 ESALs on roads between SSFL and major highways, which is much less than the ESALs projected under the soil remediation action alternatives. Still, the increase in traffic would likely have some potential adverse impacts on road pavement, which may result in roads requiring repair sooner than currently anticipated.

Human health. Under the Building No Action and Building Removal Alternatives, public receptors would be protected from chemical or radiation exposure due to containment of chemical or radioactive material within buildings or under pavement, through the application of administrative controls that limit building access, and the use of engineering controls that prevent access (locked doors) and control the movement of materials (water sprays during demolition). Following building removal, there would be no impacts on an onsite suburban resident or onsite recreational user that would be attributable to the buildings. Any residual potential impacts would be associated with chemicals or radionuclides in the soil (see Section 2.8.1.1).

Workers would be protected though compliance with site procedures that implement DOE requirements for worker protection from industrial and radiological hazards and administrative controls, such as limiting time of exposure if necessary, to ensure workers do not exceed their annual dose limits. Worker protection practices would be employed so that doses are maintained below the DOE occupational exposure limits in accordance with ALARA principles.

Waste management. Very small quantities of waste from site maintenance activities may be annually generated under the Building No Action Alternative. This waste would be transported to offsite waste management facilities with no impacts on the disposal capacities of these facilities.

Under the Building Removal Alternative, total waste generation would consist of about 10,600 cubic yards of LLW or MLLW, 120 cubic yards of hazardous waste, and 1,220 cubic yards of nonhazardous waste (primarily consisting of demolition debris). About 3,540 cubic yards of recyclable material such as asphalt, concrete, or steel would be generated. These projections are conservative because they were made assuming all material from a DOE-owned building that had a history of radioactive material use would be sent to an authorized radioactive waste disposal facility.

All waste or material under either alternative would be sent to offsite facilities for recycle or disposal, consistent with facility authorizations and acceptance criteria. No exceedance of total capacity is expected at any facility potentially receiving recyclable material or waste from Area IV and the NBZ. No facility is expected to receive waste representing a significant fraction of any daily limit (e.g., tonnage per day) that may be imposed by permit.

Cultural resources. Under the Building No Action Alternative, DOE-owned buildings would be maintained in a safe condition, with no impacts on cultural resources. Under the Building Removal Alternative, no historic properties would be affected because no part of the built environment is considered significant under NHPA, NEPA, or CEQA definitions. Under both alternatives, potential sites of traditional religious and cultural importance would be protected because public access to Area IV and the NBZ would be controlled. No NRHP-eligible archaeological sites would be affected because none is known to be located in the vicinities of the DOE buildings. Demolition under the Building Removal Alternative would be monitored, however, by a cultural resource specialist and a Native American monitor. DOE is consulting with SHPO, the Santa Ynez Band of Chumash Indians, and the SSFL Sacred Sites Council to develop an NRHP Section 106 agreement document that is expected to include stipulations and standard operating procedures for continued protection of traditional cultural resources and resolution of potential adverse impacts.

Socioeconomics. Under the Building No Action Alternative, no socioeconomic impacts on employment, regional truck traffic, infrastructure and municipal services, housing, and local government revenue are expected in Los Angeles and Ventura Counties. No traffic-related socioeconomic impacts are expected on businesses in the vicinities of the evaluated recycle and disposal facilities.

The Building Removal Alternative would employ 26 workers. Because of the large available labor force in Los Angeles and Ventura Counties, there would be only minor beneficial socioeconomics from this employment in these two counties and no impacts on housing availability. The increased heavy-duty truck traffic under this alternative is not expected to have socioeconomic impacts on businesses along the evaluated routes between SSFL and major highways. This increased traffic, however, could damage pavement along the routes used by the trucks that could result in increased expenses for local governments. Potential offsets for these increased expenses could include increased revenues from taxes on purchases of materials and fuel and rental of equipment, as well as permitting fees for project activities. No other impacts are expected on municipal services such as police or fire services. No noticeable increases in traffic volumes are expected at the evaluated recycle and disposal facilities, and no socioeconomic impacts are expected on businesses in the vicinities of these facilities.

Environmental justice. For persons in the SSFL ROI, the environmental justice analysis evaluated potential human health impacts as well as potential impacts of increased traffic due to the remediation activities. For persons in the ROIs of the evaluated recycle and disposal facilities, the environmental justice analysis evaluated the potential impacts of increased traffic within the facility vicinities. As with the soil remediation action alternatives (see Section 2.8.1.1), increased traffic was used as an indicator of several potentially detrimental traffic-related conditions that could adversely impact members of environmental justice communities.

Under the Building No Action Alternative, there would be no chemical or radiological impacts on members of the public. Under the Building Removal Alternative, there would be no onsite suburban resident during building demolition, and hypothetical exposures to a recreational user or site visitor would be minimized through controlled access to areas where building demolition occurred. Following building removal, there would be no impacts on an onsite suburban resident or recreational user that would be attributable to the buildings. Therefore, no high and disproportionate adverse impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI.

Under the Building No Action Alternative, no increases in traffic are expected in the SSFL and the regional ROIs above baseline conditions, with no disproportionately high and adverse impacts on Native American tribes and minority and low-income populations in these ROIs.

Under the Building Removal Alternative, the LOS of Woolsey Canyon Road could change from a B rating to a C rating, assuming waste and backfill were shipped during a 2-to 5-month period in each working year, but no change if shipments were made throughout each working year. There would be no change in the LOS of the other evaluated roads between SSFL and major highways. Evaluated routes would traverse minority and non-minority communities, as well as low-income and non-low-income communities, and would not pass through Native American lands. This indicates that traffic impacts on Native American, minority, or low-income populations would be the same as those experienced by the general population. Therefore, no disproportionately high and adverse traffic-related impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI.

Under the Building Removal Alternative, there would be no noticeable increase in heavy-duty truck traffic in the vicinities of the evaluated recycle and disposal facilities. Nonetheless, use of multiple disposal and recycle facilities or rail transport to rail-accessible facilities would reduce traffic in the vicinities of the evaluated facilities. Therefore, no disproportionately high and adverse impacts on Native American and minority and low-income populations are expected in the regional ROIs.

Sensitive-aged populations. Under the Building No Action Alternative, no increases in traffic above baseline conditions are expected in the SSFL ROI and the regional ROIs, so there would be no disparate impacts (that is, markedly distinct impacts relative to those on the general population) on sensitive-aged populations in these ROIs.

Under the Building Removal Alternative and assuming shipment of waste and backfill occurs over a 2- to 5-month period during each working year, there could be an increased risk to pedestrians along or crossing Woolsey Canyon Road, but this risk would be experienced by persons of all ages. It is not expected that there would be a significantly larger population of sensitive-aged persons in the group that could experience this risk compared to groups of persons living elsewhere in the SSFL ROI. Traffic volumes on Woolsey Canyon Road and all other evaluated roads in the SSFL vicinity would be reduced if waste and backfill were instead shipped throughout each working year. Furthermore, traffic volumes on all evaluated roads other than Woolsey Canyon Road could be reduced by using multiple routes between SSFL and major highway systems, which would reduce traffic on any evaluated road that may pass by or near a school or recreational area. Therefore, no disparate impacts on sensitive-aged populations are expected in the SSFL ROI.

Under the Building Removal Alternative, there would be no noticeable increase in heavy-duty truck traffic in the vicinities of the evaluated recycle and waste disposal facilities. Nonetheless, use of multiple recycle and disposal facilities or rail transport to rail-accessible facilities could reduce traffic through all communities in the regional ROIs. Therefore, no disparate impacts on sensitive-aged populations are expected in the regional ROIs.

Table 2–8 Summary of Potential Environmental Consequences under the Building Demolition Alternatives

Resource Area	*Alternatives*	
	Building No Action	***Building Removal***
Land resources	- The land use designation for Area IV would be consistent with Ventura County requirements. - No impacts on use of Sage Ranch Park or other recreation areas in the SSFL vicinity are expected. - Electrical service to DOE-owned buildings would be severed, but electrical service in Area IV would remain. Electrical and water requirements would continue to be minimal. - No short-term changes to the aesthetics and visual quality of Area IV are expected, but DOE-owned buildings could dilapidate over time, decreasing aesthetics and visual quality.	- After removal of DOE-owned buildings, the remediated area would be consistent with the landowner's (Boeing's) intent to maintain its land as undeveloped open space (Boeing 2016b). - If waste and backfill were shipped over a 2- to 5-month period in each working year, the average daily traffic on Woolsey Canyon Road would increase by up to 5.3 percent which could discourage weekday use of Sage Ranch Park. But if waste and backfill were shipped throughout each working year, the average daily traffic on Woolsey Canyon Road would increase by less than 1 percent, which would be unlikely to discourage weekday use of Sage Ranch Park. No impacts on the use of other recreation areas in the SSFL vicinity are expected; nonetheless, traffic on other roads past other recreation areas may be reduced by routing truck traffic among multiple routes between SSFL and major highways. - Annual electricity requirements would be minimal. About 315,000 gallons of water from CMWD would be annually used during 2 years. Although this annual water use would represent about 0.0005 percent of CMWD's annual supply, water use is an important consideration because of California's current drought conditions and Governor Brown's call for a statewide 25 percent reduction in potable water use (CA EO 2015). - There would be impacts on views of Area IV during the 2 years of building demolition, but long-term improvements to Area IV visual quality from returning the area to a stabilized, revegetated state.
Geology and soils	No impacts on geologic and paleontological resources are expected and no worker activities would take place in zones where earthquake-induced landslides could occur. No impacts from soil erosion or loss of soil function are expected, and there would be no need for backfill obtained from offsite sources.	- No adverse impacts are expected on bedrock geologic resources. - Minimal impacts are expected on paleontological resources during building removal. - No risks to workers are expected from potential earthquake-induced landslides, because building removal would occur outside of zones where such landslides could occur; however, in the event of an earthquake there could be a risk to demolition workers resulting from building collapse. - Soil erosion would be minimized using BMPs as summarized in Chapter 6. However, in the period between building removal and completion of site stabilization efforts, disturbed soil could erode, leading to some reduction of soil quality and functional capability within eroded areas. Because most of the area to be disturbed is currently occupied by buildings or asphalt, soil quality and functional capability within potentially eroded areas would likely be already reduced compared to that before development of Area IV. - Up to 13,500 cubic yards of backfill would be required with chemical and radioactive constituents in concentrations meeting prescribed values (e.g., AOC LUT, revised LUT, or risk-assessment-based values).[a] Loss of soil function is possible if the backfill is not of equal soil quality, including the presence of regenerative structures, organic carbon, seed bank, and beneficial soil organisms, as that for current soil at Area IV. Because most of the area to be disturbed is currently occupied by buildings or asphalt, soil quality and functional capability would likely be already reduced compared to that before development of Area IV.
Surface water resources	No changes in surface water quality and stormwater runoff quantity and velocity from baseline conditions are expected. Sources of potential surface water contamination would remain.	During building demolition, no adverse impacts on surface water quality are expected from stormwater runoff. Sources of potential surface water contamination would be removed. No increases in runoff quantity and velocity are expected that could overwhelm SSFL or regional stormwater control capacities.
Groundwater resources	No adverse impacts on groundwater quality and quantity are expected.	No adverse impacts are expected on groundwater quality. This alternative may require dewatering of the basement of Building 4024 to enable safe demolition. If this occurs, up to 200,000 gallons of groundwater could be withdrawn from Area IV that would be managed by methods such as treatment (as needed) and onsite discharge.

	Alternatives	
Resource Area	***Building No Action***	***Building Removal***
Biological resources	No adverse impacts on vegetation and wildlife habitat and biota; aquatic and wetland habitats and biota; or threatened, endangered, or rare species are expected.	- Removal of buildings would not be expected to cause measureable loss of native plant and wildlife communities, although habitat would be lost for native wildlife species using the buildings for roosting or nesting, with potential disturbance of MBTA-protected species. There would be offsetting beneficial impacts on native wildlife from elimination of habitat for nuisance species and creation of restored habitat after the buildings are removed. If backfill is substantially different from soil present before development of Area IV, it may not support restoration of vegetation similar to that previously present. - Wetlands or jurisdictional waters of the U.S. would not be directly impacted. Existing drainage structures and impervious surfaces may be removed, but replaced by more natural drainage patterns. Indirect impacts from runoff would be minimized by use of BMPs and mitigation measures. - Impacts on special-status animal species or their habitats would be short-term, may be mitigated or avoided, and would be unlikely to result in take of listed wildlife species. Adverse impacts on individual Santa Susana tarplants could occur if they are established next to buildings at the time that demolition occurs. No other special-status plant species are likely to be impacted because none have been observed or would be expected in the already disturbed areas adjacent to the buildings.
Air quality and climate	No emissions of airborne pollutants, including greenhouse gases, above baseline conditions are expected.	Emissions of pollutants such as VOCs, CO, NOx, SO_2, and particulates would occur from onsite activities, with nearly all particulate emissions arising from fugitive dust; additional emissions would occur from vehicles, including those transporting waste and backfill. A total of 1,800 to 3,900 metric tons of CO_2 would be emitted, primarily from vehicles.
Noise	No noise impacts above baseline conditions from onsite activities or from traffic to and from SSFL are expected.	Noise levels at the closest residence to Area IV are expected to be well below 65 dBA CNEL, with no expected adverse noise impacts. No adverse noise impacts are expected from traffic along the evaluated routes between SSFL and major highways Time-averaged daily noise levels at a distance of 100 feet from the evaluated roads could increase by up to 3.5 dBA CNEL, where the final noise level would be below 65 dBA CNEL (the threshold for an adverse impact is an increase of 5 dBA CNEL). Along one section of Valley Circle Boulevard, where the noise level already exceeds 65 dBA CNEL, the noise level would increase by no more than 0.6 dBA (the threshold for an adverse impact when the final noise level exceeds 65 dBA CNEL is an increase of 3 dBA CNEL).
Transportation [b]	No impacts above baseline conditions are expected.	**Shipment of radioactive waste – truck option** [b] Shipments – 1,030 truck shipments *Incident-free risks:* - Crew LCFs: 0 (5×10^{-5} to 1×10^{-4}) - Population LCFs: 0 (1×10^{-5} to 3×10^{-5}) *Accident risks:* - Population LCFs: 0 (5×10^{-11} to 6×10^{-10}) - Traffic fatalities: 0 (6×10^{-3} to 4×10^{-2}) **Shipment of radioactive waste – truck/rail option** [b] Shipments – 1,030 truck shipments from SSFL to an intermodal facility, then 65 rail shipments *Incident-free risks:* - Crew LCFs: 0 (2×10^{-5} to 4×10^{-5}) - Population LCFs: 0 (2×10^{-5}) *Accident risks:* Population LCFs: 0 (4×10^{-11}) Traffic fatalities: 0 (3×10^{-2})

Resource Area	Alternatives	
	Building No Action	***Building Removal***
Transportation [b] **(cont'd)**		**Shipment of nonradioactive waste, backfill, equipment, and supplies** [b] *Truck option:* - 1,400 truck shipments of waste, backfill, equipment, and supplies - Traffic fatality risks: 0 (2.3×10^{-3}) *Truck/rail option:* - 130 truck shipments of hazardous/nonhazardous waste from SSFL to an intermodal facility, and then 10 rail shipments; plus 1,260 truck shipments of recyclable material, backfill, equipment, and supplies Traffic fatality risks: 0 (7.0×10^{-3})
Traffic	No increases in average daily traffic or LOS on roads in the SSFL vicinity are expected, with no traffic-induced damage to road pavement.	The weekday average daily traffic on Woolsey Canyon Road would increase by about 3.4 percent in the first year of the project and 5.3 percent in the second, leading to potential weekday motorist delays on this road, assuming waste and backfill shipments occurred during a 2- to 5-month period in each working year. Traffic increases on other evaluated roads would be smaller. Increases in weekday average daily traffic on Woolsey Canyon Road could be reduced to less than 1 percent, with corresponding reductions on other roads, assuming waste and backfill shipments were made throughout each working year. Except for Woolsey Canyon Road, traffic on the evaluated roads may be further reduced by distributing traffic among multiple routes between SSFL and major highways. Assuming waste and backfill shipments are made during 2 to 5 months in each year, the LOS for Woolsey Canyon Road could change from a B rating to a C rating. No change in LOS rating would be expected if waste and backfill shipments were made throughout each working year. LOS ratings for other roads are not expected to change. Truck traffic would impose about 5,200 ESALs on the evaluated routes between SSFL and major highways. This increased traffic would likely have some adverse impacts on road pavement, so that the affected roads may require repair sooner than currently anticipated.
Human health	**Workers** Exposures from monitoring and maintenance activities would be minimal. Workers would be protected from radiation exposure and industrial hazards through compliance with DOE requirements for worker safety and radiation protection. **Members of the public** No impacts are expected because access to the buildings would be restricted.	**Workers** Conservatively assuming no reduction in exposure as D&D progresses, impacts would be: *Individual worker* - Dose: 240 millirem per year - Project LCF risk: 1 in 10,000 *Worker population* - Total Dose: 12.5 person-rem - Project LCFs: 0 (0.003) Building demolition workers would be protected from radiation exposure and industrial hazards through compliance with DOE requirements for worker safety and radiation protection. **Members of the public** No impacts are expected during building removal. Following building removal, there would be no impacts attributable to the buildings to a hypothetical onsite suburban resident or recreational user. Any residual impacts would be associated with chemicals or radionuclides in the soil (see Section 2.8.1.1).
Waste management	Very small quantities of waste from site maintenance activities may be annually generated, which would be transported to offsite waste management facilities with no impacts on the disposal capacities of these facilities.	LLW/MLLW – 10,600 cubic yards Hazardous waste – 120 cubic yards Nonhazardous waste – 1,220 cubic yards Recyclable material – 3,540 cubic yards No exceedance of total waste capacity or a daily or annual waste acceptance limit is expected at any evaluated facility.

	Alternatives	
Resource Area	***Building No Action***	***Building Removal***
Cultural resources	No archaeological or architectural cultural resources would be affected. No adverse impacts are expected on traditional cultural resources.	No adverse effects are expected on archaeological or architectural cultural resources; nor would adverse impacts be expected on traditional cultural resources.
Socioeconomics	No socioeconomic impacts on employment, regional truck traffic, infrastructure and municipal services, housing, and local government revenue are expected in Los Angeles and Ventura Counties. No socioeconomic impacts are expected on businesses in the vicinities of the offsite recycle and disposal facilities.	- Building removal would employ 26 workers with minor beneficial socioeconomic impacts. - Increased traffic during 2 years of building demolition is not expected to have socioeconomic impacts on businesses along the evaluated routes between SSFL and major highways. - Road pavement deterioration would increase expenses for local governments. DOE may need to negotiate with local governments to contribute its portion of the cost for maintenance and repair of affected roads. No other impacts are expected on municipal services such as police or fire services. - Because workers would be primarily employed from Los Angeles and Ventura Counties, workers would already be living in the ROI and would not need new housing. Therefore, there would be no impacts on housing availability. - Potential increased expenses for local governments in the SSFL ROI due to pavement deterioration could be countered by potential increased tax revenues due to purchases of materials and fuel and rental of equipment, as well as permitting fees for project activities. - No noticeable increases in traffic volumes are expected at the evaluated recycle and disposal facilities, with no expected socioeconomic impacts on businesses in the regional ROIs.
Environmental justice	No human health impacts are expected on members of the public. There would be no increases in traffic above baseline conditions in the SSFL and regional ROIs, and thus, no additional traffic-related impacts. Therefore, no disproportionately high and adverse impacts are expected on Native American tribes and minority or low-income populations in the SSFL ROI and the regional ROIs.	- No impacts are expected on members of the public during building removal; following building removal, there would be no impacts on an onsite suburban resident or recreational user that would be attributable to the buildings. Therefore, no high and disproportionate adverse impacts are expected on Native American tribes and minority or low-income populations in the SSFL ROI. - Traffic in the SSFL ROI would increase, but the evaluated routes between SSFL and major highways would traverse minority and non-minority communities, as well as low-income and non-low-income communities, and would not pass through Native American lands. This indicates that traffic impacts on Native American, minority, or low-income populations would be the same as those experienced by the general population. Therefore, no disproportionately high and adverse traffic-related impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI. - There would be no noticeable increase in heavy-duty truck traffic in the vicinities of the evaluated recycle and disposal facilities. Nonetheless, use of multiple facilities or rail transport to rail-accessible facilities would reduce truck traffic in the vicinities of the evaluated facilities. Therefore, no disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the regional ROIs.

Resource Area	*Alternatives*	
	Building No Action	***Building Removal***
Sensitive-aged populations	There would be no increases in traffic above baseline conditions in the SSFL ROI or the regional ROIs, and thus, no disparate impacts (markedly distinct impacts relative to those on the general population) are expected on sensitive-aged populations.	- Assuming shipment of waste and backfill occurs during a 2- to 5-month period in each working year, there could be an increased risk to pedestrians along or crossing Woolsey Canyon Road, but this risk would be experienced by persons of all ages. Traffic volumes could be reduced by instead shipping waste and backfill throughout each working year, and, on other than Woolsey Canyon Road, by using multiple routes between SSFL and major highway systems, thereby reducing traffic on any evaluated road that may pass by or near a school or recreation area. Therefore, no disparate impacts on sensitive-aged populations are expected in the SSFL ROI. - There would be no noticeable increase in heavy-duty truck traffic in the vicinities of the evaluated recycle and waste disposal facilities. Nonetheless, use of multiple recycle and disposal facilities or rail transport to rail-accessible facilities could reduce traffic through communities or locations (e.g., schools, recreation areas) where sensitive-aged populations may be present along the transit routes. Therefore, no disparate impacts are expected on sensitive-aged populations in the regional ROIs.

AOC = *Administrative Order on Consent for Remediation*; BMP = best management practice; Boeing = The Boeing Company; CO = carbon monoxide; CO_2 = carbon dioxide; CMWD = Calleguas Municipal Water District; CNEL = Community Noise Equivalent Level; D&D = decontamination and decommissioning; dBA = decibels A-weighted; ESAL = equivalent single axle load; LCF = latent cancer fatality; LLW = low-level radioactive waste; LOS = level of service; LUT = Look-Up Table; MBTA = Migratory Bird Treaty Act; MLLW = mixed low-level radioactive waste; NOx = nitrogen oxide; ROI = region of interest; SO_2 = sulfur dioxide; VOC = volatile organic compound.

[a] Estimates of backfill volume range from 8,140 cubic yards to 13,500 cubic yards (see Appendix D); the larger estimate (13,500 cubic yards) was used for analysis in this EIS.

[b] Transportation and human health population risks are presented as whole numbers with the actual calculated values presented in parentheses. Values in parentheses that have a negative power of 10 are less than 1. The larger the negative value of 10, the smaller the number.

2.8.1.3 Potential Environmental Consequences of the Groundwater Remediation Alternatives

Environmental consequences for each resource area are summarized in **Table 2–9** and evaluated for the Groundwater No Action, Groundwater Monitored Natural Attenuation, and Groundwater Treatment Alternatives.

Land resources. Under the Groundwater No Action Alternative, the land use designation for Area IV and the NBZ would be consistent with Ventura County requirements. No change in land use designation would result from implementing either groundwater remediation action alternative.

Compared to the Building No Action Alternative, traffic from DOE activities would minimally increase under the Groundwater Monitored Natural Attenuation Alternative, with a somewhat larger increase under the Groundwater Treatment Alternative. This increased traffic would not restrict access to, or impact activities at, Sage Ranch Park or other recreation areas in the SSFL vicinity.

Annual electrical requirements would be minimal. Water use would be minimal under the Groundwater No Action Alternative. About 5,000 gallons of water from CMWD would be used for well installation under the Groundwater Monitored Natural Attenuation Alternative, and about 8,000 gallons would be used under the Groundwater Treatment Alternative. Water use under either action alternatives would occur during a single year and would not exceed 1×10^{-5} percent of CMWD's combined imported and local water supply.

Under the Groundwater Monitored Natural Attenuation and Groundwater Treatment Alternatives, there would be potential visual impacts during well installation, bedrock removal, or groundwater treatment system installation and operation. After completion of well installation or groundwater treatment system installation and operation, views at Area IV would be similar to baseline conditions.

Geology and soils. Under both the Groundwater No Action and Groundwater Monitored Natural Attenuation Alternatives, there would be no impacts on bedrock geologic and paleontological resources. There would be no need for backfill obtained from offsite sources. No activities would take place in zones where earthquake-induced landslides could occur that could cause risks to workers. There would be no expected soil erosion or loss of soil function under the Groundwater No Action Alternative and minimal potential, during well installation, of soil erosion and loss of soil function under the Groundwater Monitored Natural Attenuation Alternative.

Under the Groundwater Treatment Alternative, there could be a loss of about 1,050 cubic yards of subsurface bedrock, but excavation of this bedrock is not expected to impact paleontological resources. There would be minimal risk of soil loss due to erosion, although loss of soil function could occur at some locations during the installation of groundwater treatment systems, including overland piping, and during the subsequent 5 years of treatment system operation. About 1,280 cubic yards of backfill with chemical and radioactive constituents in concentrations meeting prescribed values (e.g., AOC LUT, revised LUT, or risk-assessment-based values) would be required. As discussed in Section 2.8.1.1, a source of backfill with these characteristics has not been identified and it appears unlikely that a source of backfill meeting chemical AOC LUT values can be found.

No activities would take place in zones where earthquake-induced landslides could occur that could cause risks to workers.

Surface water. Under the Groundwater No Action Alternative, no changes from baseline conditions are expected on surface water quality and stormwater runoff quantity or velocity. Under the groundwater remediation action alternatives, no adverse short-term impacts are expected on surface water quality and, over the long term, sources of potential surface water contamination would be eliminated. The time required to eliminate these sources would be much shorter under the Groundwater Treatment Alternative than that under the Groundwater No Action or Groundwater Monitored Natural Attenuation Alternative. No adverse impacts are expected on SSFL or regional stormwater control capacity.

Groundwater. Under the Groundwater No Action and Groundwater Monitored Natural Attenuation Alternatives, groundwater quality would gradually improve as chemical and radioactive constituents in the groundwater attenuate or decay. Groundwater sampling and analysis may be more extensive under the Groundwater Monitored Natural Attenuation Alternative to confirm the progress of the attenuation and decay processes. As part of current groundwater monitoring operations, about 250 gallons per year of groundwater are withdrawn from Area IV (Groundwater No Action Alterative). This water is collected and shipped offsite to a permitted wastewater treatment facility in accordance with its waste acceptance criteria. These withdrawals may slightly increase under the Groundwater Monitored Natural Attenuation Alternative.

Groundwater quality under the Groundwater Treatment Alternative would improve in less time than that under the Groundwater No Action or Groundwater Monitored Natural Remediation Alternative.

Biological resources. Under the Groundwater No Action Alternative, minor potential adverse impacts on vegetation and wildlife habitat and biota could occur from groundwater monitoring operations. No adverse impacts are expected on aquatic and wetland habitats and biota or threatened, endangered, or rare species.

Under the Groundwater Monitored Natural Attenuation alternative, because installation of five additional wells would likely occur in previously disturbed areas, potential impacts on vegetation and wildlife habitat and biota would be minor and localized. No adverse impacts from well installation are expected on aquatic and wetland habitats and biota, or on threatened, endangered, or rare species outside of the proposed exemption areas. If a monitoring well were installed in a proposed exemption area, BMPs and mitigation measures would be used to avoid or minimize adverse impacts on threatened, endangered, or rare species. Monitoring operations under the Groundwater Monitored Natural Attenuation Alternative would be essentially the same as those under the Groundwater No Action Alternative, with the same potential for minor adverse impacts on vegetation and wildlife habitat and biota and no impacts on aquatic and wetland habitats and biota or threatened, endangered, or rare species.

Under the Groundwater Treatment Alternative, installation and operation of groundwater treatment units would generally be in previously disturbed areas with localized and minor potential impacts on vegetation and wildlife habitat and biota. Removal of sandstone bedrock near the RMHF could affect up to 0.25 acres of previously disturbed ground with localized and minor impacts on vegetation and wildlife habitat and biota. No substantial adverse impacts from treatment unit installation and operation or removal of bedrock are expected on aquatic and wetland habitats and biota. Installation and operation of groundwater treatment units and removal of bedrock are not expected to cause significant impacts on threatened, endangered, or rare species.

Air quality and climate. Under the Groundwater No Action Alternative, no emissions of airborne pollutants including greenhouse gases are expected above baseline conditions. Under the Groundwater Monitored Natural Attenuation Alternative, very minor emissions of airborne pollutants would occur as part of well installation and groundwater monitoring. Under the Groundwater Treatment Alternative, there would be emissions of pollutants (including particulates) from bedrock removal and treatment system installation activities, as well as from on-road vehicles. A total of 180 to 360 metric tons of CO_2 would be emitted, primarily from vehicles. See Section 2.8.1.4 for a discussion of the potential impacts of emissions from DOE activities including compliance with air quality standards.

Noise. Compared to the Groundwater No Action Alternative, under both groundwater action alternatives there would be a slight increase in noise emanating from Area IV. This slightly increased noise would be sporadic and would not cause adverse noise impacts at the nearest residence. Traffic noise would be barely above baseline conditions under the Groundwater Monitored Natural Attenuation Alternative. Truck traffic would be larger under the Groundwater Treatment Alternative than that under the Groundwater Monitored Natural Attenuation Alternative, including 15 deliveries of equipment in heavy-duty trucks and 211 shipments of excavated bedrock and backfill. Under either groundwater remediation action alternative, the increased traffic is not expected to result in adverse noise impacts along the evaluated routes between SSFL and major highways.

Transportation. Under the Groundwater No Action Alternative, very small quantities of radioactive and nonreactive wastes may be annually generated as part of site maintenance activities. No impacts above baseline conditions are expected from incident-free shipment of radioactive waste. No impacts are expected from potential accidents involving shipments of waste and other materials.

Potential impacts were evaluated under the Groundwater Monitored Natural Attenuation Alternative for shipment of nonhazardous waste and purge and well installation water from SSFL, as well as for shipment of equipment and supplies to SSFL. No fatalities are expected along the routes used for waste and material transport due to possible traffic accidents.

Similar to the analysis in Section 2.8.1.1, potential impacts from shipment of radioactive waste under the Groundwater Treatment Alternative were evaluated for a truck option and a truck/rail option. Under either option, no LCFs are expected among the transport crew or the population along the routes to the disposal facilities. In the event of a hypothetical accident during transport, no LCFs are expected among the population along the transport route, considering the risks from all possible accidents. The calculated risk of a facility from a traffic accident due totally to the mechanical forces attendant to an accident would be much larger than the calculated risk of an LCF; still, no traffic fatalities among the population along the transport routes are expected.

In addition, potential impacts were evaluated for shipment by truck of hazardous and nonhazardous wastes, backfill, equipment, and supplies to or from SSFL. No traffic fatalities are expected among the population along the transport routes.

Traffic. Compared to the Groundwater No Action Alternative, the Groundwater Monitored Natural Attenuation Alternative would result in slightly increased traffic in the SSFL vicinity. The weekday average daily traffic on Woolsey Canyon Road would increase (during 1 year) by about 0.16 percent, with smaller increases during other years and on other evaluated roads between SSFL and major highways. LOS ratings for the evaluated roads would stay the same, and there would be no damage to road pavement. Traffic volumes would be larger under the Groundwater Treatment Alternative, but these increased volumes would be temporary, with the largest increase occurring over less than a year. During this year, weekday average daily traffic on Woolsey Canyon Road would increase by about 0.36 percent, with smaller increases during other years and on other evaluated roads. There would be minimal potential for damage to road pavement, and the traffic increases would not change the LOS rating for any evaluated road.

Human health. Under all alternatives, no impacts are expected on a hypothetical future onsite suburban resident because the pumping rate of site groundwater wells is about 0.5 to 1 gallon per hour (CDM Smith 2015a), which would be insufficient for residential use. Well water use by a recreational user is not expected. Considering the slow movement of Area IV groundwater and the concentrations of chemicals and radionuclides, no impacts on offsite members of the public are expected because groundwater migration is not expected to reach offsite receptors prior to decay below screening levels.

Under all alternatives, workers would be protected from chemical and radiation exposure through implementation of DOE regulations (e.g., 10 CFR Parts 835 and 851) and DOE Orders developed to ensure protection of worker health and safety. Under the Groundwater No Action and Groundwater Monitored Natural Attenuation Alternatives, workers would perform routine monitoring and maintenance activities. Under the Groundwater Treatment Alternative, workers would install and operate groundwater treatment systems and remove a limited quantity of radioactively contaminated bedrock. Worker protection practices would be employed so that doses are below DOE occupational exposure limits and conform to ALARA principles. Removal of the bedrock would result in higher radiation doses to involved workers than other groundwater remediation activities. The Groundwater No Action Alternative and the action alternatives could pose an industrial safety risk to workers, but no total recordable cases or days away from work, restricted duty, or transfer to another job cases are expected under any alternative.

Waste management. Consistent with current site monitoring activities, about 250 gallons of purge water would be annually generated under the Groundwater No Action Alternative. This purge water would be transported to an offsite permitted wastewater treatment plant with no impacts on the capacity of this facility.

Installation of 5 wells under the Groundwater Monitored Natural Attenuation Alternative would generate about 10 cubic yards of well cuttings and about 5,000 gallons of well installation water. It was assumed that the well cuttings would be transported by truck to a nonhazardous waste facility and the well installation water to a permitted wastewater treatment facility, consistent with waste acceptance criteria. Under the Groundwater Treatment Alternative, about 1,700 cubic yards of LLW consisting of contaminated bedrock would be sent off site. In addition, it was assumed that operation of water treatment units at Area IV would require periodic replacement of water treatment media, which was further assumed to contain hazardous constituents requiring disposal as hazardous waste. A total of 20,000 pounds of media may be replaced during 5 years of water treatment operations, with a total media volume of about 26 cubic yards.

All waste under all alternatives would be sent to offsite facilities consistent with facility authorizations and acceptance criteria. No exceedance of total waste capacity is expected at any evaluated facility potentially receiving waste from Area IV. No facility is expected to receive waste containing a significant fraction of any daily limit (e.g., tonnage per day) that may be imposed by permit.

Cultural resources. No archaeological or architectural cultural resources would be affected under any of the groundwater remediation alternatives. No adverse impacts on traditional cultural resources are expected under the Groundwater No Action Alternative. Under the Groundwater Monitored Natural Attenuation and Groundwater Treatment Alternatives, changes to setting are possible from installation of monitoring wells and from installation and operation of groundwater treatment equipment. Aboveground groundwater treatment equipment would be removed after groundwater remediation was complete.

Socioeconomics. Under all groundwater remediation alternatives, no socioeconomic impacts are expected in Los Angeles and Ventura Counties regarding employment, regional truck traffic, infrastructure and municipal services, housing availability, or local government revenue. No traffic-related socioeconomic impacts are expected at the evaluated disposal facilities.

Environmental justice. Under all groundwater remediation alternatives, no impacts on members of the public are expected. Thus, no disproportionate impacts are expected on Native American and minority and low-income populations in the SSFL ROI.

Under all groundwater remediation alternatives, there would be no noticeable increases in traffic along the evaluated routes between SSFL and major highways or in heavy-duty truck traffic in the vicinity of any evaluated disposal facility. Therefore, no disproportionately high and adverse impacts on Native American and minority and low-income populations are expected in the SSFL ROI or the regional ROIs.

Sensitive-aged populations. Under all groundwater remediation alternatives, there would be no noticeable increases in traffic along the evaluated routes between SSFL and major highways or in heavy-duty truck traffic in the vicinity of any evaluated disposal facility. Therefore, no disparate impacts (that is, markedly distinct impacts relative to those on the general population) on sensitive-aged populations are expected in the SSFL ROI or the regional ROIs.

Table 2–9 Summary of Potential Environmental Consequences under the Groundwater Remediation Alternatives

Resource Area	*Alternatives*		
	Groundwater No Action	***Groundwater Monitored Natural Attenuation***	***Groundwater Treatment***
Land resources	- The land use designation for Area IV and the NBZ would be consistent with Ventura County requirements. - No impacts on use of Sage Ranch Park or other recreation areas in the SSFL vicinity are expected. - Electrical and water requirements would continue to be minimal. - There would be no change in Area IV aesthetics and visual quality from baseline conditions.	- No change is expected in land use designation. - The minimal additional traffic would not restrict access to, or impact activities at, Sage Ranch Park or other recreation areas in the SSFL vicinity. - Electricity requirements would be minimal. A total of 5,000 gallons of water from CMWD would be used during installation of 5 monitoring wells, which would represent about 9×10^{-6} percent of CMWD's annual supply. - There would be visual impacts during well installation due to views of drill rigs and supporting equipment. These impacts would occur for less than 1 year. Monitoring activities would not alter Area IV aesthetics or visual quality compared to baseline conditions.	- No change is expected in land use designation. - Traffic volumes would be larger than those under the Groundwater Monitored Natural Attenuation Alternative, but would not restrict access to, or impact activities at, Sage Ranch Park or other recreation areas in the SSFL vicinity. - Electricity requirements would be minimal. A total of 8,000 gallons of water from CMWD would be used for dust suppression during bedrock removal, which would represent about 1×10^{-5} percent of CMWD's annual supply. - There would be visual impacts during groundwater treatment system construction and operation due to the presence of water storage tanks, treatment units and other structures, and overland piping. These impacts would occur during 0.5 years of treatment system installation followed by 5 years of treatment system operation. Long-term views at Area IV would be similar to baseline conditions.
Geology and soils	No impacts on geologic (bedrock) and paleontological resources are expected. No activities would take place in zones where earthquake-induced landslides could occur. No soil erosion or loss of soil function is expected from well monitoring activities, and there would be no need for backfill obtained from offsite sources.	Same as the Groundwater No Action Alternative, except there would be a minimal potential for soil erosion and loss of soil function during well installation.	- Loss of 1,050 cubic yards of subsurface bedrock. - No impacts are expected on paleontological resources. - No activities would take place in zones where earthquake-induced landslides could occur. - Minimal risk of soil loss due to erosion. - Loss of soil function may occur at some treatment system locations during the installation of groundwater treatment systems, including overland piping, and during the subsequent projected 5 years of treatment system operations. - About 1,280 cubic yards of backfill would be required with chemicals and radionuclides in concentrations meeting prescribed values (e.g., AOC LUT, revised LUT, or risk-assessment-based values).
Surface water resources	No short-term changes from baseline conditions on surface water quality are expected, although there would be a long-term reduction of sources of potential surface water contamination. No change from baseline conditions on stormwater runoff quantity and velocity are expected.	No adverse impacts on surface water quality during well installation and well monitoring. Long-term reduction of sources of potential surface water contamination. No adverse impacts on SSFL or regional stormwater control capacities are expected.	No adverse impacts on surface water quality during treatment system installation and operation. The time required to eliminate sources of potential surface water contamination would be much shorter than that under the Groundwater Monitored Natural Attenuation Alternative. No adverse impacts on SSFL or regional stormwater control capacities are expected.

Resource Area	*Alternatives*		
	Groundwater No Action	***Groundwater Monitored Natural Attenuation***	***Groundwater Treatment***
Groundwater resources	No additional adverse impacts on groundwater quality are expected. Groundwater quality would improve over time as chemical and radioactive constituents attenuate or decay. There would be no requirement to withdraw site groundwater above baseline conditions.	Same impacts on groundwater quality as the Groundwater No Action Alternative. There could be slightly increased withdrawals of Area IV groundwater as part of groundwater monitoring operations.	No adverse impacts groundwater quality or quantity are expected on. Positive impacts on water quality would result from removal of contamination sources or treatment of groundwater.
Biological resources	Minor adverse impacts on vegetation and wildlife habitat and biota would occur from groundwater monitoring operations. No adverse impacts on aquatic and wetland habitats and biota or threatened, endangered, or rare species are expected.	Five new wells would be installed. Because these wells would be installed generally in previously disturbed areas, impacts on vegetation and wildlife habitat and biota from periodic groundwater sampling would be minor and localized. No adverse impacts on aquatic and wetland habitats and biota are expected. If a monitoring well was installed in a proposed exemption area, BMPs and mitigation measures would avoid or minimize adverse impacts of well installation and monitoring on threatened, endangered, or rare species; no adverse impacts on these species are expected from monitoring activities outside the proposed exemption areas.	Impacts on vegetation and wildlife habitat and biota would be larger than those under the Groundwater Monitored Natural Attenuation Alternative, but nonetheless localized and minor. Installation of groundwater treatment systems would generally be in previously disturbed habitats, with localized and minor impacts. Assuming sandstone bedrock containing strontium-90 source is removed, up to 0.25 acre of previously disturbed land near RMHF would be affected. No adverse impacts are expected on aquatic and wetland habitats and biota. Potential impacts on threatened, endangered, or rare species would be minimal as described under the Groundwater Monitored Natural Attenuation Alternative.
Air quality and climate	No emissions of airborne pollutants, including greenhouse gases, above baseline conditions are expected.	Minor quantities of pollutants such as VOCs, CO, NOx, SO_2, and particulates would be emitted during monitoring well installation and groundwater monitoring, and from on-road vehicles. Minimal emissions of CO_2 are expected.	Small quantities of VOCs, CO, NOx, SO_2, and particulates would be emitted during bedrock removal and treatment system installation. Additional emissions would occur from on-road vehicles. A total of 180 to 360 metric tons of CO_2 would be emitted, primarily from vehicles.
Noise	No noise impacts above baseline conditions from onsite activities or from traffic to and from SSFL are expected.	Noise levels at the closest residence could increase slightly compared to those under the Groundwater No Action Alternative, but are still expected to be well below 65 dBA CNEL, with no adverse noise impacts. There could be 11 heavy-duty truck round trips distributed over a working year, with no expected adverse traffic-related noise impacts.	Noise levels from onsite activities at the closest residence could slightly increase compared to those under the Groundwater Monitored Natural Attenuation Alternative, but are still expected to be well below 65 dBA CNEL, with no adverse noise impacts (i.e., incremental noise increases would be below the threshold of 5 dBA CNEL).

	Alternatives		
Resource Area	***Groundwater No Action***	***Groundwater Monitored Natural Attenuation***	***Groundwater Treatment***
Transportation [a]	No impacts above baseline conditions are expected.	**Shipment of nonhazardous waste, equipment, and supplies** [a, b] Shipments – 280 shipments by truck. Traffic fatality accident risks – 0 (1.5×10^{-4})	**Shipment of radioactive waste – truck option** [a] Shipments – 130 truck shipments *Incident-free risks:* - Crew LCFs: 0 (6×10^{-6} to 1×10^{-5}) - Population LCFs: 0 (2×10^{-6} to 4×10^{-6}) *Accident risks:* - Population LCFs: 0 (7×10^{-12} to 8×10^{-11}) - Traffic fatalities: 0 (8×10^{-4} to 5×10^{-3}) **Shipment of radioactive waste – truck/rail option** [a] Shipments – 130 truck shipments from SSFL to an intermodal facility, then 10 rail shipments *Incident-free risks:* - Crew LCFs: 0 (2×10^{-6} to 3×10^{-6}) - Population LCFs: 0 (2×10^{-6} to 3×10^{-6}) *Accident risks:* - Population LCFs: 0 (5×10^{-12}) - Traffic fatalities: 0 (4×10^{-3}) **Shipment of nonradioactive waste, backfill, equipment, and supplies** [a] *Truck option:* - 420 truck shipments - Traffic fatality risks: 0 (0.015) *Truck/rail option:* Not applicable. All shipments are by truck.
Traffic	No increases in average daily traffic or LOS on roads in the SSFL vicinity are expected, with no traffic-induced damage to road pavement.	The weekday average daily traffic on Woolsey Canyon Road would increase by 0.16 percent during 1 year. Traffic increases on other roads and during other years when shipments could occur would be smaller. No traffic-related impacts are expected. LOS ratings would not change for any evaluated road. No noticeable increase in ESALs would occur on the evaluated roads between SSFL and major highways, with no damage to road pavement.	The weekday average daily traffic on Woolsey Canyon Road would increase by 0.36 percent during 1 year. Traffic increases on other roads and during other years when shipments could occur would be smaller. No traffic-related impacts are expected. LOS ratings would not change for any evaluated road. Truck traffic would impose about 990 ESALs on the evaluated roads between SSFL and major highways, with minimal potential for damage to road pavement.

	Alternatives		
Resource Area	***Groundwater No Action***	***Groundwater Monitored Natural Attenuation***	***Groundwater Treatment***
Human health	**Worker** There would be no impacts on workers solely attributable to continuation of the current groundwater monitoring program; workers could receive a radiation dose from buildings and soil from monitoring and maintenance activities.	**Worker** Same as the Groundwater No Action Alternative.	**Worker** Workers would receive a radiation dose from excavation of contaminated bedrock. *Individual worker* - Dose: 130 millirem - Project LCF risk: 1 in 100,000 *Worker population* - Total Dose: 0.7 person-rem - Project LCFs: 0 (5×10^{-5}) Workers would be protected from industrial hazards and radiation exposure through compliance with DOE requirements for worker safety and radiation protection.
	Members of the public No impacts on a hypothetical future onsite suburban resident or recreational user are expected because groundwater wells do not produce sufficient water for residential use, and well water use by a recreational user is not expected. Considering the slow movement of Area IV groundwater and the concentrations of chemicals and radionuclides, no impacts on offsite members of the public are expected because groundwater migration is not expected to reach offsite receptors prior to decay below screening levels.	**Members of the public** Same as the Groundwater No Action Alternative.	**Members of the public** Same as the Groundwater No Action Alternative.
Waste management	No impacts are expected on the capacity of the permitted wastewater treatment plant that would receive approximately 250 gallons of purge water annually from Area IV.	Nonhazardous waste – 10 cubic yards Well development water – 5,000 gallons Monitoring purge water – 250 gallons/year No exceedance of total waste capacity or a daily or annual waste acceptance limit is expected at any evaluated facility.	LLW/MLLW – 1,700 cubic yards [c] Hazardous waste – 26 cubic yards [c] No exceedance of total waste capacity or a daily or annual waste acceptance limit is expected at any evaluated facility.

Resource Area	*Alternatives*		
	Groundwater No Action	***Groundwater Monitored Natural Attenuation***	***Groundwater Treatment***
Cultural resources	No archaeological or architectural cultural resources would be affected. No adverse impacts on traditional cultural resources are expected.	Archaeological and architectural cultural resources likely would not be affected. Regarding traditional cultural resources, changes to setting are possible from installation of five additional monitoring wells.	Archaeological and architectural cultural resources likely would not be affected. Regarding traditional cultural resources, changes to setting are possible during installation and operation of groundwater treatment systems and strontium-90 source removal.
Socioeconomics	No socioeconomic impacts on employment, regional truck traffic, infrastructure and municipal services, housing, and local government revenue are expected in Los Angeles and Ventura Counties. No socioeconomic impacts on businesses in the vicinities of the offsite waste management facilities are expected.	Minimal beneficial socioeconomic impacts from worker employment and purchases of equipment and supplies. There would be no socioeconomic impacts on businesses in the SSFL vicinity and no damage to pavement from additional traffic that could increase expenses for local governments.	Minimal beneficial socioeconomic impacts from worker employment and purchases of equipment and supplies. There would be no socioeconomic impacts on businesses in the SSFL vicinity and minimal damage to pavement from additional traffic that could increase expenses for local governments.
Environmental justice	No impacts on the health of members of the public are expected. There would be no increases in traffic above baseline conditions in the SSFL and regional ROIs, and thus, no additional traffic-related impacts. No disproportionate impacts on Native American tribes and minority and low-income populations are expected in the SSFL ROI or regional ROIs.	- No impacts on the health of members of the public are expected. Therefore, no disproportionately high and adverse impacts on Native American tribes and minority and low-income populations in the SSFL ROI are expected. - Because the increase in average daily traffic on the evaluated roads in the SSFL vicinity is very small (much less than 1 percent), no traffic impacts are expected. No disproportionately high and adverse impacts on Native American tribes and minority and low-income populations in the SSFL ROI are expected. - There would be no noticeable increase in truck traffic in the vicinity of any facility receiving waste under this alternative, with no expected traffic impacts. No disproportionately high and adverse impacts on Native American tribes and minority and low-income populations in the regional ROIs are expected.	- No impacts on the health of members of the public are expected. Therefore, no disproportionately high and adverse impacts on Native American tribes and minority and low-income populations in the SSFL ROI are expected. - The increase in average daily traffic on the evaluated roads in the SSFL vicinity would be slightly greater than that under the Groundwater Monitored Natural Attenuation Alternative, but the peak-year increase would still average less than 1 percent, with no expected traffic impacts. Therefore, no disproportionately high and adverse impacts on Native American tribes and minority and low-income populations in the SSFL ROI are expected. - There would be no noticeable increase in truck traffic in the vicinity of any facility receiving waste under this alternative, with no expected traffic impacts No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the regional ROIs.

	Alternatives		
Resource Area	***Groundwater No Action***	***Groundwater Monitored Natural Attenuation***	***Groundwater Treatment***
Sensitive-aged populations	There would be no increases in traffic above baseline conditions in the SSFL ROI and the regional ROIs, and thus, no additional traffic-related impacts. No disparate impacts (markedly distinct impacts relative to those on the general population) on sensitive-aged populations are expected.	- Because the increase in average daily traffic on the evaluated roads is very small (much less than 1 percent), no disparate impacts are expected on sensitive-aged populations in the SSFL ROI. - There would be no noticeable increase in truck traffic in the vicinities of disposal facilities, with no disparate impacts expected on sensitive-aged populations in the regional ROIs.	- The increase in average daily traffic on the evaluated roads would be slightly greater than that under the Groundwater Monitored Natural Attenuation Alternative, but the peak-year increase in average daily traffic would still be less than 1 percent. No disparate impacts are expected on sensitive-aged populations in the SSFL ROI. - There would be no noticeable increase in truck traffic in the vicinity of any facility receiving waste under this alternative, with no disparate impacts expected on sensitive-aged populations in the regional ROIs.

AOC = *Administrative Order on Consent for Remediation*; BMP = best management practice; CO = carbon monoxide; CO_2 = carbon dioxide; CMWD = Calleguas Municipal Water District; CNEL = community noise equivalent level; dBA = decibels A-weighted; ESAL = equivalent single axle load; LCF = latent cancer fatality; LLW = low-level radioactive waste; LOS = level of service; LUT = Lookup Table; MLLW = mixed low-level radioactive waste; NBZ = Northern Buffer Zone; NOx = nitrogen oxides; RMHF = Radioactive Materials Handling Facility; ROI = region of influence; SO_2 = sulfur dioxide; VOC = volatile organic compound.

[a] Transportation risks are presented as whole numbers with the actual calculated values presented in parentheses. Values in parentheses that have a negative power of 10 are less than 1. The larger the negative value of 10, the smaller the number.

[b] Wastes generated under the Groundwater Monitored Natural Attenuation Alternative consist of very small quantities of cuttings from monitoring well installation and water from well installation and sampling that are shipped by truck only. These wastes are not expected to be classified as low-level or mixed low-level radioactive waste, but if determined otherwise when generated, would be safely transported to appropriate authorized or permitted facilities for disposition.

[c] These volumes reflect conservative estimates of waste generation considering the range of groundwater treatment technologies that may be implemented in the future.

2.8.1.4 Potential Environmental Consequences of Combined Action Alternatives

This section addresses potential impacts for each resource area, assuming (1) implementation of six possible combinations of action alternatives, as summarized in the text box below, and (2) each combination includes *one* soil remediation action alternative, *one* building demolition action alternative, and *one* groundwater remediation action alternative (also see below).

Action Alternative Combination	Designation
Cleanup to AOC LUT Values + Building Removal + Groundwater Monitored Natural Attenuation	–
Cleanup to AOC LUT Values + Building Removal + Groundwater Treatment	Action Alternative Combination with the Largest Environmental Consequences (High Impact Combination)
Cleanup to Revised LUT Values + Building Removal + Groundwater Monitored Natural Attenuation	–
Cleanup to Revised LUT Values + Building Removal + Groundwater Treatment	–
Conservation of Natural Resources + Building Removal + Groundwater Monitored Natural Attenuation	Action Alternative Combination with the Smallest Environmental Consequences (Low Impact Combination)
Conservation of Natural Resources + Building Removal + Groundwater Treatment	–

AOC = *Administrative Order on Consent for Remedial Action*; LUT = Look-Up Table.

For most resource areas, the largest potential impacts (e.g., most waste generated, most truck round trips) are associated with the combination of the Cleanup to AOC LUT Values, Building Removal, and Groundwater Treatment Alternatives. This combination of action alternatives is termed the "High Impact Combination." Conversely, for most resource areas, the smallest impacts are associated with the combination of the Conservation of Natural Resources, Building Removal, and Groundwater Monitored Natural Attenuation Alternatives. This combination of action alternatives is termed the "Low Impact Combination." To avoid repetition, these terms are used as a shorthand way to refer to the above combinations of action alternatives. However, for those resource areas where the largest and smallest potential impacts are not necessarily encompassed by these combinations of action alternatives, the applicable combination is specified and evaluated.

The suite of groundwater treatment technologies to be implemented would be determined independently from this EIS by means of a RCRA Corrective Measures Study (see Section 2.6). Because the results of this Corrective Measures Study are yet to be determined, this EIS evaluates the potential impacts that could occur during groundwater remediation activities assuming the implementation of those technologies planned for inclusion in the Corrective Measure Study that would result in the largest potential impacts. In addition, DOE could decide to implement both groundwater remediation action alternatives (the Groundwater Monitored Natural Attenuation and Groundwater Treatment Alternatives) rather than one alternative or the other. In this event, the potential impacts for some resource areas could be slightly larger than those under the High Impact Combination (which includes potential impacts from the Groundwater Treatment Alternative, but not the Groundwater Monitored Natural Attenuation Alternative). These potential incremental impacts are addressed as appropriate in the following subsections.

Land resources. Land resources were evaluated for land use at Area IV and the NBZ, access to recreation areas in the SSFL ROI, Area IV infrastructure, and Area IV and NBZ aesthetics and visual quality.

Land use. No combination of action alternatives would cause a change in land use designation; after remediation, Area IV and the NBZ would be compatible with the landowner's (Boeing's) intent to maintain its land as undeveloped open space (Boeing 2016b).

Recreation. The High Impact Combination would result in average daily heavy-duty truck round trips ranging over 12 years from about 8 to 48. The weekday average daily traffic on Woolsey Canyon Road would conservatively increase by 3.4 to 5.3 percent during the first 2 years, by 7.3 percent to 7.6 percent during the next 9 years, and by 5.6 percent during the final year. There would be smaller increases in traffic on other evaluated roads. Traffic would not be noticeably increased if both groundwater remediation action alternatives were implemented.

The Low Impact Combination would result in heavy-duty truck traffic that would primarily occur over 4 years. The average daily truck trips during these years would range from about 8 to 47, and the average daily traffic on Woolsey Canyon Road would increase by 3.5 to 7.4 percent. There would be smaller increases in traffic on other evaluated roads. There would be minor increases in average daily traffic in subsequent years (e.g., less than 0.1 percent on Woolsey Canyon Road), primarily due to shipments of monitoring well purge water and environmental monitoring samples.

Under all action alternative combinations, motorists could experience or perceive delays in using Woolsey Canyon Road to access Sage Ranch Park, which could reduce its weekday use during the years of site remediation. Increased traffic, however, would occur for about three times as many years under the High Impact Combination as those under the Low Impact Combination. Except for Woolsey Canyon Road, traffic on any evaluated road that may pass a recreation area in the SSFL vicinity could be reduced by distributing truck traffic among the four evaluated routes between SSFL and major highways.

Infrastructure. Annual electrical requirements would be minimal under all combinations of action alternatives.

CMWD is the expected source for water for remediation activities such as dust suppression. Over 12 years, about 41 million gallons of water would be used under the High Impact Combination. The maximum annual water use would be about 4.0 million gallons, representing about 0.007 percent of CMWD's current imported and local water supply. If both groundwater remediation action alternatives were implemented, both the maximum annual and total water use would increase by about 5,000 gallons. Over 4 years, about 8.6 million gallons of water would be used under the Low Impact Combination. The maximum annual water use would be about 4.0 million gallons, again representing about 0.007 percent of CMWD's combined imported and local water supply.

Under any combination of action alternatives, water use is important because of California's current drought conditions and Governor Brown's Executive Order requiring a statewide 25 percent reduction in potable water use (CA EO 2015). Water use may be potentially reduced through measures such as using surfactants to assist in dust control.

*Aesthetics and visual quality***.** Over all combinations of action alternatives, all DOE-owned buildings and considerable quantities of soil would be removed. Soil would be backfilled on excavated areas and re-graded and re-contoured as necessary, and disturbed areas would be stabilized and revegetated. During remediation operations, onsite views at Area IV and the NBZ would be degraded. In the long term, stabilization and revegetation of affected areas would introduce a new surface texture and color in areas that were previously barren and improve onsite aesthetics and visual quality.

Geology and soils. Excavation of 1,050 cubic yards of subsurface bedrock was assumed under action alternative combinations that include the Groundwater Treatment Alternative (such as the High Impact Combination). Excavation of this bedrock would have minimal potential adverse impacts on bedrock geologic resources.

Under any combination of action alternatives, there would be minimal potential impacts on paleontological resources (i.e., loss of fossils) because the Santa Susana Formation where these resources largely occur is mostly located within the proposed exemption areas. Nonetheless, potential impacts on paleontological resources would likely be largest under action alternative combinations that include the Cleanup to AOC LUT Values Alternative and smallest for action alternative combinations that include the Conservation of Natural Resources Alternative. Outside of the proposed exemption areas, about 1 acre of land containing chemical or radioactive constituents exceeding AOC LUT values overlies the Santa Susana Formation, but less than 0.1 acre of land containing chemical (but no radioactive) constituents exceeding risk-assessment-based values overlies the Santa Susana Formation.

There could be risks to workers remediating soil in some locations at Area IV and the NBZ that are within zones where earthquake-induced landslides could occur. Buildings are not in areas of landslide risk, but bedrock assumed to be removed under the Groundwater Treatment Alternative is on the edge of a geologic hazard zone. Potential risks to workers from landslides would be largest under the High Impact Combination and smallest under the Low Impact Combination (because of the lesser extent of soil remediation and no bedrock removal). DOE would minimize risks to workers by implementing the 2010 AOC (DTSC 2010a) exemption process for certain areas if, during the planning and design of soil remediation activities, it was determined that excavating soil in these areas would present unacceptable risks. Seismic shaking can also pose a risk to workers removing buildings. Risks to workers due to proximity to structures that could collapse due to seismic shaking would be the same under all action alternative combinations. These risks would not be affected if DOE implemented both groundwater remediation action alternatives.

About 138 acres of land outside the proposed exemption areas would be disturbed under the High Impact Combination, while about 40 acres outside the proposed exemption areas would be disturbed under the Low Impact Combination. Disturbed land would primarily include areas where buildings and pavement are removed and soil is remediated. Although potential impacts from soil erosion would be minimized using BMPs, as summarized in Chapter 6, rainstorms could result in soil erosion, leading to a reduction of soil quality and functional capability within eroded areas.

About 715,000 cubic yards of backfill from offsite sources may be required under the High Impact Combination. The quality of this backfill for biological activity, filtration, and vegetation support may be less than that of current soil at Area IV and the NBZ, in which case the backfill would be less able to support growth of vegetation similar to that present before development of Area IV. Sources for this large quantity of backfill, containing chemical and radioactive constituents in concentrations less than AOC LUT values and of comparable quality, have not been located, and it appears unlikely that a source of backfill meeting chemical AOC LUT values can be found (see Section 2.3.3.1). As noted in Section 2.3.2, if a source of backfill that meets all of the AOC LUT values cannot be reasonably found, then DTSC, DOE, and EPA would enter into a consultation process, and DTSC would determine the best available source of backfill (DTSC 2010a).

About 125,000 cubic yards of backfill from offsite sources may be required under the Low Impact Combination. This backfill would need to be of comparable quality to that of current soil at

Area IV and the NBZ and contain chemical and radioactive constituents in concentrations that meet risk-assessment-based values. DOE has not identified and evaluated potential sources of backfill to determine whether it would meet constituent concentration values consistent with risk-assessment-based values. However, because the allowable constituent concentrations in backfill under this combination of action alternatives would generally be higher than AOC LUT values, DOE expects that finding acceptable sources of backfill would be more likely.

Surface water. The High Impact Combination would have the greatest potential for impacts on surface water, primarily because of the large area of disturbed land (138 acres). The Low Impact Combination would have the smallest potential for impacts on surface water because it would have the least soil disturbance (40 acres) and would result in the least potential for soil erosion that could increase sediment levels in runoff. The Groundwater Monitored Natural Attenuation Alternative would have less potential for soil erosion than the Groundwater Treatment Alternative because it would disturb less soil that is currently shielded from erosion by vegetation when compared to the excavation and earthmoving actions required under the Groundwater Treatment Alternative. If DOE implemented both groundwater remediation action alternatives, the potential for soil disturbance would be essentially the same as that from implementing the Groundwater Treatment Alternative alone.

Under any combination of action alternatives, the BMPs and minimization measures described in Chapter 6 would be implemented to filter sediments and other contaminants from surface water runoff and limit increases in runoff velocity and volume. Except possibly for scenarios where an unusually large rainstorm occurs in the interval between soil excavation and revegetation of disturbed areas, coupled with exceedance of the stormwater control system capacity, no impacts are expected on surface water quality on site and in regional waterways or on SSFL or regional stormwater control capacities. To forestall the risks of potential impacts under these scenarios, DOE would evaluate mitigation measures; these measures could including requiring that, in areas excavated to bedrock, excavation and backfill activities be completed prior to or following the typical rainfall of December through May. DOE would also construct additional stormwater retention structures (such as catch basins or retention basins) and/or implement additional erosion control measures if runoff studies indicate the NPDES stormwater control system design capacity would be exceeded.

Implementing any combination of action alternatives would result in a long-term improvement in surface water resources at Area IV and its vicinity because a potential source of surface water contamination would be removed.

Groundwater. The combination of action alternatives with the largest positive impact on groundwater quality, in the shortest time frame, would be the High Impact Combination. Nearly all of the positive impact would result from implementation of the Groundwater Treatment Alternative. Although the Building Removal Alternative would be considered under all combinations of action alternatives, the Area IV buildings are not a source of chemicals or radionuclides to groundwater. Although the Cleanup to AOC LUT Values Alternative would remove more chemical constituents in soil than the Cleanup to Revised LUT Values or Conservation of Natural Resources Alternative, and the Cleanup to AOC LUT Values and Cleanup to Revised LUT Values Alternatives would remove more radioactive constituents in soil than the Conservation of Natural Resources Alternative, there would be little difference expected among the soil removal action alternatives in terms of potential positive impacts on groundwater. The added benefit to groundwater cleanup from soil removal is relatively low because the most highly impacted soil has already been removed. There would be no adverse impacts on groundwater from soil removal. The Low Impact Combination would have a comparable positive impact on groundwater quality, but this positive impact would be achieved over a much longer time frame.

If both groundwater remediation action alternatives were implemented, the advantageous features of monitored natural attenuation would be combined with other technologies employing active measures to remediate groundwater. The source of the water used for site remediation activities is expected to be CMWD.

Biological resources. The High Impact Combination would have the largest overall potential impacts. Although the soil remediation action alternatives would each have substantial potential impacts on biological resources, the largest would occur under the Cleanup to AOC LUT Values Alternative. Vegetation and wildlife habitat and soil would be removed from about 130 acres of land outside the proposed exemption areas, including about 51 acres of relatively undisturbed native habitat (including coast live oak woodland, northern mixed chaparral, and Venturan coastal scrub). This activity would cause profound disturbance to affected areas and require a substantial, focused, and prolonged effort to achieve revegetation and restoration of habitat, including replacement of removed soil with soil similar in parent material, texture, and nutrient status; collection and propagation of native plants including oaks and shrubs; and several years of maintenance, weed control, and monitoring until the vegetation is self-sustaining.

Building removal would occur in previously disturbed habitats with low to moderate potential impacts on biological resources. Native species of birds and bats that roost or nest in the buildings would lose these sites when the buildings are removed. However, direct impacts on nesting or roosting species could be avoided or minimized through a combination of seasonal timing of demolition activities to avoid seasons when nesting is occurring, humane hazing of individuals within the buildings prior to demolition (e.g., by human activity in proximity to perching birds, inducing them to leave), and measures to prevent their reentry until demolition is complete. If listed species such as Santa Susana tarplant are established in proximity to buildings, direct impacts could be minimized by surveys and avoidance where possible. (No other sensitive plant species are expected in the approximately 8.4 acres of highly disturbed habitat adjacent to the buildings to be removed.) Unavoidable impacts on individual tarplants could be mitigated by salvage of seed, propagation, and replanting as part of restoration activities following demolition.

Compared to the Groundwater Monitored Natural Attenuation Alternative, there would be greater surface disturbance under the Groundwater Treatment Alternative through the assumed emplacement and operation of treatment units and excavation of subsurface bedrock; however, potential impacts on threatened, endangered, or rare species would likely be avoidable due to the localized nature of the activities, the small areas affected, and the proximity of well sites to existing access roads and disturbed areas. If both groundwater remediation action alternatives were implemented, surface disturbance would be essentially the same as that under the Groundwater Treatment Alternative alone.

The Low Impact Combination would have the smallest overall potential impacts. The Conservation of Natural Resources Alternative would remove vegetation and wildlife habitat from about 32 acres outside the proposed exemption areas, which is about 25 percent of the disturbed acreage under the Cleanup to AOC LUT Values Alternative and 8 acres less than the disturbed acreage under the Cleanup to Revised LUT Values Alternative. The Conservation of Natural Resources Alternative would have far fewer potential impacts on vegetation and wildlife habitat and biota, wetland and aquatic habitats and biota, and threatened, endangered, or rare species than the Cleanup to AOC LUT Values Alternative, and also fewer impacts than the Cleanup to Revised LUT Values Alternative. Potential impacts under the Building Removal Alternative have been summarized above. Impacts on these resources under the Groundwater Monitored Natural Attenuation

Alternative would be smaller than those under the Groundwater Treatment Alternative, but either groundwater action alternative would have comparatively low impacts on biological resources, and the differences between the groundwater action alternatives in terms of biological impacts are modest.

Air quality and climate. The air quality analysis evaluated three combinations of action alternatives that would result in the highest potential impacts: (1) the Cleanup to AOC LUT Values, Building Removal, and Groundwater Treatment Alternatives; (2) the Cleanup to Revised LUT Values, Building Removal, and Groundwater Treatment Alternatives; and (3) the Conservation of Natural Resources, Building Removal, and Groundwater Treatment Alternatives. Emissions under the Groundwater Monitored Natural Attenuation Alternative were not quantitatively estimated because this alternative would generate very low emissions, and the Groundwater Treatment Alternative represents worse-case emissions for either groundwater remediation action alternative. Emissions presented in this section for the three combinations of action alternatives would be slightly smaller if the Groundwater Monitored Natural Attenuation Alternative were implemented under any action alternative combination, and slightly larger if both groundwater remediation action alternatives were implemented.[33]

Projected emissions were evaluated relative to air quality conditions within three air domains and their applicable Federal, state, and local air pollution standards and regulations. These domains are:

- Ventura County and the area directly adjacent to SSFL, which are within the South Central Coast Air Basin;
- South Coast Air Basin, which includes portions of Los Angeles County; and
- regions beyond Ventura County and the South Coast Air Basin, spanning several air basins and jurisdictional agencies.

For criteria pollutants where an evaluated domain is in attainment of the National Ambient Air Quality Standards (NAAQS), annual emissions were compared to the EPA Prevention of Significant Deterioration threshold for new major sources (250 tons per year of a pollutant) as an indicator of the magnitude of projected potential air quality impacts. For criteria pollutants where an ROI does not attain or is in maintenance of a NAAQS, annual emissions were compared to the applicable pollutant threshold that requires a conformity determination for that region. For example, because Ventura County attains the NAAQS for all pollutants except ozone, emissions from proposed activities within this ROI were compared to the following annual emission thresholds: (1) 50 tons of VOCs and NOx; and (2) 250 tons of carbon monoxide, SO_2, particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), and particulate matter less than 10 microns in diameter (PM_{10}). If emissions were determined to potentially exceed an EPA Prevention of Significant Deterioration or conformity threshold, further analysis was conducted to determine whether they would contribute to exceedance of an ambient air quality standard or conform to the approved State Implementation Plan.

[33] The term, "High Impact Combination" is not used in this subsection because the largest potential impacts are not necessarily encompassed by the combination of the Cleanup to AOC LUT Values, Building Removal, and Groundwater Treatment Alternatives. This is primarily because the main focus of the air impacts analysis is on comparison of emissions against annual emission thresholds and daily ambient air quality standards rather than total emissions. The term, "Low Impact Combination" is not used because the potential impacts from the Groundwater Monitored Natural Attenuation Alternative are negligibly small and are not addressed. Rather, the appropriate action alternative combinations are specified and evaluated. Three potential action alternative combinations are addressed to ensure comparison of the ranges in emissions from these combinations against the annual thresholds and daily standards.

Estimates were made of peak annual and peak daily emissions. Peak annual emissions from the combinations of action alternatives were compared to annual indicator emission thresholds for the three evaluated domains, whereas peak daily emissions were used to indicate the potential for an action alternative combination to contribute to an exceedance of an ambient air quality standard. The thresholds assumed for the air domain outside of Ventura County and the South Coast Air Basin include ranges of values that encompass air quality conditions within all regions traversed by the proposed truck trips.

Ventura County. Peak annual emissions under all three evaluated combinations of action alternatives would be well below the indicator emissions thresholds identified for Ventura County. There is also little difference in peak annual and peak daily emissions for the three evaluated combinations of action alternatives. For example, the ranges in annual emissions vary by no more than about 7 percent for VOCs, carbon monoxide, NOx, and SO_2 across the three evaluated combinations of action alternatives, by 35 percent for PM_{10}, and by 9 percent for $PM_{2.5}$. The projected elevated levels of PM_{10} emissions primarily result from fugitive dust from operation of equipment and trucks on unpaved surfaces and trucks on paved roads internal to SSFL. DOE would implement measures to control fugitive dust emissions (PM_{10} and $PM_{2.5}$) from the proposed activities, including measures to comply with Ventura County Air Pollution Control District Rule 55 (Fugitive Dust), which restricts emissions of fugitive dust from being visible beyond the property line of a source. Therefore, these controls and restrictions would ensure that emissions of fugitive dust from the combined action alternatives would not contribute to an exceedance of a PM10 ambient air quality standard at any offsite location.

South Coast Air Basin. For the South Coast Air Basin, the ranges in peak annual and daily emissions for the three evaluated combinations of action alternatives would be somewhat larger than those for the Ventura County ROI, but nonetheless reflect only minor differences in projected emissions. For example, considering both the nearby and distant disposal scenarios, the ranges in annual emissions vary by no more than about a factor of 2 for VOCs, carbon monoxide, NOx, and SO_2 across the three combinations of action alternatives, by 57 percent for PM_{10}, and by 50 percent for $PM_{2.5}$. None of the annual emissions would exceed the South Coast Air Basin indicator emission thresholds, except for NOx under the distant disposal site scenario. These emissions would occur intermittently from an average of up to 48 daily truck round trips and would extend over several miles of roads across the South Coast Air Basin. As a result, these emissions would be diluted in the atmosphere to the point that they would produce minimal ambient impacts in a localized area and would not contribute to an exceedance of an ambient air quality standard. For this same reason, these combined action alternatives also would produce minimal ambient impacts of hazardous air pollutants and toxic air contaminants within the South Coast Air Basin.

Outside Ventura County and the South Coast Air Basin. To define the worst-case indicator emission thresholds for the regions outside of Ventura County and the South Coast Air Basin, the most degraded air quality conditions were assumed for any area where trucks would travel between SSFL and offsite disposal facilities. Hence, the worst-case air quality conditions for the regions traversed by trucks to nearby (Buttonwillow site) and distant (NNSS or US Ecology in Idaho) disposal sites occur within the San Joaquin Valley Air Basin and the Mojave Desert Air Basin. For two of the three combinations of action alternatives (the Cleanup to Revised LUT Values, Building Removal, and Groundwater Treatment Alternatives and the Conservation of Natural Resources, Building Removal, and Groundwater Treatment Alternatives), peak annual emissions generated by truck travel between SSFL and the disposal facility locations would exceed these worst-case NOx emission thresholds. However, truck mileages driven solely within the San Joaquin Valley Air Basin and Mojave Desert Air Basin would produce emissions that would remain below their applicable NOx emission thresholds. Trucks driven within all other air basins also would produce emissions that would remain below their applicable NOx emission thresholds.

Although relatively high levels of daily NOx emissions were estimated for regions outside Ventura County and the South Coast Air Basin, these emissions would occur intermittently from an average of up to 48 daily haul truck round trips and would extend over hundreds of miles of roadways. As a result, these emissions would be diluted in the atmosphere to the point that they would produce minimal ambient impacts in a localized area and would not contribute to an exceedance of an ambient air quality standard. For this same reason, minimal ambient impacts of hazardous air pollutants and toxic air contaminants are expected outside of Ventura County and the South Coast Air Basin.

Green cleanup. The above discussion addresses calculated impacts assuming use of California average off-road and on-road vehicle fleets for calendar year 2019. Implementing equipment that meets EPA Nonroad Tier 3 and 4 emission standards and new trucks that meet the most recent EPA on-road standards would reduce these potential impacts (see Chapter 6, Mitigation Measure AQ-1). In the Ventura County domain, emissions from the average year 2019 fleet, as averaged over all air pollutants, would be reduced by 21 percent for off-road equipment that meets EPA Nonroad Tier 3 standards, and 58 percent for on-road heavy-duty trucks. In the South Coast Air Basin and the evaluated domain outside Ventura County and the South Coast Air Basin, emissions from the average year 2019 fleet, as averaged over all air pollutants, would be reduced by 61 percent. Therefore, implementing the proposed green cleanup fleets would produce substantial emission reductions compared to use of California average fleets.

Climate change. Peak annual emissions of CO_2 would range from about 3,000 to 8,900 metric tons under the combination of the Cleanup to AOC LUT Values, Building Removal, and Groundwater Treatment Alternatives; 6,000 to 17,000 metric tons under the combination of the Cleanup to Revised LUT Values, Building Removal, and Groundwater Treatment Alternatives; or 6,100 to 17,000 metric tons under the combination of the Conservation of Natural Resources, Building Removal, and Groundwater Treatment Alternatives. Total emissions of CO_2 would range from about 30,000 to 89,000 metric tons under the combination of the Cleanup to AOC LUT Values, Building Removal, and Groundwater Treatment Alternatives; 14,000 to 37,000 metric tons under the combination of the Cleanup to Revised LUT Values, Building Removal, and Groundwater Treatment Alternatives; or 9,700 to 29,000 metric tons under the combination of the Conservation of Natural Resources, Building Removal, and Groundwater Treatment Alternatives. Emissions under each combination of action alternatives would be slightly smaller if the Groundwater Monitored Natural Attenuation Alternative was implemented and slightly larger if both groundwater action alternatives were implemented.

Climate change could impact implementation of the alternatives and the adaptation strategies needed to respond to future conditions. Within Ventura County, the main effect of climate change is increased temperature and aridity. Analyses predict that, in the future, the region will experience: (1) an increase in temperatures, droughts, and wildfires; and (2) and scarcities of water supplies (California Energy Commission 2012; IPCC 2013; USGCRP 2014). Current operations at SSFL have adapted to droughts, high temperatures, wildfires, and scarce water supplies; however, future exacerbation of these conditions could impede proposed activities during extreme events.

Noise. There would be little difference in the intensity of noise emanating from Area IV for any combination of action alternatives. All combinations would require use of heavy equipment, and similar noise intensities would be experienced at the nearest residence, with no expected noise impacts. In addition, all combinations would entail up to 48 average daily heavy-duty truck round trips, with possible occasional spikes to 96 round trips. Over the entire range of daily truck round trips, time-averaged noise levels in residential areas would increase by no more than 3.5 dBA CNEL along all roads where noise would remain below 65 dBA CNEL and would increase by no more than 0.6 dBA CNEL along the road where noise levels would exceed 65 dBA CNEL (one section of Valley Circle Boulevard already exceeds 65 dBA CNEL). Although the increased traffic would be audible to persons in the vicinities of the evaluated roads, the increased noise would not be expected to exceed "normally acceptable" levels and would not exceed the adverse impact thresholds per the *L.A. CEQA Thresholds Guide* (LA 2006).

The combination of action alternatives having the longest noise duration (12 years) would be the High Impact Combination, primarily because of the volume of soil removed. There would be no change in noise duration if both groundwater remediation action alternatives were implemented. The combination of action alternatives having the shortest noise duration would be the Low Impact Combination. Because much less soil would be removed, almost all remediation activities under this combination of action alternatives would be completed in 4 years. After that, there would be very minor traffic noise, primarily from transport of monitoring well purge water for offsite disposition and monitoring samples to offsite laboratories.

Transportation. Maximum risks of transporting radioactive waste to the evaluated disposal facilities would occur under the High Impact Combination or the combination of the Cleanup to Revised LUT Values, Building Removal, and Groundwater Treatment Alternatives. For incident-free transport and assuming all radioactive waste shipments were by truck, maximum LCF risks to truck crews and the population would occur for shipment to Energy*Solutions* in Utah. The risk of a single LCF among the truck crews or in the population would be 9×10^{-4} (1 chance in 1,100) and 2×10^{-4} (1 chance in 5,000), respectively. If shipments were made using the truck/rail option, the maximum risk of a single LCF among the truck/rail crews would be 3×10^{-4} (1 chance in 3,300) for shipment to NNSS. The maximum truck/rail option risk of a single LCF in the population would be 2×10^{-4} (1 chance in 5,000) for shipment to Energy*Solutions* in Utah. The risk of a single LCF from an accident, considering all possible accidents from minor to severe, would be 5×10^{-9} (1 chance in 200 million), assuming all shipments were by truck to Energy*Solutions* or 3×10^{-10} (1 chance in 3.3 billion) by the truck/rail option for either evaluated facility.

Minimum risks would occur under the Low Impact Combination. For incident-free transport and assuming all radioactive waste shipments were by truck, maximum LCF risks to truck crews and the population would occur for shipment to Energy*Solutions* in Utah. The risk of a single LCF among the truck crews or in the population would be 5×10^{-4} (1 chance in 2,000) and 1×10^{-4} (1 chance in 10,000), respectively. If shipments were made using the truck/rail option, the maximum risk of a single LCF among the truck/rail crews would be 2×10^{-4} (1 chance in 5,000) for shipment to NNSS. The maximum truck/rail option risk of a single LCF occurring in the population would be 9×10^{-5} (1 chance in 11,000) for shipments to Energy*Solutions*. The maximum risk of a single LCF from an accident, considering all possible accidents from minor to severe, would be 3×10^{-9} (1 chance in 330 million), assuming all shipments were sent by truck to NNSS or 2×10^{-10} (1 chance in 5 billion) by the truck/rail option to either evaluated facility.

The largest traffic accident risks from transporting all radioactive waste, all nonradioactive waste, and all material (backfill, equipment, and supplies) would occur under the High Impact Combination. Under the truck option, considering shipment of all radioactive and nonradioactive waste and material, the number of traffic-related fatalities is estimated to be about 1 (calculated value of 0.84). Under the truck/rail option, the number of transportation-related fatalities is estimated to be about 3 (calculated value of 2.9). The smallest risks would occur under the Low Impact Combination. The number of fatalities that estimated to result from transporting all waste and material is 0 (calculated value of 0.45) under the truck option and 0 (calculated value of 0.42) under the truck/rail option.

Traffic. Under the High Impact Combination, there would be about 119,000 heavy- and medium-duty truck round trips. In addition, there would be about 68,600 round trips of cars or light-duty trucks, primarily for worker commutes. The largest increase in traffic would occur on Woolsey Canyon Road. Over 12 years, the weekly average daily traffic volume would increase by 3.4 to 7.6 percent. During most of these years, the LOS for Woolsey Canyon Road could change from a B rating to a C rating. Motorists on Woolsey Canyon Road during weekdays when heavy-duty trucks would be traveling to or from SSFL could experience delays compared to baseline conditions; there could also be delays at the intersection of Woolsey Canyon Road with Valley Circle Boulevard. The increased traffic could be reduced on roads other than Woolsey Canyon Road by distributing traffic among multiple routes between SSFL and major highways.

Traffic associated with the High Impact Combination would impose about 210,000 ESALs on the roads on the evaluated routes between SSFL and major highways. These increases were determined assuming each evaluated route received all traffic. Because some of the evaluated roads already need repair, increased vehicle traffic could further damage the surrounding roads, causing them to need repair sooner than currently anticipated.

If both groundwater remediation action alternatives were implemented, the number of heavy- and medium-duty truck round trips would increase during a 12-year period by about 42 round trips compared to the High Impact Combination estimate of 119,000 round trips. Thus, there would be no noticeable increase in traffic volumes or ESALs from those analyzed under the High Impact Combination.

Under the Low Impact Combination, there would be about 20,800 heavy- and medium-duty truck round trips. In addition, there would be about 20,800 round trips of cars or light-duty trucks, generally from worker commutes. The largest increase in traffic would occur on Woolsey Canyon Road, where the weekly average daily traffic would increase by 3.5 to 7.4 percent during the first 4 years of this action alternative combination, with a change in LOS from a B rating to a C rating, similar to that under the High Impact Combination. Traffic increases for subsequent years would be about 0.092 percent, primarily due to shipments of well monitoring purge water and environmental samples and worker commutes. Traffic delays similar to those under the High Impact Combination could occur, except that the delays would last for 4 years rather than 12. The increased traffic could be reduced on roads other than Woolsey Canyon Road by distributing traffic among multiple routes between SSFL and major highways.

Traffic associated with this combination of action alternatives would impose about 45,000 ESALs on the roads along the evaluated routes between SSFL and major highways, assuming each route received all traffic. Because some of the evaluated roads already need repair, this increase in vehicle traffic could further damage surrounding roads, causing them to need repair sooner than currently anticipated.

A safety concern is noted: heavy-duty trucks making a sharp right turn from Woolsey Canyon Road onto Valley Circle Boulevard may need to pull partially into an adjacent lane, resulting in a risk of incidents with oncoming traffic. This risk would be applicable to all action alternatives, but particularly the soil remediation action alternatives and the Building Removal Alternative, and may be mitigated by measures such as installation of a traffic signal at the intersection or posting of a flag person when shipments are made from Area IV.

Human health. Following remediation of Area IV and the NBZ, the principal risk would be residual chemicals and radioactive material remaining in the soil. Following removal of DOE buildings under the Building Removal Alternative, there would be no remaining impact attributable to the buildings. Under the groundwater remediation action alternatives, neither near-term activities such as installing wells and removing the strontium-90 subsurface bedrock source, nor the remaining activities such as monitoring or operating treatment equipment would result in chemical or radiation exposures to offsite members of the public. Consequently, the combined potential impacts would be dominated by the impacts associated with soil. The potential impacts on a hypothetical future onsite suburban resident following any of the soil action alternatives would be smaller than those under the No Action Alternative, which are very close to the potential impacts from background soil. The High Impact Combination, under which the most soil would be removed from the site, would be expected to have the lowest residual risk. The Low Impact Combination, under which soil with chemical and radionuclide concentrations meeting risk-assessment-based values would remain on site, would have a slightly higher residual risk.

Implementing different combinations of action alternatives would have little effect on the maximum number of workers on site in a year, but would have a large effect on the number of years that workers could be exposed to chemical, radiological, and industrial hazards. Under the High Impact Combination, workers would be subject to hazards over about a 12-year period, while under the Low Impact Combination, workers would be subject to hazards for about a 4-year period. In addition, there could be a combined impact on workers involved in both building demolition (decontamination and decommissioning [D&D] workers) and in soil or groundwater remediation (remediation workers). However, because the potential impacts on remediation workers are estimated to be significantly less than those for D&D workers, the combined impacts would not be significantly larger than those for D&D workers alone. Regardless of the combination of action alternatives, workers would be protected in accordance with DOE regulations (e.g., 10 CFR Parts 835 and 851) and DOE Orders. Worker protection practices would be employed so that doses are as low as reasonably achievable below DOE occupational exposure limits.

Waste management. Over all combinations of action alternatives, the total LLW/MLLW volume would be up to 103,000 cubic yards, which would not impact the total waste disposal capacity at NNSS or Energy*Solutions* in Utah. There would be about 4,550 to 7,980 truck shipments from SSFL that would occur over 4 to 12 years, depending on the combination of action alternatives. Depending on the combination of action alternatives, the average daily number of offsite shipments would range from less than 1 to about 14. Under the truck option and assuming all waste was delivered to a single facility, there would be the same number of daily shipments arriving at that facility. There could be logistical concerns at a facility to ensure that personnel, equipment, and active disposal space are available for these deliveries plus deliveries from other waste generators. However, these concerns could be alleviated through careful scheduling and coordination with the disposal facility operators. Under the truck/rail option, there would be the same number of daily deliveries to NNSS, but reduced daily deliveries (all by rail) to Energy*Solutions* in Utah compared to those under the truck option.

The total hazardous waste volume (about 49,100 cubic yards for all action alternative combinations) would not impact the total disposal capacity at any evaluated hazardous waste facility. There would be about 3,690 to 3,930 truck shipments from SSFL that would occur over 4 to 12 years, depending on the combination of action alternatives, with an average daily number of offsite shipments ranging from less than 1 to about 8. Average daily tonnages would range from less than 1 ton to about 150 tons. Under the truck option, there would be the same number of daily deliveries at any assumed single disposal facility. The projected shipments would not impact the daily or yearly receipt limit, if applicable, at any of the evaluated facilities. Under the truck/rail option, there would be the same number of daily deliveries to the Buttonwillow or Westmorland facilities in California, because these facilities lack direct rail accessibility, but reduced daily shipments (all by rail) to US Ecology in Idaho.

The total nonhazardous waste volume would range from about 53,200 to 794,000 cubic yards. The high end of the range would occur under any combination of action alternatives that includes the Cleanup to AOC LUT Values and Building Removal Alternatives; this volume of waste would represent about 48 percent of the capacity being constructed or planned at the McKittrick Waste Treatment Site in California (assuming all nonhazardous waste was sent to this site). There would be about 4,020 to 59,600 truck shipments from SSFL over 4 to 12 years, depending on the combination of action alternatives. Over this time, the average daily number of offsite shipments would range from less than 1 to about 25, and the average daily tonnage would range from about 1 ton to about 490 tons. Under the truck option, there would be the same number of daily deliveries to any of the evaluated facilities, assuming all waste was shipped to a single facility. The projected shipments would not exceed an annual or daily receipt limit at any of the evaluated facilities, but would represent 16 percent of the daily limit at the McKittrick Waste Treatment Site. Under the truck/rail option, waste would be shipped to the Mesquite Regional Landfill in California at a rate that would represent up to 2 percent of the site's daily waste acceptance limit.

About 3,540 cubic yards of recyclable material would be delivered to offsite recycle facilities over 2 years under all combinations of action alternatives. There would be less than two average shipments per day, assuming shipments occurred each year over a 5-month period, but less than one per day if the shipments were spread over a working year. There is adequate recycle capacity in the vicinity of SSFL, so no impacts on this capacity are expected.

Therefore, no combination of action alternatives would generate waste that would lack disposal capacity. The evaluated facilities have adequate total capacities, and the shipments are not expected to exceed daily acceptance limits, where applicable. Careful coordination with some disposal facilities operators may be needed to avoid any logistical concerns regarding waste receipt scheduling. Nonetheless, any concerns regarding capacities or scheduling logistics at any single facility may be alleviated by measures such as use of multiple facilities (multiple facilities exist for all wastes evaluated in this EIS) or use of the truck/rail option for delivery of waste to rail-accessible facilities.

Cultural resources.

Archaeological and architectural cultural resources. No combination of action alternatives would have an effect on architectural cultural resources because none has been identified as eligible for listing on the NRHP (i.e., no historic structures) and no impacts on this resource class have been determined under NEPA criteria.

For archaeological resources, proposed exemptions to the 2010 AOC (DTSC 2010a) requirement to remediate chemical and radioactive contaminants to LUT values would allow DOE to avoid potential impacts on archeological sites that are listed or eligible for listing on the NRHP (i.e., historic properties) or otherwise significant under NEPA or CEQA eligibility criteria. For this reason, the potential adverse effects would be similar, but would vary somewhat among the alternatives. Under all alternatives, if an unanticipated archaeological resource is encountered, DOE would comply with applicable regulations and the Section 106 agreement document currently under development, which would include a provision for unanticipated archaeological finds. However, based on the intensive survey for archaeological sites, finding a previously unrecorded archeological resource is unlikely.

The High Impact Combination would have the greatest potential to encounter unanticipated archaeological resources, primarily because this combination includes the Cleanup to AOC LUT

Values Alternative which would cause the largest soil disturbance of any of the soil remediation action alternatives. The Building Removal Alternative would be unlikely to encounter unanticipated archaeological resources. Comparing the two groundwater remediation action alternatives, the Groundwater Treatment Alternative involves greater ground disturbance and construction and, thus, would have a greater potential to encounter unanticipated archaeological resources, were any to be present. If both groundwater remediation action alternatives were implemented, the potential for effects on unanticipated archaeological resources would be essentially the same as that from implementing the Groundwater Treatment Alternative alone.

The Low Impact Combination would have the least potential to encounter unanticipated archaeological resources, primarily because this combination includes the Conservation of Natural Resources Alternative which would cause the least soil disturbance of any of the soil remediation action alternatives. As discussed above, the Building Removal Alternative would be unlikely to encounter unanticipated archaeological resources, and between the two groundwater remediation action alternatives, the Groundwater Monitored Natural Attenuation Alternative would have a lesser potential to encounter unanticipated archaeological resources.

Traditional cultural resources. The 2010 AOC (DTSC 2010a) proposed an exemption from cleanup actions for "Native American artifacts that are formally recognized as Cultural Resources." For example, the proposed exemption would apply to historic properties such as those listed on, or eligible for listing on, the NRHP. However, traditional cultural resources that include properties of traditional religious and cultural importance that do not meet the NRHP criteria could also be protected under the proposed exemption. The Santa Ynez Band of Chumash Indians has designated the entire SSFL, an area that includes all archaeological sites, regardless of NRHP eligibility, as well as all isolates and the landscape, as a Native American sacred site (the Santa Susana Sacred Site). They believe that the site is eligible for inclusion on the NRHP as a traditional cultural property. In 2014, the tribe filed paperwork nominating the site to be included in the *State of California Native American Heritage Commission Sacred Lands Inventory* (NAHC 2014). DOE is consulting with SHPO, the Santa Ynez Band of Chumash Indians, and the SSFL Sacred Sites Council to develop an agreement intended to resolve adverse impacts through avoidance, minimization, or mitigation of impacts during and subsequent to cleanup activities.

Under all action alternatives, there could be changes in setting as cleanup progresses in Area IV and the NBZ; after cleanup is complete, this impact would be removed, but the affected areas would have been re-contoured, which would change the setting of the traditional cultural resource. In addition, for traditional cultural resources, potential effects on archaeological sites are considered under all action alternative combinations because the Santa Susana Sacred Site includes all archaeological sites regardless of NRHP eligibility, as well as all isolates and the landscape.

The High Impact Combination would have the greatest potential to impact traditional cultural resources primarily because this combination would have the longest cleanup duration and the most landscape alteration. The Building Removal Alternative would be unlikely to encounter unanticipated archaeological resources and would remove structures that could be considered intrusive. Between the two groundwater remediation action alternatives, the Groundwater Treatment Alternative involves more ground disturbance and construction, and thus has more potential to encounter unanticipated archaeological resources or alter the landscape. The Groundwater Treatment Alternative would have a greater potential to affect the Santa Susana Sacred Site, and would involve more-extensive aboveground treatment facilities that could temporarily affect its setting. This potential for impacts would be essentially the same if both groundwater remediation action alternatives were implemented.

The Low Impact Combination would have the least potential to encounter unanticipated archaeological resources, primarily because this combination includes the Conservation of Natural Resources Alternative which would have shortest cleanup duration and least landscape alternation of any of the soil remediation action alternatives. As discussed above, the Building Removal Alternative would be unlikely to encounter unanticipated archaeological resources and would remove structures that could be considered intrusive. Between the two groundwater remediation action alternatives the Groundwater Monitored Natural Attenuation Alternative would involve less ground disturbance and construction, have less potential to affect the Santa Susana Sacred Site, and create less extensive structures (well heads) that could affect its setting.

DOE is consulting with SHPO, the Santa Ynez Band of Chumash Indians, and the SSFL Sacred Sites Council to develop an agreement intended to resolve potential adverse impacts through avoidance, minimization, or mitigation of impacts during and subsequent to cleanup activities.

Socioeconomics. The socioeconomics analysis addresses employment, potential economic impacts on businesses, infrastructure and municipal services in the SSFL ROI, as well as local government revenues, and potential economic impacts on businesses near the evaluated recycle and disposal facilities.

Employment. For most years under the High Impact Combination, the number of onsite workers would range from 25 to 26 workers over 12 years of remediation. In addition, during the third year of the project, there would be a need for an additional five workers over about 6 working months to install groundwater treatment equipment and remove bedrock containing strontium-90. Under the Low Impact Combination, the number of onsite workers would be 25 to 26 for 4 years, plus 6 workers in a single year working an average of 5 days per well to install 5 groundwater monitoring wells. In addition, for all evaluated years, there would be 10 workers working an average of 1 month a year for environmental monitoring.

Under any combination of action alternatives, site activities would have a minor beneficial impact on the economy in Los Angeles and Ventura Counties by providing employment and increasing sales for industries that provide equipment, supplies, and rentals. Because workers would likely originate from Los Angeles and Ventura Counties, new spending or economic activity in the region would be minimal.

Truck traffic. The High Impact Combination would result in increased traffic in the SSFL vicinity over 12 years, with the most noticeable increase occurring on Woolsey Canyon Road. However, the additional vehicle traffic is not expected to result in socioeconomic impacts on businesses on this road, and traffic on other evaluated roads would increase by no more than 2.8 percent, assuming all traffic traversed each road, with minimal potential for socioeconomic impacts on businesses. The largest concentration of retail establishments, restaurants, and other businesses would occur on Topanga Canyon Road. The projected increase in average daily traffic (0.15 to 0.36 percent) is not expected to result in socioeconomic impacts on businesses along this road.

Traffic under the Low Impact Combination would increase in the SSFL vicinity, primarily over the first 4 years, with much smaller increases thereafter. Again, the additional vehicle traffic is not expected to result in socioeconomic impacts on businesses on Woolsey Canyon Road, and average daily traffic on other evaluated roads would increase by no more than 2.7 percent, assuming all traffic traversed each road, with minimal potential for socioeconomic impacts on businesses. The average daily traffic on Topanga Canyon Boulevard under the Low Impact Combination would increase by 0.15 to 0.35 percent during the first 4 years of site remediation, and by less than 0.01 percent thereafter, which is not expected to result in socioeconomic impacts on businesses along this road.

Under any combination of action alternatives, the increased amount of truck traffic would be insufficient to result in socioeconomic impacts in the SSFL ROI.

Infrastructure and municipal services. Under any combination of action alternatives, there could be damage to local roads from the potentially large number of trucks required for remediation of Area IV and the NBZ. Recognizing this, DOE may need to negotiate with local governments to contribute its portion of the cost for maintenance and repair of affected roads. No impacts on other municipal services are expected.

Housing. For any combination of action alternative, workers would be primarily employed from Los Angeles and Ventura Counties with no impacts on housing availability.

Local government revenue. The High Impact Combination would have the largest potential beneficial and adverse impacts on local government revenue because activities, including increased truck traffic, would occur for 12 years. The Low Impact Combination would have the smallest potential beneficial and adverse impacts on local government revenue because activities, including increased truck traffic, would primarily occur for 4 years. Beneficial impacts could result from increased revenues from fuel taxes, fees, or other project expenses, while adverse impacts could result from increased expenses for pavement repair.

Disposal facilities. Disposal facility impacts depend on the quantities of radioactive, hazardous, and nonhazardous wastes to be delivered. There is a significant difference among the combinations of action alternatives for shipment of LLW and MLLW. LLW and MLLW would be delivered to an assumed single disposal facility at average daily rates ranging from 2 to 5 deliveries for either combination of action alternatives that includes the Cleanup to AOC LUT Values Alternative, with deliveries occurring over 12 years. For combinations of action alternatives that include the Cleanup to Revised LUT or Conservation of Natural Resources Alternative, deliveries would range up to 14 per day, with deliveries occurring over slightly over 3 years to 4 years. Peak deliveries (14 per day) under these action alternative combinations would last for only 1 to 2 years. This truck traffic is not expected to cause socioeconomic impacts on businesses in the vicinities of the evaluated disposal facilities.

There is almost no difference among the combinations of action alternatives for shipment of hazardous waste. Hazardous waste would be shipped under the Building Removal Alternative and in equal quantities under all soil remediation action alternatives. The only difference among all action alternatives is that very small quantities of hazardous waste (about 26 cubic yards) might be generated under the Groundwater Treatment Alternative. The largest average daily truck delivery to a single assumed hazardous waste facility would be 8 deliveries. This frequency of truck traffic is not expected to have socioeconomic impacts on businesses in the vicinities of the evaluated facilities.

The differences among the combinations of action alternatives for shipment of nonhazardous waste are primarily due to differences in soil volumes removed under the soil remediation action alternatives. Under the combination of the Cleanup to AOC LUT Values, Building Removal, and Groundwater Treatment Alternatives, waste would be shipped to disposal facilities over 12 years, and the average number of heavy-duty trucks received at a single assumed disposal facility could range up to 25 per day. Under the combination of the Cleanup to Revised LUT Values, Building Removal, and Groundwater Treatment Alternatives, waste would be shipped to disposal facilities over slightly over 4 years, and the average number of heavy-duty trucks received at a single assumed disposal facility could range up to about 8 per day. Under the combination of the Conservation of Natural Resources, Building Removal, and Groundwater Treatment Alternatives, waste would be shipped to disposal facilities over 4 years, and the average number of heavy-duty trucks received at a single assumed disposal facility could range up to about 8 per day. Assuming all nonhazardous waste was shipped to a single nonhazardous waste facility, no or only minimal socioeconomic impacts are expected because of the locations of the facilities and/or the ease of access from major highways.

Deliveries to an assumed single recycle facility would average up to two trucks per day, assuming all deliveries were made during 2 to 5 months in each of 2 years. The daily number of delivery trucks would be reduced if waste was shipped throughout each working year. The minimal increased daily deliveries would have no impacts on traffic volumes in the vicinities of any of these recycle facilities, and, thus, no socioeconomic impacts are expected in the vicinities of any of the evaluated facilities.

Although potential socioeconomics impacts on businesses in the vicinity of any single facility accepting recyclable material or radioactive, hazardous, or nonhazardous waste for disposal are minimal (at worst), these potential impacts could be further reduced by shipping waste to multiple authorized facilities; by using multiple routes (as available) for delivery to individual facilities; or by shipping waste by rail to rail-accessible disposal facilities.

Environmental justice.

SSFL ROI. Under any combination of action alternatives, the risks to a member of the public of both the incidence of cancer and a cancer fatality would be dominated by potential impacts from background concentrations of chemical and radioactive constituents. Therefore, there would be no disproportionately high and adverse impacts on Native American tribes and minority and low-income populations.

Under the High Impact Combination, the largest increase in daily traffic would occur on Woolsey Canyon Road, where over 12 years, the average daily traffic would increase by 3.4 to 7.6 percent. If both groundwater remediation action alternatives were implemented, there would be essentially the same increase in average daily traffic as that presented above. Under the Low Impact Combination, the largest increase in daily traffic volume would occur on Woolsey Canyon Road, where the average daily traffic would increase by 3.5 to 7.4 percent over 4 years, with minor traffic increases thereafter. Under both combinations of action alternatives, there would be considerably smaller increases in traffic on the other evaluated roads between SSFL and major highways.

Although there would be increases in the traffic on the evaluated routes between SSFL and major highways, the routes would traverse minority and non-minority communities, as well as low-income and non-low-income communities, and would not pass through Native American lands. This indicates that potential impacts on Native American tribes and minority, or low-income populations would be the same as those experienced by the general population. Other than Woolsey Canyon Road, traffic volumes on the evaluated roads could be reduced by using multiple routes to major highway systems. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI.

Regional ROIs. Regional environmental justice impacts depend on the quantities of radioactive, hazardous, and nonhazardous wastes that would be delivered to the disposal facilities and the schedules for these deliveries.

There is a significant difference among the combinations of action alternatives regarding the shipped quantities of radioactive waste, primarily resulting from differences in soil removals under the soil remediation action alternatives. Total volumes could range from 57,600 cubic yards to 103,000 cubic yards, and the average daily deliveries to a single assumed LLW/MLLW facility could range from less than 1 to about 14. Even if all waste deliveries were made to a single LLW/MLLW disposal facility, the projected frequency of truck traffic would not result in noticeable traffic-related impacts in the ROI for that facility.

There is almost no difference among the combinations of action alternatives regarding the total quantity of hazardous waste (about 26 cubic yards), although daily deliveries to the evaluated disposal facilities would differ as would the duration of the deliveries. Even if all waste deliveries were made to a single hazardous waste disposal facility, the projected frequency of truck traffic (up to 8 truck deliveries per day) would not result in noticeable traffic-related impacts in the ROI for that facility.

There are significant differences among the combinations of action alternatives for shipped quantities of nonhazardous waste; these differences primarily results from differences in the soil volumes removed under the soil remediation action alternatives. Under the combination of the Cleanup to AOC LUT Values Alternative, Building Removal Alternative, and either groundwater remediation action alternative, about 794,000 cubic yards of nonhazardous waste (soil, debris, etc.) would be shipped to disposal facilities over 12 years. The average number of heavy-duty trucks received at nonhazardous sites could range up to 25 trucks per day. There would be no or minimal impacts from increased traffic in the vicinities of the evaluated facilities.

Under the combination of either the Cleanup to Revised LUT Values or Conservation of Natural Resources Alternative, the Building Removal Alternative, and either groundwater remediation action alternative, however, about 53,200 cubic yards of nonhazardous waste would be generated. This waste would be shipped to disposal facilities over approximately 4 years. The average number of heavy-duty trucks delivered to a single assumed nonhazardous waste facility could be up to 8 per day during 2 years; daily deliveries during other years would be smaller. This frequency of truck traffic is not expected to result in traffic-related impacts in the ROI for that facility.

Under any combination of action alternatives, about 3,540 cubic yards of recyclable material would be shipped to recycle facilities during 2 years of building demolition. As addressed in the socioeconomics section, the minimal increased daily deliveries would have no impacts on traffic volumes in the vicinities of any of these recycle facilities.

The number of truck deliveries to any single facility could be reduced if multiple disposal facilities were used, if multiple routes (as available) were used in the vicinities of individual facilities, or if waste were shipped to one or more rail-accessible facilities. Considering this and the above analysis, no combination of action alternatives would have disproportionately high and adverse impacts on Native American tribes and minority and low-income populations in the regional ROIs for the evaluated recycle and disposal facilities.

Sensitive-aged populations.

SSFL ROI. Under both the High and Low Impact Combinations, average daily traffic would increase on Woolsey Canyon Road as discussed in the Environmental Justice section. There would be no noticeable additional increases if both groundwater remediation action alternatives were implemented. Under both combinations of action alternatives, but for a longer duration under the High Impact Combination than under the Low Impact Combination, this increased traffic could result in greater risks to pedestrians along or crossing Woolsey Canyon Road, although these risks would be experienced by persons of all ages. Traffic volumes on other evaluated roads are not expected to be noticeably larger than those under baseline conditions. In addition, traffic on all evaluated roads, other than Woolsey Canyon Road, that pass by or are in the vicinity of schools or recreation areas could be reduced by distributing traffic among the evaluated traffic routes. Under any combination of action alternatives, therefore, no disparate impacts (that is, markedly distinct impacts relative to those on the general population) are expected on sensitive-aged populations in the SSFL ROI.

Regional ROIs. As discussed in the environmental justice section, even if all radioactive waste deliveries were made to a single facility and all hazardous waste deliveries were made to a single facility, the projected truck traffic would not result in noticeable traffic-related impacts. Furthermore, no schools or recreation areas have been identified in the ROIs of the evaluated radioactive and hazardous waste facilities. Therefore, no disparate impacts are expected on sensitive-aged populations in these ROIs.

The combination of the Cleanup to AOC LUT Values Alternative, the Building Removal Alternative, and either groundwater remediation action alternative would generate the most nonhazardous waste to be shipped to offsite facilities. Assuming all nonhazardous waste was shipped to a single assumed facility, traffic-related impacts are expected to be minimal at the two evaluated facilities with a school or recreation area in their vicinities (Antelope Valley Landfill and the McKittrick Waste Treatment Site, both in California). The combination of either the Cleanup to Revised LUT or Conservation of Natural Resources Alternative, the Building Removal Alternative, and either groundwater action alternative combination would generate the least amount of nonhazardous waste. The average number of heavy-duty trucks delivered to a single assumed nonhazardous waste facility could be up to 8 per day during 2 years; daily deliveries during other years would be smaller. The potential impacts of this increased traffic at any single assumed facility would be minimal. Furthermore, for any combination of action alternatives, the number of truck deliveries to any single facility could be reduced if multiple disposal facilities were used or if waste were shipped to one or more rail-accessible facilities. Therefore, no disparate impacts on sensitive-aged populations are expected in the regional ROIs for the evaluated nonhazardous waste facilities under any combination of action alternatives.

2.8.2 Summary of Potential Cumulative Impacts

"Council on Environmental Quality Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act" (40 CFR Parts 1500-1508) define cumulative effects as impacts on the environment that result from the incremental impacts of the proposed action when added to the incremental impacts of other past, present, and reasonably foreseeable future actions, regardless of which agency or person undertakes such other actions (40 CFR 1508.7). Reasonably foreseeable onsite actions at SSFL included in the cumulative impact analysis of this EIS are ongoing and planned demolition, remediation, and waste transportation activities conducted by DOE, NASA, and Boeing. Activities in the SSFL ROI that could contribute to cumulative impacts could include new residential development, new industrial and commercial ventures, resource investigation and development, new utility and infrastructure development, new waste treatment and disposal facilities, and contaminated site remediation. Future actions that are speculative or are not well defined were not analyzed, including the future use of SSFL.

Potential cumulative impacts are summarized in **Table 2–10** for each resource area. Chapter 5 presents the detailed cumulative impacts analysis which includes a more detailed discussion of the onsite and offsite activities considered in this cumulative impacts assessment.

Table 2–10 Summary of Potential Cumulative Impacts

Resource Area	*DOE Contribution to Cumulative Impacts*	*NASA and Boeing Contribution to Cumulative Impacts*	*Other Contributions to Cumulative Impacts*	*Cumulative Impacts*
Land resources	**Land use:** 40 to 138 acres disturbed; no zoning or land use conflicts. **Recreation:** Increased traffic could discourage weekday use of Sage Ranch Park; no impacts on other recreation areas in the SSFL vicinity are expected. **Infrastructure:** 3,000 to 16,000 gallons per day water consumption for dust suppression. **Aesthetics and visual quality:** Removal of buildings and revegetation would result in beneficial long-term effects on aesthetics and visual quality.	**Land use:** 194 to 275 acres disturbed; no zoning or land use conflicts. Approximately 20 acres of additional undeveloped land in the Southern Buffer Zone could be disturbed if Boeing uses these areas as sources of clean backfill. **Recreation:** Increased traffic could discourage weekday use of Sage Ranch Park; no impacts on other recreation areas in the SSFL vicinity are expected. **Infrastructure:** 210,000 to 214,000 gallons per day water consumption for dust suppression. **Aesthetics and visual quality:** Removal of buildings and revegetation would result in beneficial long-term effects on aesthetics and visual quality.	**Land use:** acreage disturbed not available. **Recreation:** No impacts identified. **Infrastructure:** Annual water use for CMWD averages 177,644 acre feet (or approximately 159 million gallons per day). **Aesthetics and visual quality:** No impacts identified.	**Land use:** 235 to 414 acres disturbed; no zoning or land use conflicts **Recreation:** Increased traffic could discourage weekday use of Sage Ranch Park; no impacts on other recreation areas in the SSFL vicinity are expected. **Infrastructure:** SSFL water use would be approximately 0.1 percent of CMWD's annual supply, but because of severe drought California is attempting to reduce potable water consumption state-wide by 25 percent. Therefore, cumulative SSFL water use, although small, may be controversial. **Aesthetics and visual quality:** Removal of buildings and revegetation would result in beneficial long-term effects on aesthetics and visual quality.
Geology and soils	There would be 40 to 138 acres of soil disturbance and loss of soil with mineralogical and biological composition capable of supporting unique vegetation in Area IV and the NBZ. 125,000 to 715,000 cubic yards of backfill would be needed. It is unlikely that a source of backfill meeting the DOE AOC LUT values would have the same physical and chemical properties as existing SSFL soils.	There would be 194 to 275 acres of soil disturbance and loss of soil with mineralogical and biological composition capable of supporting unique vegetation at SSFL. 315,000 to 403,000 cubic yards of backfill would be needed. It is unlikely that an offsite source of backfill meeting the NASA AOC LUT values would have the same physical and chemical properties as existing SSFL soils. Boeing has identified potential borrow areas for backfill in the Southern Buffer Zone. If soil is taken from these borrow areas, an additional 20 acres could be disturbed.	Other construction activities in the region could disturb soils. Although stormwater pollution prevention plan requirements and BMPs would limit soil erosion, some soil erosion is likely. If the soils are similar to those present at SSFL, cumulative impacts on these soil types could result. Other construction activities in the region could require soils for backfill, but are just as likely to result in excess soil from foundation excavation and slope cutting. Therefore, these activities are not likely to consume a large quantity of soil and contribute to a soil shortage.	There would be 235 to 414 acres of soil disturbance and loss of soil with mineralogical and biological composition capable of supporting unique vegetation at SSFL. 440,000 to 1,120,000 cubic yards of backfill would be needed. It is unlikely that a source of backfill meeting DOE and NASA AOC LUT values would have the same physical and chemical properties as existing SSFL soils.

Resource Area	*DOE Contribution to Cumulative Impacts*	*NASA and Boeing Contribution to Cumulative Impacts*	*Other Contributions to Cumulative Impacts*	*Cumulative Impacts*
Surface water resources	With implementation of control and mitigation measures, DOE's actions would generate no impacts on surface water quality or on local and regional stormwater control capacity, and would not contribute to cumulative impacts. Cleanup would result in a long-term reduction of potential sources of surface water contamination.	With implementation of control and mitigation measures, NASA's and Boeing's actions would generate no impacts on surface water quality or on local and regional stormwater control capacity, and would not contribute to cumulative impacts. Cleanup would result in long-term reduction of potential sources of surface water contamination.	Offsite developments would be subject to compliance with stormwater pollution prevention plans and BMPs that would limit the potential for increased soil erosion and sediment loading in runoff during construction and operation.	With implementation of control and mitigation measures, DOE, NASA, and Boeing actions at SSFL would generate no impacts on surface water quality or local and regional stormwater control capacity and would not be expected to contribute to cumulative impacts. Cleanup would result in long-term reduction of potential sources of surface water contamination.
Groundwater resources	Impacts on the quantity of site groundwater are expected to be minimal because groundwater would not be withdrawn during soil excavation. If required, removal of 200,000 gallons of groundwater during demolition of one of the DOE buildings would have a short-term, localized impact on water levels. Because of the relatively small size of SSFL compared to the adjacent groundwater basins and the relatively small quantity of groundwater that would be withdrawn, none of the proposed groundwater remediation technologies are expected to have an appreciable impact on the quantity of groundwater available for use by populations in adjacent groundwater basins. DOE groundwater cleanup activities at SSFL would have a long-term beneficial impact on groundwater quality.	Impacts on the quantity of site groundwater are expected to be minimal because groundwater is deeper beneath the NASA- and Boeing-administered areas and is expected to be withdrawn during soil excavation. Because of the relatively deep groundwater and because the buildings and other structures have shallow foundations, demolition of buildings is not expected to require dewatering. Because of the relative size of SSFL compared to the adjacent groundwater basins and the relatively small quantities of groundwater that are expected to be withdrawn, none of the proposed groundwater remediation technologies is expected to have an appreciable impact on the quantity of groundwater available for use by populations in adjacent groundwater basins. NASA and Boeing groundwater cleanup activities at SSFL would have a long-term beneficial impact on groundwater quality.	No other contributions to cumulative impacts in the ROI were identified.	Because of the relatively small size of SSFL compared to the adjacent groundwater basins, the depth to the aquifer, and the relatively small quantities of groundwater that would be withdrawn, none of the proposed remediation technologies are expected to have an appreciable impact on the quantity of groundwater available for use by populations in adjacent groundwater basins. Groundwater cleanup activities at SSFL would have a long-term beneficial impact on groundwater quality.

Resource Area	*DOE Contribution to Cumulative Impacts*	*NASA and Boeing Contribution to Cumulative Impacts*	*Other Contributions to Cumulative Impacts*	*Cumulative Impacts*
Biological resources	40 to 138 acres disturbed, including about 13 to 51 acres of relatively undisturbed native habitat. Removal of existing vegetation and topsoil would increase the difficulty of re-establishing native plant species and would reduce or eliminate the value of re-established habitat for most wildlife species. Remediation would require prolonged efforts to restore native vegetation and wildlife habitat. If backfill is substantially different than that originally present, it may not support native vegetation.	194 to 275 acres disturbed. Similar impacts as described for DOE. Approximately 20 acres of additional undeveloped land in the Southern Buffer Zone could be disturbed if Boeing uses these areas as sources of clean backfill.	Projects outside SSFL are generally sufficiently distant to minimize the potential for cumulative effects with the remediation projects on SSFL. However, certain proposed projects (such as Sterling Properties in Dayton Canyon) developed on land that supports threatened, endangered, or rare species or relatively undisturbed native habitat, and of the same type that would be affected by SSFL remediation activities (e.g., oak woodlands and habitat for Braunton's milk-vetch and Santa Susana tarplant), could have cumulative adverse impacts.	235 to 414 acres disturbed at SSFL. The combined soil excavation and building removal activities of DOE, NASA, and Boeing would cause profound disturbance (removal of vegetation and soils). The effects of vegetation and soil removal could result in long-term impacts due to the intense effort needed to restore the habitat. Simultaneous implementation of remediation activities by DOE, NASA, and Boeing would create cumulative disturbance of habitat and could interfere with regional movement of wildlife species such as mountain lion, bobcat, and ringtail.
Air quality and climate	Onsite activities would not contribute to exceedance of an ambient air quality standard at an offsite location. There would be 32 to 48 daily heavy-duty truck round trips (the maximum from SSFL between DOE, NASA, and Boeing would be 96, per the Transportation Agreement [Boeing 2015a]). These trips would extend across hundreds of miles of roadways, depending on the route taken to a disposal facility. As a result, emissions would be dispersed in the atmosphere to the point that they would produce minimal impacts in a localized area. Implementation of a green cleanup truck fleet proposed by DOE would minimize project air quality impacts. The total carbon dioxide emissions generated by the high DOE combination of alternatives would be 89,000 metric tons.	Onsite activities would not contribute to exceedance of an ambient air quality standard at an offsite location. There would be 48 to 64 daily heavy-duty truck round trips. As a result, emissions would be dispersed in the atmosphere to the point that they would produce minimal impacts in a localized area. NASA and Boeing cleanup actions would emit about 139,000 and 30,000 metric tons of carbon dioxide, respectively.	Numerous cumulative projects, such as those listed in Appendix D, Table D-7, would cause additional emissions impacts within the South Coast Air Basin.	Onsite activities would not contribute to exceedance of an ambient air quality standard at an offsite location, except possibly for occasional exceedances of particulate matter standards. For the South Coast Air Basin region, an area already in extreme nonattainment for the ambient ozone standards, emissions of ozone precursors from DOE activities, in combination with ozone precursor emissions from cumulative projects, would have the potential to contribute to exceedance of an ozone standard. Emissions generated from proposed DOE activities outside of Ventura County and the South Coast Air Basin would be diluted in the atmosphere and would produce minimal impacts in a localized area. Emissions from DOE trucks traveling within the San Joaquin Valley Air Basin (which has extreme nonattainment for ambient ozone standards), combined with cumulative emissions from other traffic has the potential to contribute to an exceedance of an ambient ozone standard within this region. Implementation of a green cleanup truck fleet proposed by DOE would minimize project air quality impacts. The total cumulative carbon dioxide emissions generated by SSFL cleanup activities would be 258,000 metric tons, a negligible contribution to future climate change.

Resource Area	*DOE Contribution to Cumulative Impacts*	*NASA and Boeing Contribution to Cumulative Impacts*	*Other Contributions to Cumulative Impacts*	*Cumulative Impacts*
Noise	The nearest residence is approximately 5,000 feet from the Area IV boundary and would experience an approximate 50 dBA equivalent sound level during workday hours. Assuming the maximum authorized number of daily round trips from Area IV (96 total round trips by DOE, NASA, and Boeing), time-averaged noise levels in residential and recreation areas along potential haul routes are expected to increase by up to 3.5 dBA CNEL, where the final noise level would be below 65 dBA CNEL (the threshold for an adverse impact is an increase of 5 dBA CNEL) or, along one section of Valley Circle Boulevard where the noise level already exceeds 65 dBA CNEL, the noise level would increase by no more than 0.6 dBA CNEL (the threshold for an adverse impact when the final noise level exceeds 65 dBA CNEL is an increase of 3 dBA CNEL).	Remediation activities conducted by NASA and Boeing are expected to generate noise levels similar to those generated by DOE remediation activities.	Offsite residential, commercial, and industrial development projects typically generate temporary localized elevated noise levels at the construction site, temporary increases in construction truck traffic noise along nearby roads, and localized increases in noise levels during project operation. Construction and operations noise would be localized near the individual project sites following a similar pattern to noise levels described for construction activities on SSFL. Therefore, noise from offsite development projects would generally not be cumulative with activities on SSFL.	Projected noise levels at the closest residence to onsite remediation activities would be well below 65 dBA community noise equivalent level. Assuming 96 daily truck round trips, time-averaged noise levels in residential and recreation areas along potential haul routes are expected either to increase by no more than 5 dBA CNEL (the threshold for an adverse impact where the final noise level would be below 65 dBA CNEL) or by no more than 3 dBA CNEL (the threshold for an adverse impact where the final noise level would be above 65 dBA CNEL). Noise levels for truck transportation would not increase over levels described for DOE activities alone because the total number of DOE, NASA, and Boeing daily truck round trips would not exceed 96 in accordance with the Transportation Agreement (Boeing 2015a). Although cumulative noise levels would not be greater than the levels for DOE activities alone, these higher levels would occur for a longer period of time. In a hypothetical scenario where a development project was undertaken adjacent to existing residences, the noise of the development project would be dominant, and distant noise generated at SSFL, which is more than 5,000 feet from the closest residence, would not contribute appreciably to overall noise levels. Truck trips conducted in support of other projects in the ROI could potentially follow portions of the same routes used by SSFL trucks. Any cumulative increase in truck traffic noise would be temporary. Therefore, only minor cumulative noise impacts are expected.

Resource Area	*DOE Contribution to Cumulative Impacts*	*NASA and Boeing Contribution to Cumulative Impacts*	*Other Contributions to Cumulative Impacts*	*Cumulative Impacts*
Transportation	**Radiological impacts:** Collective transportation worker dose of 0.14 to 1.5 person-rems and collective general population dose of 0.092 to 0.39 person-rem. No LCFs would be anticipated. **Nonradiological impacts:** 0.28 to 2.9 potential accident fatalities could result from DOE transportation activities.	**Radiological impacts:** For NASA remediation activities, collective transportation worker dose of 0.50 person-rem and collective general population dose of 0.19 person-rem. No LCFs would be anticipated.[a] Boeing remediation activities are not expected to generate any radioactive waste. **Nonradiological impacts:** 1 (0.50 to 0.58) potential accident fatality could result from NASA and Boeing transportation activities.	**Radiological impacts:** The total number of potential LCFs (among the workers and general population) estimated to result from nationwide radioactive material transportation over the period between 1943 and 2073 is 514, or an average of 4 LCFs per year. The transportation-related LCFs represent about 0.0007 percent of the total number of cancer deaths expected over the same time period; therefore, this rate is indistinguishable from the natural fluctuation in the annual death rate from cancer. **Nonradiological impacts:** 43,000 estimated traffic fatalities occurring in California from 2017-2028. 11,400 estimated traffic fatalities in the four neighboring counties (2017-2028).	**Radiological impacts:** Collective transportation worker dose of 0.64 to 2 person-rems and collective general population dose of 0.28 to 0.58 person-rem. No LCFs would be anticipated. The potential doses from transport of radioactive materials associated with remediation activities at SSFL are insignificant compared to the doses from other nuclear material shipments. The majority of the cumulative risk to workers and the general population would be due to general transportation of radioactive material unrelated to remediation activities at SSFL. **Nonradiological impacts**: 1 (0.79) to 4 (3.5) potential accident fatalities could result from SSFL (DOE, NASA, and Boeing) transportation activities; representing about 0.008 percent of the total number of traffic fatalities expected in California and 0.03 percent of the total number of traffic fatalities expected in the four surrounding counties. The potential traffic fatalities from operations at SSFL are indistinguishable from the natural fluctuation in the total annual death rate from traffic fatalities.
Traffic	**Level of service:** Largest weekday, average daily traffic increase would be on Woolsey Canyon Road (3.4 to 7.6 percent). The LOS on Woolsey Canyon Road could degrade from LOS B to C for approximately 4 to 12 years. **Pavement deterioration:** 20,800 to 119,000 additional truck trips depending on the action alternative combination; equivalent single axle loads would increase by 45,000 (Low Impact Combination) to 210,000 (High Impact Combination) from DOE truck trips.	**Level of service:** Largest weekday, average daily traffic increase would be on Woolsey Canyon Road (22.4 to 26.5 percent). The LOS on Woolsey Canyon Road could degrade from LOS B to C. **Pavement deterioration:** 86,100 to 109,000 additional truck trips depending on the remediation option; equivalent single axle loads would increase by 220,000 to 330,000 from NASA and Boeing truck trips.	**Level of service:** Current level of service on routes from SSFL ranges from B (stable traffic flow with no delay) to F (forced traffic flow with considerable delay). **Pavement deterioration:** Estimated baseline equivalent single axle loads range from 38,000 to 74,000 depending on the route.	**Level of service:** Largest percentage traffic increase would be on Woolsey Canyon Road (30 percent). The LOS on Woolsey Canyon Road could degrade from LOS B to C. **Pavement deterioration:** Estimated single axle loads associated with DOE, NASA, and Boeing remediation activities at SSFL would increase from a baseline of 38,000 to 74,000, to 260,000 to 540,000, depending on the alternative. Between 17 and 39 percent of the increase would be attributable to DOE activities. Increased truck traffic could further damage the surrounding roads, causing them to need repair sooner than currently anticipated.

Resource Area	*DOE Contribution to Cumulative Impacts*	*NASA and Boeing Contribution to Cumulative Impacts*	*Other Contributions to Cumulative Impacts*	*Cumulative Impacts*
Human health	A hypothetical onsite suburban resident or recreational user is assumed to be exposed to contaminated soil in Area IV for 24 hours a day, 350 days per year for 30 years, consistent with the SRAM. A hypothetical recreational user is assumed to be exposed 8 hours per day for 75 days per year for 30 years. Worker exposure to chemical and radioactive constituents could occur during soil remediation, building demolition, and groundwater remediation. Physical and administrative controls would be employed to ensure that workers would be protected in compliance with DOE requirements for worker safety and radiation protection. Radiation protection practices would be employed so that radiation doses are ALARA.	Because the DOE onsite suburban resident scenario already includes exposure for 24 hours a day, 350 days per year for 30 years, consistent with the SRAM, no additional time could be spent on NASA or Boeing areas of SSFL. The total exposure time for a hypothetical recreational user would not increase, regardless of which area of SSFL is being traversed. Worker exposure to chemical and radioactive constituents could occur during soil remediation, building demolition, and groundwater remediation. Physical and administrative controls would be employed to ensure that workers would be protected in compliance with regulatory requirements for worker safety and radiation protection	None identified.	Because the onsite suburban resident scenario conservatively includes exposure for 24 hours a day, 350 days per year for 30 years, consistent with the SRAM, no additional time could be spent on NASA or Boeing areas of SSFL. A resident can only be in one area at a time and cannot be in both areas simultaneously. Therefore, the effects are not additive, and the cumulative effect cannot be greater than the greater of the individual area efforts. The impacts from adjacent areas under control of NASA or Boeing to a resident in Area IV are expected to be insignificant and would result in a minimal addition to cumulative impacts because these areas are separated by significant distances relative to a residential exposure scenario. Likewise, the contributions from Area IV to hypothetical onsite suburban residents in NASA or Boeing remediation areas also would be small and would make a minimal addition to cumulative impacts. It is unlikely that the same workers would perform remediation work for DOE, NASA, and/or Boeing because remediation activities are planned to occur in overlapping years. If workers do perform remediation work in more than one area, they can only be in one area at a time and would not be exposed to both simultaneously. Whatever time they spend in one area would take away from the time they could spend in another area and would be limited to applicable regulatory standards and guidelines. Because work practices during excavation or demolition would control dust, impacts would be localized to the work area. Therefore, contributions from remediation activities in one area of SSFL on remediation workers in an adjacent area would only minimally add to cumulative impacts on worker health.

Resource Area	DOE Contribution to Cumulative Impacts	NASA and Boeing Contribution to Cumulative Impacts	Other Contributions to Cumulative Impacts	Cumulative Impacts
Waste management	Considering all DOE soil remediation, building demolition, and groundwater remediation activities, DOE would generate 57,600 to 103,300 cubic yards of LLW/MLLW, about 49,100 cubic yards of hazardous waste, 53,200 to 794,000 cubic yards of nonhazardous waste, and 3,540 cubic yards of recyclable material.	Considering all soil remediation and building removal activities, NASA could generate 87,000 cubic yards of LLW/MLLW [a] (no LLW/MLLW would be generated by Boeing). NASA and Boeing combined would generate 489,700 to 752,700 cubic yards of hazardous waste, 398,000 cubic yards of nonhazardous waste, and 37,700 cubic yards of recyclable material.	None identified.	DOE is projected to generate and ship off site about 40 to 54 percent of the SSFL cumulative volume of LLW and MLLW, 6 to 9 percent of the cumulative volume of hazardous waste, 12 to 67 percent of the cumulative volume of nonhazardous waste (primarily soil), and about 9 percent of the cumulative volume of recyclable material. Sufficient capacity exists for all types of waste generated by DOE, NASA, and Boeing, and the impact on any single facility's capacity can be reduced by sending waste to multiple disposal facilities.
Cultural resources	**Archaeological resources:** NRHP–eligible sites would be protected from impacts (i.e., adverse effects) through implementation of a Programmatic Agreement under Section 106 of the NHPA. Sites that are not individually eligible, but are contributing elements of the Chumash-designated Santa Susana Sacred Site, could be adversely impacted. However, cultural resources that are not NRHP-eligible could be protected under the 2010 AOC exemption process. **Architectural resources:** No structures located in DOE-administered areas are NRHP-eligible. **Traditional cultural resources:** The character-defining traits of the Chumash-designated Santa Susana Sacred Site include all archaeological and natural resources, settings, and viewsheds. Cleanup activities would affect some archaeological resources. Plants and animals may be disturbed, dislocated, or destroyed. Beneficial impacts would be achieved through restoration of viewsheds by removal of structures. Removal of contamination would also be beneficial.	**Archaeological resources:** NRHP–eligible areas on NASA-administrated lands would be protected from impacts (i.e., adverse effects) through implementation of its Programmatic Agreement under Section 106 of the NHPA. **Architectural resources:** NASA proposes to preserve one or more NRHP-eligible structures, but demolition of other structures would contribute to cumulative effects. **Traditional cultural resources:** Impacts from NASA and Boeing activities on the Chumash-designated Santa Susana Sacred Site would have similar impacts on those described for DOE. Beneficial impacts would be achieved through restoration of viewsheds by removal of structures. Removal of contamination would also be beneficial.	Of the 129 actions identified within 10 miles of SSFL, as many as 21 have the potential to contribute to cumulative impacts. **Archaeological resources:** Large-scale developments outside SSFL would contribute to cumulative adverse impacts if archaeological sites are disturbed during project construction, paved over, or disturbed at a later date due to human activity. **Architectural resources:** None specifically identified. **Traditional cultural resources:** Loss of defining characteristics of traditional cultural values at other locations within the ROI could add to cumulative impact on the viewsheds.	**Archaeological resources:** The overall trend in the region is toward a reduction in NRHP-eligible archaeological sites, both pre-contact Native American and post-contact, as these impacts accumulate. Where NHPA is applicable, adverse effects to NRHP-eligible sites would be mitigated, but mitigation could include removal of the site; where NHPA is not applicable, or where sites may be removed from the overall inventory of archaeological resources. The protection of NRHP-eligible sites at SSFL would not add to cumulative, regional impacts. However, the overall complement or archaeological sites, particularly those that are not eligible for the NRHP, could continue to be reduced. **Architectural resources:** Because there are no NRHP-eligible structures within the DOE area of potential effects, DOE cleanup activities would have no cumulative effect on architectural resources. **Traditional cultural resources:** Cumulative adverse effects on traditional cultural resources are likely as cleanup occurs on the entire SSFL and as development occurs in previously undeveloped land in the ROI, including in areas with intact landscapes or remote locations where traditional resources may still retain integrity. Beneficial impacts would be achieved through restoration of viewsheds by removal of structures at SSFL. Removal of contamination at SSFL would also be beneficial.

Resource Area	*DOE Contribution to Cumulative Impacts*	*NASA and Boeing Contribution to Cumulative Impacts*	*Other Contributions to Cumulative Impacts*	*Cumulative Impacts*
Socio-economics	**Employment:** DOE onsite activities would require 25 to 26 workers. Workers would likely originate primarily from Ventura and Los Angeles Counties. **Truck Drivers and Traffic:** DOE would require from 32 to 48 truck drivers. A maximum of 95 truck drivers could be required for 2-day one-way truck trips to distant facilities. Traffic conditions near businesses would not change substantially. **Infrastructure and Municipal Services:** Impacts on roads would result in impacts on local government funding and expenses. DOE may need to negotiate with local governments to contribute its portion of the cost for maintenance and repair of affected roads. **Housing Availability:** Because workers would likely originate from the region, changes to housing availability are not expected. **Disposal facility impacts:** Increases in truck traffic are not expected to have a cumulative adverse economic impact on local businesses near disposal facilities because the maximum number of daily truck trips would be relatively small. The largest number of daily shipments would be to a nonhazardous waste facility (25 shipments).[b]	**Employment:** NASA and Boeing onsite activities would require 150 to 175 workers. Workers would likely originate primarily from Ventura and Los Angeles Counties. **Truck Drivers and Traffic:** NASA and Boeing would require an estimated 9 to 42 truck drivers. A maximum of 202 truck drivers could be required for 2-day truck trips to distant facilities. Traffic conditions near businesses would not change substantially. **Infrastructure and Municipal Services:** Impacts on roads would result in impacts on local government funding and expenses. **Housing Availability:** Because NASA and Boeing workers would likely originate from the region, changes to housing availability are not expected. **Disposal facility impacts:** Increases in truck traffic are not expected to have a cumulative adverse economic impact on local businesses near disposal facilities because the maximum number of daily truck trips would be relatively small. The largest number of daily shipments would be to a nonhazardous waste facility (42 shipments).[b]	The populations in Los Angeles and Ventura Counties are projected to increase by 9 percent from 2013 through 2030. **Employment:** More than 117,000 construction workers are in the region. **Truck Drivers and Traffic:** Approximately 7,200 workers are employed in specialized freight trucking in the region, plus approximately 26,600 employees in general truck transportation. **Infrastructure and Municipal Services:** Population growth could increase traffic levels, but also could increase spending by local and state government agencies on roadways and mass transit projects. **Housing Availability:** Projected population growth in the ROI would increase the demand for housing. Future housing development is expected to meet the demands of population growth. **Disposal facility impacts:** None identified.	**Employment:** SSFL remediation activities would require 175 to 201 workers. SSFL site activities would have a minor beneficial impact on the economy in Los Angeles and Ventura Counties by providing employment and increasing sales for industries that provide equipment, supplies, and rentals. Because workers would likely originate from the region, new spending in the region would be minimal. **Truck Drivers and Traffic:** Employment of 73 to 297 SSFL truck drivers would represent 1 to 4 percent of the available truck drivers in Los Angeles and Ventura Counties, and would not adversely affect the truck transportation industry. Traffic conditions near businesses would not change substantially. Business sales and revenues would not change substantially. **Infrastructure and Municipal Services**: DOE truck trips would represent 19 to 52 percent of the total shipments from SSFL. Impacts on roads would result in impacts on local government funding and expenses. DOE activities would not require additional services, so there would be no cumulative impacts on other municipal services. **Housing Availability:** Because SSFL workers would likely originate from the region, changes to housing availability are not expected. **Disposal facility impacts:** Increases in truck traffic from SSFL waste disposal activities are not expected to have a cumulative adverse economic impact on businesses near waste disposal facilities because the maximum number of daily truck trips would be relatively small. DOE estimates that the combined maximum daily truck shipments arriving at a nonhazardous waste facility would be 43.[b] DOE estimates the maximum daily truck shipments to facilities for other types of waste would be less – 17 at LLW or MLLW facilities, 39 at hazardous waste facilities, and 4 at recycle facilities (see Appendix D).[c]

Resource Area	*DOE Contribution to Cumulative Impacts*	*NASA and Boeing Contribution to Cumulative Impacts*	*Other Contributions to Cumulative Impacts*	*Cumulative Impacts*
Environmental justice	Impacts on minority and low-income populations would be the same as those experienced by the general population. Therefore, no disproportionately high and adverse effects on minority and low-income populations are expected.	Impacts on minority and low-income populations would be the same as those experienced by the general population. Therefore, no disproportionately high and adverse effects on minority and low-income populations are expected.	None identified.	Cumulative impacts on minority and low-income populations would be the same as those experienced by the general population. Therefore, no disproportionately high and adverse cumulative effects on minority and low-income populations are expected.
Sensitive-aged populations	Impacts on sensitive-aged populations would be the same as those experienced by the general population. No disparate impacts (markedly distinct impacts relative to those on the general population) on sensitive-aged populations are expected.	Impacts on sensitive-aged populations would be the same as those experienced by the general population. No disparate impacts on sensitive-aged populations are expected.	None identified.	Cumulative impacts on sensitive-aged populations would be the same as those experienced by the general population. Because there would be adverse cumulative impacts on members of the public, there would be no disparate cumulative impacts on sensitive-aged populations.

ALARA = as low as reasonably achievable; AOC = *Administrative Order on Consent for Remediation*; BMP = best management practices; Boeing = The Boeing Company; CMWD = Calleguas Municipal Water District; CNEL = community noise equivalent level; dBA = decibels A-weighted; LCF = latent cancer fatality; LLW = low-level radioactive waste; LOS = level of service; LUT = Look-Up Table; MLLW = mixed low-level radioactive waste; NASA = National Aeronautics and Space Administration; NBZ = Northern Buffer Zone; NHPA = National Historic Preservation Act; NRHP = *National Register of Historic Places*; ROI = region of influence; SRAM = *Final Standardized Risk Assessment Methodology Revision 2 Addendum, Santa Susana Field Laboratory, Ventura County, California* (MWH 2014).

[a] NASA did not conduct radiological operations in its areas of SSFL; estimated quantities of radioactive waste from NASA remediation are due to naturally occurring isotopes and the LUT values established in accordance with the 2010 NASA *Administrative Order on Consent for Remedial Action* (DTSC 2010b).

[b] The years in which the maximum number of daily waste deliveries may occur for different waste types would be different for DOE, NASA, and Boeing. For example, the maximum daily deliveries of nonhazardous waste from NASA and Boeing combined would likely occur when the number of DOE is shipments small (due to DOE's planned sequence of activities). Therefore, the combined maximum daily delivery is not the sum of the individual organizations' maximum daily deliveries.

[c] In accordance with a Transportation Agreement between DOE, NASA, and Boeing (Boeing 2015a), the maximum total number of daily heavy-duty truck round trips from SSFL would be limited to 96. The 96 heavy-duty truck round trips would be split between activities such as trips to disposal facilities or recycle facilities and shipment of backfill to SSFL. Therefore, it is highly unlikely that 96 shipments per day to any single disposal facility would occur.

Chapter 3
Affected Environment

3.0 AFFECTED ENVIRONMENT

This chapter describes the areas that could be affected by the proposed alternatives evaluated in this *Draft Environmental Impact Statement for Remediation of Area IV and the Northern Buffer Zone of the Santa Susana Field Laboratory (Draft SSFL Area IV EIS)*. These descriptions of the affected environment provide context for understanding the environmental consequences described in Chapter 4 of this environmental impact statement (EIS) and serve as baselines from which any potential environmental impacts can be evaluated.

Identifying or defining the region of influence (ROI) for each resource area is an important component in analyzing impacts. ROIs are specific to the resource area evaluated, and encompass geographic areas within which potential impacts could be expected to occur. The ROIs for this EIS may be as limited as Area IV, or extend to all or other parts of Santa Susana Field Laboratory (SSFL), to the communities surrounding SSFL and beyond.

3.1 Land Resources

Land resources include both land use and visual resources. The ROI for land resources encompasses SSFL Area IV, the Northern Buffer Zone (NBZ), and the surrounding areas that could be affected by the proposed activities. This section describes the existing land use; recreation; infrastructure, including existing buildings and associated utilities; and aesthetics and visual resources (sensitive visual resources and viewsheds) within and in the surrounding terrain of SSFL Area IV that could be affected by the proposed activities.

3.1.1 Land Use

SSFL is located entirely within Ventura County, California, at the eastern edge where Ventura County borders Los Angeles County. SSFL occupies 2,850 acres in the hills between Chatsworth and Simi Valley. SSFL is divided into four administrative areas and two contiguous buffer zones north and south of the administrative areas. Area IV is approximately 290 acres in size and is located in the western portion of SSFL. At one time, Area IV housed over 200 buildings and associated other infrastructure used for conventional energy and nuclear research. Approximately 90 percent of the former infrastructure has been decontaminated, decommissioned and demolished (by the U.S. Department of Energy [DOE], The Boeing Company [Boeing], or their predecessors), and any remaining infrastructure that formerly housed research and testing support facilities is inactive and planned for demolition. The NBZ is approximately 182 acres in size. Roads providing access to and from Area IV, including the proposed truck routes between Area IV and the major highways, are in Los Angeles County. **Figure 3–1** shows the location of SSFL and the onsite administrative areas and buffer zones.

In accordance with California law, the counties have adopted general plans that provide goals and policies to guide current and long-term development within their jurisdictions. Under state law, the goals, policies, and implementation measures in the general plan are mandatory, and any land use approvals made by planning commissions and boards of supervisors must conform to the general plan.

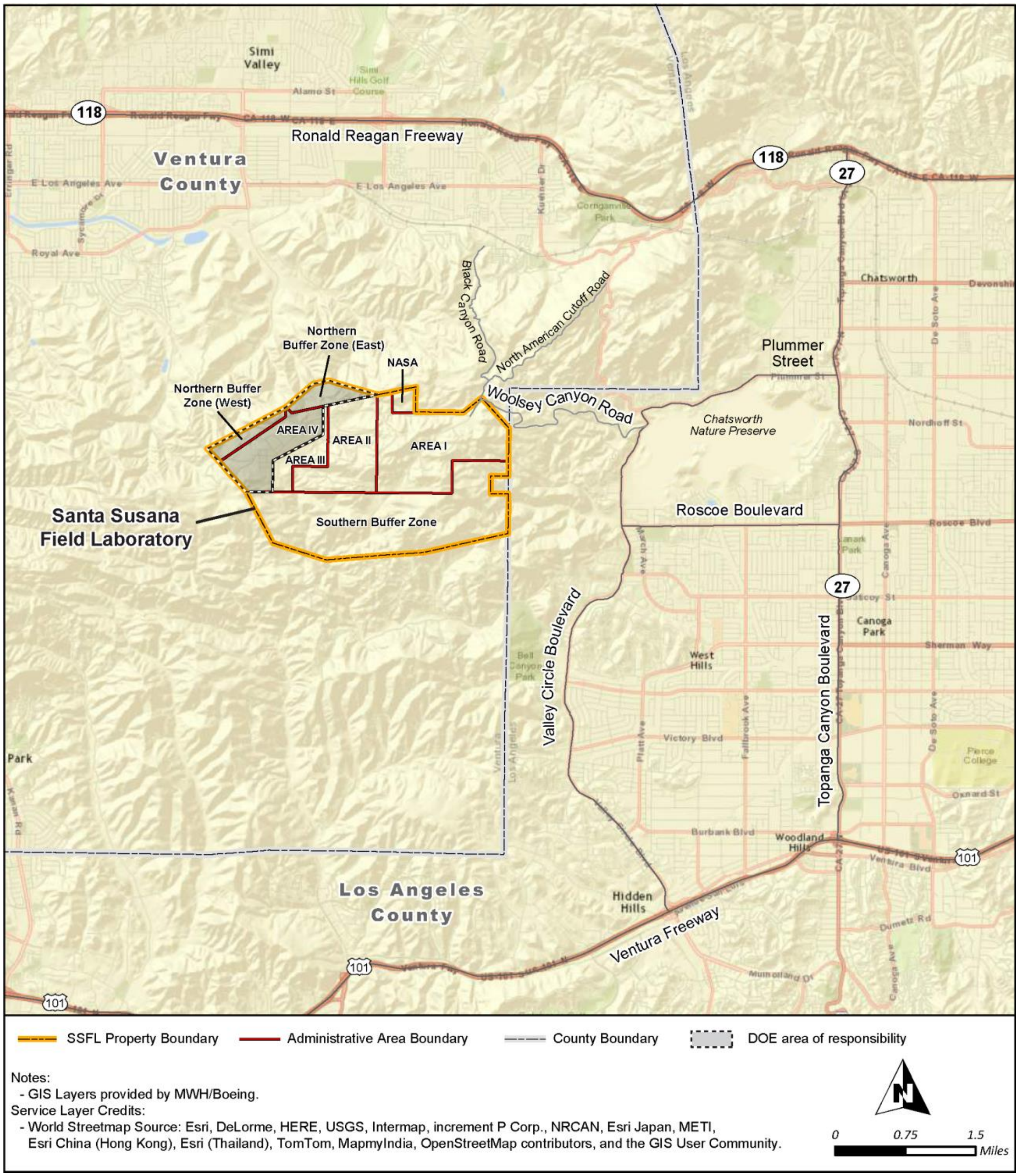

Figure 3–1 Santa Susana Field Laboratory Location

The *Ventura County General Plan* (Ventura County 2015a) Land Use Element sets specific goals, policies, and programs for the county's existing and future land use designations, population and housing, and employment and commerce/industry. *Ventura County Non-Coastal Zoning Ordinance* (Ventura County 2015b) includes zoning designations used for SSFL. Zoning further describes the division of land into zones within which various uses are permitted.

Figure 3–2 is a land use map for Ventura County. SSFL is located in the unincorporated area of Ventura County and is not located within any specific plan area or other project area designated by the *Ventura County General Plan* (Ventura County 2015a). The general plan designation for SSFL is open space, although it is zoned rural agriculture and open space. The land use is modified by a special use permit to allow industrial uses (Ventura County 2011a). The NBZ, located north of Area IV, consists of undeveloped land. The NBZ congruently operates under the same special use permit as the rest of SSFL; however, no industrial activities were conducted in the NBZ, and the land remains in a naturally vegetated state.

Area IV is zoned rural agriculture (RA-5 ac) and the NBZ is zoned open space (OS-160 ac) by the *Ventura County Non-Coastal Zoning Ordinance* (Ventura County 2015b). The purpose of the rural agriculture zone is to provide for and maintain a rural setting where a wide range of agricultural uses are permitted while surrounding residential land uses are protected. The purpose of the open space zone is to provide for: preservation of natural resources, managed production of resources, outdoor recreation, public health and safety, formation and continuation of cohesive communities by defining boundaries, promotion of efficient municipal services and facilities by confining urban development, and support of the mission of military installations.

The *City of Los Angeles General Plan* (City of Los Angeles 2001) includes a framework element with a land use chapter that summarizes the existing and projected future land use conditions and characteristics for the city. According to this general plan, the proposed project-related truck routes traverse several land use designations, including a mix in density of single family residential and multi-family residential; limited to community commercial; limited to light industrial; and open space.

Land use in closest proximity to SSFL consists primarily of open space with some low-density uses, including the American Jewish University Brandeis-Bardin Campus to the north, Runkle Canyon to the northeast, and cattle grazing to the west. Bell Canyon, southeast of SSFL and bordering Los Angeles County, is the closest community in proximity to SSFL. The approximately 1,133-acre community is zoned for residential and commercial/industrial uses and hosts a population of 3,883 residents (Ventura County 2015a). Properties to the east of SSFL within Los Angeles County are zoned light agricultural, with variances to permit higher-density uses such as mobile home parks.

3.1.1.1 Recreation

SSFL sits within a rare and vital wildlife corridor connecting the Sierra Madre Ranges of the Los Padres National Forest to the Santa Monica Mountains and the Pacific Ocean. Termed the Santa Monica - Sierra Madre Connection and comprising approximately 125,000 acres, the corridor consists of sandstone cliffs, oak woodlands, and scrub and meadows, with valley and mountain vistas. Several formally designated open space areas are located within close proximity to SSFL and are a part of this unique corridor. Figure 3–2, the Ventura County land use map, illustrates the location of these open space areas in proximity to SSFL. In addition, several small recreation and open space areas are located along project related truck routes to and from SSFL.

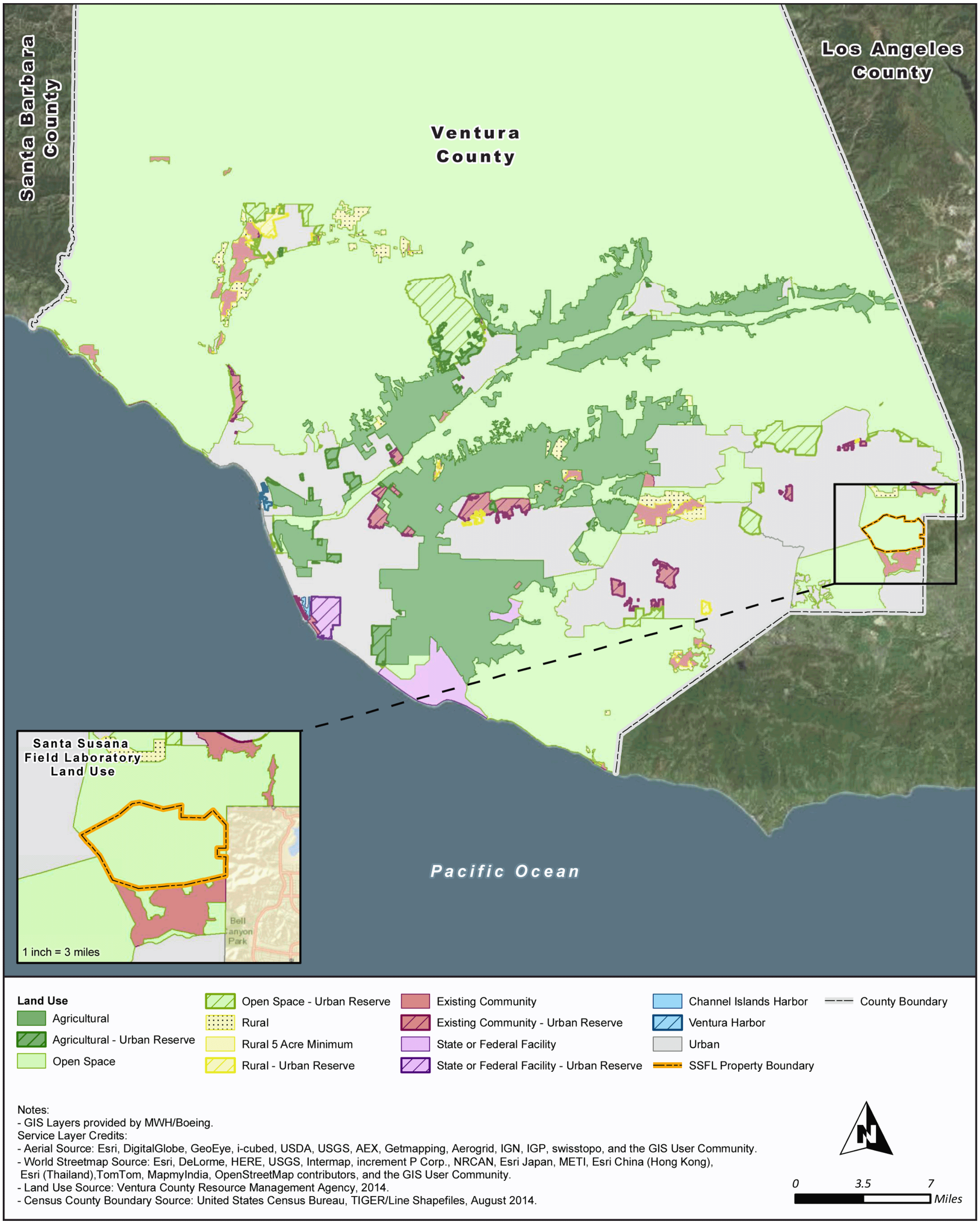

Figure 3–2 Ventura County Land Use Map

Santa Monica Mountains National Recreation Area

The SSFL is included in the study area for the National Park Service's *Rim of the Valley Corridor Draft Special Resource Study and Environmental Assessment* (*Draft ROTV EA*) (NPS 2015e). The "Rim of the Valley" encompasses the mountains encircling the San Fernando, La Crescenta, Santa Clarita, Simi, and Conejo Valleys of Los Angeles and Ventura Counties (NPS 2013). The *Draft ROTV EA,* issued in April 2015, analyzes alternatives to determine whether or not the area contains nationally significant resources and would be suitable as an addition to the Santa Monica Mountains National Recreation Area. Alternatives range from building a collaborative partnership to explore means of establishing an interconnected system of parks, habitats, and open space, connecting urban neighborhoods and the surrounding mountains, to expanding the boundaries and providing new authoritative management to improve recreation and habitat connectivity for the Santa Monica Mountains National Recreation Area. Additional lands would only be acquired and incorporated from willing landowners. **Figure 3–3** provides an overview of the study area.

Sage Ranch Park

Sage Ranch Park, owned and operated by the Santa Monica Mountains Conservancy is located in the Simi Hills between the San Fernando and Simi Valleys. It is situated immediately northwest of SSFL Area I (1 mile northeast of Area IV), along the Los Angeles-Ventura county line. The park has two entrances, one located at the terminus of Woolsey Canyon Road at Black Canyon Road, approximately 1 mile north of the intersection, and a secondary access point to the park located farther north off Black Canyon Road.

Sage Ranch is a 625-acre park that provides easily accessible hiking, biking, and equestrian trails; sandstone rock formations; expansive views; ample parking; an outdoor amphitheater; picnic tables; camp sites (tent camping only); and filming locations (SMMC 2015).

Upper Las Virgenes Canyon Open Space Preserve

Formerly Ahmanson Ranch, this 2,983 acre preserve is located in the Simi Hills in Ventura County, at the western edge of the San Fernando Valley, south of Area IV. This vast parkland includes recreational amenities such as miles of hiking, biking and equestrian trails; wedding and event spaces; a nature center; historic sites; picnic tables, and filming locations. Natural park features include rolling hills with valley oaks and a sycamore-lined canyon bottom, as well as the headwaters of Malibu Creek and expansive natural and city views. The park is accessible at the Victory Trailhead at the western terminus of Victory Boulevard in West Hills, at the Upper Las Virgenes Canyon Trailhead at the northern end of Las Virgenes Canyon Road in Calabasas, and through trails headed east on National Park Service land at Cheesebro Canyon (SMMC 2014).

3.1.1.2 Infrastructure

This section describes existing buildings and utilities, as well as utilities that currently and previously served Area IV in the past. These utilities include water, natural gas, sewer and electrical services, and communications.

Area IV Existing Buildings

As described in Chapter 2, Section 2.5, of this EIS, 22 structures remain in Area IV, 18 of which are owned by DOE and the remainder by Boeing. Three types of structures remain; metal sheds used for outside storage of equipment and materials, prefabricated metal upper structures, and cinder block/concrete walls with metal roofs. Figure 2–6 in Section 2.5 shows the locations of these buildings.

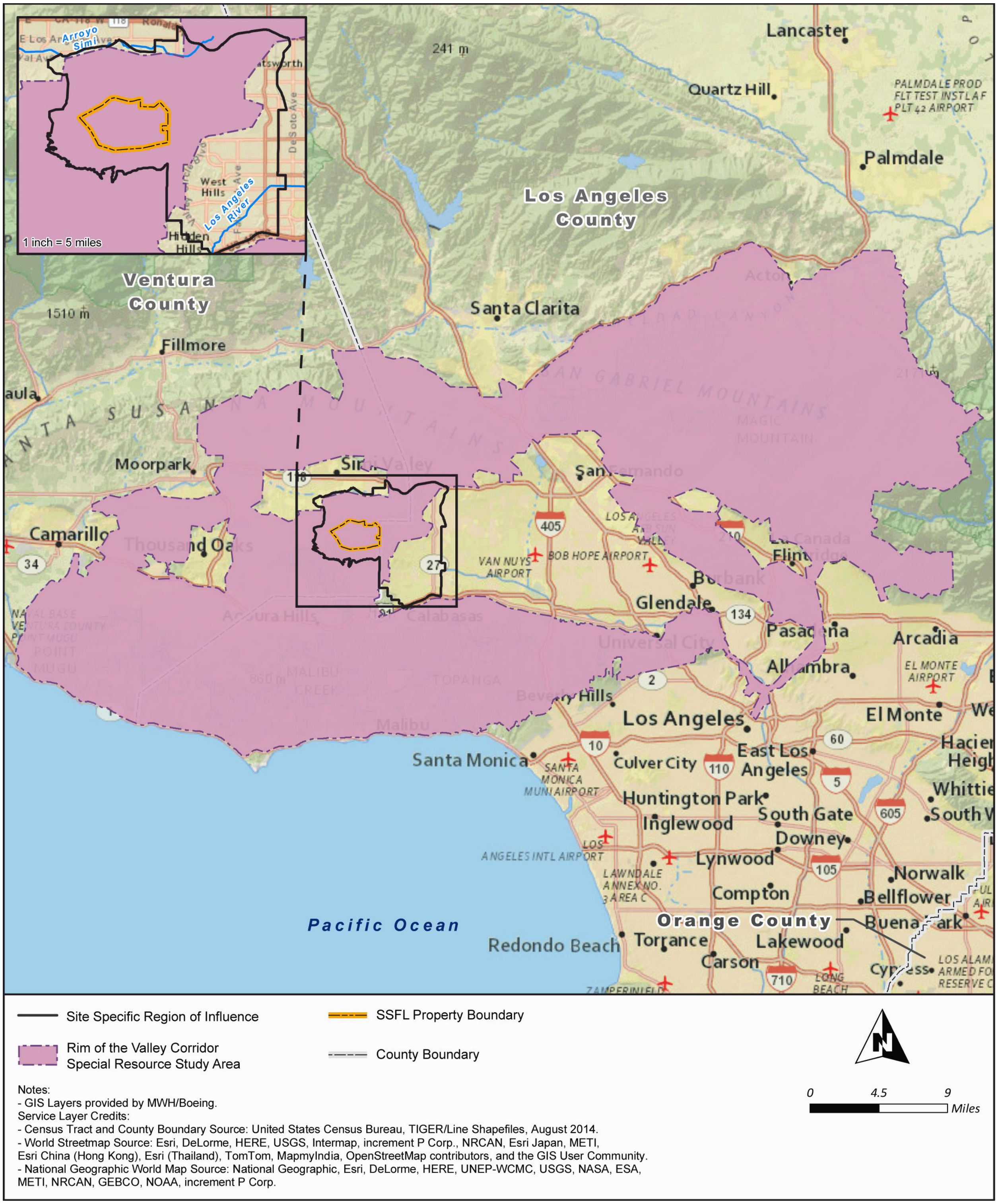

Figure 3–3 Rim of the Valley Corridor Special Resource Study Area

Water

Ventura County Waterworks historically supplied water to SSFL. Water was pumped to SSFL from Simi Valley and entered SSFL from the east near the main entrance gate. The water supply lines provided water directly to various buildings throughout SSFL. This water was used primarily for sanitation and dust control purposes. Drinking water was provided by portable 5-gallon drinking water dispensers. Currently, all water services have been severed to all Area IV buildings, and portable facilities are used for drinking and sanitary purposes.

Project-related water needs for onsite remediation (e.g., dust control, backfill compaction, and source removal) would be obtained from the Calleguas Municipal Water District (CMWD). **Table 3–1** provides district projections for its imported and local water supply through 2035. In an average year, the district has a combined imported and local water supply of 177,644 acre feet per year. In 2011, CMWD projected that it would have a combined water supply of 195,389 acre feet per year to accommodate population and job growth (CMWD 2011). However, these projections may not reflect conditions going forward. Southern California has been under drought conditions for several years, and the governor has mandated water conservation measures in the state. On July 2, 2014, the CMWD Board of Directors passed a resolution appealing for extraordinary water conservation efforts and a minimum 20 percent reduction in water usage in its service area (CMWD 2014). After twice proclaiming in 2014 that severe drought conditions in California had resulted in states of emergency, on April 1, 2015, Governor Brown issued Executive Order B-29-15, which directs the State Water Resources Control Board to impose restrictions that would achieve a statewide 25 percent reduction in potable water usage through February 28, 2016 (CA EO 2015). As a result, Californians reduced their potable urban water use by 24 percent compared to 2013 usage (New York Times 2016). In May 2016, California suspended the mandatory 25 percent reduction and directed local communities to set their own conservation standards (SWRCB 2016). Southern California remains in a severe drought condition.

Table 3–1 Calleguas Municipal Water District Imported and Local Water Supply Projections[a]

Hydrologic Condition	*Volume (acre-feet/year)*				
	2015	*2020*	*2025*	*2030*	*2035*
Imported Water Supply					
Average Year	129,004	136,966	140,753	142,365	143,777
Dry Year	131,876	139,975	143,819	145,534	147,013
Multiple Dry Years	131,104	139,985	145,255	148,545	149,548
Local Water Supply					
Average Year	66,434	70,404	70,974	73,354	74,055
Dry Year	67,333	71,511	72,096	74,592	75,310
Multiple Dry Years	60,301	64,489	65,793	66,834	67,574
Total Water Supply					
Average Year	195,438	207,370	211,727	215,719	217,832
Dry Year	199,209	211,486	215,915	220,126	222,323
Multiple Dry Years	191,405	204,474	211,048	215,379	217,122

[a] These projections made in 2011 do not reflect the 25 percent reduction in potable water usage required by Executive Order B-29-15, issued by California Governor Brown on April 1, 2015, or the resolution of the Calleguas Municipal Water District Board of Directors passed in July 2014, which appealed for extraordinary waste conservation efforts and a minimum 20 percent reduction in water usage in its service area.

Source: CMWD 2011.

Table 3–2 provides district projections for water demands through 2035. Municipal and industrial uses account for 90 percent of the water distributed by CMWD's purveyors. Agricultural uses account for the remaining 10 percent (CMWD 2011). In 2005, a total of 156,037 acre-feet was used in the CMWD service area, with single family households using 56.6 percent of the total (CMWD 2011). In 2010, water usage was 138,954 acre-feet. Lower usage was due to the implementation of the water supply allocation program, which was triggered because of reduced availability of State Water Project supplies, and because CMWD service area had cooler than normal weather in 2010 (CMWD 2011).

Table 3–2 Calleguas Municipal Water District Total Water Demand[a]

Hydrologic Condition	*Volume (acre-feet/year)*				
	2015	*2020*	*2025*	*2030*	*2035*
Average Year	179,818	188,687	192,121	198,164	202,160
Dry Year	185,960	194,699	198,843	206,556	211,547
Multiple Dry Years	185,654	194,330	198,448	205,556	210,205

[a] These projections made in 2011 do not reflect the 25 percent potable water reduction usage required by Executive Order B-29-15, issued by California Governor Brown on April 1, 2015, or the resolution of the Calleguas Municipal Water District Board of Directors passed in July 2014, which appealed for extraordinary waste conservation efforts and a minimum 20 percent reduction in water usage in its service area.

Source: CMWD 2011.

Natural Gas

Southern California Gas Company supplied natural gas to SSFL in the past. Although there is no longer gas service to buildings in Area IV, a main pipeline that runs completely underground across the site remains. This pipeline runs from northeast Area I to the western boundary of SSFL at Area IV and extends beyond the site boundaries on both the east and west ends. Because this pipeline currently serves the surrounding communities, it would be left in place and remain active during and after the proposed activities.

Sewer System

Septic tanks and their associated leach fields were used at SSFL until approximately 1960, when an integrated sewer system was installed. In 1961, buildings in Areas IV were connected to a sanitary sewer system that piped sewage to a central wastewater treatment plant located in Area III. The water supply and sewer system are no longer operational in Area IV, and the Area III wastewater treatment plant has been removed. Portable restrooms and wash stations are currently in use in Area IV.

Electrical System

Southern California Edison provides electricity to SSFL from the Chatsworth Substation in Chatsworth, California. There is also a Southern California Edison–owned substation located along the northern boundary of Area IV. **Figure 3–4** shows the locations of the existing electrical distribution infrastructure.

Communication System

Cellular telephone coverage from Simi Valley is used for phone communication. Two-way radios are used for onsite emergency communication.

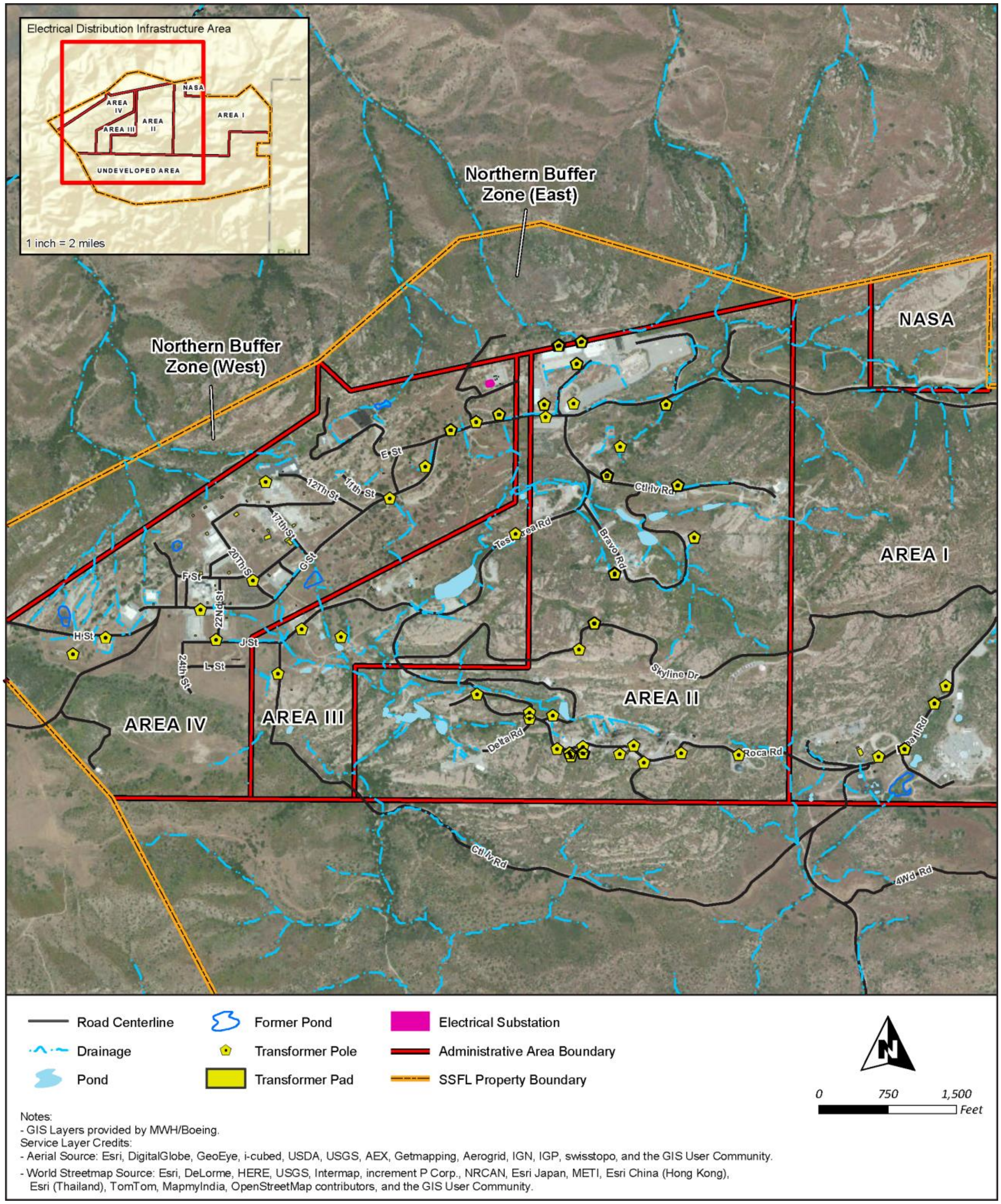

Figure 3–4 Santa Susana Field Laboratory Electrical Distribution System

3.1.2 Aesthetics and Visual Quality

This section describes the existing visual characteristics of the ROI, including viewer sensitivity levels, landscape character types, and visual modification classes. Appendix B, Section B.1, describes the aesthetics and visual resources methodology.

The Ventura County General Plan (Ventura County 2015a) discusses visual resources and their importance to the county's character and includes goals and policies to protect visual resources. Among the goals are preservation and protection of significant open views and the visual resources of the county, visual resources within the viewsheds of lakes and state- and county-designated scenic highways and other scenic areas; and enhancement and maintenance of the visual appearance of buildings and developments. The policies concerning scenic resource areas are subject to the Scenic Resource Protection Overlay Zone and standards set forth in the *Ventura County Non-Coastal Zoning Ordinance* (Ventura County 2015b); however, because SSFL is not located in an area protected by Ventura County as a scenic resource, these standards do not apply.

Sensitivity Level

Landforms, vegetation, water surfaces, and cultural modifications (physical changes caused by human activities) give a landscape its inherent visual qualities and form the overall impression of an area (Headley 2010). Determining the sensitivity level of potential changes to an area entails characterizing the quality of the landscape and identifying the primary user groups. Sensitivity levels are highest for views involving designated areas of aesthetic, recreational, cultural, or scientific interest such as parklands, scenic roads, recreational areas, and historic sites. Areas considered to have no sensitivity are those for which there are no public views or no identifiable indications of public interest in the quality of the visual resources (Headley 2010).

Primary viewer groups may be classified according to each group's expected sensitivity to changes in visual conditions. Sensitivity is ranked as high, moderate, low, or "no sensitivity." To varying degrees, sensitive viewers include recreational users (hikers, cyclists, equestrians) and travelers on roadways (interstate, state, and local roads). For all viewer groups, sensitivity is expected to increase with proximity to a given location.

Area IV, including the NBZ, is a restricted area that is not accessible or viewable by the public and is not visible from nearby roadways. Only workers and those on official tours or business are able to access the site. Onsite workers primarily experience foreground views limited to the urban-industrial landscape. As such, no sensitive viewer groups were identified for Area IV, including the NBZ. From certain onsite locations, workers and visitors do, however, enjoy background views of the Simi Hills.

Landscape Character Type

SSFL sits on the top of an east-west-trending sandstone ridge (the Simi Hills). The highest elevations of the ridge occur in the eastern portion (Areas I and II), more than 2,000 feet above the valley floors. The ridge forms the southern portion of the Simi Valley and the western portion of the San Fernando Valley. In terms of landform, the eastern portion of the ridge is characterized by massive, vertical sandstone outcrops that are observed from the San Fernando Valley.

Although still steep, the northern slope above the Simi Valley is less vertical, with less rock outcrop prominence, except along the ridge top. The 2,000-foot elevation change makes the Simi Hills a prominent landscape feature.

The landforms create many lines making distinctive features. The lines are primarily linear, horizontal, and vertical. This includes the skyline, bedrock outcrops, bedrock fractures, drainages, and vegetation patterns.

The landscape has distinctive coloration. This includes the tans of the bedrock outcrops, seasonal green and brown vegetation, and dark greens trees (primarily oaks). As such, color variety and landscape pattern diversity create great visual interest.

Texture at SSFL is considered moderate; created by the contrast of colors, bedrock, landscape lines, and predominant grass/shrub vegetation.

The landform of Area IV is distinctly different from landforms in the rest of SSFL in that the central portion of Area IV is relatively flat (Burro Flats) and slopes gently to the southeast. The flat landscape offers great views within SSFL of the steep, sandstone features of Area II. Sandstone rock outcrops are less prominent within the central portion of Area IV, and the majority of the flat areas were developed to house research activities. Rock outcrops are most prominent in the NBZ, which is considered an extension of the overall landscape, bordering Area IV to the north and west. As buildings and other structures have been removed over time, vegetation, including grasses, weeds, and shrubs, has re-established plant cover.

The northern and western boundaries of Area IV and the NBZ are typified by vertical bedrock outcrops and steep, downsloping terrain. The southern portion of Area IV is also unique for SSFL, as the landform is the result of a different geologic formation, the Santa Susana Formation. The landform is more rounded and curving than the rest of SSFL, lacks bedrock outcrops, and rises to a hill slope that provides panoramic views of the remainder of SSFL and Simi Valley to the north.

As SSFL sits on top of a ridge, the foreground and mid-ground scenic views occur only from the site. There are no publicly accessible viewpoints from which to view Area IV. Sage Ranch provides mid-ground views of Areas I and II. None of the SSFL property is visible to or from the San Fernando Valley (except from Woolsey Canyon Road). There are background views of National Aeronautics and Space Administration (NASA) facilities in Area II that are visible from Simi Valley, but the vast majority of the site is not visible. Area IV's landscape dips downward to the south from the northern boundary. The highest elevations within northern Area IV are along its northern edge, blocking any views of Area IV from Simi Valley. There are limited spots along the northern edge of Area IV where Simi Valley is visible; however, Simi Valley cannot be observed from any of the former Area IV operational areas.

Area IV's and the NBZ's landscape character type has been categorized as urban-industrial (i.e., an area consisting of or bordered by urban and/or industrial land uses within the foreground distance (Headley 2010).

Visual Modification Class

Visual modification class descriptors are used to describe the visual congruence and coherence of a site. There are four visual modification classes based on the degree of noticeable change or incongruence of modifications to the natural landscape, ranging from Class 1, the least modified landscapes, to Class 4, highly modified landscapes.

Viewing Points

The three representative viewing points shown in **Figure 3–5** were selected based on their representation of common views experienced by viewers in each landscape character type in Area IV. These viewing points represent a class of views common across the project area. The landscape type, sensitivity level, and visual modification class for each viewing point are summarized in **Table 3–3**.

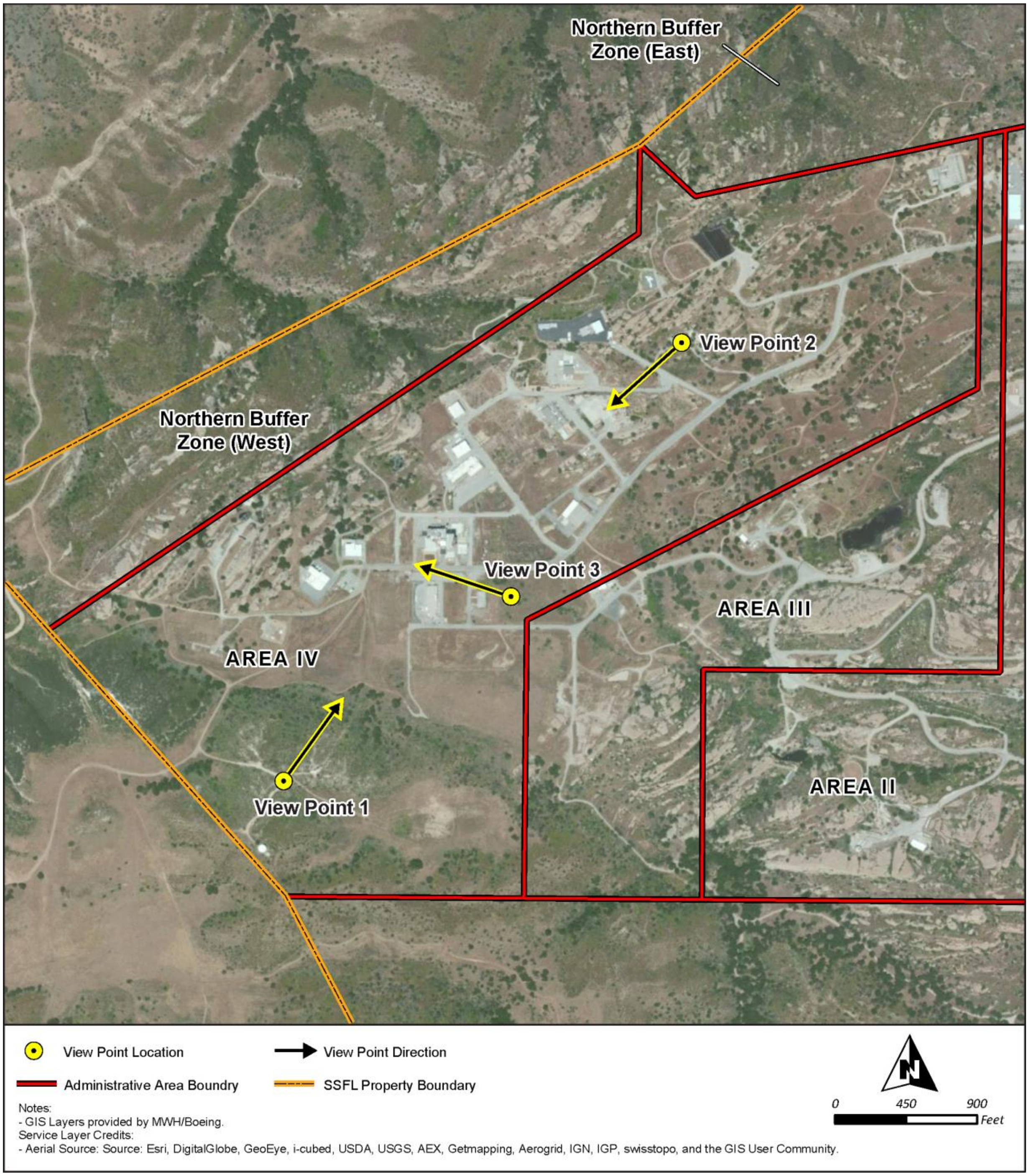

Figure 3–5 Representative Area IV Viewing Points

Table 3–3 Viewing Point Survey Summary

Viewing Point	*Landscape Character*	*Public Sensitivity*	*Visual Modification Class*
1	Urban-Industrial	No Sensitivity	3
2	Urban-Industrial	No Sensitivity	3
3	Urban-Industrial	No Sensitivity	4

See Appendix B for detailed definitions and analysis methodologies for aesthetics and visual quality.
Notes:

Landscape Character = Landscape character is the overall impression created by the unique combination of visual features, including land, vegetation, water, and structures. Categories are based on the basic character elements of form, line, color, and texture of the landform, vegetation, and structures.

Urban-Industrial = Refers to those areas where parklands (parks, open space, or reserves) are bordered by high-density (industrial, commercial, or residential) development within the foreground distance zone.

Public Sensitivity = A classification based on expected sensitivity to changes in visual conditions.

Visual Modification Class = A classification based on the overall congruence and coherence of the proposed project area and associated space.

Visual Modification Class 3 = Distracting, Visually Co-Dominant – Adverse changes in landscape features that have occurred in the past appear incongruous or incoherently arrayed to the point that they are distracting and compete for attention with other features in view.

Visual Modification Class 4 = Visually Dominant, Demands Attention – Landscapes are of the lowest quality. Adverse changes in landscape features that have occurred in the past appear incongruous or incoherently arrayed to the point that they are the focus of attention.

Viewing Point 1, shown in **Figure 3–6**, is located on a western ridge east of water tower number 2, overlooking a west-to-east panoramic view of Area IV. Extended views of the Simi Hills in the background can be viewed from this location. This viewing point has a landscape character type of urban-industrial, no sensitivity level, and a visual modification class of 3.

Figure 3–6 Viewing Point 1

Viewing Point 2, shown in **Figure 3–7**, is located at the former Building 4093 L85 reactor site, with direct east-to-west views of the existing buildings in Area IV. Extended views of the Simi Hills and rock outcrops can be viewed from this location. This viewing point has a landscape character type of urban-industrial, no sensitivity level, and a visual modification class of 3.

Figure 3–7 Viewing Point 2

Viewing Point 3, shown in **Figure 3–8**, is centrally located in Area IV with on-the-ground south-to-north views of the existing Sodium Pump Test Facility and other buildings. Extended views are limited. This viewing point has a landscape character type of urban-industrial, no sensitivity level, and a visual modification class of 4.

Figure 3–8 Viewing Point 3

3.2 Geology and Soils

Geologic resources are consolidated or unconsolidated earth materials, including ore and aggregate materials, fossil fuels, and landforms. For purposes of this EIS, soils are considered any unconsolidated geologic material above solid bedrock, including weathered bedrock.

SSFL is located in the Simi Hills, a northeast/southwest trending sub-range of the Santa Monica Mountains of California. The ROI for geology and soils encompasses Area IV and the NBZ. As shown in **Figure 3–9**, the topography of Area IV and the NBZ ranges from 1,300 feet above mean sea level within the lower extent of the NBZ, to 1,810 feet above mean sea level within the central portion of Area IV (Burro Flats), to 2,150 feet above mean sea level along the southwestern boundary of Area IV. Along the northwestern boundary of Area IV, the land slopes steeply towards Simi Valley. The central portion of Area IV, where the majority of development occurred, is relatively flat and is named Burro Flats.

3.2.1 Geologic Formations

Two geologic formations underlie Area IV, the Chatsworth Formation and the Santa Susana Formation. The Chatsworth Formation also underlies the NBZ. **Figure 3–10** shows the relative locations of these rock formations across SSFL, as well as other geologic features described in Section 3.2.1.3. The description of the geologic units and structures presented in this section is predominantly taken from the *Draft Site-Wide Groundwater Remedial Investigation Report, Santa Susana Field Laboratory, Ventura County, California* (MWH 2009b).

3.2.1.1 Chatsworth Formation

The Chatsworth Formation, deposited about 70 to 65 million years ago during the Cretaceous Period, underlies about 89 percent of Area IV and the NBZ and consists primarily of over 6,000 feet of massive thick-bedded sandstone with lesser amounts of interbedded shale, siltstone, and conglomerate. The Chatsworth Formation is divided into an upper and lower unit. The Lower Chatsworth Formation is exposed (or outcrops) only in the southeastern portion of SSFL (not Area IV or the NBZ). The Upper Chatsworth Formation is subdivided into two sandstone units referred to as Sandstone 1 and Sandstone 2, respectively. These sandstone units are separated and bounded above and below by fine-grained shale units. Area IV and the NBZ are primarily underlain by Sandstone 2, which comprises three coarser-grained members separated by two finer-grained members. These members from oldest to youngest are: Silvernale, Spa, Lower Burro Flats, ELV, and Upper Burro Flats.

3.2.1.2 Santa Susana Formation

The Santa Susana Formation is only found at SSFL in the southern portions of Area IV and southwestern-most portion of Area III and is separated from the Chatsworth Formation by the Burro Flats Fault. The Santa Susana Formation is lower Eocene and Paleocene in age and, according to *Geologic Map of the Calabasas Quadrangle* (Dibblee 1992), comprises four mapped units (from youngest to oldest):

- Gray micaceous claystone and siltstone with few minor thin sandstone beds;
- Tan coherent fine grained sandstone that locally contains thin shell-beds and calcareous concretions;

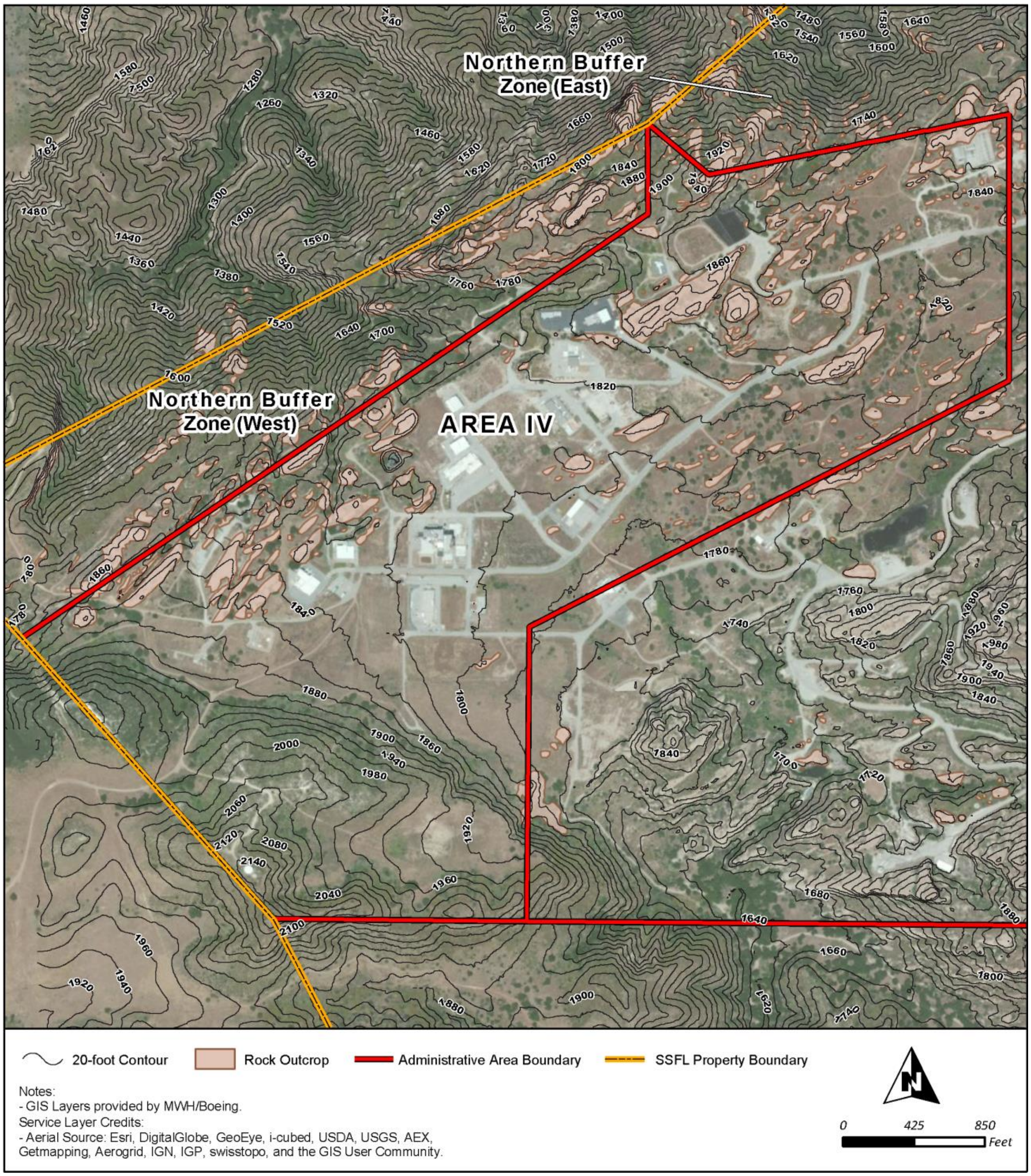

Figure 3–9 Topographic Map of Area IV and the Northern Buffer Zone

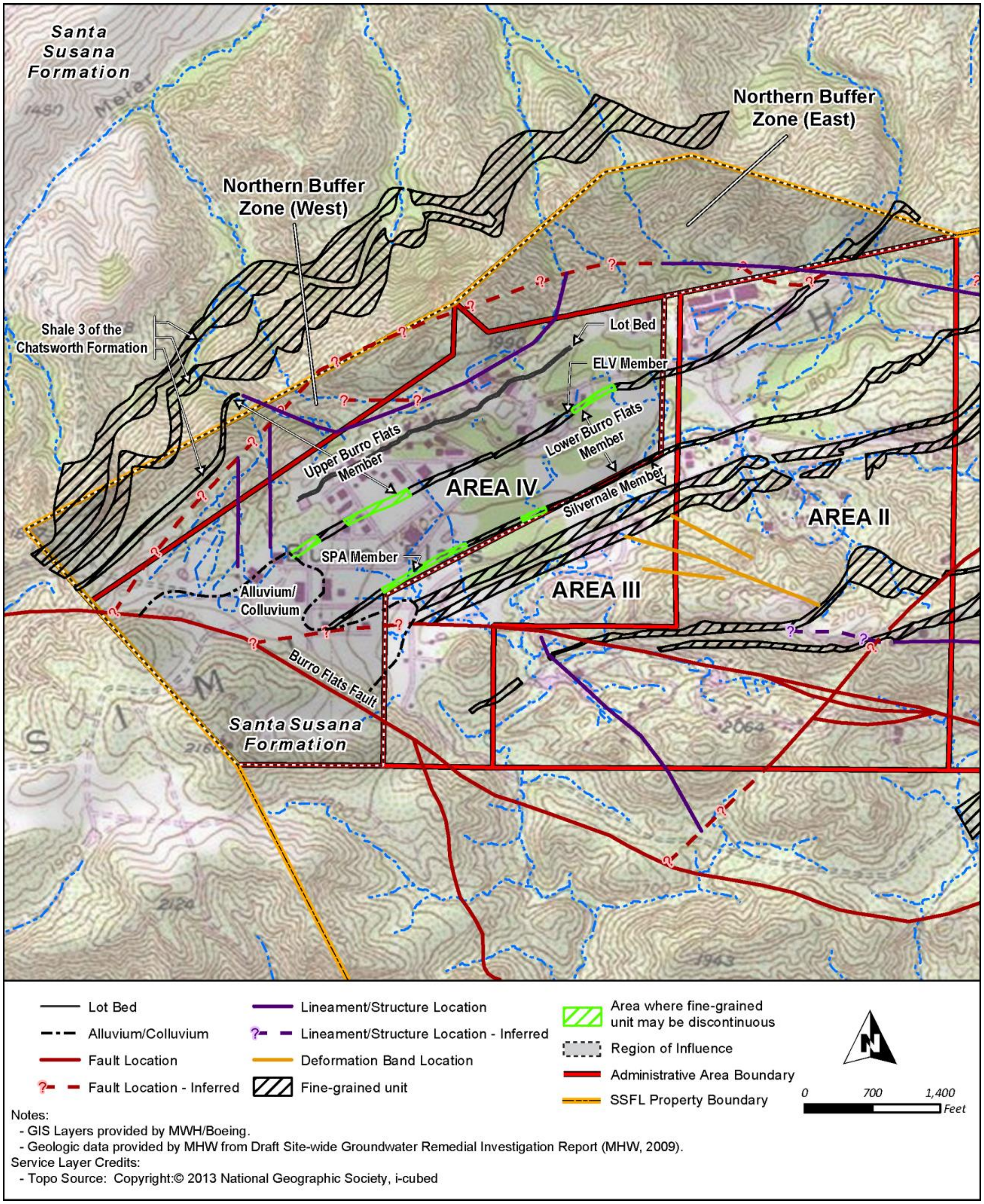

Figure 3–10 Geologic Map of Area IV and the Northern Buffer Zone

- Tan, semi-friable bedded sandstone, locally pebbly (also defined as the Las Virgenes Sandstone Member); and
- Gray to brown cobble conglomerate with smooth cobbles of quartzite, metavolcanic, and granitic rocks in a sandstone matrix that locally includes thin lenses of red clay (also known as the Simi Conglomerate Member).

The entire formation is as much as 3,280 feet thick but only the upper units outcrop in Area IV.

3.2.1.3 Geologic Faults

A fault or fault zone is a surface or zone of fractures with displacement of the rocks on either side of the fault/fault zone of at least 5 feet with respect to each other. The Burro Flats Fault, the dominant structural feature in the southern portion of Area IV, places the Chatsworth Formation in contact with the Santa Susana Formation.

Fractures and joints (surfaces of fracture or parting in the rock without displacement) are prevalent throughout the Chatsworth Formation and may be important conduits for groundwater and contaminant movement.

The fractures and joints are well interconnected vertically and horizontally (Cherry et al. 2009), although joints in the Chatsworth Formation sandstones tend to end when they encounter shale beds greater than 3 feet thick. Termination of joints at shale beds may limit connectivity, but the connectivity may continue along the shale bedding planes. Some seeps are found near the contact between shale beds and sandstone units indicating that these fractures conduct groundwater. In the thick-bedded sandstone units of the Upper Chatsworth Formation found north of Burro Flats, joints are relatively sparse (Wagner and Perkins 2009).

None of the faults in Area IV have been classified as "active" faults by the California Geological Survey (Jennings and Bryant 2010). Active faults are those that have had movement within the last 11,700 years. Area IV and the NBZ are, however, susceptible to earthquakes due to movement along distant faults. Some slopes in the valleys in the NBZ and the north-facing slope of the hill in the southernmost part of Area IV have been identified as Earthquake-Induced Landslide Zones (California Department of Conservation 1998) (see **Figure 3–11**). This designation is based on topography, geologic materials and structure, geotechnical data, rock strength data, and estimates of earthquake-related shaking.

3.2.2 Soil

Bedrock is exposed at the ground surface over about 40 percent of Area IV and the NBZ, meaning there is no soil in these areas. A thin veneer of soil (typically less than 5 feet thick) covers much of the rest of Area IV and the NBZ, although soil depth in the Burro Flats area can be 5 to 10 feet and sometimes up to 20 feet thick.

Soils in Area IV and the NBZ are shown in **Figure 3–12**. According to the U.S. Department of Agriculture's Natural Resources Conservation Service, the three predominant soil types in Area IV and NBZ are sedimentary rock land, a sandy loam of the Saugus series, and a loam of the Zamora series. The sedimentary rock land, found mostly in the mountainous area of the NBZ, consists of residuum of weathered bedrock and unweathered bedrock, with slopes of 30 to 75 percent. Bedrock is found at the surface or in the top 20 inches of this soil type (USDA 2014d).

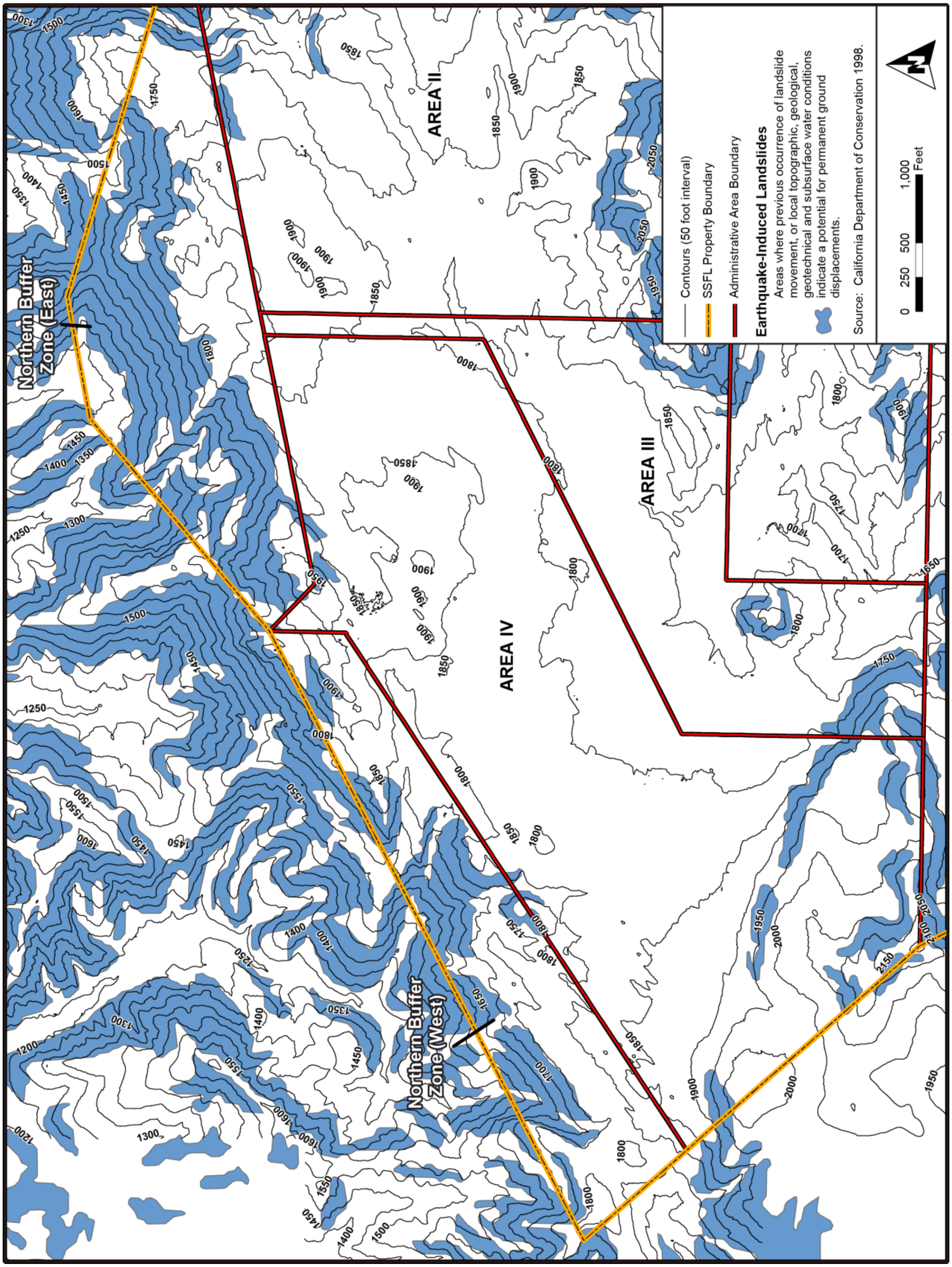

Figure 3–11 Seismic Hazard Zones at Santa Susana Field Laboratory and the Northern Buffer Zone

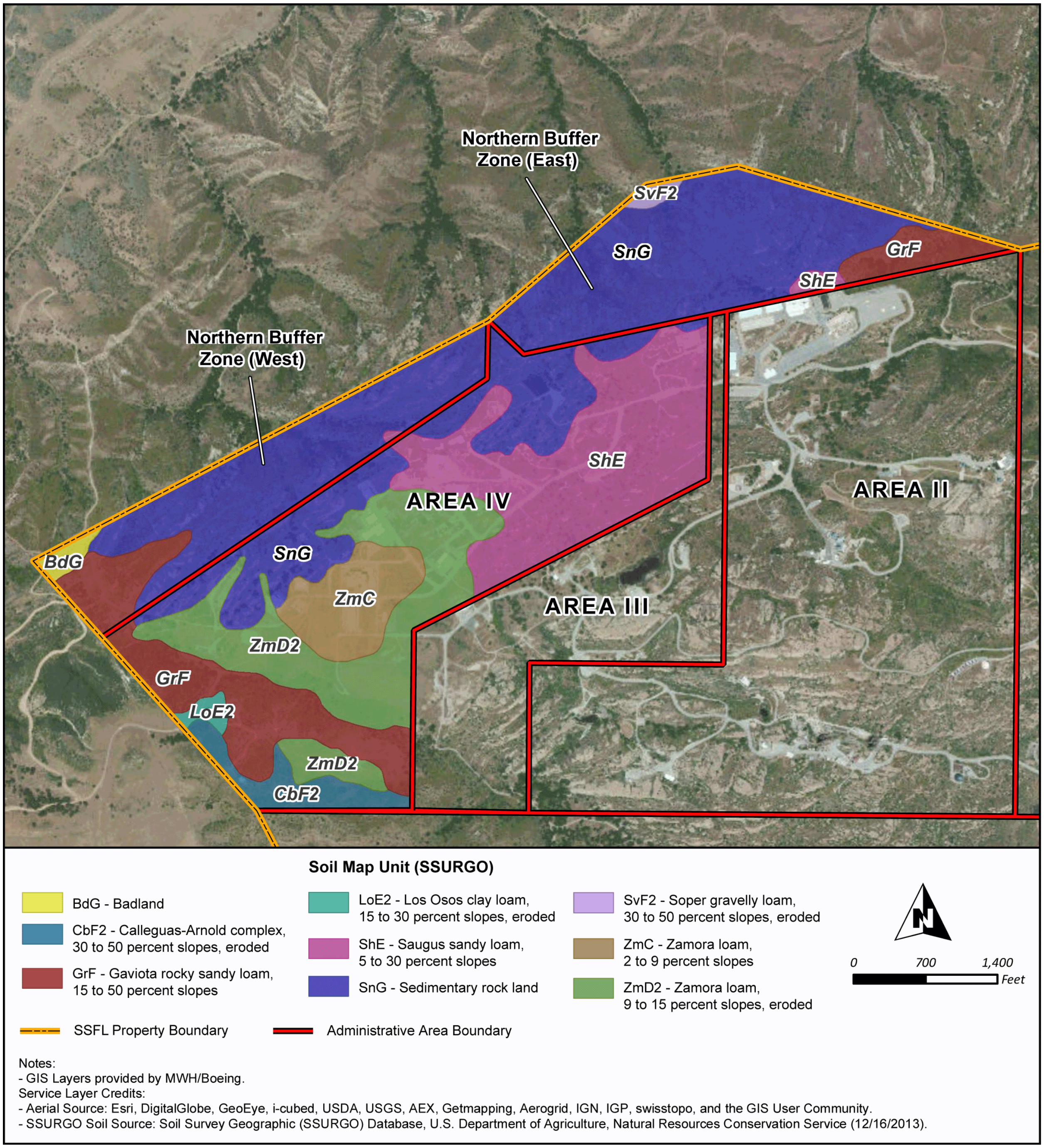

Figure 3–12 Soil Type Distribution in Area IV and the Northern Buffer Zone

The Saugus series soils consist of deep, well drained soils that usually form on dissected terraces, such as Burro Flats, and foothills. The sandy loam of the Saugus series is moderately permeable and usually has slopes of 5 to 30 percent. The Saugus series soils are predominantly found in the northeast part of Area IV (USDA 2014a).

The Zamora series soils are typically well drained loam that forms on nearly level grade or on strongly sloping fans and terraces. The Zamora series in Area IV has slopes that range from 2 to 15 percent (USDA 2014b, 2014c) and are generally found in the southern part of Area IV.

A fourth soil type, Gravota, is also found in the southern part of Area IV, and the southwestern and northeastern corners of the NBZ. Gravota soils consist of rocky, sandy loam with 15 to 50 percent slopes (USDA 2014c).

3.2.3 Mineral Resources

The California Division of Mines and Geology mapped Area IV and the NBZ entirely as an area "containing mineral deposits, the significance of which cannot be evaluated from available data" (CDMG 1981).

No petroleum or geothermal resources have been identified in Area IV or the NBZ. The closest active petroleum production wells are located approximately 3 miles to the east of Area IV in Los Angeles County (California Department of Conservation 2015).

3.2.4 Paleontological Resources

A number of paleontologic resource localities are recorded from the Chatsworth Formation; these localities, however, have generally been found in the siltstone beds of the lower portion of the Chatsworth Formation, which does not underlie Area IV or the NBZ. Fossils in the upper portion of the formation are rare and often referred to as being nonexistent (Minch 2014).

The southern, hilly portion of Area IV is underlain by the upper portion of the Santa Susana Formation. This formation has produced fossilized sharks, eagle ray, and chimaeroids, also known as ratfish, which are relatives of the shark. One such vertebrate fossil locality has been recorded in the hills northwest of the NBZ (Minch 2014).

3.2.5 Extent of Soil and Bedrock with Concentrations of Chemicals and Radionuclides Exceeding Look-Up Table[1] Values

3.2.5.1 Sources of Chemicals and Radionuclides

The Energy Technology Engineering Center (ETEC) was DOE's center of excellence for liquid metals (primarily sodium, potassium, and mercury) and for general metals compatibility testing. Research conducted in Area IV involved small-scale nuclear reactor testing, liquid metal applications, steam production, and coal gasification. These and other historical activities at SSFL resulted in the release to the environment of chemicals and radioactive materials that are now the subject of proposed cleanup activities.

[1] Look-Up Table (LUT) values identify the cleanup levels for radionuclides and chemicals in soil in Area IV and the NBZ. The LUT values were developed as stipulated in the *2010 Administrative Order on Consent for Remedial Action* (2010 AOC) (DTSC 2010a) and are based on background levels or method reporting levels as determined by EPA for radioactive materials and DTSC for chemicals. These LUT values are included in Appendix D.

Polychlorinated biphenyls (PCBs) were used extensively in the large grid of electrical components supplying power to the site. Diesel fuel used in backup generators for the nuclear reactors was stored across Area IV. Silver-containing wastes leaked or were discharged from onsite photographic laboratories. Dioxins were produced from burning wastes. Trichloroethylene (TCE) and other solvents were used to machine and clean metallic components for energy research and for rocket engine testing in adjacent areas. Production of rocket engine fuels and igniters in Area IV also contributed to releases of chemicals to the environment.

Leach fields located throughout Area IV were used during the earliest days of operations for treating sanitary wastewaters. Sometimes wastes from energy research were also released into the leach fields. The Sodium Disposal Facility (burn pit), which was originally intended to remove metallic sodium and potassium from metal components, was also used to dispose of solvents, other metals, and radionuclides. Radioactive liquids were released from waste holdup tanks (such as at the Sodium Reactor Experiment [SRE]) into leach fields (at the Radioactive Materials Handling Facility [RMHF]) and were in runoff from some nuclear facilities.

3.2.5.2 Soils Investigation History

Investigation of releases of radionuclides began in the 1960s as part of routine monitoring for all facilities. When observed, radioactively contaminated soil and bedrock were removed, based on the standards of the time, either as part of an interim removal action or when a facility was demolished.

Investigation of chemical contamination in Area IV was initiated in the mid-1980s under California Toxic Pits rules for closure of impoundments used to treat or store wastes. Impoundments with major contamination, such as the Sodium Disposal Facility, were subject to removal actions following discovery of contamination. Leach fields were also investigated and removed. Investigation of soil contamination was expanded in the 1990s under the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) process. The operational areas of Area IV were divided into the 5 RFI reporting areas (also called groups) and 23 RFI sites identified in **Figure 3–13**. Storage tank sites, trenches, landfills, leach fields, chemical storage areas, and chemical process areas were identified as areas of concern for potential contamination. The groups are identified by number. Those in Area IV are Groups 3, 5, 6, 7 and 8; Groups 5 and 8 are divided into subgroups. Chemical characterization in accordance with the RFI process continued under the 2007 *Consent Order for Corrective Action* (2007 CO) (DTSC 2007), issued by the California Department of Toxic Substances Control (DTSC). Numerous soil samples were collected from the RFI sites in each group for chemical analysis, and the results were reported in RFI reports for each investigation area (CH2M Hill 2008, 2009; MWH 2006; 2007, 2009a).

In June 2009, the U.S. Environmental Protection Agency (EPA) initiated a radiological study of Area IV and the NBZ with funding provided by DOE. EPA's radiological characterization continued in accordance with the framework and requirements established by the 2010 *Administrative Order on Consent for Remedial Action* (2010 AOC) (DTSC 2010a) between DOE and DTSC. The 2010 AOC specified that EPA would perform radiological characterization and DOE would perform the chemical characterization of soil in Area IV and the NBZ.

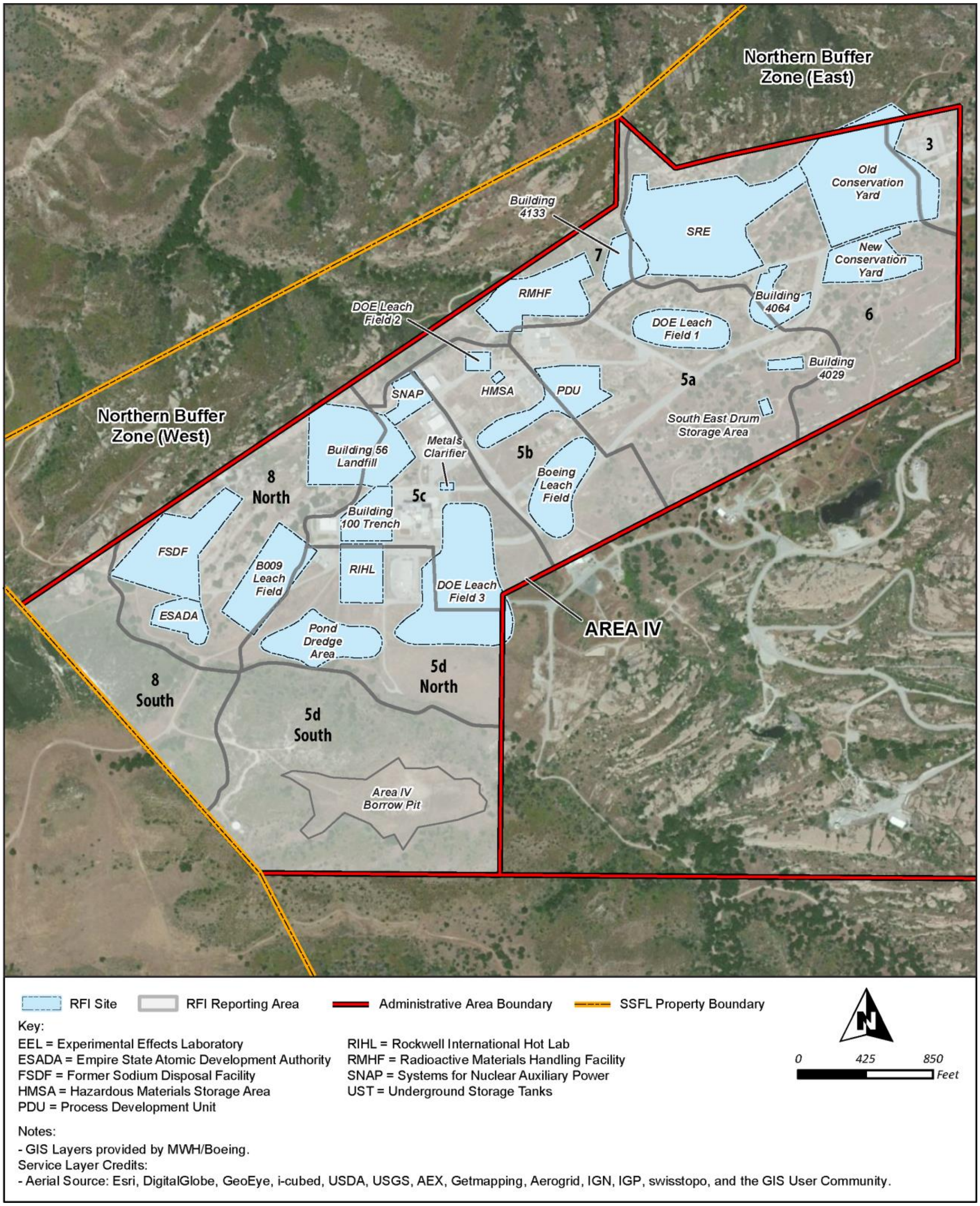

Figure 3–13 RCRA Facility Investigation Sites

There were four parts to EPA's radiological characterization:

- **Radiological Background Study**. The purpose of the EPA background study was to determine the local background levels of radiation found in soils not affected by the site operations. Soil samples were collected at sites remote from SSFL to determine soil concentrations of radionuclides from natural sources or sources not related to Area IV operations. The results of the background study were used to determine concentrations of radionuclides in Area IV in soils that resulted from past operations.
- **Historical Site Assessment (HSA).** This was EPA's independent review of documents and aerial photographs that provided insight into past radiological operations in Area IV and past spills and releases of radiological materials. The goal of this part of the project was to identify the universe of potential radiological contaminants and locations where radiological contaminants remaining in Area IV and the NBZ might be located. The extensive historical research performed by EPA during the HSA found no evidence that DOE conducted operations or used land in the NBZ. The results of the HSA were compiled in the *Final Historical Site Assessment Report* (HGL 2012a).
- **Gamma Radiation Scan.** EPA used sensitive survey instruments to scan the accessible areas of Area IV and the NBZ to identify locations of elevated gamma radiation. Any identified gamma radiation "hot spots" were then sampled by EPA for a full range of potential radiological contaminants in the next part of the project.
- **Radiological Site Characterization.** EPA's final site characterization task included testing the soil, groundwater, and surface water for a broad range of potential radiological contaminants. In all, EPA collected 3,487 soil samples and 55 sediment samples for radiological characterization.

EPA's work produced the definitive characterization of radionuclides within Area IV and the NBZ. According to EPA, this effort was one of the most comprehensive technical investigations ever undertaken for low-level radioactive contamination (EPA 2012). Soil samples were analyzed for up to 55 selected radionuclides, depending on the operational history of the area being sampled and compared to field action levels (FALs)[2] established by EPA. Eleven radionuclides equaled or exceeded the FALs and were identified as site-related.[3] Cesium-137 and strontium-90, and to a lesser extent, plutonium 239/240 were the most frequently observed above the FALs. The FALs were exceeded in 291 samples for cesium-137, 153 samples for strontium-90, and 14 samples for plutonium 239/240. Eight other site-related radionuclides equaled or exceeded their respective FALs in 5 or fewer samples, with three radionuclides (tritium, nickel-59, and europium-154) equaling or exceeding the FALs in only one sample each (HGL 2012b).

Of the 55 radionuclides analyzed, 28 were detected above the FALs. In addition to the 11 recognized as site-related, there were 17 that are naturally occurring radionuclides. As part of its characterization activities, EPA conducted an extensive background study for the presence of radionuclides in the region of SSFL (HGL 2011). The background study demonstrated a degree of variability in the concentrations of naturally occurring radionuclides. Therefore, EPA noted that the activity levels of some of these radionuclides could exceed the FALs without being attributed to site

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[2] Look-Up Table values for radionuclides have not been established and were not available for EPA's characterization activities. EPA therefore established FALs for its characterization efforts, consisting of the background threshold values for radionuclides (determined from a background study (HGL 2011) or the 2σ upper confidence level minimum detection concentration, as applicable.

[3] The 11 radionuclides known to be site-related that equaled or exceeded the FALs were tritium (hydrogen-3), nickel-59, cobalt-60, strontium-90, cesium-137, europium-152, europium-154, plutonium-238, plutonium-239/240, americium-241, and curium-243/244. The analytical techniques used do not distinguish plutonium-239 from plutonium-240 or curium-243 from curium-244.

operation (HGL 2012b). EPA determined that four locations required further evaluation of naturally occurring radionuclides and recommended that DOE review decay series and radionuclide ratios to support a determination of the origin of the radionuclides (HGL 2012b). The results of the Radiological Site Characterization are presented in the *Final Radiological Characterization of Soils, Area IV and the Northern Buffer Zone, Area IV Radiological Study, Santa Susana Field Laboratory, Ventura County, California* (HGL 2012b).

In parallel with EPA's radiological characterization, DOE performed chemical characterization of Area IV and the NBZ in three phases. Phase 1 was collocated sampling with EPA, during which EPA collected a soil sample for radionuclide characterization and provided DOE with soil for chemical analysis. This phase included sampling drainages leading into the NBZ and drainages in Area III. Phase 2 involved random soil sampling in the NBZ, also performed in coordination with EPA. Phase 3 soil sampling was based on a data gap analysis using the information collected for Area IV to determine where additional soil sampling was needed. DOE's Phase 3 sampling only involved analysis of samples for chemicals (EPA conducted an independent data gap analysis and radiological soil sampling). During the three 2010 AOC (DTSC 2010a) sampling phases, DOE collection 5,854 soil samples for chemical analysis. These samples, together with the 2,259 RFI samples, make a total of about 8,000 soil samples that have been collected and analyzed for chemical constituents in Area IV and the NBZ (CDM Smith 2017). Among the chemicals most frequently observed in soils at concentrations exceeding Look-Up Table (LUT) values were PCBs (from electrical components), polycyclic aromatic hydrocarbons (PAHs) (from fuels and burning of wastes), dioxins (from burning of wastes), petroleum chemicals (mostly from diesel fuel), mercury (from electrical components and energy transfer medium), and metals (antimony, cadmium, chromium VI, mercury, selenium, and silver (CDM Smith 2017).

In accordance with the 2010 AOC, DTSC has established chemical LUT values. Final radiological LUT values have not been set so provisional LUT values have been established for radionuclides. **Figure 3–14** shows the portions of Area IV, the NBZ, and offsite areas, where radiological and chemical constituents in soil exceed the chemical and provisional radiological LUT values.

3.2.5.3 Previous Removal Actions

Throughout site operations and afterward, DOE implemented a number of removal actions to remediate soil, bedrock, and structures (e.g., buildings, transformers, and parking lots) with concentrations of radionuclides or chemicals that exceeded the cleanup standards used at the time. The most notable of these removal actions were as follows (most of the subject facilities are included in Figure 3–13):

- The Former Sodium Disposal Facility (FSDF) was used for cleaning sodium and other alkali metals from metal components. The process resulted in the discharge of mercury, PCBs, cesium-137, and solvents to two ponds and the contamination of a concrete pad. In 1980, approximately 20 cubic yards of soil were excavated from the Lower Pond to remove cesium-137. In 1992 and 1993, soil was excavated to the bedrock interface, and all debris found within the excavation was removed. Soil was also removed from two drainages north of the FSDF. Limited excavation of buried objects occurred in August 1996. Soil sampling conducted in 1995 identified mercury, total petroleum hydrocarbons (TPHs), PCBs, and

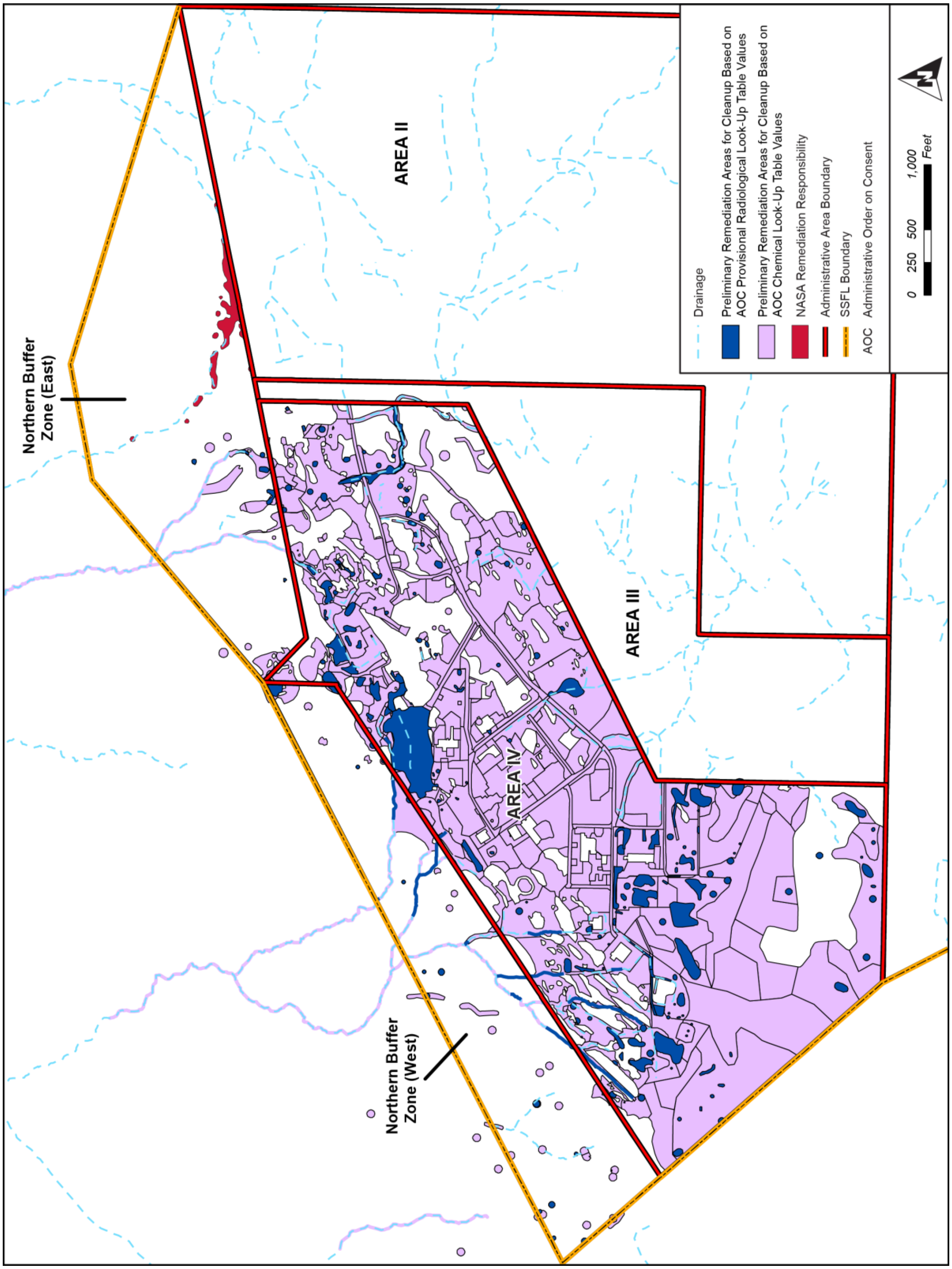

Figure 3–14 Extent of Radiological and Chemical Constituents above Look-Up Table Values

dioxins in soil; additional soil and debris removal continued until 2000. In all, 14,000 cubic yards of soil were removed from FSDF. Ultimately, the excavated ponds were backfilled with soil from the Area IV borrow pit. The site was remediated and released for unrestricted use in 1998 (Sapere 2005).

- The SRE engineering test building (Building 4003) was used to test Systems for Nuclear Auxiliary Power (SNAP) reactor burnup samples and evaluate irradiation experiments. Interior structures and components exposed to radioactive materials were removed from the building in 1975. Interior sewer lines suspected of contamination were removed in 1982, and the building was demolished in 1999. The former SRE Reactor Building (Building 4143) was demolished, including the removal of surrounding soils and underground structures, in 1999 (Sapere 2005; Rockwell 1976, 1983). In 1979, the SRE retention pond was allowed to dry out. Soil exceeding the standards at that time was removed. Mercury was inadvertently released to the soil during decommissioning of the steam generation plant. Contaminated buildings, soil, and bedrock were removed. Unconsolidated materials in the former SRE area include both native soil and fill placed in various building excavations during demolition. Native soils are estimated to be up to 10 feet thick at some locations, with bedrock surface expressions in others. The basement excavation of the former SRE Reactor Building contains approximately 30 feet of fill material. In 2000, the former septic tank, leach field and associated drain lines were removed. Levels of radioactivity were below the soil cleanup standards of the time.
- Building 4059 was used for testing small nuclear reactors under vacuum conditions and, later, for the Large Leak Test Rig Sodium Test Program. A French drain was installed adjacent to the building to lower the water table and prevent water from entering the building. In 1969, a leak was detected in the reactor core, and the reactor was shut down. Removal of activated concrete and debris started in 1991 and continued through 1992. Some of the concrete and metal debris was placed at the RMHF (Sapere 2005). Decontamination began again in 1994, and equipment was dismantled in 1997. Building 4059, the French drain, and storage tanks were removed in 2003 and 2004. The resulting excavation was backfilled with approximately 5,000 to 8,000 cubic yards of material from an Area IV borrow pit (CH2M Hill 2008).
- Building 4010 was used for the SNAP Experimental Reactor and the SNAP-8 Experimental Reactor. The building was decommissioned and decontaminated in 1978, and approximately 265 cubic yards of radioactive waste were removed. DOE released the building for unrestricted use in 1982, and the building was subsequently demolished (Rocketdyne 2000).
- Radioactive contamination at the RMHF leach field site was discovered in 1975 during routine monitoring. The source of the contamination is thought to have been an inadvertent release of radioactive liquid in 1962 or 1963. In 1978, contaminated soil from the leach field was removed down to bedrock, and radioactivity in accessible bedrock was removed by hydraulic hammering. The environmental report on the removal of the leach field (Rockwell 1982; Carroll, Marzec, and Stelle 1982) states that, after excavation, on average 300 picocuries per gram of strontium-90 and traces of cesium-137 remained in bedrock cracks. Following removal of the bedrock that could be excavated, the bedrock was sealed with a bituminous asphalt mastic material, and the site was backfilled with 10 feet of soil. In 2006, about 50 cubic yards of soil were removed from the slope north of the RMHF buildings because there were elevated levels of cesium-137. A sump pump at the canopy-covered drum storage area was excavated in 2007 (HGL 2012a).

- The former 17th Street Pond was a man-made pond that received drainage from the Process Development Unit. By 1997, the pond had filled in with silt and, in 1997 and 1998, this former pond was screened for radionuclides. Radioactive isotopes of thorium, uranium, and cesium were detected. Radioactivity in most of the samples was less than the cleanup criteria used at that time (CH2M Hill 2008). However, portions of the former 17th Street Pond were excavated in 1998, when approximately 2,100 cubic feet of soil were removed (Boeing 1999). A final survey was performed in 1999, and the site was released for unrestricted use in 2004 (Sapere 2005).
- The Old Conservation Yard was used for storage of materials used in other areas of Area IV. Soil containing cesium-137 was found in a 400-square-foot area in the southwest corner of the Old Conservation Yard (known as the Rocketdyne Conservation Yard at that time) in 1988 (Rockwell 1990); the contamination was remediated in 1989. The site was released for unrestricted use in 1995.

Other, less extensive removals or removals of unknown quantities of soil and debris were documented in the HSA (HGL 2012a), including the following:

- Building 4024 was a SNAP Reactor building where unknown quantities of soil and debris were removed when underground liquid and gas holdup tanks were removed.
- Building 4073 was a kinetics experiment water boiler where underground lines and tanks were removed.
- Building 4029 was a radiation measurement facility. Three radioactive source storage wells were excavated in 1989. The total volume of soil and debris was about 100 cubic feet (about 3.7 cubic yards).
- The Sodium Component Test Installation complex comprised 11 numbered structures. Demolition of the complex was completed in 2002 and included extensive excavation of underground concrete pits. No radiological contamination was found in the debris.
- Building 4020 was the Rockwell International hot laboratory ("Hot Lab"), which was used for remote handling of highly radioactive materials. Basement demolition was conducted in 1997. Three areas of soil contamination were identified during demolition; a total of 34 cubic yards of contaminated soil were removed from two of the locations. The volume of contaminated soil in the third location was not stated in the HSA. Uncontaminated soil excavated during demolition was stockpiled and used to backfill the excavation.
- Building 4654 was an interim storage facility in the SRE complex consisting of eight 20-inch-diameter galvanized steel storage tubes anchored into bedrock. The tubes were excavated in 1984 and 1985, and the excavation was backfilled with clean concrete rubble and local soil; 220 cubic yards of low-activity waste were excavated.
- Building 4028 was a shield test reactor located in the RMHF area. The building included a 200-square-foot, 20-foot-high concrete vault that was built into a slope, and so was not entirely underground). In 1975, 30 cubic yards of contaminated soil were removed from the slope north and west of Building 4028. In 1988, 55 cubic yards of radioactive debris from reactor demolition were removed off site. About 130 cubic yards of soil, primarily contaminated with cesium-137, were excavated and removed from the south perimeter fence area sometime between 2003 and 2009. In 2006, about 10 cubic yards of cesium-137

impacted soil were removed from the RMHF holdup pond area located northwest of Building 4028.

- Building 4009 was a sodium graphite reactor. When a 1,500-gallon underground diesel fuel tank was removed in 1987, 24 tons of petroleum-contaminated soil were also removed. EPA found little additional information concerning other excavation work at Building 4009 that was related to removal of septic tanks, holdup tanks and leach fields.

  EPA's HSA documents many cases where there is evidence or an indication of soil excavation, but where there are few details about the amount of soil removed or even the purpose of the excavation. In several cases, structures (e.g., buildings, parking lots, concrete pads, and storage areas) were demolished and removed, and the size of the excavation is not known. Other excavations are observed on aerial photographs or mentioned in historical documentation with few details. Additional excavations documented in the HSA include Buildings 4027, 4023, 4036/4037, 4093, 4633, 4643, 4793, 4030, 4046, 4641, 4005, 4042, 4048, 4049, the 4012 complex, 4013, 4025, 4228, 4355, 4478, 4402, 4606, 4607, 4615, 4026, 4226, 4358, 4826, 4334/4335, 4293, 4354, 4502, 4714, 4735, 4007, 4008, 4171, 4172, 4500, 4521, 4611, 4612, 4459, 4626, 4662, 4383, 4487, 4468, 4520, 4173, 4353, 4041, 4153, 4163, 4183, 4184, 4185, 4653, 4689, 4695, 4753, 4064, 4622, 4664, and 4317/4730.

3.2.5.4 Areas of Soil and Bedrock with Concentrations of Chemicals and Radionuclides Exceeding Look-Up Table Values

The 2010 AOC (DTSC 2010a) addresses soil and bedrock containing chemicals and radionuclides exceeding LUT values. The estimated volume of soil containing chemical concentrations above LUT concentrations is 1,410,000 cubic yards. The estimated volume of soil containing radionuclides above LUT values is 91,000 cubic yards. About 97 percent (by volume) of soil containing radionuclides above LUT values also contains chemicals above LUT values. In other words, only about 3 percent of soil containing radionuclides above LUT values does not contain chemicals that are also above LUT values (see Appendix D).

The largest contiguous area where soil contains radionuclides at concentrations above LUT values is found at the former RMHF. The source of the radionuclides, largely strontium-90, is the former leach field and runoff from RMHF. In 1978, the leach field and some bedrock were excavated and removed, but strontium-90 remains in the underlying rock and adjacent soils, particularly to the west of the leach field. Other areas where radioactive constituents in soil and bedrock exceed the LUT values include the following:

- The SRE Pond, including parts of the former northern drainage pathway from the pond, as well as along the SRE discharge pipeline pathway in the Old and New Conservation Yards.
- The Building 4064 leach field and areas downslope of the leach field.
- The former 17th Street Pond, including along the drainage pathway from the Process Development Unit to the former pond. The pond was partially excavated in 1979, but radionuclide activity in soil is present above LUT values.
- The Rockwell International Hot Lab, including several areas within the currently open area south of G Street and west of 22nd Street.
- The Pond Dredge Area located south of the Rockwell International Hot Lab.
- The Empire State Atomic Development Authority located south of FSDF.

- FSDF, where soils exceeding radiological LUT values are present in several discontinuous areas.
- The northeast corner of the NBZ (West); along the border with the Old Conservation Yard; along the border with Area IV down slope (west) of the SRE; and the isolated locations in the eastern half of the NBZ (East) and the NBZ (West).

As shown on Figure 3–14, much of the soil in Area IV contains at least one chemical at a concentration above its LUT value. Exceptions to this are nearly the entire Area IV borrow pit; the bedrock outcroppings; a former parking area on the north side of 17th Street at G Street; much of the DOE Leach Field 1 RFI site along 11th Street; the eastern part of the SRE RFI site and the contiguous western side of the Old Conservation Yard RFI site; and much of the undeveloped land south of the New Conservation Yard in the northern part of Area IV. Most of the soil in the NBZ is not impacted by chemicals or radionuclides.

Chemicals present in soil in Area IV (and in some cases the NBZ) that could potentially present a risk to human health and the environment include PCBs, PAHs, dioxins, pesticides, herbicides, and volatile organic compounds (VOCs). These chemicals, except for VOCs, often adhere to soil particles and can travel along drainage pathways as the sediment is carried in surface water. Generally these chemicals are found in soil at concentrations exceeding the LUT values in more limited areas, including the following:

- PCBs in concentrations exceeding LUT values were found in soil samples from isolated locations scattered across Area IV. A few of the larger areas are the Outfall 5 drainage pathway into the NBZ; the former 17th Street Pond and drainage pathways south of the pond; the southwest part of the Process Development Unit RFI site; the RMFH and SRE RFI sites; the north slope of the Old Conservation Yard RFI site; and the drainage pathway through the New Conservation Yard RFI site.
- PAHs, which are common products of carbon fuel combustion, were found in soil at concentrations exceeding LUT values over much of Area IV. Areas where soil PAH concentrations exceeding LUT values are common include former leach fields in the DOE Leach Field 3 RFI site; the Hazardous Material Storage Area RFI site; the RMHF and the drainage area to the west of RMHF and the SRE; drainage pathways in the Old and New Conservation Yards; and the former 17th Street Pond.
- Dioxin was found in soil at concentrations exceeding the LUT value in several of the surface water drainage pathways.
- TPH concentrations in soil exceed the LUT value in isolated locations across Area IV, as well as in larger areas in the RMHF drainage pathways; the SRE Building 4143 Area; near a group of fuel rod test towers and associated buildings in the DOE Leach Fields 3 RFI site; and the Rockwell International Hot Lab.
- Lead was detected in soil at concentrations exceeding the LUT value in the northern part of Old Conservation Yard (near a former debris area); the former 17th Street Pond drainage area; along a drainage pathway from the Boeing Leach Field RFI Site; in the RMFH and SRE RFI sites; and several isolated locations in other areas of Area IV.

- Silver was detected in soil at concentrations exceeding the LUT value in several areas in the Process Development Unit drainage pathways, including the former 17th Street Pond and the northeastern part of Area IV.
- Mercury was found in soil at concentrations exceeding the LUT value in isolated locations across Area IV, but was found more frequently in areas in the SRE Building 4143 area; locations in the DOE Leach Fields 3 RFI site (near the former fuel rod towers, a metallurgical laboratory, the leach fields, and a building where mercury was used in sodium heat transfer); and the northern slope of the Old Conservation Yard.

3.3 Surface Water Resources

This section describes the existing surface water quality and hydrology for Area IV, the NBZ, and the ROI. The ROI for surface water resources includes all drainages from Area IV and the NBZ and extends along these drainages off site to their confluence with the larger downstream collectors, Bell Creek and Arroyo Simi. This includes drainages where sampling data show impacts from past operations within Area IV (Section 3.3.1). The ROI is depicted in **Figure 3–15**.

3.3.1 Existing Conditions

Surface water present in the ROI is primarily sourced by seasonal precipitation and, as such, is intermittent. In addition to the intermittent stormwater runoff, a minimal amount of surface water flow is supported by groundwater seeps (essentially small springs, occasionally observed as trickles of water, puddles, or muddy areas) both within and immediately downslope of Area IV and the NBZ. Surface water drainage from the ROI is directed by a northeast-southwest-trending drainage divide. Drainage from the northern portion of the ROI flows north into Meier Canyon, which connects to Arroyo Simi, which flows westward toward the Pacific Ocean. Drainage from the southern portion flows to the southeast through SSFL Areas III and II, then into the Bell Creek drainage system. Bell Creek is a tributary of the larger Los Angeles River system that flows east and southward to the Pacific Ocean. Stormwater drainage from the SSFL site does not connect with or comingle with the former Chatsworth Reservoir (now the Chatsworth Nature Preserve).

The ROI is subject to seasonal precipitation and dryness, with the majority of rainfall on site occurring in November through March, with little to no rainfall typically observed between April and October (Boeing and NASA 2011). Average annual rainfall at SSFL is approximately 18 inches (EPA 2007a), with a wide range of observed rainfall totals between wet and dry water years (Boeing and NASA 2011). The drainages from the SSFL site are ephemeral; surface flow occurs only following a rainfall event. The drainages are dry the majority of the year (EPA 2007a; Boeing and NASA 2011). The Santa Susana Mountains and the drainages downslope of SSFL are subject to flash floods following the periods of intense rainfall periodically observed in the ROI (HGL 2010). The channel capacity of the upper reach of Arroyo Simi at the northern edge of the ROI would not fully contain runoff during a 100-year flood event (City of Simi Valley 2012). Bell Creek, downstream of SSFL, meets Arroyo Calabasas and becomes the Los Angeles River. The Los Angeles River extends 51 miles downstream of its confluence with Bell Creek, with a concrete channel lining the river banks for its full length and varying sections of lined and unlined river bottom for the purpose of maintaining flood flow conveyance capacity.

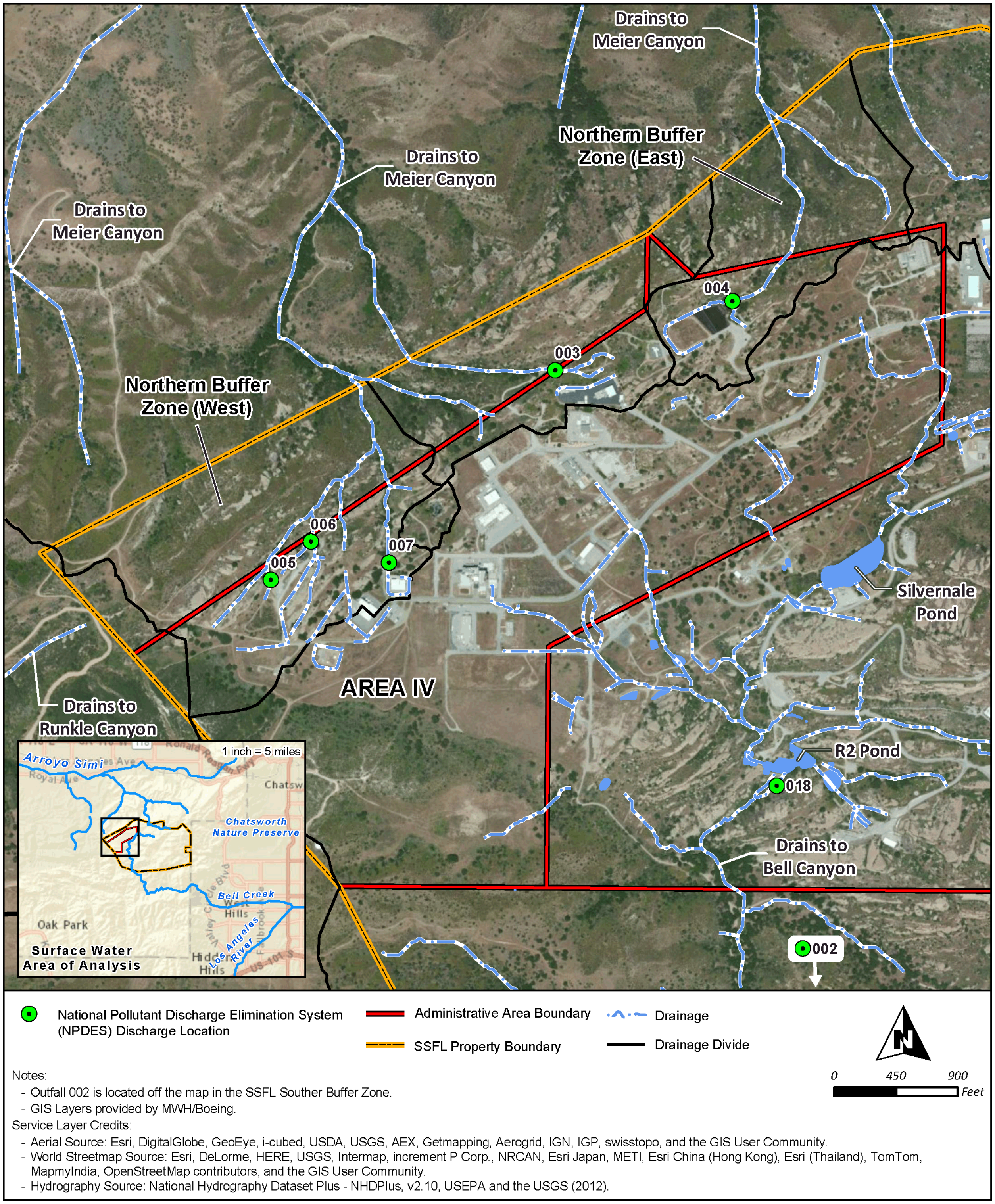

Figure 3–15 Area IV Surface Water

The regional watersheds for Arroyo Simi and the Los Angeles River are depicted in **Figure 3–16**. Arroyo Simi, Calleguas Creek, Bell Creek, and the Los Angeles River are listed on the Los Angeles Regional Water Quality Control Board (LARWQCB) 2010 303(d) list[4] of water-quality-impaired segments. The pollutants identified on the 303(d) list for Reach 7 of Calleguas Creek/Arroyo Simi are ammonia, boron, chlordane, chloride, chlorpyrifos, diazinon, dieldrin, indicator bacteria, organophosphorus pesticides, sedimentation/siltation, sulfates, total dissolved solids, toxaphene, toxicity, and trash; for Reach 6 of the Los Angeles River, they are coliform bacteria and selenium (SWRCB 2010).

SSFL operates under a National Pollutant Discharge Elimination System (NPDES) permit issued to Boeing by LARWQCB. This permit allows the discharge of stormwater runoff and treated groundwater into the Bell Creek watershed to the south, as well as the discharge of stormwater runoff from the northwest slope into Calleguas Creek (Boeing 2011b). These surface discharges are monitored at 20 NPDES outfall locations, of which 10 intercept surface water flow from the ROI. LARWQCB identified discharges from SSFL as consistently exceeding effluent limits for dioxin, heavy metals, and other pollutants (EPA 2007a, Boeing 2007c, 2008c, 2009a, 2010a, 2011a, 2012c, 2013a, 2014b). Analysis submitted to LARWQCB by Boeing regarding contaminant levels in stormwater runoff from SSFL demonstrated that substantial portions of the dioxin and heavy metals in the runoff could be attributed to atmospheric deposition, ambient precipitation, wildfires that occurred on site in 2005, and the erosion of native soil not impacted by historical operations at SSFL. The analysis also identified stormwater runoff from other locations in the basin with dioxin and metals concentrations similar to and, in some cases, higher than the concentrations observed in runoff from SSFL (Boeing 2008c).

At seeps, the groundwater is close enough to the ground/surface to support vegetation and occasionally seep onto the ground surface. Water quality monitoring at the seeps in the NBZ (which are immediately downslope of the Area IV groundwater impact area) is done by collecting water from shallow wells located where water has been observed at the surface. This monitoring has detected carbon disulfide, toluene, and tritium in the groundwater. Only tritium is considered to be site related. Tritium has not, however, been observed in the offsite seeps downslope of Area IV and the NBZ (CDM Smith 2015a).

The seven outfalls (Outfalls 2, 3, 4, 5, 6, 7, and 18) shown in Figure 3–15 receive surface water runoff from portions of Area IV that were at one time operational. Multimedia filtration systems are used to filter the surface water runoff before it leaves the SSFL. Outfalls 3, 4, 5, 6 and 7 are located within Area IV or on the northern boundary of Area IV; Outfalls 2 and 18 are located to the south of Area IV. Depending on the amount of rainfall, surface water intercepted at these outfalls is currently diverted to Silvernale Pond for treatment prior to discharge to the Bell Creek watershed. Outfall locations 5 and 7 are lined settling ponds and are designed to retain surface water prior to transfer to Silvernale Pond. The retention structures at outfall locations 3, 4, 5, 6 and 7 are designed to capture, contain, and divert the 1-year, 24-hour storm event to Silvernale Pond, which, depending

[4] Section 303(d) of the 1972 Federal Water Pollution Control Act requires states, territories, and authorized tribes to develop a list of water-quality-impaired segments of waterways. The list includes waters that do not meet water quality standards necessary to support the beneficial uses of that waterway, even after point sources of pollution have installed the minimum required levels of pollution control technology. The 303(d) list identifies pollutants in the waterways and forms the basis for jurisdictions to establish priority rankings for waters on the lists and develop action plans, called Total Maximum Daily Loads. The Total Maximum Daily Loads establish the allowable daily pollutant loadings or other quantifiable parameters (e.g., pH [acidity/alkalinity] or temperature) for a waterbody and thereby provide the basis for establishing water-quality-based controls. These controls are intended to provide the pollution reduction necessary for a waterbody to meet water quality standards.

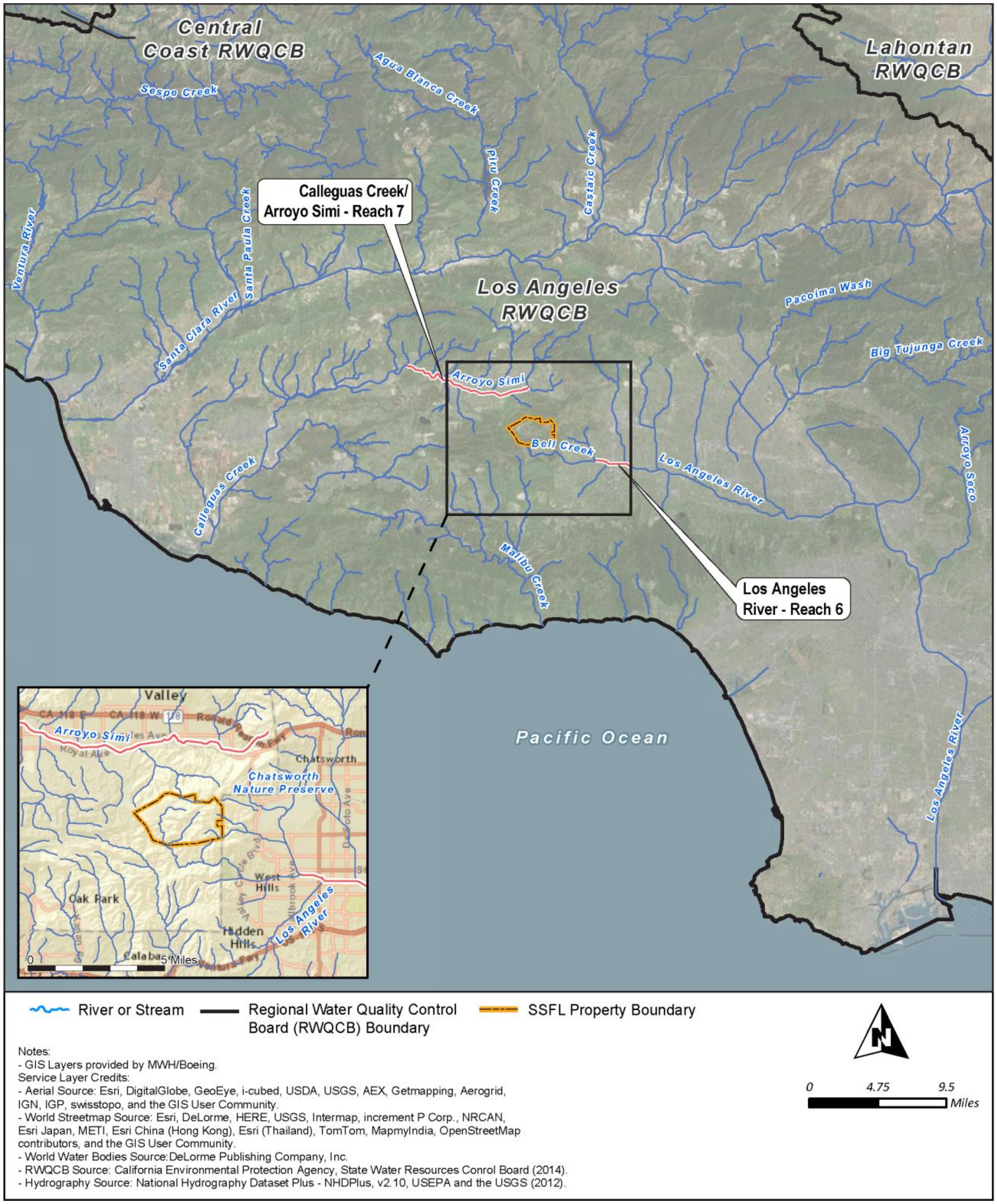

Figure 3–16 Regional Drainage Basin

on the outfall location, ranges from 50,000 to 207,000 gallons per day. Rainfall in excess of these volumes is allowed to flow undiverted past the outfall location. Discharges from these locations are monitored for compliance with the NPDES permit. Details about the specific outfall monitoring locations are presented in **Table 3–4**.

Table 3–4 Santa Susana Field Laboratory Area IV NPDES Monitoring Locations

Outfall	*Area IV Land Use*	*Drainage/Creek*	*Filter Type*
2	South slope below R2-A Pond	Located downstream of Outfall 18 and is an additional water quality monitoring point prior to release to the Bell Creek/Los Angeles River watershed.	Sediment erosion BMPs, including hydromulching, straw wattles, and straw bales
3	Radioactive Material Handling Facility	Intercepts runoff from the drainage north of the RMHF before it continues downstream into the Calleguas Creek/Arroyo Simi watershed.	Three-stage filter of sand, GAC, and zeolite
4	Sodium Reactor Experiment	Intercepts runoff from the drainage surrounding the site of the SRE before it is released into the SRE Pond.	Three-stage filter of sand, GAC, and zeolite
6	Former Sodium Disposal Facility	Intercepts runoff from the drainage originating at the lower FSDF area before it continues downstream into the Calleguas Creek/Arroyo Simi watershed.	Three-stage filter of sand, GAC, and zeolite
7	Building 100	Intercepts runoff from the Building 100 area before it continues into the Calleguas Creek/Arroyo Simi watershed.	Two-stage filter of sand and GAC
18	R2-A Pond	Intercepts runoff from the central and western Area IV, Area III, and Area II, including runoff from the Silvernale Pond, before it continues to Outfall 2 and, ultimately, the Bell Creek/Los Angeles River watershed.	Eight parallel filter cells of sand, GAC, and zeolite

BMPs = best management practice; FSDF = Former Sodium Disposal Facility; GAC = granulated activated carbon; RMHF = Radioactive Material Handling Facility; SRE = Sodium Reactor Experiment
Source: Boeing 2014a.

There were multiple exceedances of regulatory limits (for dioxin, cyanide, lead, mercury, copper, nickel, zinc, iron, total suspended solids, chloride, pH, gross beta, and nitrate) in the years immediately following the 2005 wildfire. These exceedances have diminished over time, with exceedances only for iron in 2011 and 2012. There were no exceedances for these six outfalls in 2013 (Boeing 2007c, 2008c, 2009a, 2010a, 2011a, 2012c, 2013a, 2014b). Implementation of water quality control measures, including upgrades of outfall treatment controls; restoration of burned hillslopes; and best management practices contributed to these reductions in regulatory exceedances.

3.4 Groundwater Resources

The ROI for groundwater resources, shown in **Figure 3–17**, includes Area IV, the NBZ, and offsite areas to the north of the NBZ, where groundwater discharges at the surface through seeps and springs. Groundwater is present within soils and weathered bedrock, as well as within the fractures and matrix of unweathered bedrock. The lateral extent of the ROI is demonstrated by data collected from monitoring wells (installed in bedrock), piezometers (devices installed to measure groundwater level, and also used to collect samples), seep wells, and from springs where the groundwater discharges. There are areas of groundwater in the ROI containing chemical and radioactive constituents above maximum contaminant levels[5] (MCLs) that are attributable to historical DOE activities (areas of impacted groundwater). Per the 2007 CO (DTSC 2007), specific cleanup levels for groundwater are being developed as part of the Groundwater Corrective Measures Study; however, in this EIS, MCLs are used as a general indicator of water quality. **Figure 3–18** shows the plumes of impacted groundwater for Area IV and the NBZ.

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[5] MCLs are standards set by the EPA for drinking water quality. An MCL is the legal threshold limit on the amount of a substance that is allowed in public drinking water supply systems under the Safe Drinking Water Act. MCLs are often used as groundwater cleanup standards.

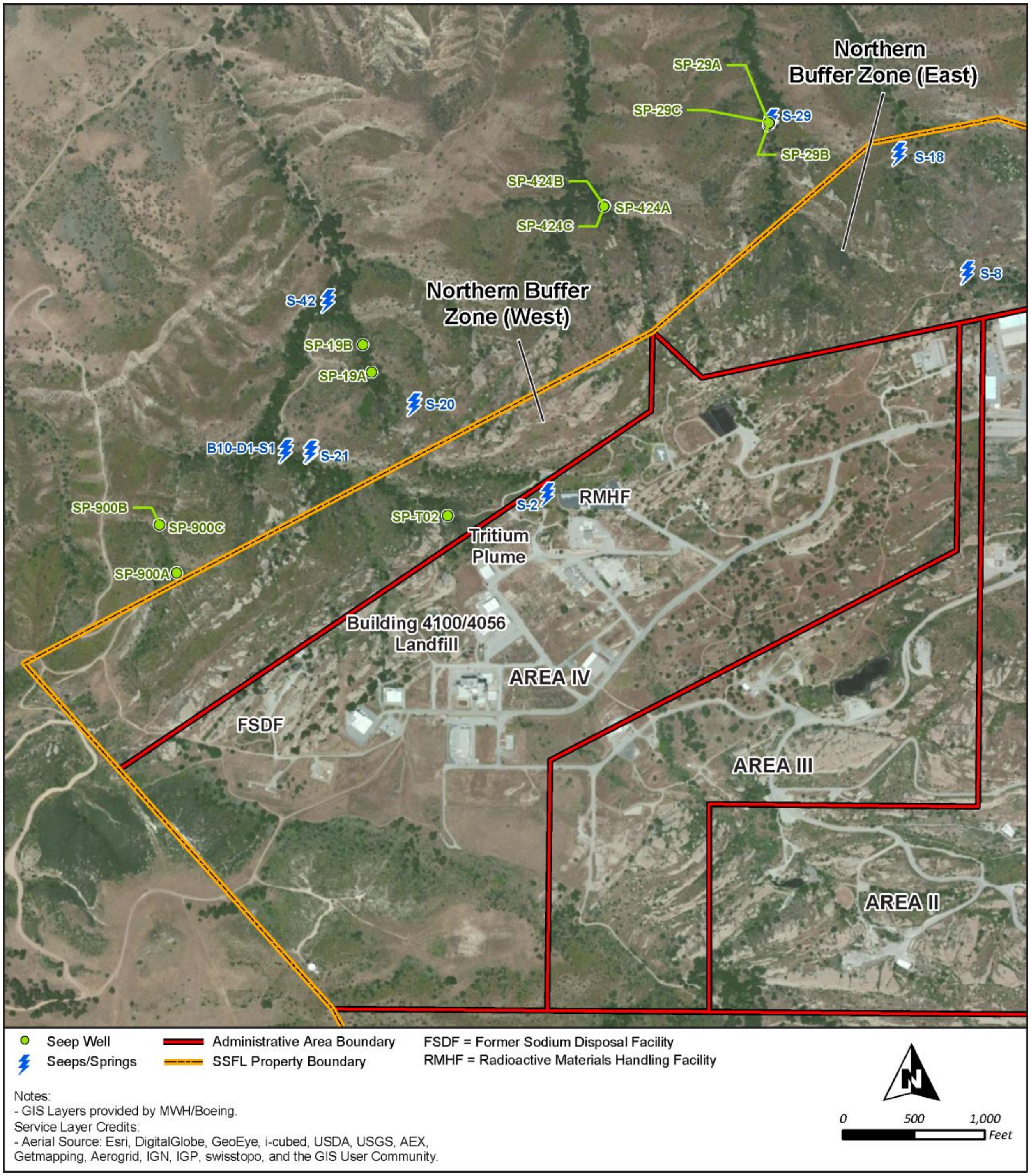

Figure 3–17 Region of Influence for Groundwater

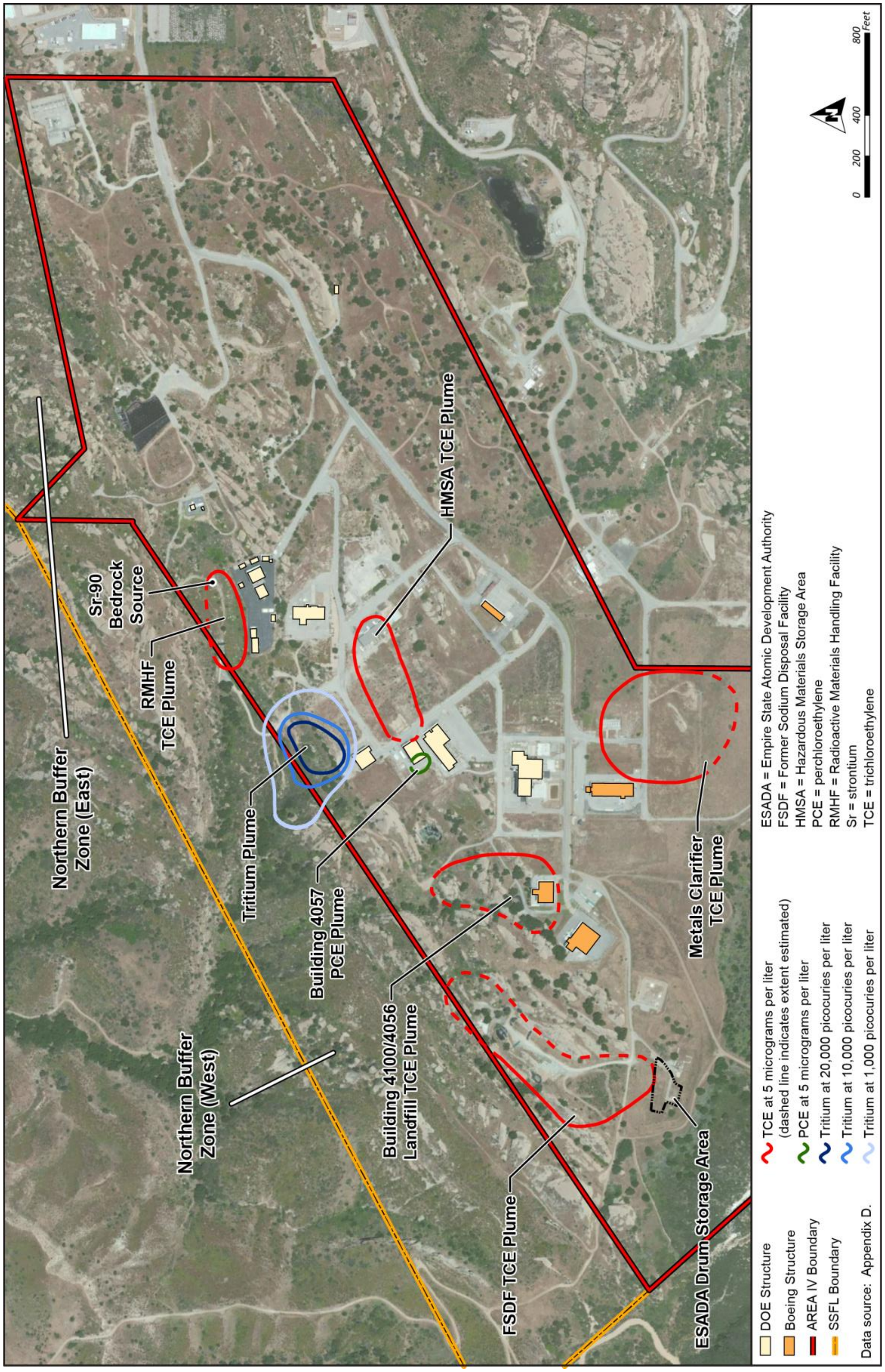

Figure 3–18 Groundwater Plumes

Because SSFL is not located within a defined regional groundwater basin as defined by the *Water Quality Control Plan, Los Angeles Region, Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties* (Water Quality Control Plan) (CRWQCB 1994), there are no designated beneficial uses for the groundwater beneath Area IV and the NBZ. However, the Water Quality Control Plan notes that areas that fall outside the major basins may be potential or actual sources of water for downgradient basins. For this reason, the beneficial uses designated for the downgradient basin to the north, the Simi Valley Regional Basin, apply to Area IV and NBZ groundwater; the beneficial uses designated for the downgradient basin to the southeast, the San Fernando Valley Basin, apply to Area IV groundwater. These uses include municipal and domestic supply, industrial service supply, industrial process supply, and agricultural use. Area IV and NBZ groundwater also currently supports vegetation and, therefore, wildlife habitat.

There are no operating water supply wells in Area IV or the NBZ. There is one formerly used water supply well in the northeastern part of Area IV.

3.4.1 Groundwater Zones

Groundwater beneath Area IV and the NBZ occurs as:

- Near-surface groundwater in the alluvial soils and/or weathered Chatsworth Formation bedrock, and
- Chatsworth Formation groundwater in the unweathered Chatsworth Formation bedrock.

Figure 3–19 is a conceptual model showing groundwater flow at Area IV and the NBZ. Groundwater units are directly or indirectly recharged by precipitation; mean precipitation is 18.6 inches per year (MWH 2009b). The average recharge is estimated to be less than 2 inches per year (MWH 2009b); therefore, the majority of precipitation evaporates, is taken up by plants, or is lost as runoff. The perched near-surface water is replenished by infiltration from rain; this water eventually passes through the shallow groundwater zone to replenish the Chatsworth Formation groundwater (MWH 2009b). The topographic setting of SSFL, on a ridge, creates a "groundwater mound," i.e., a ridge of groundwater that mimics the topography. Water flows downward through the vadose, or unsaturated, zone and then outward from the center of the mound. Compared with other areas of SSFL, the Burro Flats area has much less topographic relief, which provides more time for precipitation to infiltrate below ground.

TCE (and other water soluble constituents) present in soil would dissolve into precipitation infiltrating through the soil and migrate to the perched near-surface groundwater. Once in the groundwater, the dissolved constituents would migrate with groundwater flow. Impacted perched groundwater leaking through the low-permeability layer would infiltrate through the underlying weathered and competent (unweathered) rock and into the Chatsworth Formation through fractures in the competent rock. In the Chatsworth Formation, the impacted groundwater is expected to migrate slowly, primarily to the northwest and southeast. The constituents would also diffuse from the groundwater in the fractures into the rock matrix, thereby decreasing the concentrations in the fractures and generally slowing the migration of the plume front.

Groundwater would be removed from the hydrogeologic system by discharge through groundwater seeps and springs, discharge to surface water, uptake by plants, and pumping wells. Area IV groundwater discharges through the seeps and springs shown in Figure 3–19 on the slopes of the NBZ and to the northwest of the NBZ.

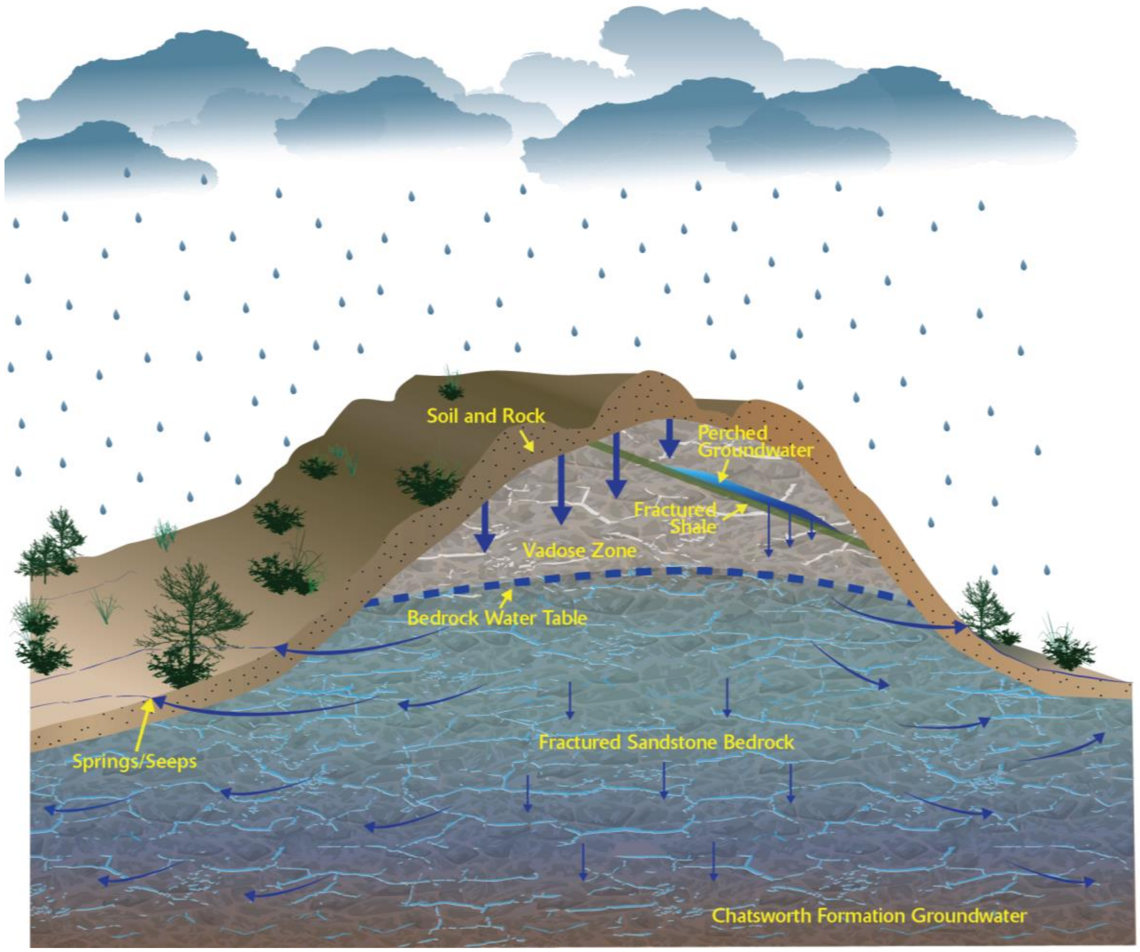

Figure 3–19 Groundwater Movement Conceptual Model

3.4.1.1 Near-Surface Groundwater

Investigation of the near-surface groundwater at SSFL was initiated during the period from March 2001 through May 2003 (MWH 2003). At that time, 30 Area IV piezometers and 10 Area IV shallow bedrock groundwater wells were installed. Additional piezometers were installed in 2007 and 2008 (MWH 2009b).

Near-surface groundwater beneath portions of Area IV and the NBZ can exist in the alluvium and weathered bedrock that sits on the bedrock. It occurs as perched groundwater above and separated by an unsaturated zone from the Chatsworth Formation groundwater. Generally, the near-surface groundwater in Area IV and the NBZ is found along drainage features and near the outcrop of the fine-grained members of the Chatsworth Formation. The fine-grained shale bedrock layers are less permeable than the sandstone members and are therefore more likely to allow the development of a shallow water table (perched water).

The extent of near-surface groundwater varies considerably, depending on the amount of precipitation and time of year. During the wet period, there is a larger area of near-surface groundwater occurring in Burro Flats.

3.4.1.2 Chatsworth Formation Groundwater

Groundwater enters the Chatsworth Formation (sandstone bedrock) through infiltration from the near-surface groundwater. Chatsworth Formation groundwater is found within pore spaces between grains of rock (primary porosity) and in the open fractures (secondary porosity). The effective porosity of the rock matrix (the interconnected pore spaces) is about 14 percent of the rock. By comparison, the secondary porosity (space in the interconnected fractures) is much smaller, about 0.01 percent (MWH 2009b).

Investigation of the bedrock groundwater was initiated in 1986 with the installation of a well at the Building 4056 landfill site. Since then, 61 additional bedrock wells (2 of which have been abandoned) have been installed throughout Area IV and near the boundary with the NBZ. The majority of the Chatsworth Formation wells installed in Area IV are "open hole" (i.e., there is no well casing within the bedrock zone). This means that locations of fractures that may be sources of groundwater in these wells are not always known. Some of these wells are open over hundreds of feet.

Where a number of wells are located close together, but are open at different depths, the change in vertical gradients, with depth, can be observed. Data from "clusters" of three wells indicate that, at the top of the northwest-sloping escarpment that forms the northern border of Burro Flats, there is a fairly strong downward vertical gradient from the upper part of the bedrock to the middle zone, but an upward gradient from the bottom zone to the middle zone (MWH 2009b).

3.4.2 Extent of Impacted Area IV and NBZ Groundwater

The current conditions of the groundwater were evaluated during the development of the *RCRA Facility Investigation (RFI) Groundwater Remedial Investigation Work Plan, Area IV, Santa Susana Field Laboratory, Ventura, California (Area IV Groundwater Remedial Investigation Work Plan)* (CDM Smith 2015a). The evaluation was facilitated by the division of Area IV and the NBZ into 19 groundwater investigation areas, based on history of land use and operations. During the evaluation, some areas were identified as needing additional investigation, others as being well-characterized, and others as uncontaminated. Groundwater investigation areas where impacted groundwater is currently found are described in this section. The groundwater investigation has shown three areas of groundwater with historically higher TCE concentrations in Area IV: the FSDF TCE plume (which may extend into the NBZ), Hazardous Material Storage Area (HMSA) perched groundwater TCE plume, and Building 4100/4056 landfill TCE plume. There are another three areas with historically lower concentrations of groundwater contamination (mainly solvents) that are also being evaluated for potential cleanup methodologies: the RMHF TCE plume (which may extend into the NBZ), Metals Clarifier TCE plume, and Building 4057 Warehouse perchloroethylene (PCE) plume. Additionally, there is a tritium plume near the former Building 4010 (which extends into the NBZ) and a strontium-90 source near RMHF. These areas are being assessed for groundwater cleanup considerations. Additional information about investigation of impacted groundwater can be found in the *Area IV Groundwater Remedial Investigation Work Plan*.

3.4.2.1 Former Sodium Disposal Facility Trichloroethylene Plume

Groundwater beneath FSDF exhibits the highest concentrations of TCE of any location in Area IV. Prior to aquifer pumping at FSDF in 1997, the maximum TCE concentration observed in this plume was 4,100 parts per billion. During and following pumping, TCE concentrations decreased, with a maximum concentration of 1,600 parts per billion reported in a sample collected in 2013 (CDM Smith 2015a).

FSDF was used from 1956 to 1978 to clean alkali metals (sodium and potassium/sodium mixtures) from metallic components and other materials (pipes, valves, tanks, and instruments). In addition to sodium-contaminated materials, FSDF received chemical wastes, including chlorinated solvents (i.e., TCE), PCBs, metals such as mercury, and radionuclides (primarily cesium-137). The site was also used for the burning of "Santowax," an organic compound (a mixture of terphenyls) used as a heat transfer medium during thermal studies.

Various soil and debris removals at and in the vicinity of the FSDF ponds occurred from 1980 to 2000. In all, 14,000 cubic yards of soil were removed from the site, including 20 cubic yards of soil contaminated with cesium-137. Ultimately, the ponds were backfilled with soil from the Area IV borrow pit, and the site was hydro-seeded and planted.

Impacted groundwater is found in weathered bedrock and alluvium (during rainy periods) and in the Chatsworth Formation groundwater. It appears that the majority of the TCE remains in the upper bedrock due to the tightness of the bedrock below FSDF. The TCE now found in FSDF groundwater likely originated from discharge to the ponds or leakage to the ground from drums stored near the ponds. Through various removal actions, the original source of TCE that contaminated the groundwater, soil, and sediment at the ponds has been removed down to bedrock. As precipitation infiltrates downward, it can come in contact with existing contaminated near-surface groundwater and contaminated weathered rock, where TCE can diffuse from the rock matrix into the water.

In March 2013, DTSC approved a work plan (DTSC 2013c) for a Groundwater Interim Measure (GWIM) (MWH 2008, MWH and Hargis 2009), including groundwater pumping at FSDF. The purpose of the GWIM is to collect data on aquifer properties, remove some contaminants mass, and possibly control plume migration for locations within SSFL that exceed 1,000 parts per billion TCE in groundwater. For Area IV, this definition applies to FSDF. The scope of the GWIM for FSDF is to pump groundwater from the near-surface groundwater and treat the extracted groundwater in an onsite facility to remove contaminants. Treated water would be released in a manner that would help flush contaminated groundwater toward the extraction well.

3.4.2.2 Hazardous Material Storage Area Trichloroethylene Plume

An area of 2 to 3 acres of TCE-impacted groundwater has been identified at HMSA in the perched (near-surface) groundwater within the weathered bedrock. HMSA is located on a groundwater divide in the Chatsworth Formation, with groundwater flowing radially outward, predominantly to the east, southeast, southwest, and west. The source of the TCE is most likely spills, discharges, or leakage associated with former operations in Buildings 4457, 4026, and 4357, which are no longer present, but were formerly located in the vicinity of the plume. Groundwater quality in this area has historically been monitored through sampling of a series of five piezometers and one shallow screened well in the weathered bedrock and three monitoring wells in the Chatsworth Formation bedrock.

Since monitoring of the HMSA plume began in 2001, TCE has been detected at concentrations greater than the MCL (5 parts per billion) in near-surface groundwater in four piezometers. Concentrations of TCE below the MCL have been detected in piezometers east, west, north, and south of the HMSA TCE plume, indicating that the extent of TCE is fairly well defined in the near-surface groundwater of HMSA. TCE also has been detected at concentrations below the MCL in two of the three Chatsworth Formation monitoring wells. TCE concentrations in the piezometers have remained fairly constant (around 75 parts per billion) over the past 5 years, indicating that the plume is not moving laterally or downward from its location. This consistency in TCE concentration over time is different from the observed TCE concentration trends at other locations in Area IV.

3.4.2.3 Radioactive Materials Handling Facility TCE Plume

RMHF (which still exists) was used for processing, packaging, and shipping radioactive materials that were used and generated in the various nuclear testing facilities in Area IV. Monitoring wells installed in the drainage to the north of RMHF exhibit TCE and strontium-90. The source of the TCE and strontium-90 in the groundwater is the former RMHF leach field. Other operations at RMHF do not appear to have impacted groundwater below or adjacent to the facility.

The former leach field was constructed in 1959 near the eastern edge of RMHF for disposal of sanitary wastewater. The leach field was taken out of service for sanitary purposes in late 1961, when the central wastewater treatment facility was installed in Area III; however, it may have still been used for disposal of other liquid wastes generated at RMHF after that time.

A pipeline directed sanitary effluent from RMHF Buildings 021 to 022 to the leach field. This pipeline was also connected to a liquid waste holdup tank in the yard of RMHF (Rockwell 1982). The tank was intended to hold radioactive liquids until they decayed sufficiently to meet discharge standards. The tank apparently received liquid containing TCE and strontium-90 wastes. Strontium-90 has a half-life of 28.8 years. Liquids containing TCE and strontium-90 wastes were released from the holdup tank into the leach field at various unknown times. The impact of strontium-90 on groundwater is discussed below in Section 3.4.2.7.

TCE concentrations in wells west of RMHF ranged from 34 parts per billion to 85 parts per billion prior to 1994. At that time, pumping of a monitoring well was initiated. Pumping continued periodically until 2005; in all, 3.9 million gallons were pumped from the well. TCE concentrations decreased significantly in the downgradient wells during and following pumping. In 2014, TCE concentrations ranged from less than 1.5 parts per billion to about 11 parts per billion (CDM Smith 2015a).

3.4.2.4 Metals Clarifier Trichloroethylene Plume

The Metals Clarifier groundwater investigation area is approximately 4 acres in the southern part of Area IV. This area includes the location of the former Building 4065 Chemical and Metallographic Analysis Laboratory (with its associated metals clarifier) and several former DOE buildings with leach fields where TCE may have been used and released to the environment. Near-surface groundwater is monitored by three piezometers located immediately downgradient of the metals clarifier location and the potential leach field source areas.

Constructed in 1963, Building 4065 was used as a vacuum test facility until 1972. From 1973 until it was demolished in 1999, the building was used as the Chemical and Metallographic Analysis Laboratory. Metals preparations activities were conducted under large fume hoods. The fume hoods channeled fluids to a three-stage metals clarifier located on the south side of the building via below-grade pipes within a concrete trench. The clarifier was approximately 4 by 12 feet long and 6 feet deep; discharge was piped underground to a sewage treatment plant in Area III. Records indicate that solvents were not stored in aboveground or underground storage tanks associated with the building (CH2M Hill 2008).

There were four sanitary sewer leach fields to the south of Building 4065 that were associated with DOE Buildings 4353, 4363, 4373, and 4383. Records indicate that none of the 12 aboveground storage tanks or 9 underground storage tanks associated with these buildings was used for TCE storage. The facilities supported the SNAP and SRE programs from the 1950s through the 1970s, and development and testing of large sodium pumps from the mid-1970s through 2001. The leach fields were removed from 2000 through 2002.

The buildings associated with the leach fields were used for a variety of research, manufacturing, and storage purposes. Solvents were used in some of these buildings, as well as in other, associated buildings. Although no solvents were reported to have been used in Building 4462, VOCs were found in one soil sample collected near Building 4462, which is in the potential source area.

Relatively low and decreasing levels (less than or equal to 12 parts per billion) of TCE have been detected in three piezometers that have been monitoring the plume since they were installed in 2000 and 2002. In 2014, only one well registering 8.7 parts per billion TCE was above the MCL.

3.4.2.5 Building 4057 Warehouse Perchloroethylene Plume

A plume of PCE (also known as tetrachloroethylene)-impacted groundwater exceeding its MCL of 5 parts per billion is found in the vicinity of former Buildings 4059 and 4626 and the existing Building 4057 Warehouse. The source of PCE that has been detected in the near-surface and Chatsworth Formation groundwater is likely impacted soil near former Building 4626 and, potentially the Building 4057 Warehouse. Building 4626 was used for equipment storage. Soil samples collected on the south side of Building 4626 were found to contain VOCs, including PCE at a concentration of 37 micrograms per kilogram at a depth of 9 feet. The Building 4057 Warehouse was used as a Liquid Metals Engineering Center Laboratory. A flammable materials storage cabinet was located outside the north wall of the building.

Former Building 4059 and its associated French drain and storage tanks were removed in 2003 and 2004. During excavation, groundwater in the area was pumped to keep the basement and excavation dry. This action may have pulled impacted groundwater originating at Building 4626 toward Building 4059.

3.4.2.6 Tritium Plume

As shown in Figure 3–18, a plume of tritium-impacted groundwater is present over an approximately 4.4-acre area southwest of RMHF, west of the former Building 4010 (SNAP 8ER), and east of former Building 4059. The tritium plume extends into the NBZ. Tritium is a radioactive isotope of hydrogen that can be produced naturally through cosmic ray interactions in the upper atmosphere, as well as from neutron reactions in nuclear reactors. It is a low-energy beta-emitter with a half-life of approximately 12.3 years, and tritium atoms can easily become part of water molecules.

Tritium was first found in Area IV groundwater in 1989. Although the source of the tritium plume has not been definitively determined, the tritium was most likely produced as a byproduct of neutron bombardment of the concrete containment walls associated with the former Area IV reactors (Rockwell 1992), then released into soil and bedrock by percolating groundwater. All reactor operations, and therefore tritium production, stopped by 1974.

As tritium flows through the fractured rock, it diffuses from areas of higher activity (groundwater in the fractures) to areas of lower activity (pore water in the rock matrix). This diffusion has the effect of decreasing the concentration of tritium in the groundwater in the fractures. In the tritium plume area, groundwater flows through the bedrock fractures downward and to the northwest and discharges at seeps or springs at the ground surface on the slope to the northwest of the plume.

Several monitoring wells have been sampled multiple times from 2004 through 2014, a span of nearly one half-life of tritium. As tritium has not been produced since 1974, the activity of the remaining tritium is expected to continue to decrease through radioactive decay. A comparison of the tritium activity in wells that were sampled in the 2004 to 2005 time frame and again in 2014 indicates that tritium activity has decreased more than expected from radioactive decay alone, likely due to diffusion of the tritium from the fractures into the rock matrix (CDM Smith 2015a). The MCL for tritium is 20,000 picocuries per liter. In early 2014, tritium activity exceeded the MCL at two wells, one with an activity of 28,000 picocuries per liter and the other an activity of 40,000 picocuries per liter (CDM Smith 2015a).

3.4.2.7 Radioactive Materials Handling Facility Bedrock Strontium-90

Radioactive contamination at the RMHF leach field site was discovered in 1975 during routine monitoring in the vicinity of RMHF, when vegetation was analyzed and found to be contaminated by radioactivity. In 1978, contaminated soil from the leach field was removed to bedrock, and radioactive material found in accessible bedrock was removed by hydraulic hammering. During removal of the leach field, concentrations of up to 115,000 picocuries per gram of strontium-90 were observed in the excavated materials. The environmental report on the removal of the leach field states that, after excavation, an average of 300 picocuries per gram of strontium-90 and traces of cesium-137 remained in bedrock cracks. Following removal of the bedrock material that could be excavated, the bedrock was sealed with a bituminous asphalt mastic material, and the site was backfilled with 10 feet of soil. Shallow soils contaminated with strontium-90 in the area of the RMHF former leach field may be secondary, minor sources of strontium-90 to groundwater through recharge by infiltration from the surface.

Groundwater is monitored by one near-surface groundwater and seven Chatsworth Formation monitoring wells near and potentially downgradient from the former RMHF leach field. TCE was detected in samples collected during the 1990s, and the location was subjected to prolonged groundwater pumping to remove TCE. The presence of strontium-90 in groundwater was found after well RD-98 was installed in 2008 at the western end of the former RMHF leach field. When sampled first in 2008 and 2009, strontium-90 was below its MCL of 8 picocuries per liter. However, groundwater surface elevation levels were low at that time. Concentrations in RD-98 increased with rising water levels. The highest concentration of strontium-90 in RD-98, as reported by EPA in 2011, was 183 picocuries per liter, corresponding with the highest groundwater elevation (HGL 2012d). With the ongoing drought in southern California, the water table has been dropping along with strontium-90 concentrations. This indicates that remaining strontium-90 at the leach field site is shallow and has not migrated deeply into the bedrock. However, without remediation, this source is expected to remain for a long time. Overall, strontium-90 contamination in the groundwater is expected to present limited risk beyond a local area near the RMHF former leach field or for periods beyond several half-lives of strontium-90 (i.e., about 150 years[6]).

[6] The most recent strontium-90 concentration, reported in 2016, was 26.5 picocuries per liter (CDM Smith 2016a).

3.4.2.8 Building 4100/4056 Landfill Trichloroethylene Plume

The Building 4100/4056 Landfill groundwater investigation area is located northeast of FSDF. Groundwater is monitored by one bedrock well and one piezometer. Although the Chatsworth Formation groundwater is impacted, there is no documented source for the VOCs found in groundwater at Building 4100.

Building 4100 originally functioned as a support facility for the Southwest Atomic Power Association, which studied reactor core configurations using thorium and uranium, and later, high-energy neutrons. That program was terminated in 1974, and the building was subsequently used for other experimental purposes, including the Advanced Epithermal Thorium Reactor and Fast Critical Experiment Laboratory. It was subsequently decontaminated, decommissioned, and released for unrestricted use in 1980 (CH2M Hill 2008). In 1980, Boeing used the building for a high-energy, computer-aided, tomography facility and a radioactive sample counting laboratory. A sanitary leach field for Building 4100 was located about 30 feet east of the building. During the 2001 excavation to remove the leach field, it was discovered that the leach field had previously been removed (CH2M Hill 2008).

Built in 1957 and 1958, Building 4009 was a nuclear test facility and an in-service inspection facility that housed a moderated reactor and a sodium graphite reactor. A sanitary leach field was located about 50 feet north of Building 4009. In addition to receiving sanitary wastes, the leach field received liquid wastes after they were determined to be within acceptable limits for discharge of radioactive materials. After 1961, when a central sewer system was installed, only operational wastes were discharged to the leach field. The leach field and lines and a septic tank were removed in 2002. Each reactor had an associated 1,000-gallon waste holdup tank used to hold water prior to discharge to the leach field. The moderated reactor also had a 1,200-gallon tank that held Santowax.

Soil sampling during the Building 4100 Trench RFI (MWH 2007) did not identify chlorinated VOCs (such as TCE) in the soil. Although no source for the TCE in the groundwater has been identified, it was assumed to have originated at Building 4100.

TCE-impacted groundwater has been identified in the Chatsworth Formation groundwater at the Building 4056 Landfill. The landfill originated in the 1960s and contains asphalt, concrete, and scrap metal generated during excavation of a basement for Building 4056 that was never completed. The excavation, located east of the landfill, is a circular vertical pit extending approximately 65 feet into the bedrock. The landfilled materials were placed in topographic low areas, resulting in a relatively flat surface. In the mid-1970s, drums of waste containing grease, oils, alcohols, sodium, sodium reaction products, phosphoric acid, asbestos, rags, and rope were stored in the middle part of the landfill. The drums were removed in the early 1980s. Some metal debris was observed in the bottom of the excavation when the pit was dewatered in 1999.

TCE was detected in samples collected in the late 1980s, with concentrations increasing to over 80 parts per billion in 2000 and 2002. In 2014, TCE was reported at 57 parts per billion (CDM Smith 2015a). An increase in concentration of TCE breakdown products during this time may indicate that TCE is naturally degrading.

3.5 Biological Resources

Biological resources include vegetation and wildlife habitats; aquatic and wetland habitats; and rare, threatened, and endangered species that either occur or have the potential to occur in the SSFL area of interest. The ROI for biological resources encompasses areas that could be directly or indirectly impacted by the proposed activities, including Area IV and the NBZ.

3.5.1 Introduction

SSFL occupies approximately 2,850 acres of hilly terrain, with approximately 700 feet of topographic relief near the crest of the Simi Hills. The Simi Hills are bordered on the east by the San Fernando Valley and to the north by the Simi Valley. Most of the land adjacent to SSFL is undeveloped and mountainous (Ogden 1998).

The SSFL site is located along the crest of the Simi Hills and is a part of the linkage design (South Coast Wildlands 2008) or wildlife corridor that provides wildlife passage from the Santa Monica Mountains to the south through the Simi Hills and Santa Susana Mountains to the Sierra Madre range to the north (Penrod et al. 2006). Mammals such as bobcat, coyote, mountain lion, and deer pass through the open space areas of SSFL. SSFL also provides connectivity for plant dispersal, as their distribution changes in response to environmental changes. Natural communities on SSFL include unique communities associated with the sandstone outcrops and restricted to the local vicinity, as well as more-widespread plant communities that are characteristic of the region. SSFL, including its adjoining buffer areas, is bordered to the south and west by the Upper Las Virgenes Canyon Open Space Preserve (formerly Ahmanson Ranch, which was purchased in 2003 and set aside by the Santa Monica Mountains Conservancy). SSFL is adjoined on the north by the American Jewish University Brandeis-Bardin Campus, which is largely undeveloped and used for educational purposes, and on the northeast by the Sage Ranch, which is parkland.

SSFL lies in a semiarid Mediterranean-climate region, with precipitation falling mostly during the cooler months (November through March). The summer months are typically dry. Temperatures are moderated by the relatively cool waters of the nearby Pacific Ocean and a "marine layer" of overcast and fog that frequently reaches SSFL, which both moderates temperatures and elevates humidity, especially from May through July. Native plant species of the region have adapted to the Mediterranean climate in various ways, enabling them to grow during the cooler months when soil moisture is replenished by rainfall and to endure or escape the prolonged summer drought. Because of SSFL's location at and near the summit of a low mountain range in a semiarid environment, water is scarce and very seasonal. Consequently, development of riparian and wetland vegetation is limited to ephemeral to intermittent drainages and small man-made impoundments.

The geology of the area is characterized by steep outcrops of the Chatsworth Formation, a thick sequence of steeply dipping sandstone beds interbedded with siltstone. Between the resistant sandstone outcrops, which are conspicuous features of SSFL, are more or less level or flat areas that overlie more-erodible portions of the formation. Most of the development in Area IV took place on Burro Flats, the largest of these areas of relatively flat topography.

The NBZ adjacent to Area IV is characterized by steep, nearly barren sandstone outcrops that parallel the northern border of Area IV to the west, giving way to relatively dense chaparral on less rocky slopes toward the eastern boundary of Area IV. The bedding plane of these outcrops lies nearly parallel to the slope in some areas, which results in steep slabs of bedrock that are covered with a thin veneer of soil alternating with bare patches of sandstone where the veneer of soil and vegetation has slipped from the surface.

Several intermittent drainages lead north from Area IV into the NBZ and southeast into Areas II and III. Engineered stormwater collection and treatment systems, developed to address NPDES discharge requirements, control stormwater flows northward from Area IV. These flows are currently diverted at the stormwater treatment outfalls and piped to Silvernale Pond in Area III for treatment before being released into the Bell Canyon watershed. These stormwater collection and treatment systems receive runoff primarily during the winter rainy season (November through March). No permanent water flow or natural water bodies are present within Area IV or the NBZ.

Vegetation on Area IV and the NBZ has been disturbed by a variety of activities. In September 2005, the Topanga fire burned through most of SSFL. The effects of the fire are visible on the oak trees and large shrubs, which are still recovering from the fire's effects. The fire bypassed portions of Area IV and of the NBZ, leaving portions of vegetation intact near the western end of Area IV and the NBZ. In 2010 and 2011, most of the aboveground vegetation was mowed or otherwise mechanically reduced to ground level by EPA (as described in Section 3.5.2) to facilitate a survey of Area IV and the NBZ for contaminants. Vegetation manipulation continued through 2014 to facilitate access for soil borings and other site characterization activities and for fire prevention. The topography of the ROI has a high degree of variability, which influences the plants and animals that may be present. The land is relatively flat in the majority of Area IV, with a few large sandstone outcrops in scattered locations, primarily in the northern part of the ROI. The southwestern portions of Area IV encompass hills that continue to the west and south. The NBZ is distinguished by very steep north-facing slopes and massive sandstone outcrops.

Data Review. This section is based on a literature review and extensive field surveys, including identification of critical habitat for federally threatened and endangered species. The following paragraphs summarize the sources of information used to prepare this section; these sources include existing documents, as well as with surveys conducted from 2009 through 2014.

The California Natural Diversity Database (CNDDB) was accessed on multiple occasions from 2010 through 2015, prior to conducting vegetation and wildlife habitat and sensitive plant surveys, as well as to update historical and recent occurrence and location information for listed species that are known to occur or could potentially occur within the ROI (CDFW 2015).

The following recent and previously developed biological resource information for SSFL, Area IV, and the NBZ was also analyzed:

- *Environmental Impact Statement for Proposed Demolition and Environmental Cleanup Activities at Santa Susana Field Laboratory, Ventura County California* (NASA 2014a).
- *California Gnatcatcher Habitat Assessment and Protocol Survey of Potential Habitat within Santa Susana Field Laboratory Area IV and the Northern Buffer Zone* (Griffith Wildlife Biology 2010, 2011, 2012).
- *Annual Biological Monitoring Report 2010–2011*, *Quarterly Biological Monitoring Report #5*, Final *Biological Monitoring Report 2010–2012 for the Radiological Study of the Santa Susana Field Laboratory Area IV and the Northern Buffer Zone* (HGL and Envicom 2011a, 2011b, 2012).
- *Least Bell's Vireo Protocol Survey of the EPA Radiological Study Area at the Santa Susana Field Laboratory, 2012* (Werner 2012).
- *Biological Opinion for the Santa Susana Field Laboratory Area IV Radiological Study Project, Ventura County, California* (USFWS 2010).

- *Biological Assessment for the Santa Susana Field Laboratory Area IV Radiological Study, Ventura County, California* (EPA 2009a).
- *Biological Conditions Report Santa Susana Field Laboratory Ventura County, California* (Ogden 1998). The report includes the results of several vegetation and wildlife surveys conducted from 1995 through 1997. The studies encompassed the entire SSFL site, but focused on sites potentially undergoing remediation and closure. All habitats were visited, but no trapping, quantitative surveys, or focused protocol surveys for endangered, threatened, or rare species were conducted.
- *Addendum to Biological Conditions Report Santa Susana Field Laboratory Ventura County, California* (MWH and AMEC 2005). This addendum includes data from additional surveys conducted between 2000 and 2004.
- *Biological Report on Braunton's Milk-Vetch Habitat* (MWH Global 2009). This report includes the results of surveys conducted in 2006 within the Braunton's milk-vetch critical habitat at SSFL Area IV.

Surveys conducted specifically to support this EIS include the following:

- *Wetlands Assessment.* Biologists conducted surveys to delineate potential jurisdictional wetlands and waters of the U.S. on Area IV and the NBZ during May 2014 (see Appendix I).
- *Fall Biological Survey Report for Santa Susana Field Laboratory Area IV and Northern Undeveloped Areas* (SAIC 2009a). Biologists conducted vegetation and sensitive plants surveys on October 5-9, 2009, and October 21–22, 2009. Surveys included Area IV and the NBZ and were conducted with the aid of hard copies of high-resolution aerial photos, which were used to supplement the differential global positioning system in locating and delineating areas of interest. A supplemental visit was made on November 10, 2009, to field check the mapped vegetation categories within the previously developed portions of Area IV and the NBZ.
- *California Red-Legged Frog Habitat Site Assessment at Santa Susana Field Laboratory Area IV and Vicinity* (SAIC 2010). This study reports the results of surveys conducted in October 2009 and February 2010 in the vicinity of Area IV of SSFL.
- *Site Assessment for Quino Checkerspot Butterfly, Santa Susana Field Laboratory (SSFL) Area IV, Ventura County, California* (Faulkner 2010). This site assessment consisted of a suitable habitat assessment of the project area that included documenting both larval and adult host plants for the federally listed endangered butterfly and preparing an opinion on the potential for butterfly presence. This study was conducted by a permitted biologist with host plant survey and mapping assistance from the DOE team (DOE 2010a).

3.5.2 Vegetation

Vegetation on Area IV and the NBZ consists of a variety of different plant communities, ranging from oak and walnut woodlands, to chaparral, to grasslands, as well as areas that are unvegetated disturbed/developed. Sandstone outcrops are also prominent throughout Area IV and the NBZ and support a unique vegetation community.

Natural and man-made disturbances over the years have resulted in plant communities at a variety of different successional stages. The vegetation communities support uniquely adapted groups of plants that are prone to fire. Many of the plants have developed methods for adapting to fire, such as underground root crowns that allow them to re-sprout after fire or production of seeds that can remain in the ground for many years and germinate in response to smoke, heat, and ash (UCCE 2014). As previously mentioned, vegetation across most of SSFL was burned during the September 2005 Topanga fire, and different portions of SSFL were burned with variable intensity, resulting in a variety of degrees of burning. A few localized areas were not burned, including patches of oaks and chaparral in the NBZ and chaparral in the western corner of Area IV. In some of the burned areas, woody species such as oaks, California walnuts, and shrubs are still recovering from the effects of that fire.

In addition to the effects of the Topanga fire, there has been considerable vegetation manipulation since 2009 to facilitate access for equipment to conduct radiological, chemical, and soil sampling of Area IV and the NBZ. In 2010 and 2011, most of the herbaceous and shrubby vegetation in Area IV, with some exceptions to trees such as oaks and California walnuts and the occasional shrub, was mowed or otherwise mechanically reduced to a height of approximately 6 to 18 inches to allow passage of gamma radiation detection equipment to facilitate a survey of Area IV and the NBZ for radiological contamination. During this vegetation-clearing activity, limited pruning of mature trees was done to allow access under the canopy. The vegetation clearing was conducted subject to stipulations in a Biological Opinion from the U.S. Fish and Wildlife Service (USFWS) that was developed to avoid or minimize impacts on endangered or threatened plants and wildlife species (USFWS 2010). Cutting within designated critical habitat or areas occupied by listed species was limited to the use of hand tools, and the extent of vegetation removal in areas with sensitive biological resources was delineated by a USFWS-approved biologist. In 2012 through 2014, more vegetation clearing and mowing occurred in various areas throughout Area IV and the NBZ to enable access for soil sampling rigs and to reduce fire danger. Biologists have provided guidance to minimize native plant removal and avoid shrubs and trees to the maximum extent practical.

The flatter areas of Area IV are mostly previously developed and are in some stage of vegetation recovery following removal of structures and remediation of the individual building sites at various times over the years. The vegetative cover of these previously developed areas varies across Area IV and is related to a variety of factors, including the year and seasonal timing of remediation, type of restoration activities, and characteristics of adjacent locations. Some former facility sites support a high abundance of invasive nonnative plant species, while other sites support a prevalence of native species, including sensitive plants.

Except in areas that have been recently disturbed, the vegetation in Area IV and the NBZ has been gradually recovering from clearing and cutting mentioned above and generally appears to be regaining the characteristics of the pre-existing vegetation. Prior to cutting, upland vegetation of Area IV was primarily grassland dominated by nonnative species, coastal scrub, and chaparral communities dominated by native species, with oak woodland present in locations that have favorable exposures and soil conditions. Oak woodlands had an understory of weedy grasses, and forbs were also typically present in the annual grassland community. Disturbed areas exhibited a vegetative cover dominated by both introduced and native species that are easily able to disperse to and establish in open habitats.

Table 3–5 details the acreage of each vegetation type within the survey area, including a breakdown of the acreages within Area IV, and the eastern and western portions of the NBZ. Scientific plant names follow *The Jepson Manual* (Baldwin et al. 2012).

Table 3–5 Vegetation Types Identified in Area IV and the Northern Buffer Zone[a]

Vegetation Types	Area IV	Northern Buffer Zone		Total
		Western	Eastern	
	Acres			
Northern Mixed Chaparral – Burned (C-B)	79.3	47.0	65.7	192.0
Northern Mixed Chaparral – Sandstone Outcrops (C-S)	27.6	17.2	16.3	61.1
Northern Mixed Chaparral – Unburned (C-UB)	5.0	2.5	1.3	8.8
Formerly Disturbed – Mulefat-dominated (MF)	0.9	0.0	0.0	0.9
Formerly Disturbed – Revegetated (RV)	21.4	0.0	0.0	21.4
Formerly Disturbed – Weed-dominated (WD)	14.0	0.0	0.0	14.0
Coast Live Oak Woodland/Savanna (CLO)	49.7	6.2	7.4	63.3
Unvegetated Disturbed/Developed (UDD)	40.1	1.4	0.9	42.4
California Walnut Woodland (CWW)	8.1	0.4	1.0	9.4
Nonnative Annual Grassland (AG)	39.8	3.3	1.8	44.9
Steep Dipslope Grassland (SDG)	0.0	0.4	7.3	7.7
Venturan Coastal Scrub (VCS)	3.1	0.0	0.0	3.1
Riparian (R)	0.9	0.9	0.7	2.5
TOTAL [b]	**289.9**	**79.3**	**102.4**	**471.6**

[a] Based on Geographical Information System analysis of vegetation mapping done by the report preparers from air photos and on the ground surveys.
[b] Totals may not equal the sums of table entries due to rounding.

Figure 3–20 depicts the vegetation and wildlife habitats in Area IV and the NBZ based on surveys conducted in 2009 and updated in 2014. This figure was created by delineating polygons of different vegetation types using the Geographic Information System and a digital version of high-resolution aerial photographs as a base. The figure contains 9 vegetation types, 2 with 3 subtypes each, for a total of 13 categories. Classification of the vegetation categories is consistent with *Preliminary Descriptions of Terrestrial Natural Communities of California* (Holland 1986), except where no suitable category exists. For example, this document does not include a suitable vegetation category for weed-dominated areas, so a category was developed to identify this vegetation type.

The vegetation types described in detail in the paragraphs that follow are based on the *Fall Biological Survey Report for Santa Susana Field Laboratory Area IV and Northern Undeveloped Areas* (SAIC 2009a), with updates based on recent field work. Sensitive habitats in Area IV and the NBZ include Venturan coastal sage scrub, steep dipslope grassland, sandstone outcrops, northern mixed chaparral, California walnut woodland, Coast live oak woodland and savanna, wetlands, vernal pools, and riparian habitat. Information about special status plant species documented from the Area IV and the NBZ and a discussion on invasive nonnative plant species that have the potential to adversely affect the vegetation and wildlife habitat types and cause long-term alteration and degradation of the biological environment are also included.

3.5.2.1 Northern Mixed Chaparral

Northern mixed chaparral is the most abundant vegetation type onsite. In general, these areas have not been mechanically disturbed in the past and occur on steeply sloping hillsides. Northern mixed chaparral is particularly well developed in the NBZ and on two hills in the western portion of Area IV. Due to the different appearance and functionality of the habitat, three subtypes were mapped and are described in the next few paragraphs: burned, unburned, and sandstone outcrops.

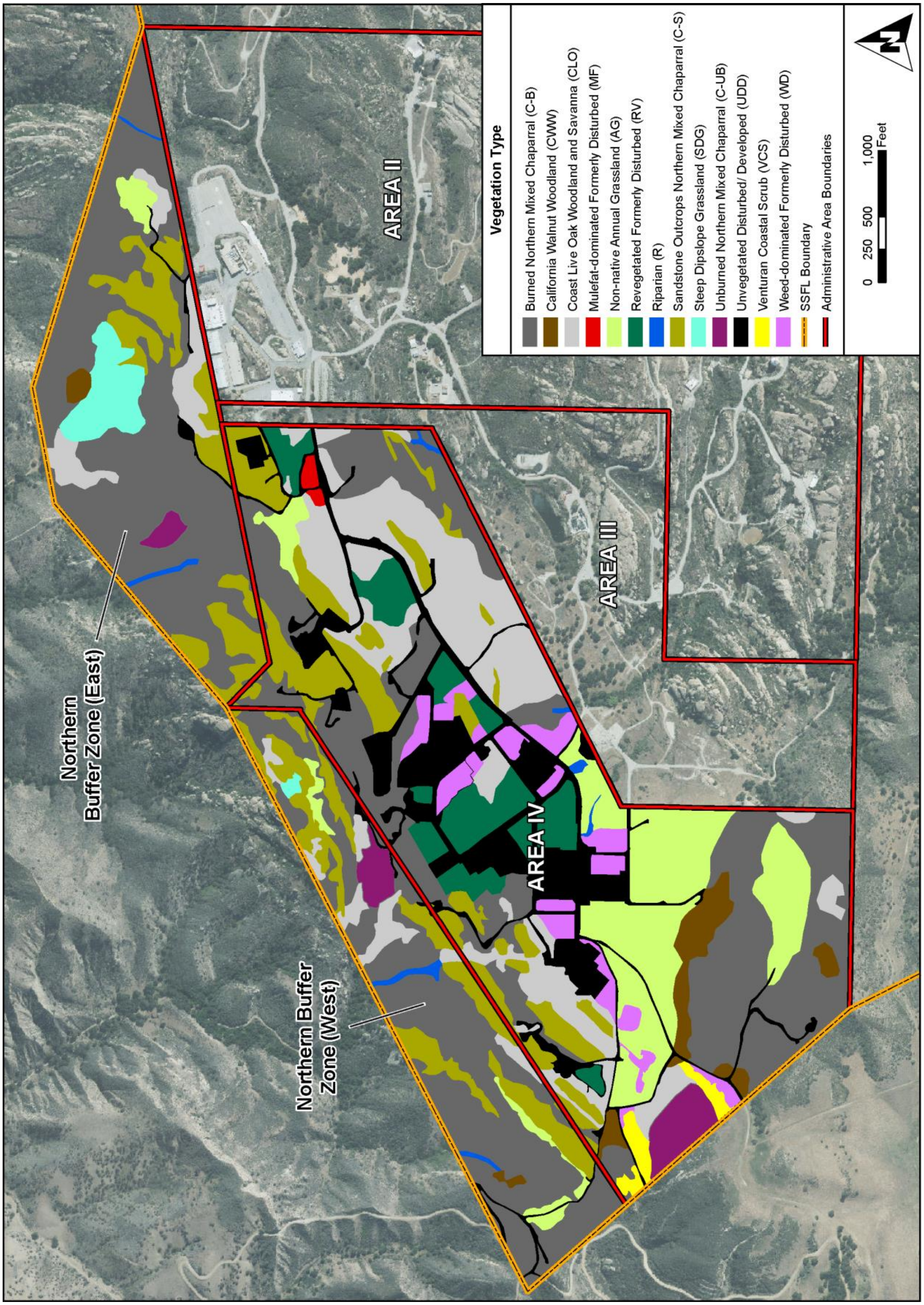

Figure 3–20 Vegetation and Wildlife Habitats Mapped in the Study Area

Northern Mixed Chaparral – Burned (C-B). The 2005 fire burned different portions of Area IV and the NBZ with variable intensity, resulting in a variety of degrees of burning, with some areas not burned at all. Burned northern mixed chaparral occupies one hill in the western portion of Area IV and most of the NBZ. Sticky snapdragon (*Antirrhinum multiflorum*) and deerweed (*Acmispon glaber*) were prominent in the landscape during the 2009 surveys, but these short-lived plants have subsequently diminished in abundance on Area IV and the NBZ. Dominant species vary in different portions of the ROI, but most include re-sprouting seedlings and subshrubs (i.e., low-growing shrubs with a woody base) of woody chaparral species such as chamise (*Adenostoma fasciculatum*), hoary leaf ceanothus (*Ceanothus crassifolius*), buckbrush (*C. cuneatus*), big-pod ceanothus (*C. megacarpus*), hairy ceanothus (*C. oliganthus*), chaparral yucca (*Hesperoyucca whipplei*), poison oak (*Toxicodendron diversilobum*), mountain mahogany (*Cercocarpus betuloides*), laurel sumac (*Malosma laurina*), and sugar bush (*Rhus ovata*). Species typical of coastal sage scrub, including black sage (*Salvia mellifera*), purple sage (*Salvia leucophylla*), and California sagebrush (*Artemisia californica*), have been established in some areas and are abundant in places among the regenerating chaparral dominants.

Braunton's milk-vetch (*Astragalus brauntonii*), listed as endangered under the Federal Endangered Species Act (ESA), is one of the dominant plants in localized portions of northern mixed chaparral-burned in Area IV, as discussed in Section 3.5.5.1. Malibu baccharis (*Baccharis malibuensis*) (California Rare Plant Rank [CRPR] 1B.1; rare, threatened, or endangered in California and elsewhere, seriously endangered in California) has been observed to be abundant in a portion of the area occupied by Braunton's milk-vetch. In addition, three sensitive species of mariposa lily have been identified in burned or manipulated northern mixed chaparral and adjacent grass-dominated areas. These are Plummer's mariposa-lily (*Calochortus plummerae*), CRPR 4.2; Catalina mariposa lily (*Calochortus catalinae*), CRPR 4.2; and a species tentatively identified as slender mariposa lily (*Calochortus clavatus* var. *gracilis*), CRPR 1B.2.

In spring 2014, this community type was recovering gradually within the area that had been hand trimmed (hill in the southwestern portion of Area IV), and most of the pre-existing dominant species in place were regenerating from seed or crown sprouts. Additionally, successional species such as woolly blue curls (*Trichostema lanatum*), the sensitive Malibu baccharis, Indian warrior (*Pedicularis densiflora*), and slender sunflower (*Helianthus gracilentus*) were evident. Elsewhere on Area IV and the NBZ, areas classified as burned chaparral were recovering following vegetation trimming. These areas have high concentrations of thickleaf yerba santa (*Eriodictyon crassifolium*), with lesser amounts of coyote brush (*Baccharis pilularis*), laurel sumac, and Palmer's goldenbush (*Ericameria palmeri*), as well as native and nonnative grasses and forbs, including needlegrass (*Stipa* spp.), narrow-leaved milkweed (*Asclepias fascicularis*), wild oats (*Avena* spp.), ripgut brome (*Bromus diandrus*), and Mediterranean mustard (*Hirschfeldia incana*).

Northern Mixed Chaparral – Unburned (C-UB). In most cases, unburned areas are restricted to low-lying swales dominated by ceanothus and laurel sumac. There are small pockets of northern mixed chaparral that were missed by the September 2005 fire in the NBZ. These areas support tall chaparral shrubs, similar in species composition to those described for burned northern mixed chaparral. Although uncommon, where unburned areas occur along ridgelines, they are dominated by chamise and manzanitas (*Arctostaphylos* spp.).

Unburned northern mixed chaparral also occurs on a conical hill at the northwestern corner of Area IV. In 2009, vegetation on this hill was dominated by mature chaparral species, including chamise, chaparral yucca, holly leaf redberry, hoary leaf ceanothus, buckbrush, big-pod ceanothus, hairy ceanothus, and bigberry manzanita (*Arctostaphylos glauca*). Shrubs were about 4 feet or taller in height and, in most places, the vegetation was thick and impenetrable. Occasional disturbed paths and clearings in the unburned northern mixed chaparral supported stands of nonnative grasses and forbs, including wild oats, ripgut brome, Mediterranean mustard, and tocalote (*Centaurea melitensis*). In 2011, the vegetation on the conical hill was removed to facilitate access by the gamma scanning equipment. Most of the large shrubs were cut at or near the ground level and removed. A few large shrubs were left standing, but some of these blew over during a wind storm. In September 2013 and July 2014, vegetation was still recovering with a combination of shrubs, including chamise, the sensitive Malibu baccharis, black sage (*Salvia mellifera*), hoary leaf ceanothus, hairy ceanothus, bigberry manzanita, and woolly blue curls (*Trichostema lanatum*) as well as some herbaceous, typically fire-following species, including branching phacelia (*Phacelia ramosissima*), California peony (*Paeonia californica*), slender sunflower, chaparral zygadene (*Zigadenus fremontii*), and the endangered Braunton's milk-vetch (*Astragalus brauntonii*) observed. Neither Malibu baccharis nor Braunton's milk-vetch had been observed in this area prior to the vegetation cutting. Braunton's milk-vetch showed evidence of deer browsing, as was the case on the hillside with previously burned chaparral.

Northern Mixed Chaparral – Sandstone Outcrops (C-S). The northern mixed chaparral – sandstone outcrops vegetation type is mainly located at the northern end of Area IV and in the NBZ. These areas are described as very large sandstone outcrops that dominate 80 percent or more of the ground surface. In general, these occur as wide, linear features, as the outcrops form in natural rows, with some outcrops at or near the soil level, and others 40 or more feet above the soil level. Due to the size and frequency of the outcrops, the habitat function of the northern mixed chaparral is very different in these areas. Sandstone outcrops support a distinctive community of primarily native herbs and subshrubs growing with nonnative annual grasses in fissures and other areas where soil can accumulate and trap seeds. Mosses, club mosses, and lichens are prevalent on sandstone outcrops, particularly on shaded northerly exposures, where they trap soil and facilitate the establishment of flowering plant species. The sandstone outcrops support very limited cover by shrubby species; however, vegetation similar to the unburned northern mixed chaparral occurs around the edges of the outcrops and the spaces between them, undoubtedly receiving extra moisture from rainfall runoff from the outcrops. On the north-facing slopes, these habitats often have patches of steep dipslope grassland, as described further in Section 3.5.2.3. The Santa Susana tarplant (*Deinandra minthornii*), listed under the California Endangered Species Act (CESA) as rare and discussed in Section 3.5.5.1, is one of the plant species closely associated with sandstone outcrops, and is frequently observed growing in fissures in the rock, where the silvery rosettes of chalk dudleya (*Dudleya pulverulenta*) are also commonly seen.

In 2014, the sandstone outcrops continued to support a variety of species, including Santa Susana tarplant, bushy spike moss (*Selaginella bigelovii*), chalk dudleya, lanceleaf liveforever (*Dudleya lanceolata*), and pockets of steep dipslope grasslands. In addition, numerous species of lichens are prominent throughout Area IV and the NBZ, especially on northerly exposures.

3.5.2.2 Venturan Coastal Scrub (VCS)

Venturan coastal scrub occurs around the base of a hill in the northwest corner of Area IV. This vegetation type appears to be transitional between unburned northern mixed chaparral and California walnut woodland. Dominant plant species include giant wild rye (*Leymus condensatus*), black sage (*Salvia mellifera*), and purple sage (*Salvia leucophylla*). In July 2014, after vegetation clearing, these areas had relatively dense populations of regenerating shrub species similar to those present prior to clearing, including dense purple sage, black sage, giant wild rye, and small patches of California sagebrush (*Artemisia californica*).

3.5.2.3 Coast Live Oak Woodland and Savanna (CLO)

The coast live oak woodland and savanna vegetation type is dominated by coast live oak trees (*Quercus agrifolia*) with a variable understory, depending on surrounding habitat. In the northern part of Area IV, such vegetation generally occurs with an understory of annual grasses and forbs such as ripgut brome, wild oats, and lesser amounts of tocalote in areas with scattered large sandstone outcrops. Re-sprouting snowberry (*Symphoricarpos mollis*) and poison oak contribute to the understory in some areas. In the NBZ, coast live oak woodland and savanna occurs at margins of the northern mixed chaparral subtypes, and common chaparral plant species are intermixed with the oak trees. The difference between the woodland and savanna is the degree of closure of the oak canopy (in general, a savanna has scattered trees with a more open, grassland understory, and a woodland has more trees with a greater canopy cover, although the canopy is still open, with a variable understory). Because the coast live oak woodland and savanna vegetation types are very similar and are somewhat limited in the ROI, the two categories were combined for this analysis.

In July 2014, oak woodlands and savanna appeared to be in relatively good condition. The oak trees that had been trimmed were still in place and the understory was largely recovered and included annual grasses, poison oak, snowberry, hummingbird sage (*Salvia spathacea*), and blue dicks (*Dichelostemma capitatum*). Shrubs such as laurel sumac, Palmer's goldenbush, and blue elderberry (*Sambucus nigra* ssp. *caerulea)* were sparsely distributed. Some of the oak trees, especially in the eastern part of Area IV that had been severely burned but survived the Topanga fire, showed the combined effects of the fire damage coupled with effects from the past 3 years of severe drought.

3.5.2.4 Steep Dipslope Grassland (SDG)

Steep dipslope grassland occurs on steep north-facing slopes in the NBZ. In particular, sites with this vegetation type have steeply dipping sandstone bedrock, with the slope angle following the bedding plane. The sandstone bedrock is overlain by a thin layer (one to several inches) of soil. Steep dipslope grassland is dominated by nonnative annual grasses and herbs, including wild oats and ripgut brome. However, sizeable areas support a unique mixture of annual and perennial native herbs and wildflowers that are also present within this vegetation type (e.g., bushy spike-moss, shooting stars [*Dodecatheon clevelandii*], wild onion [*Allium* spp.], common goldenstar [*Bloomeria crocea*], blue dicks, lance-leaved dudleya [*Dudleya lanceolata*], and mariposa lily [*Calochortus* spp.]).

3.5.2.5 California Walnut Woodland (CWW)

California walnut woodland is defined by the presence of southern California black walnut trees (*Juglans californica*). Southern California black walnuts are a special status species (CRPR 4.2, "uncommon and fairly endangered in California" [CNPS 2015]). Plant communities where southern California black walnut is dominant or co-dominant are also identified as sensitive in the CNDDB (CDFW 2015). In Area IV, California walnut woodland occurs at the base of hills at the western side of Area IV. They are on north- or east-facing slopes in the transition between chaparral/coastal scrub and grassland. In these areas, coast live oaks are also dominant, and the understory is characterized by shrubs and subshrubs, including poison oak and purple sage. Several California black walnuts are also present at the bottom of steep slopes at the western edge of the NBZ.

In September 2013, areas vegetated by California walnuts had largely recovered from the trimming activities, and the understory vegetation had largely regrown. In July 2014, trees appeared to be healthy and seedlings were present in areas near the woodlands.

3.5.2.6 Formerly Disturbed Sites

Formerly disturbed sites in Area IV support a variety of native and nonnative plants. For that reason, this vegetation type is divided into three subcategories: mulefat-dominated, weed-dominated, and revegetated. These subcategories are described in the following paragraphs.

Formerly Disturbed – Mulefat-dominated (MF). This vegetation type is dominated by mulefat (*Baccharis salicifolia*), a species chiefly known to occur along sandy floodplains of stream courses. Understory is minimal, and this vegetation type may be transitional to other naturally occurring types such as northern mixed chaparral. The dominance of this vegetation type on some of the previously disturbed sandy sites may be related to the coincidence of freshly disturbed sandy soil following restoration and ample rainfall coinciding with the release of the short-lived, wind-dispersed mulefat seeds during the fall. Formerly disturbed, mulefat-dominated vegetation types occur in a few locations in the northern portion of Area IV.

In September 2013, mulefat recovered from the vegetation trimming activities, which largely left the mulefat shrubs in place. In 2014, mulefat volunteers were observed in various areas within this vegetation type, which has resulted in plants of various ages.

Formerly Disturbed – Weed-dominated (WD). This vegetation type includes extensive stands of invasive nonnative species such as Mediterranean mustard (*Hirschfeldia incana*), tamarisk (*Tamarix ramosissima),* tree-of-heaven (*Ailanthus altissima*), Italian thistle (*Carduus pycnocephalus*), and Russian thistle (*Salsola tragus*). This vegetation type only applies to sites with large-scale infestations of nonnative invasive species. Sites with more-localized patches of nonnative invasive species are identified separately.

In September 2013, subsequent to mowing to facilitate EPA access, these weed-dominated areas generally reverted to a weedy vegetation cover. In 2014, many areas where buildings had recently been demolished were dominated by weeds. Some areas in the western portion of Area IV that had previously extensive stands of weeds have gradually converted to annual grasslands, which could be the effect of multiple years of drought or the natural succession of vegetation.

Formerly Disturbed – Revegetated (RV). Sites with formerly disturbed, revegetated vegetation types occur in various locations where buildings and pads have been removed and planted with a mix of native species. This vegetation type typically includes somewhat open shrub-dominated areas with annual grasses in the space between shrubs. Many formerly disturbed sites that had been revegetated now support stands of mulefat or coyote brush. Coast goldenbush (*Isocoma menziesii*), coastal bush sunflower (*Encelia californica*), and deerweed may also be present or prevalent on these sites. A few of the formerly disturbed revegetated sites now support stands of needlegrass (*Stipa* spp.) a native perennial bunchgrass.

In September 2013, subsequent to mowing to facilitate EPA access, these formerly disturbed, revegetated areas had largely recovered due to re-sprouting of the dominant shrubs to facilitate access for the EPA gamma scanning effort. Subsequent to the gamma scanning, several buildings and pad sites were decommissioned and hydromulched using a seed mix consisting of mostly native species. In addition, the sensitive Santa Susana tarplant has colonized many formerly disturbed areas that have natural populations on nearby sandstone outcrops acting as a seed source and soils derived from sandstone.

3.5.2.7 Unvegetated Disturbed/Developed (UDD)

This mapping category is applied to areas that do not support vegetation types such as existing pads, buildings, or roads. Small dirt tracks (e.g., "two tracks") are not included in this category, but rather that of the surrounding vegetation type. Most areas in this designation are located in Area IV.

3.5.2.8 Nonnative Annual Grassland (AG)

This vegetation category applies to areas dominated by annual species, particularly annual grasses such as ripgut brome and wild oats. In 2014, native grasses and herbs such as needlegrass, blue dicks, golden stars, Mariposa lilies, and hairy vetch (*Vicia villosa*) were also present within this vegetation type. Vegetative cover is typically dense and soils are relatively deep. Nonnative annual grassland occurs in scattered locations in Area IV and the NBZ.

3.5.2.9 Riparian (R)

Riparian vegetation type is present along a few drainages in Area IV and in the NBZ. It is characterized by scattered riparian trees, such as willows (*Salix* spp.) and California sycamore (*Platanus racemosa*). Other trees that can occur in riparian habitats and uplands are present as well, including coast live oak, California bay laurel (*Umbellularia californica*), and blue elderberry. The channel bottom has exposed bedrock that contains pools, which often become saturated following heavy rainfall events (SAIC 2009a). Plants typical of shady slopes are noted nearby, include California wild rose (*Rosa californica*), California blackberry (*Rubus ursinus*), and coastal wood fern (*Dryopteris arguta*). This vegetation type also occurs in the southern portion of Area IV, where there are clear drainage channels with recovering mulefat, elderberry, and willow trees.

3.5.2.10 Invasive Plant Species

Executive Order 12112 defines an invasive species as "an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health." Several invasive species have been documented during surveys conducted in 2009 (SAIC 2009a, 2009b).

As previously discussed, a large portion of the ROI, including the NBZ, is recovering from a wildland fire that burned through the area in September 2005. The 2009 survey (SAIC 2009a) noted the NBZ was relatively free of human disturbance and, consequently, was relatively free of invasive species. The same was noted for most of the hilly area in the southwestern part of Area IV, including much of the critical habitat of the Braunton's milk-vetch, discussed under special status species. The previously developed portions of Area IV and nearby areas had a higher concentration of invasive species (SAIC 2009b, 2010) than other portions of Area IV. Currently, areas where woody vegetation is re-establishing after the 2005 fire and subsequent mowing and other mechanical vegetation reduction measures performed from 2010 through 2014, are more vulnerable to invasion than they would otherwise be because of the relative openness of the vegetation compared to pre-fire conditions.

Table 3–6 lists invasive species observed in Area IV or the NBZ. These species are considered to have the greatest potential to spread on Area IV and the NBZ as a result of remediation activities. A more complete listing of invasive species observed on Area IV with comments about their occurrence on site and their status according to the California Invasive Plant Council and the California Department of Food and Agriculture is included in SAIC (2009b). This report characterizes existing conditions with respect to invasive nonnative species and provides preliminary recommendations to minimize the spread of specific species. This characterization focused on previously developed areas.

Table 3–6 Invasive Plant Species Present in the Region of Influence

Scientific Name *Common Name*	*Comments*
Ailanthus altissima Tree-of-heaven	Several localized occurrences on previously disturbed sites.
Brassica spp. Wild mustard	Dense populations were noted in previously disturbed areas north of critical habitat.
Centaurea calcitrapa Purple star thistle	Localized on the unpaved access road to the Ahmanson Ranch gate in the southwestern part of Area IV and the NBZ. Adjacent to critical habitat for Braunton's milk-vetch.
Centaurea solstitialis Yellow star thistle	Localized. Currently absent as a result of control efforts in 2013. Should be monitored in the future to determine if it has been re-established.
Hirschfeldia incana Shortpod mustard, summer mustard	Widespread in previously disturbed areas.
Nicotiana glauca Tree tobacco	Common at previously disturbed sites.
Pennisetum setaceum Fountain grass	Becoming widespread along roads and facilities sites. Where present, it can occupy same habitat as Santa Susana tarplant in sandstone boulders.
Salsola tragus Russian thistle	Localized on certain previously disturbed sites.
Tamarix ramosissima Mediterranean tamarisk	Localized on some previously remediated sites.
Washingtonia robusta Mexican fan palm	Volunteer plants of this or a similar fan palm species are present chiefly along roadsides.

3.5.3 Wildlife

SSFL's locality and diversity of vegetation communities provides suitable habitat conditions for a variety of wildlife species, including birds, mammals, reptiles, amphibians, and invertebrates. Wildlife observations have been recorded since 1983 and, over the years, various surveys have been conducted across the SSFL property (Faulkner 2010; Griffith Wildlife Biology 2010, 2011, 2012; Ogden 1998; SAIC 2009a, 2010; Werner 2012). Prior to the 2005 Topanga fire, 19 bird species, 13 mammal species, 10 reptile species, 3 amphibian species, and 2 fish species were documented throughout SSFL (Ogden 1998). Since then, general wildlife and protocol surveys have been performed in Area IV and the NBZ. Sixty-four bird species have been identified during these surveys, as well as numerous mammal, reptile, and invertebrate species. No fish were identified in Area IV or the NBZ, which lack surface water during most of the year.

The primary habitat types for wildlife species in the study are oak woodland and savanna, grasslands (both native and nonnative), mixed chaparral, disturbed sites, and riparian. These are more general habitat types than those used to characterize vegetation types described in the previous section and are described with their associated wildlife species. The nomenclature for wildlife species is from standard sources.

3.5.3.1 Coast Live Oak Woodland and Savanna Habitat

Coast live oak woodland and savanna communities, especially those connected to other undisturbed and/or healthy habitats, even if off site, are considered of high value to wildlife. Oak woodlands habitats are known to have a diversity of wildlife species in California and support up to 331 species to varying degrees (CalPIF 2002). Wildlife species use oak trees as cover and nesting habitat, as well as foraging (for insects and acorns). Birds utilize all canopy levels for nest placement in association with oaks from the highest branches to mid-canopy cavities to the grasses on the ground underneath. Species observed utilizing oak woodlands on Area IV and the NBZ include acorn woodpeckers (*Melanerpes formicivorus*), Nuttall's woodpecker (*Picoides nuttallii*), western scrub jay

(*Aphelocoma californica*), song sparrow (*Melospiza melodia*), and northern mockingbird (*Mimus polyglottos*). Owls such as the western screech owl (*Megascops kennicottii*) and barn owls (*Tyto alba*) have been observed using the oaks on Area IV and the NBZ. In 2014, active bird nests were located in oak trees; these included blue-gray gnatcatcher (*Polioptila caerulea*), Pacific-slope flycatcher (*Empidonax difficilis*), phainopepla (*Phainopepla nitens*), oak titmouse, American goldfinch (*Spinus tristis*), and house finch (*Haemorhous mexicanus*). Mule deer and coyote often use the trees as cover during the day or night. Additionally, many of the characteristic wildlife species of grasslands are found in and around coast live oak woodland and savannah habitat because of the presence of grassland plant species in the oak understory.

3.5.3.2 Grasslands (Native and Nonnative) Habitat

Native and nonnative grasslands occupy portions of the ROI, sometimes intermixing into oak woodlands to form savannas (see Figure 3–20). Wildlife species observed in these types of grasslands also overlap into other adjacent, more extensive habitats such as mixed chaparral. Common reptile species include western whiptail lizard (*Aspidoscelis* [*Cnemidophorus*] *tigris*), side-blotched lizard (*Uta stansburiana*), and western fence lizard (*Sceloporus occidentalis*). The latter is especially visible in sparsely vegetated edge areas such as road margins. Other reptiles, such as the gopher snake (*Pituophis melanoleucus*), southern alligator lizard (*Gerrhonotus multicarinatus*), and southern Pacific rattlesnake (*Crotalus oreganus* ssp. *helleri*), also occur. The latter is especially prevalent around sandstone outcrops.

Two reptiles that are known to occur throughout SSFL, including Area IV and the NBZ, in open areas with little vegetation are the silvery legless lizard (*Anniella pulchra pulchra*) and coast horned lizard (*Phrynosoma coronatum blainvillii*); these two species are considered California species of special concern.

Common grassland rodents, including the California ground squirrel (*Spermophilus beecheyi*), Botta's pocket gopher (*Thomomys bottae*), kangaroo rat species (*Dipodomys* spp.), deer mice species (*Peromyscus* spp.), meadow mice (*Microtus californicus*), and harvest mice (*Reithrodontomys megalotis*), also utilize nonnative grasslands and are expected to occur in the project vicinity. Lagomorphs, including desert cottontail (*Sylvilagus audubonii*), have been observed throughout Area IV and the NBZ, especially near scattered shrubs. Common gray fox (*Urocyon cinereoargenteus*), introduced red fox (*Vulpes vulpes*), striped skunk (*Mephitis mephitis*), ringtail (*Bassariscus astutus*), and bobcat (*Lynx rufus*) may forage in open areas. Larger mammals such as mule deer (*Odocoileus hemionus*), coyote (*Canis latrans*), and mountain lion (*Puma concolor*) occur, hunt, and browse in these habitats. Raptors, such as red-tailed hawk (*Buteo jamaicensis*), American kestrel (*Falco sparverius*), and turkey vulture (*Cathartes aura*), along with many species of grassland foragers, such as blue grosbeak (*Passerina caerulea*), black phoebe (*Sayornis nigricans*), lazuli bunting (*Passerina amoena*), American crow (*Corvus brachyrhynchos*), lark sparrow (*Chondestes grammacus*), and mourning dove (*Zenaida macroura*), have been observed on site.

3.5.3.3 Mixed Chaparral and Coastal Scrub Habitat

Mixed chaparral, locally interspersed with coastal scrub and present in the ROI, is considered of high value for bird species cover, food, and nesting potential. Birds that use these habitats include California towhee (*Pipilo crissalis*), spotted towhee (*P. maculatus*), California thrasher (*Toxostoma redivivum*), wrentit (*Chamaea fasciata*), blue-gray gnatcatcher (*Polioptila caerulea*), lesser goldfinch (*Carduelis psaltria*), western scrub jay, and California quail (*Callipepla californica*) (CalPIF 2004; SAIC 2009a).

Other characteristic bird species observed in the habitat include loggerhead shrike (*Lanius ludovicianus*), Anna's hummingbird (*Calypte anna*), song sparrow, northern mockingbird, house wren (*Troglodytes aedon)*, and house finch (*Carpodacus mexicanus*). The coastal California gnatcatcher (*Polioptila californica californica*), a federally listed threatened species, prefers sage scrub habitat, but has not been observed on Area IV or the NBZ during protocol surveys and other field work conducted since one was heard in December 2009 (USFWS 2010). This species is discussed in detail in Section 3.5.5. Most of the chaparral vegetation on site burned in the 2005 Topanga fire, except for the western portion of Area IV and patches here and there in the NBZ. As described in the vegetation discussion, sage scrub species are prevalent locally in the regenerating chaparral. Similar to grassland habitats, several species of rodents are expected to use this community, attracting predators such as bobcat.

A unique feature of this study area is the presence of large sandstone rock outcrops that occur as rock walls among the chaparral in the NBZ. These provide microhabitats, caves, and crevices preferred for cover and other uses by select species. Species that nest or roost within, or otherwise use rock outcrops, include white-throated swift (*Aeronautes saxatalis*), barn owl (*Tyto alba*), cliff swallow (*Petrochelidon pyrrhonota*), barn swallow (*Hirundo rustica*), canyon wren (*Catherpes mexicanus*), common raven (*Corvus corax*), turkey vulture, golden eagle (*Aquila chrysaetos*), desert wood rat (*Neotoma lepida*), and various bats (Chiroptera). A resident pair of golden eagles has nested in one of two nearby locations in sandstone bluffs in the NBZ. Honey bees (*Apis mellifera*) were observed to have large combs among the rocks on Area IV and the NBZ at several locations (SAIC 2009a). Some of the oak woodland species utilize rock cavities to cache acorns and other food items.

3.5.3.4 Disturbed Sites Habitat

Formerly developed areas and areas occupied by existing structures and pavement are, for the most part, sparsely vegetated. These areas exhibit limited value for most wildlife species due to the absence of plant cover (for food, nesting, and shelter). These areas do provide habitat for common songbirds such as mourning dove and house finch, which forage on the bare ground for seeds and invertebrates and nest in the structures. Previously disturbed areas that are undergoing revegetation provide foraging opportunities for flocks of migratory and wintering songbirds. Additionally, overhead power and communication lines stretching from existing structures are frequent perching sites for avian species, such as acorn woodpecker, mourning dove, western scrub jay, American kestrel, black phoebe, and lark sparrows. Existing buildings also provide space for roosting or nesting for barn and cliff swallows, owls, and bats. Coyotes are commonly seen near building sites.

Other species that exhibit higher tolerance for human activity and use disturbed habitats include brown-headed cowbird (*Molothrus ater*), European starling (*Sturnus vulgaris*), common raven, and American crow. Greater roadrunner (*Geococcyx californianus*) has been observed using bare ground areas for hunting lizards. Roads are frequently used as thoroughfares for coyote, mule deer, gray fox, and raccoons. Berms on or adjacent to disturbed areas are often used for burrowing by rodents such as California ground squirrels (*Spermophilus beecheyi*). Numerous reptiles, such as western fence lizards and alligator lizards, are often observed on developed areas basking in the sun.

3.5.3.5 Riparian Habitat

Riparian areas provide important wildlife habitat; however, these habitats are very limited on Area IV due to its location at the top of the watershed. There are very limited areas occupied by willows where intermittent runoff concentrates, though these areas are too small to support an abundance or variety of riparian species. Avian species normally associated with riparian zones within these small areas were not observed during surveys. These areas are too far removed from permanent water, and they do not hold water for long enough periods to support sensitive amphibian species (SAIC 2009a). Mulefat stands, normally characteristic of sandy stream channels, are prevalent on the sandy soils in many formerly disturbed sites and are used by common songbirds as cover. Several ephemeral and intermittent drainages that lead northward from Area IV downslope across the NBZ support limited riparian habitat.

3.5.4 Aquatic and Wetland Habitats and Biota

Wetlands provide important watershed functions by trapping floodwaters; recharging groundwater; removing pollution; and providing fish, wildlife, and plant habitat. Federal jurisdictional wetlands have legal protection under Section 404 of the Clean Water Act (CWA) (Title 33, *United States Code,* Section 1344 [33 U.S.C. 1344]). Activities that have the potential to discharge fill into waters of the U.S. (including wetlands) require a Section 404 permit from the U.S. Army Corps of Engineers (USACE) authorizing the activity. In addition to the Section 404 permit, proposed activities that would add fill to jurisdictional features such as wetlands also require certification under CWA Section 401. State agencies (for SSFL, LARWQCB) administer the provisions of CWA Section 401 and provide certification.

USACE defines wetlands as "areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (USACE 1987). Wetlands are recognized as a special aquatic site under CWA Section 404(b)(1) guidelines, and a "no net loss" policy continues to guide Federal regulatory actions affecting wetlands under CWA Section 404. Jurisdictional wetland areas are identified and delineated according to USACE's *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)* (USACE 2008), per the requirements of the USACE Los Angeles District.

Non-wetland waters of the U.S. include streams, rivers, ponds, and lakes that are tributaries to Traditional Navigable Waters. Traditional Navigable Waters are all waters subject to the ebb and flow of the tides and waters that are presently used, have been used in the past, or may be used in the future to transport interstate or foreign commerce (Title 33, *Code of Federal Regulations*, Section 328.3(a)(1) [10 CFR 328.3(a)(1)]). USACE jurisdiction over waters on the project site includes the low-flow and active floodplain channels up to the extent of the Ordinary High Water Mark, based on guidance from *A Field Guide to the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the United States* (Lichvar and McColley 2008).

Jurisdictional determination field surveys for waters of the U.S. (including wetlands) were conducted May 6–8, 2014 (see Appendix I). The results of these surveys are considered preliminary and subject to verification by USACE's Los Angeles District.

Figure 3–21 shows wetlands, vernal pools, jurisdictional waters, ponds, and NPDES outfalls in Area IV and the NBZ, or in other SSFL areas but important to the proposed activities. A total of 0.2 acres of palustrine (ponded) wetlands are located within Area IV. Due to the location of SSFL at the summit of the Santa Susana Mountains and the semiarid environment, water is scarce and the development of natural wetlands is limited and there are no floodplains in Area IV and the NBZ.[7] The mapped wetlands are related man-made impoundments and include the small impoundment below Outfall 004 (also known as the SRE pond) and the isolated man-made excavation northwest of Outfall 007 (the Building 4056 excavation).

[7] Because there are no floodplains, DOE's regulation 10 CFR Part 1022 does not apply with respect to floodplain actions.

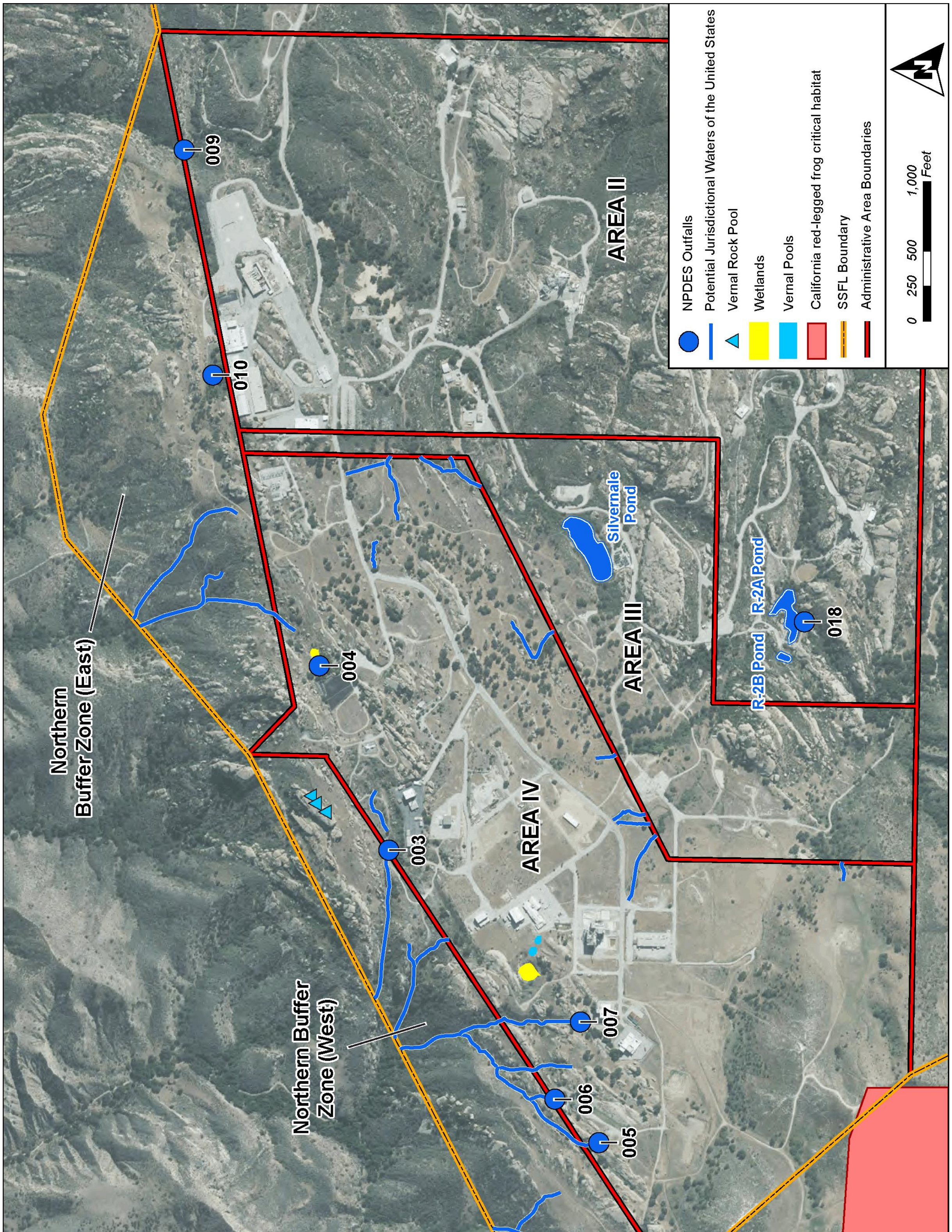

Figure 3–21 Wetlands, Vernal Pools, Ponds and Jurisdictional Waters of the U.S.

There are no perennial streams (streams containing running water year-round) or naturally occurring permanent water bodies within the Area IV and the NBZ (EPA 2009a). The mapped waters of the U.S. only include ephemeral natural stream channels and do not include upland constructed drainage features (such as swales, asphalt drainage ditches, and culverts). A total of 13,100 linear feet covering 0.62 acres of riverine waters of the U.S. were mapped in Area IV and the NBZ (see Appendix J). Stormwater runoff from the upland developed area is currently diverted at the stormwater treatment outfalls and routed to Silvernale Pond in Area III for treatment before being released into the Bell Canyon watershed. In some years, the runoff completely evaporates in Silvernale Pond before it can be released to the Bell Canyon watershed. Section 3.3 of this chapter provides additional information on the stormwater outfalls and treatment systems.

An aquatic resources habitat assessment conducted in October 2009 and February 2010 evaluated man-made features that supported permanent or semi-permanent water on or near Area IV for their potential to support California red-legged frog (listed under the ESA as threatened and discussed in Section 3.5.5.2) (SAIC 2010). This habitat assessment included the Outfall 4 site and two nearby larger impoundments in Area II (the R-2A and R-2B ponds adjacent to Outfall 18) and Area III (Silvernale Pond). Silvernale Pond and the R-2A and R-2B ponds at Outfall 18 were selected for the assessment because of their proximity to Area IV and their substantial size and relative permanence, as well as because they receive runoff from the southern part of Area IV. The southern part of Area IV and its vicinity, including Silvernale Pond, R-2A Pond, and R2B Pond, drains southward into Bell Canyon and ultimately to the Los Angeles River. During a site visit conducted in early October 2009, no sites on Area IV held water (SAIC 2010). However, Silvernale Pond and one of the ponds associated with Outfall 18 held water at that time. Upland habitat surrounding each site includes large areas of sandstone outcrops interspersed with chaparral recovering from the 2005 Topanga fire and small areas of coast live oak woodlands (SAIC 2010).

Approximately 0.05 acres of potentially jurisdictional wetlands were mapped in Area IV and the NBZ (see Figure 3–21). Potential jurisdictional wetlands included a man-made impoundment (the SRE pond) and vernal pools. As shown in Figure 3–21, two isolated vernal pools covering 0.025 acres and three vernal rock pools were identified in Area IV and the NBZ. Vernal pools are seasonal wetlands that begin to fill in late fall or early winter during rain events. Year-to-year variation in the time and duration of precipitation affects the depth and extent of standing water. In dry years, many pools do not fill. Vernal pools can provide habitat for federally listed fairy shrimp species, as discussed in Section 3.5.5.

3.5.5 Threatened, Endangered, and Rare Species

Plant and wildlife species that have threatened, endangered, or rare status under the ESA and CESA (including listed, proposed, and candidate species) and the potential to occur in Area IV or the NBZ are discussed in the following section. DOE has been conducting informal consultation with both USFWS and the California Department of Fish and Wildlife (CDFW) through periodic meetings and telephone conferences concerning threatened, endangered, and rare species protected under ESA or CESA since 2009 (summarized in Appendix E, Table E–4) and is currently preparing a biological assessment. DOE plans to submit the biological assessment to both agencies and expects to enter formal Section 7 Consultation with USFWS and continue consultation with CDFW.

3.5.5.1 Threatened, Endangered, and Rare Plant Species

A biological assessment (EPA 2009a) and Biological Opinion (USFWS 2010) were prepared to address EPA surveys of SSFL Area IV and the NBZ for radiological contamination. The biological assessment and Biological Opinion identified nine plant species that are listed as endangered or threatened or rare; are candidates for listing pursuant to the ESA or CESA; have the potential to occur within or in the vicinity of Area IV and the NBZ; or could be affected by the proposed action. **Table 3–7** provides a list of these species, their regulatory status, a general habitat description and distribution, and known or potential occurrences in the project vicinity. Of these nine plant species, two were confirmed to be present in Area IV or the NBZ: Braunton's milk-vetch and Santa Susana tarplant. In addition to federally and state-listed plant species, this assessment considered other species regarded as sensitive, including species identified as CRPR 1 or CRPR 4 and listed in Ventura County as Locally Important; these species are included in Table 3–7 as "other sensitive plant species." Locations of Braunton's milk-vetch, the Santa Susana tarplant, Malibu baccharis, and other sensitive plant species known to occur on SSFL are shown on **Figure 3–22**.

Table 3–7 Federally and State-Listed Plant Species and Other Sensitive Plant Species that May Occur in Area IV and the Northern Buffer Zone

Scientific Name Common Name	*Status (ESA/CESA/ CRPR/VC)* [a]	*General Habitat Description*	*Potential Occurrence in the Region of Influence*
Federally and State-Listed Plant Species			
Astragalus brauntonii Braunton's milk-vetch	FE/-/1B.1/-	Occurs in scattered locations in southern California foothills below about 1,500 feet elevation. Usually found in chaparral, but also in valley grassland, sage scrub, and closed-cone pine forest; possibly restricted to carbonate soils. Found in Ventura, Los Angeles, and Orange Counties. This perennial plant typically flowers from March to July.	This species and its designated critical habitat are present in Area IV.
Deinandra minthornii Santa Susana tarplant	-/SR/1B.2/-	Occurs in chaparral and coastal scrub on sandstone outcrops and crevices at 919 to 2,493 feet elevation. Found in Ventura and Los Angeles Counties. This perennial deciduous shrub blooms in July through November.	This species was found on sandstone outcrops, primarily in the NBZ.
Chorizanthe parryi var. *fernandina* San Fernando Valley spineflower	FC/SE/1B.1/LI	Occurs in coastal sage scrub (sandy) at 10 to 3,396 feet elevation. Recently rediscovered in 1999. Currently known from only three occurrences. Most historical habitat is now heavily urbanized. Rediscovered at Ahmanson Ranch (Upper Las Virgenes Canyon Open Space Preserve) and on Newhall Ranch. This annual herb typically flowers from April to June.	This species has not been observed in Area IV or the NBZ; however, focused surveys for this species at the appropriate time of year have not been conducted.
Dudleya abramsii ssp. *parva* (=*Dudleya parva*) Conejo dudleya	FT/-/1B.2/LI	Occurs in coastal scrub and valley and foothill grasslands on rocky slopes and grassy hillsides at 197 to 1,476 feet elevation. Known from approximately 10 occurrences in Ventura County from the western end of the Simi Hills to the Conejo Grade. This perennial herb blooms from May to June.	This species has not been observed in Area IV or the NBZ; however, focused surveys for this species at the appropriate time of year have not been conducted.
Dudleya cymosa ssp. *marcescens* Marcescent dudleya	FT/SR/1B.2/LI	Occurs in boulder surfaces and rocky volcanic cliffs in chaparral at 492 to 1,706 feet elevation. Known from fewer than 10 occurrences in the Santa Monica Mountains of Ventura and Los Angeles Counties. This perennial herb blooms from April to July.	This species has not been observed in Area IV or the NBZ; however, focused surveys for this species at the appropriate time of year have not been conducted.
Dudleya cymosa ssp. *ovatifolia* (inclusive of *Dudleya cymosa* ssp. *agourensis*) Santa Monica Mountains dudleya	FT/-/1B.2/LI	Occurs in Chaparral and cismontane woodland on rocky volcanic soils at 656 to 1,640 feet elevation. Known only from the western Santa Monica Mountains in Ventura and Los Angeles Counties. This perennial herb blooms from May to June.	This species has not been observed in Area IV or the NBZ; however, focused surveys for this species at the appropriate time of year have not been conducted.

Scientific Name Common Name	***Status (ESA/CESA/ CRPR/VC)*** [a]	***General Habitat Description***	***Potential Occurrence in the Region of Influence***
Navarretia fossalis Spreading navarretia	FT/-/1B.1/-	Occurs in chenopod scrub, freshwater marshes and swamps, plays and vernal pools at 98 to 2,149 feet elevation. Known from Los Angles, Riverside, San Diego, and San Luis Obispo Counties. This annual herb blooms from April to June. Critical habitat has been designated for this species.	Suitable habitat for this species is unlikely, although a habitat assessment has not been conducted in Area IV or the NBZ. The closest known occurrences are vernal pools in the Cruzan Mesa and Plum Canyon, about 10 miles northeast of SSFL.
Orcuttia californica California Orcutt grass	FE/SE/1B.1/LI	Occurs in vernal pools at 49 to 2,165 feet elevation. Known from fewer than 20 occurrences in Ventura, Los Angeles, Riverside, and San Diego Counties. This annual herb blooms generally from April to June, but has been recorded flowering as late as August.	Suitable habitat is very limited, and this species has not been observed in Area IV or the NBZ. However, focused surveys for this species have not been conducted.
Pentachaeta lyonii Lyon's pentachaeta	FE/SE/1B.1/-	Found in openings of chaparral and valley and foothill grasslands, usually at the ecotone between grassland and chaparral or the edges of firebreaks, at 98 to 2,067 feet elevation. Known from fewer than 20 extant occurrences in Santa Monica Mountains and western Simi Hills. This annual herb blooms from March to August. Critical habitat for this species has been designated.	This species is not known to occur within Area IV, the NBZ or the vicinity. However, focused surveys for this species at the appropriate time of year have not been conducted. The nearest known location is the western Simi Hills, about 6 miles west of Area IV and the NBZ.
Other Sensitive Plant Species found on Area IV or the NBZ			
Baccharis malibuensis Malibu baccharis	-/-/1B.1/LI	Occurs in chaparral, coastal scrub oak woodlands, and grassy openings at about 164 to 984 feet elevation. Known to occur in Los Angeles County near Malibu from six occurrences. This shrub blooms from August through September.	This species is found in the southwestern corner of the Area IV.
Calochortus catalinae Catalina mariposa lily	-/-/4.2/-	Occurs in chaparral, cismontane woodland, coastal scrub, and valley and foothill grasslands at 50 to 2,300 feet elevation. This perennial herb blooms from a bulb from February to June and dies back each year.	This species is found in grasslands on the western end of Area IV.
Calochortus clavatus var. *gracilis* Slender mariposa lily	-/-/1B.2/LI	Occurs in chaparral, coastal scrub, and valley and foothill grasslands, in shaded foothill canyons often on grassy slopes, at 1,049 to 3,280 feet elevation. Known from about 100 occurrences in Los Angeles and Ventura Counties. This perennial herb blooms from a bulb from March to June and dies back each year.	This species is found in several locations in Area IV including near RMHF and in the western portion of Area IV including the Braunton's milk-vetch critical habitat. Subject to taxonomic revision. It is also possible that the plant found in Area IV could be club-haired mariposa lily (*C. clavatus* var. *clavatus*), which has a CRPR of 4.3).
Calochortus plummerae Plummer's mariposa lily	-/-/4.2/LI	Occurs in chaparral, cismontane woodland, coastal scrub, lower montane coniferous forest, and valley and foothill grasslands on granitic or rocky substrates at 128 to 5,557 feet elevation. Can be common after fire. This perennial herb blooms from a bulb from May to July and dies back each year.	This species is found in several locations in dipslope grassland in NBZ and in the western portion of Area IV. Subject to taxonomic revision.

Scientific Name *Common Name*	*Status (ESA/CESA/ CRPR/VC)* [a]	*General Habitat Description*	*Potential Occurrence in the Region of Influence*
Juglans californica California black walnut	-/-/4.2/-	Occurs in chaparral, cismontane woodland, and coastal scrub communities on hillsides and in alluvial soils, often as a dominant in a decline vegetation community. This deciduous large shrub or tree is endemic to cismontane southern California. Re-sprouting after fires produces a shrubby growth form.	This species is found in several localized areas in the western portion of Area IV and the NBZ, generally in deeper soils at the base of hillsides with northern or eastern exposures. Often forms in woodlands with coast live oak in the transition between chaparral/coastal scrub and grassland.

[a] ***Status***:
CESA = California Endangered Species Act (California Department of Fish and Wildlife):
SE = California state listed as endangered
SR = California state listed as rare
CRPR = California Rare Plant Rank (California Department of Fish and Wildlife/California Native Plant Society):
1B = Plants rare, threatened, or endangered in California and elsewhere.
4 = Plants of Limited Distribution – A Watch List
.1 = Seriously endangered in California.
.2 = Fairly endangered in California
ESA = Federal Endangered Species Act (U.S. Fish and Wildlife Service):
FE = Federally listed as endangered
FT = Federally listed as threatened
FC = Federal candidate for listing under the ESA
NBZ = Northern Buffer Zone
RMHF = Radioactive Materials Handling Facility
VC = Ventura County Checklist of Rare Plants LI = Locally Important
(1 - 5 occurrences in Ventura County)

Source: CDFW 2015; County of Ventura 2014; CNPS 2015; SAIC 2010; EPA 2009a; USFWS 2010.

Braunton's milk-vetch (*Astragalus brauntonii*). Braunton's milk-vetch is a robust perennial plant in the pea family (Fabaceae) and is federally listed as endangered with a CRPR of 1B.1 (rare, threatened, or endangered in California and elsewhere; seriously endangered in California). Braunton's milk-vetch is present on the western portion of Area IV on two hills with calcareous soils derived from the Santa Susana formation. Critical habitat (USFWS 2006b) has been designated over a portion of this area (Figure 3–22). The existing recovery plan for Braunton's milk-vetch (USFWS 1999) does not include the population of the species at SSFL because it was not discovered on site until after the 2005 Topanga fire. The designated critical habitat encircled most of the population documented subsequently during surveys by the EIS preparers in 2009. At that time, the population was roughly estimated to be about 18,500 individuals that were nearing the end of their life span (SAIC 2009a).

In 2012 and 2013, additional Braunton's milk-vetch was discovered on a hill along the Area IV boundary north of the designated critical habitat after the chaparral vegetation had been cleared to facilitate radiological surveys conducted by EPA in 2011. The hill, unburned by the 2005 Topanga fire, had been covered with dense chaparral, scrub, and woodland vegetation prior to its clearing. The Braunton's milk-vetch plants that emerged presumably had been in the seedbank and were stimulated to germinate by removal of the thick vegetation. The number of plants that established on the hill subsequent to clearing in 2011 is estimated to be a few hundred individuals. The locations of these plants are included in Figure 3–22.

Braunton's milk-vetch is a short-lived perennial and is one of the tallest members of the *Astragalus* genus, reaching a height of 5 feet (1.5 meters). It has a thick taproot and woody basal stem from which numerous stems arise. Braunton's milk-vetch has woolly stems and leaves and light purple flowers clustered on stems with rows of 35 to 60 flowers (racemes). Plants typically bloom from March to July, and later produce two-chambered seed pods.

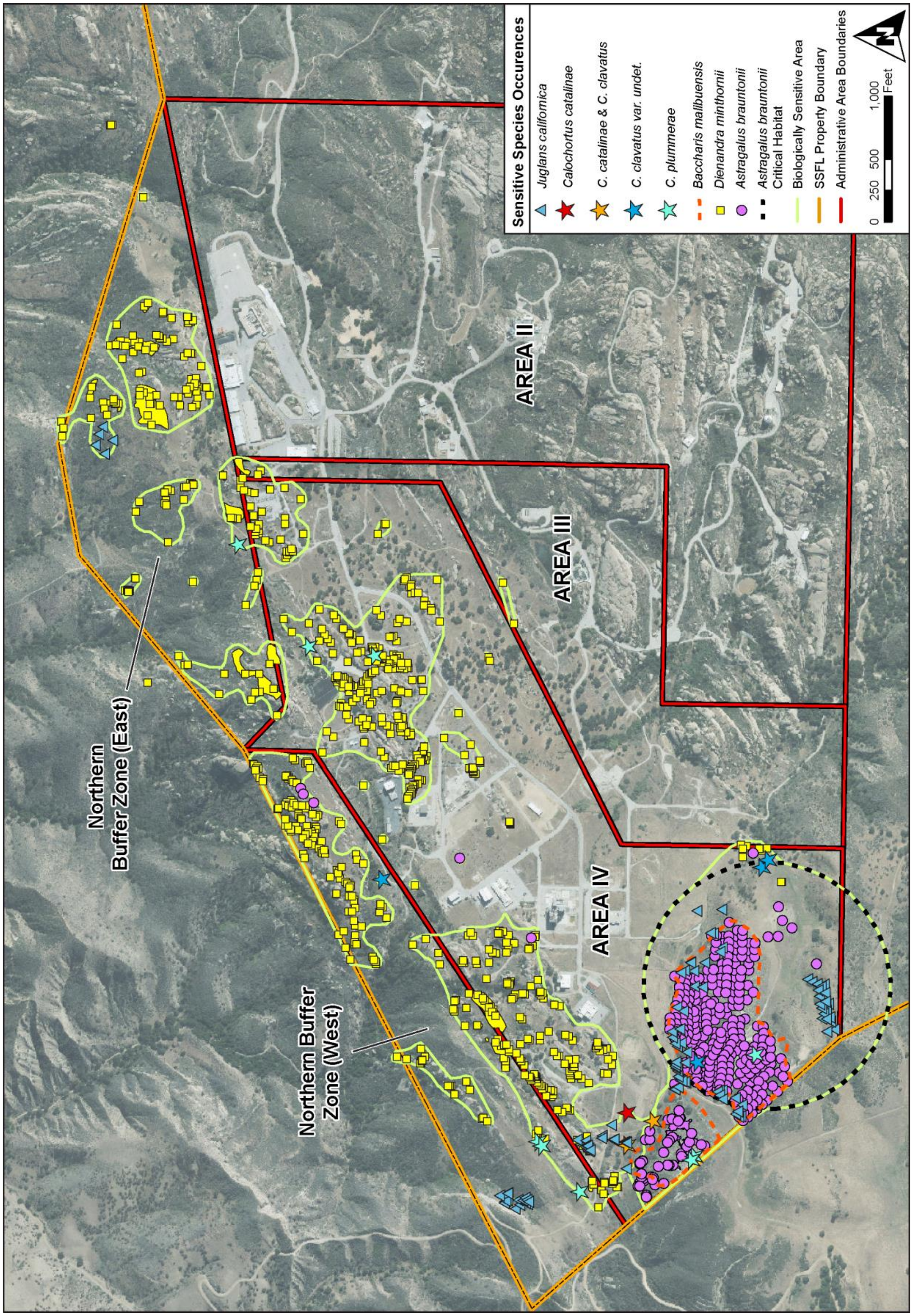

Figure 3–22 Locations of Sensitive Plants

Recruitment of seedlings is stimulated by fire and other mechanisms promoting scarification of seeds. Numbers of individuals in any given year vary depending on the stage of the fire cycle and site disturbance (Landis 2007; EPA 2009a). Pollinators are primarily native megachilid bees and a native bumble bee species (EPA 2009a). Seeds produced in the rear chamber of the pod are innately dormant with a thickened seed coat typical of many chaparral plants; these dormant seeds are adapted to germinate after disturbance from fire or mechanical scarification. Dormancy allows seeds to persist in the soil for many years. Seeds produced in the front chamber of the pod germinate readily. Braunton's milk-vetch is currently known from about four metapopulations (i.e., a group of smaller populations linked by genetic interchange) in Ventura, Los Angeles, and Orange Counties and occurs from 800 to 2,100 feet (244 to 640 meters) in elevation. It is often associated with fire-dependent chaparral habitat dominated by chamise and yucca, but is also found in valley grassland, sage scrub, and closed-cone pine forest. The species appears to be restricted to carbonate and calcareous soils and is primarily known to occur on outcrops and along the tops of knolls (Landis 2007; EPA 2009a; USFWS 2010).

Threats to Braunton's milk-vetch include urban development; fragmentation of habitat; reduction of necessary pollinators and their associated species; threats from fire suppression activities; and random, naturally occurring extinction due to disturbances in small population sizes. The period of greatest sensitivity for this species is expected to be during growth, flowering, and seed production, estimated as March–August in the first year following a fall season fire event, and continuing for 3 to 5 years, declining with each successive year. Browsing of the plants at SSFL by mule deer, noted during 2009 surveys and subsequently, may be reducing the amount of seed produced there (EPA 2009a, observations by the preparers). In 2014, protective devices were put around 11 surviving individuals to minimize browsing by deer, thereby facilitating seed production.

Santa Susana Tarplant (*Deinandra minthornii*). Santa Susana tarplant is a perennial drought-deciduous subshrub in the sunflower family (Asteraceae) and is state-listed as rare with CRPR of 1B.2 (rare, threatened, or endangered in California and elsewhere; fairly endangered in California). It grows up to 3.3 feet (1 meter) high, less than 12 inches (30 centimeters) in diameter, with numerous ascending stems from the base. It blooms from July through October or November and reproduces by seed, although during surveys in November 2009 the tarplant was observed to be re-sprouting from the base following a fire (EPA 2009a). The species is restricted to localized portions of the Simi Hills, Santa Susana Mountains, and Santa Monica Mountains of Los Angeles and Ventura Counties. It grows in crevices in sandstone bluffs and outcrops in chaparral and coastal scrub, 919 to 2,493 feet (280 to 760 meters) in elevation (CDFW 2015). It typically grows directly upon and within sandstone rock crevices, or in soil in very close proximity to rocks. It was also noted growing on west-facing cliffs on Conejo volcanic breccias in one location in the Santa Monica Mountains, north of Lake Sherwood; this was the only occurrence not associated with sandstone (EPA 2009a).

Santa Susana tarplant is known to occur in substantial numbers in suitable habitat at SSFL in Area IV and the NBZ (Figure 3–22). Focused surveys for Santa Susana tarplant in Area IV and the NBZ in 2009 found the species closely associated with sandstone outcrops, typically growing in fissures in the rock. Some plants were also observed in cracks in pavement or remediated sites near sandstone outcrops populated by tarplants, which act as a seed source. The close association of Santa Susana tarplant with sandstone outcrops is clearly visible in Figure 3–22. In 2009 there were 679 locations of Santa Susana tarplant recorded in Area IV and the NBZ, with many locations representing multiple plants. Based on preliminary analysis of the data recorded, the total amount of Santa Susana tarplant recorded in Area IV and the NBZ is roughly 850 individuals (SAIC 2009a).

Since the 2009 surveys, additional occurrences have been documented and are included in Figure 3-22.

The species is threatened by development, road construction and maintenance, and possibly by nonnative species. Research studies on its reproductive biology, germination and growth, and habitat requirements are needed to develop a conservation strategy and recovery plan for this species (EPA 2009a).

3.5.5.2 Threatened, Endangered, and Rare Animal Species

As previously discussed, CNDDB queries were conducted in 2009 and 2010 to evaluate the federally and state-listed wildlife species that had been recorded within an area encompassing nine USGS 7.5 Minute Topographic Map Quadrangles surrounding SSFL. Using these queries, in addition to updated queries completed in 2015; local knowledge; a review of other reports from the area, including a biological assessment (EPA 2009a) and Biological Opinion (USFWS 2010) addressing EPA's Radiological Survey of Area IV and the NBZ; and field reconnaissance; a list was generated of potential species that have threatened, endangered, or rare status under the ESA and CESA (including listed, proposed, and candidate species) and that either occur or have suitable habitat in Area IV or the NBZ. This list is presented in **Table 3–8**, along with Federal and/or state conservation status, general habitat descriptions, and an assessment of the potential for occurrence of the species. DOE is currently preparing a biological assessment to support Section 7 ESA consultation with USFWS and continued consultation with the CDFW.

Table 3–8 Federally and State-Listed Animal Species that May Occur in Area IV and the Northern Buffer Zone

Scientific Name Common Name	*Status (Federal/ State)* [a]	*General Habitat Description*	*Potential Occurrence in the Region of Influence*
Birds			
Polioptila californica. californica Coastal California gnatcatcher	FT/SC	Obligate, permanent resident of coastal sage scrub below 2,500 feet (762 meters) in southern California. Occupies low coastal sage scrub in arid washes, on mesas, and slopes. Not all areas classified as coastal sage scrub are occupied. Generally found at elevations below 3,000 feet (914 meters), ranges from Ventura County south through Los Angeles, Orange, Riverside, San Bernardino, and San Diego Counties, extending into Mexico. Designated critical habitat for this species does not occur within Area IV or the NBZ (USFWS 2010).	Low. This species was heard once in December 2009 from Area IV (USFWS 2010) and 151 acres (61 hectares) of potential suitable habitat were identified for the gnatcatcher within Area IV and the NBZ (USFWS 2010). Subsequent protocol surveys conducted during 2010, 2011, and 2012 encompassing suitable habitat on Area IV and the NBZ (Griffith Wildlife Biology 2010, 2011, 2012) revealed no California gnatcatchers on site, nor have gnatcatchers been observed during other surveys of Area IV and the NBZ. Based on this information and current conditions, this species may be an occasional visitor; however, it appears unlikely that this species would breed in Area IV.
Vireo bellii ssp. *pusillus* Least Bell's vireo	FE/SE	A riparian species, this bird depends on dense, low-growing thickets of willows, mulefat, mugwort, and California wild rose. Vireos inhabit areas where an overstory of taller willows, cottonwoods, and sycamores is also present. During the winter, they are known to occur in mesquite scrub vegetation. Foraging may take place in adjacent chaparral and coastal sage scrub. The vireo can be found in a variety of locations generally associated with major streams from Santa Barbara to San Diego Counties.	Low. This species has not been observed within Area IV or the NBZ, and is not expected to nest in these locations due to the absence of well-developed riparian woodlands. It was not found during a protocol survey conducted in 2012 (Werner 2012). There is a low probability that the species may nest or be present temporarily during migration due to the limited riparian habitat in Area IV or the NBZ and disturbed areas containing stands of mulefat in Area IV.

Scientific Name *Common Name*	*Status (Federal/ State)* [a]	*General Habitat Description*	*Potential Occurrence in the Region of Influence*
Gymnogyps californianus California condor	FE/SE	Rare and local in arid, mountainous areas occurring solitary or in small groups, especially at food sources (carrion) and bathing and roosting sites. Occurs only in southern California, central California, and northern Arizona, where it has been reintroduced.	Not expected. The ROI "falls outside of the currently used area and [is] not within the historic range" of the condor (EPA 2009a). The USFWS concurred with a "no effect" determination for this species based on this information (USFWS 2010).
Amphibians and Reptiles			
Rana draytonii (*Rana aurora* ssp. *draytonii*) California red-legged frog (CRLF)	FT/SC	This frog prefers aquatic habitat such as ponds, marshes, and creeks with still water for breeding. It needs riparian and upland areas with a combination of dense vegetation and open areas for cover, aestivation (i.e., seasonal dormancy), food, and basking. Frogs in cooler areas may hibernate in burrows for the winter. Current range includes Sonoma and Butte Counties in the north to Riverside County in the south, mostly in the western (i.e., coastal) part of the counties. The southwestern corner of Area IV lies at the edge of a unit of revised designated critical habitat (Figure 3–21 [USFWS 2010]).	Low. No records of the CRLF occur within Area IV or the NBZ (USFWS 2010). In 2010, no evidence of CRLF was found during surveys (SAIC 2010). However, two California Natural Diversity Database records exist of the CRLF within 3 miles to the south. The USFWS identified the possibility that the CRLF could occur in Area IV or the NBZ based on the nearby records, conditions on site, and information contained in the revised critical habitat designation (USFWS 2010).
Invertebrates			
Euphydryas editha ssp. *Quino* Quino checkerspot butterfly (QCB)	FE/ -	Occupies a variety of habitat types including grasslands, coastal sage scrub, chamise chaparral, red shank chaparral, juniper woodland, and semi-desert scrub that support native species of plantain, the butterfly's primary larval host plant. This species can also be found at the lower edge of the chaparral, in desert canyons, and in canyon washes.	Not expected. Physical and biological factors that are known to support QCB colonies occur on Area IV and the NBZ. However, it is unlikely that Area IV and the NBZ, either currently or in the recent past, support populations of this species. Historically, the QCB has not been recorded in Ventura County. It would be nearly impossible for the QCB to establish new colonies given the distance from extant populations (Faulkner 2010). The USFWS did not rule out the species' presence and proposed avoidance measures in the Biological Opinion (USFWS 2010).
Streptocephalus woottonii Riverside fairy shrimp	FE/ -	This fairy shrimp is restricted to deep vernal pools and ponds with specific chemistry and temperature conditions in non-marine and non-riverine waters from southern California into Mexico. It is also found in depressions that support suitable habitat, such as road ruts and ditches. All known vernal pool habitat lies within annual grasslands, which may be interspersed with chaparral or coastal sage scrub vegetation. Designated critical habitat for this species does not occur within Area IV or the NBZ (USFWS 2010).	Low. Focused surveys for the species have not been conducted. Because Area IV and the NBZ are within the range of the species, populations are known to occur in the region, and areas capable of supporting suitable habitat occur on site, it is possible that riverside fairy shrimp occur within Area IV and the NBZ (USFWS 2010).

Scientific Name Common Name	Status (Federal/ State) [a]	General Habitat Description	Potential Occurrence in the Region of Influence
Branchinecta lynchi Vernal pool fairy shrimp	FT/ -	Usually found in vernal pools, although they are found in a range of natural and artificially created ephemeral habitats such as alkali pools, seasonal drainages, stock ponds, vernal swales, and rock outcrops, but not in riverine, marine, or other permanent bodies of water. The species tends to occur primarily in smaller pools, at elevations from 33 feet (10 meters) to 4,003 feet (1,220 meters), currently known in 28 counties across the Central Valley and coast ranges of California. Designated critical habitat for this species does not occur within Area IV or the NBZ (USFWS 2010).	Low. Focused surveys for the species have not been conducted. Because the study area falls within the range of the species, populations are known to occur in the region, and areas capable of supporting suitable habitat occur on site, it is possible that vernal pool fairy shrimp occur within Area IV and the NBZ (USFWS 2010).

NBZ = Northern Buffer Zone; ROI = region of influence; USFWS = U.S. Fish and Wildlife Service.

[a] *Notes*:

FE = Federally listed as endangered SE = California state-listed as endangered

FT = Federally listed as threatened SC = California species of special concern

FC = Federal candidate for listing under the ESA

Sources: CDFW 2015; Faulkner 2010; SAIC 2009a; EPA 2009a; USFWS 2010.

California Condor (*Gymnogyps californianus*). USFWS listed the California condor as endangered on March 11, 1967 (32 *Federal Register* [FR] 4001). Critical habitat was determined to encompass several backcountry locations in central and southern California (42 FR 47840). No critical habitat occurs within or near the boundaries of Area IV or the NBZ. Extirpated from nearly all of their historic range in western North America by the early 1900s, by the 1980s, the California condor had been reduced to just a few dozen individuals occupying the mountainous regions of southern California. Loss of habitat, illegal shooting, egg collecting, human disturbance at nesting and foraging areas, and lead poisoning all contributed to this steep population decline. Ongoing recovery efforts and a captive breeding program beginning in 1987 have increased the condor's total wild population to 228 free flying birds as of 2014. Today, small populations persist in southern and central California (128 free flying birds), as well as along the Grand Canyon in Arizona and Utah and in Baja California, Mexico. The California condor continues to be a state and federally listed endangered species.

Condors frequent backcountry wilderness areas such as Hopper Canyon in Ventura County and Bitter Creek National Wildlife Refuge in Kern County and are not known or expected to occur in or near the SSFL site in the foreseeable future.

Coastal California Gnatcatcher (*Polioptila californica californica*). The USFWS listed the coastal California gnatcatcher as threatened on March 30, 1993 (58 FR 16742). The USFWS also published a revised designation of critical habitat for this subspecies in 2007; no critical habitat occurs within the boundaries of Area IV and the NBZ (USFWS 2010).

The SSFL site supports approximately 151 acres (61 hectares) of potential suitable habitat for the coastal California gnatcatcher within Area IV and the NBZ, with approximately 3.1 acres (1.3 hectares) of this area classified as Venturan coastal scrub (see Section 3.5.2). Because the Topanga fire burned much of Area IV and the NBZ in September 2005, several other plant communities on SSFL including northern mixed chaparral, coast live oak woodland and savanna, steep dipslope grassland, and California walnut woodland are recovering from this fire and contain aspects of habitat suitable for coastal California gnatcatchers (USFWS 2010). Prior to 2010, focused surveys for coastal California gnatcatcher had not been conducted on the SSFL site (USFWS 2010). Coastal California gnatcatcher was reported on the SSFL site during a site visit by a USFWS biologist on December 2, 2009 (USFWS 2010). Subsequently, protocol surveys encompassing Area IV and the NBZ were conducted during 2010, 2011, and 2012 in support of EPA vegetation clearing and gamma scanning activities (Griffith Wildlife Biology 2010, 2011, 2012) and did not reveal any coastal California gnatcatchers, nor have coastal California gnatcatchers been observed during other surveys of Area IV and the NBZ.

Based on this information, it appears that the coastal California gnatcatcher may be an occasional visitor to Area IV, but is unlikely to breed there under current conditions.

According to information from USFWS records and the CNDDB, other nearby recorded locations for the coastal California gnatcatcher are located approximately 3.9 miles (6.4 kilometers) south of Area IV in Las Virgenes Canyon; approximately 9.2 miles (15 kilometers) west near Little Simi Valley, northwest of State Route 23 and Tierra Rejada Road, Moorpark; and approximately 10 miles (16 kilometers) west near California Lutheran University (CDFW 2015).

Least Bell's Vireo (*Vireo bellii* ssp. *pusillus*). The least Bell's vireo was once widespread with a summer range from northern California all the way to Baja California, Mexico, extending as far east as Death Valley. The vireo today inhabits a variety of locations from Santa Barbara to San Diego Counties generally in or near major riparian corridors. Based on CNDDB and USFWS records, the species has been observed at several locations within Ventura County, including the Santa Clara River (approximately 14 miles from Area IV), Arroyo Simi (9 miles from Area IV) and at Hansen Dam in Los Angeles County (16 miles from Area IV) (USFWS 1998a; CDFW 2015). The least Bell's vireo is a riparian-dependent species, requiring dense, low-growing thickets of willows, mulefat, mugwort, and California wild rose (EPA 2009a). Least Bell's vireos often inhabit areas where an overstory of taller willows, cottonwoods, and sycamores is also present. During the winter, they are known to occur in mesquite scrub vegetation. Foraging sometimes takes place in adjacent chaparral and coastal sage scrub (EPA 2009a).

Least Bell's vireo has not been observed at SSFL; however, USFWS determined that a portion of Area IV and the NBZ in seasonal drainages that have limited riparian habitat may support potentially suitable least Bell's vireo habitat (USFWS 2010). A total of 2.5 acres of riparian habitat has been identified on Area IV and the NBZ (Table 3–5). Other areas characterized as "formerly disturbed areas dominated by mulefat," amounting to 0.9 acres in Area IV (SAIC 2009a), also may provide some habitat for this species. Subsequent to the Biological Opinion for the EPA radiological survey (USFWS 2010), a protocol survey (Werner 2012) conducted on Area IV did not find least Bell's vireos, and no individuals have been observed during other field surveys and monitoring conducted in Area IV and the NBZ.

Based on this information, it appears that the least Bell's vireo may be an occasional visitor to Area IV or the NBZ, but is unlikely to breed there under current conditions.

California Red-legged Frog (*Rana draytonii* [*Rana aurora* ssp. *draytonii*]). The California red-legged frog (CRLF) is federally listed as threatened, as a species that may occur at or near Area IV and the NBZ (USFWS 2010). SSFL lies within the current and historic breeding range of the CRLF (USFWS 2002). Two CNDDB records exist of the CRLF within 3 miles of Area IV to the south (SAIC 2010). Revised critical habitat for this federally listed threatened species was designated by USFWS (March 17, 2010), and approximately 1 acre of critical habitat located in the Upper Las Virgenes Canyon Unit lies within Area IV (**Figure 3–23**). Area IV and the NBZ also contain several primary constituent elements described in the revised designation of critical habitat for the CRLF, as discussed in the Biological Opinion (USFWS 2010).

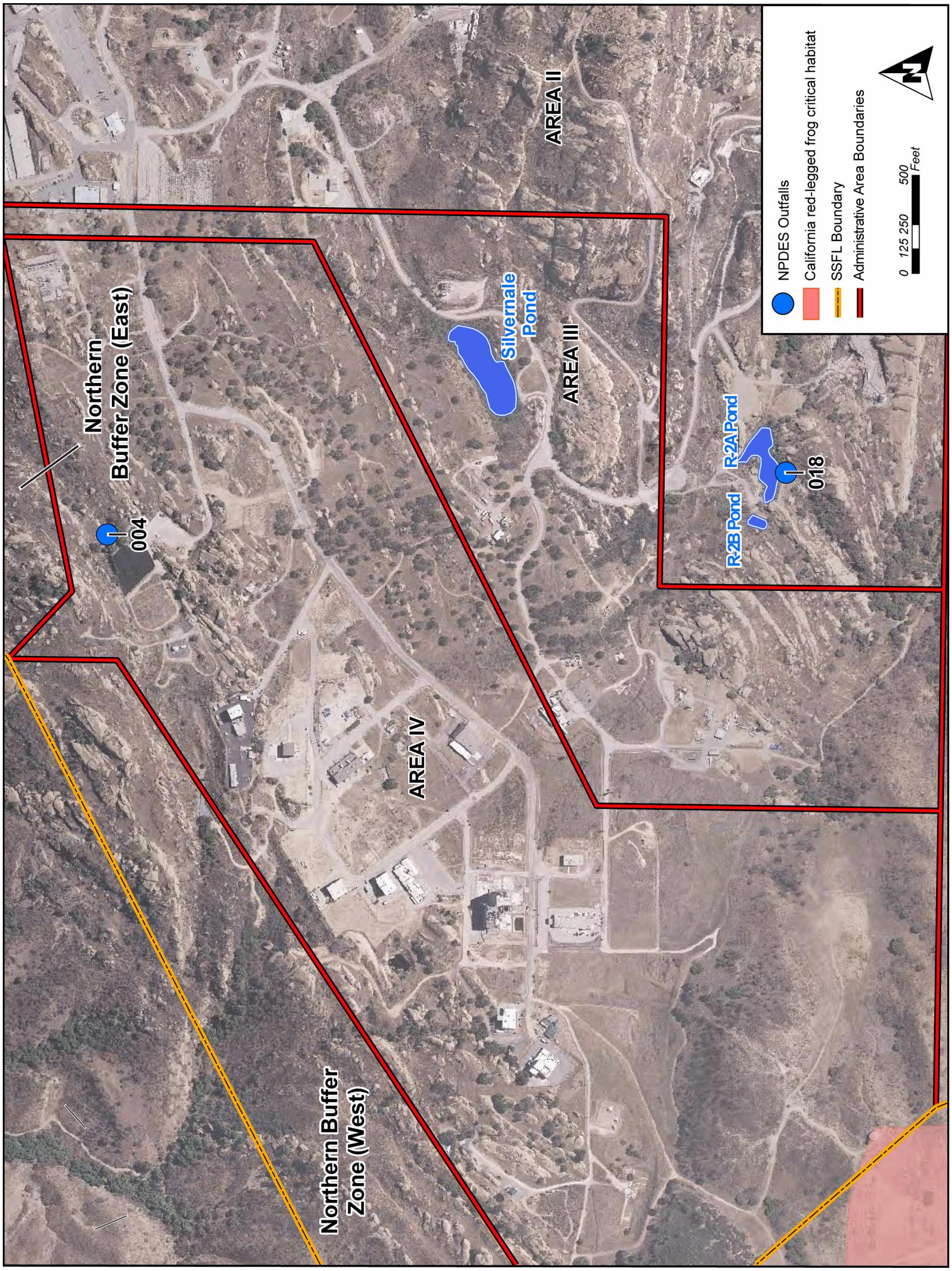

Figure 3–23 California Red-Legged Frog Habitat Assessment Locations at Outfall 4, Silvernale Pond, Ponds at Outfall 18 and Recently Designated California Red-legged Frog Critical Habitat

The CRLF is not known to occur in or near SSFL. A habitat assessment conducted in 2010 focused on three habitats that possessed qualities that could support the CRLF (SAIC 2010). Of those, only Outfall 4/SRE pond is within the Area IV (or the NBZ) (Figure 3–23). The report also addressed Silvernale Pond and the ponds at Outfall 018 because of their hydrological connection to Area IV and the potential for CRLF, if present at either locality, to migrate into Area IV during a wet period.

Although no evidence of the CRLF was found in the three habitats investigated, they each have some physical characteristics suitable for supporting the CRLF, at least seasonally, but their distance and isolation from existing CRLF locations and aspects of the habitat make occupation by the CRLF unlikely (SAIC 2010).

Quino Checkerspot Butterfly (*Euphydryas editha* ssp. *quino*). The federally listed endangered Quino checkerspot butterfly (QCB) has been recorded from northern Los Angeles County to northern Baja California, Mexico. Historically, populations occupied Los Angeles, Orange, Riverside, and San Diego Counties in southern California and the QCB was considered one of the more abundant spring-flying butterfly species in the region.

Since the 1950s, the number of known populations has been reduced significantly; it is currently found in isolated colonies in Riverside and San Diego Counties. There are no records of this butterfly from Ventura County for at least the last 70 years. Reasons for the species' decline, leading to its listing as endangered in 1997, include removal of habitat, fires, grazing, larval host plant reduction caused by invasive plant competition, introduced predators and parasites, pollution, drought, and perhaps a number of other factors. In the face of these factors, the insect has been unable to recover in sufficient numbers to maintain its historic population size (Faulkner 2010).

Although there are no recent records of the QCB from Ventura County, the USFWS considers the species as potentially resident in Ventura County, and thus requires site assessments for the species in suitable habitats. Because larval host plants are present, protocol adult surveys may be required during the anticipated flight season (February to May in most years) to verify presence/absence, with weather as the determining factor for initiation and termination of surveys. Larval surveys are sometimes conducted, but are more difficult and require additional USFWS permits.

On March 29, 2010, a permitted biologist conducted a QCB habitat assessment for the presence of larval host plants in Area IV. Both physical and biological factors exist on the SSFL site that are elsewhere known to support QCB colonies (Faulkner 2010). However, it is unlikely that Area IV and the NBZ currently support, or in the recent past supported, populations of this butterfly species. Much of Area IV and the NBZ has been fragmented and habitats have been degraded. Primary larval host plant populations are few, small, and often widely separated from each other. Potential secondary larval hosts are uncommon or absent from Area IV and the NBZ and are not in close proximity to the primary larval hosts. It would be unlikely for the QCB to establish new colonies given the distance from extant populations (Faulkner 2010). It is possible to have disjunct populations of the QCB, but current understanding of the biology and distribution of this insect leads to the opinion that individuals or colonies would not be found on this site. Even so, the USFWS determined in the Biological Opinion that the species is potentially present (USFWS 2010).

Riverside Fairy Shrimp *(Streptocephalus woottonii)* and Vernal Pool Fairy Shrimp *(Branchinecta lynchi)*. The riverside fairy shrimp, listed as federally endangered, is protected under the *Vernal Pools of Southern California Recovery Plan* (USFWS 1998b, 2010). This fairy shrimp is endemic to vernal pools from southwestern Riverside County and western San Diego County, California, to northwestern Baja California, Mexico. There is one recorded occurrence in Ventura County, just west of Simi and approximately 8 miles from Area IV (CDFW 2015). This species' narrow habitat requirements are deep, cool, lowland vernal pools that retain water through the warmer weather of late spring. Area IV includes some of the habitat typically found to form vernal pools.

The USFWS designated the vernal pool fairy shrimp as threatened on September 19, 1994. Critical habitat for this species was designated on February 10, 2006 (USFWS 2006a). This species is also covered under the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (USFWS 2005). The vernal pool fairy shrimp occupies a variety of different vernal pool habitats, from small, clear, sandstone rock pools to large, turbid, alkaline, grassland valley floor pools, but tends to occur primarily in smaller pools less than 0.05 acres (0.02 hectares) in area. This species is currently found in 28 counties across the Central Valley and coast ranges of California, and in Jackson County of southern Oregon. Occurrences in Los Angeles County include the Cruzan Mesa vernal pools, and occurrences in Ventura County include the Carlsberg vernal pools and two locations within the Los Padres National Forest.

There are no known records of riverside fairy shrimp or vernal pool fairy shrimp within Area IV or the NBZ (USFWS 2010). Nine vernal pools were identified on SSFL Areas I and IV in 2010 and were surveyed for fairy shrimp. Fairy shrimp were found to be present in these pools (Padre 2010), but were identified as the versatile fairy shrimp (*Branchinecta lindhali*), an unlisted species. The pools occurred in sandstone outcrop areas unlikely to be directly affected by remediation activities. Full protocol surveys would be required for any sites that would be directly impacted by remediation activities (Padre 2014). However, it is possible that not all of the vernal pools or vernally inundated areas in Area IV and the NBZ have been mapped, and any additional ponded areas that could provide habitat for listed vernal pool branchiopods would need to be mapped and surveyed (USFWS 2010).

3.6 Air Quality and Climate Change

This section describes the regional air quality and climate change conditions that apply to the proposed activities.

3.6.1 Air Quality

3.6.1.1 Definition of Resource

Air quality at a given location can be described by the concentrations of various air pollutants in the atmosphere. Air pollutants are defined as two general types: (1) criteria pollutants and (2) toxic compounds. Criteria pollutants are regulated under national and/or state ambient air quality standards. EPA establishes the National Ambient Air Quality Standards (NAAQS). The California Air Resources Board (ARB) establishes the state standards, called the California Ambient Air Quality Standards (CAAQS), and is responsible for enforcing both Federal and state air pollution regulations. The NAAQS represent maximum acceptable concentrations that generally may not be exceeded more than once per year, as well as annual standards, which may not be exceeded at any time. The CAAQS represent state maximum acceptable pollutant concentrations that are not to be equaled or exceeded. The California and national ambient air quality standards are shown in **Table 3–9**.

Table 3–9 California and National Ambient Air Quality Standards

Pollutant	*Averaging Time*	*California Standards*	*National Standards*	
			Primary [a]	*Secondary* [b]
Ozone (O_3)	8-hour	0.07 ppm	0.075 ppm	Same as primary
	1-hour	0.09 ppm	–	–
Carbon monoxide (CO)	8-hour	9 ppm	9 ppm	–
	1-hour	20 ppm	35 ppm	–
Nitrogen dioxide (NO_2)	Annual	0.03 ppm	0.053 ppm	Same as primary
	1-hour	0.18 ppm	0.10 ppm	–
Sulfur dioxide (SO_2)	24-hour	0.04 ppm	–	–
	3-hour	–	–	0.5 ppm
	1-hour	0.25 ppm	75 ppb	–
Respirable particulate matter (PM_{10})	Annual	20 $\mu g/m^3$	–	–
	24-hour	50 $\mu g/m^3$	150 $\mu g/m^3$	Same as primary
Fine particulate matter ($PM_{2.5}$)	Annual	12 $\mu g/m^3$	12 $\mu g/m^3$	15 $\mu g/m^3$
	24-hour	–	35 $\mu g/m^3$	Same as primary
Lead	Rolling 3-month average	–	0.15 $\mu g/m^3$	Same as primary
	Quarterly Average	–	–	–
	30-day average	1.5 $\mu g/m^3$	–	–

PM_n = particulate matter less than or equal to *n* microns in aerodynamic diameter; ppm = parts per million; ppb = parts per billion; $\mu g/m^3$ = micrograms per cubic meter.

[a] National Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect public health.

[b] National Secondary Standards: The levels of air quality necessary to protect the public from any known or anticipated adverse effects of a pollutant.

Source: ARB 2013.

EPA also regulates hazardous air pollutants that pose some level of acute or chronic health risk (cancer or noncancer) to the general public. In California, ARB regulates these compounds and refers to them as toxic air contaminants. The atmospheric concentration of both criteria pollutants and airborne toxic compounds are expressed in units such as parts per million or micrograms per cubic meter.

The main pollutants of concern considered in this air quality analysis include volatile organic compounds, ozone, carbon monoxide, nitrogen oxides, particulate matter less than 10 microns in diameter (PM_{10}), and particulate matter less than 2.5 microns in diameter ($PM_{2.5}$). Although ambient standards have not been established for volatile organic compounds or nitrogen oxides (other than nitrogen dioxide), these pollutants are important as precursors to ozone formation.

Identifying an analysis domain for air quality requires knowledge of the pollutant type and source emission rates, the proximity of project emission sources to other emission sources, and local and regional meteorology. Air emissions generated during the proposed onsite cleanup activities would mainly affect air quality within the immediate project area surrounding the SSFL. SSFL lies within the eastern portion of Ventura County, which is in the South Central Coast Air Basin. Due to the proximity to Los Angeles County, emissions generated on site also would affect the western part of Los Angeles County, which is in the South Coast Air Basin. Truck emissions from hauling waste to disposal sites would produce more dispersed effects throughout western Los Angeles County and portions of Central California, as well as Nevada, Utah, and/or Idaho as trucks travel between these locations. **Figure 3–24** shows the Ventura County and the South Coast Air Basin analysis domains for SSFL.

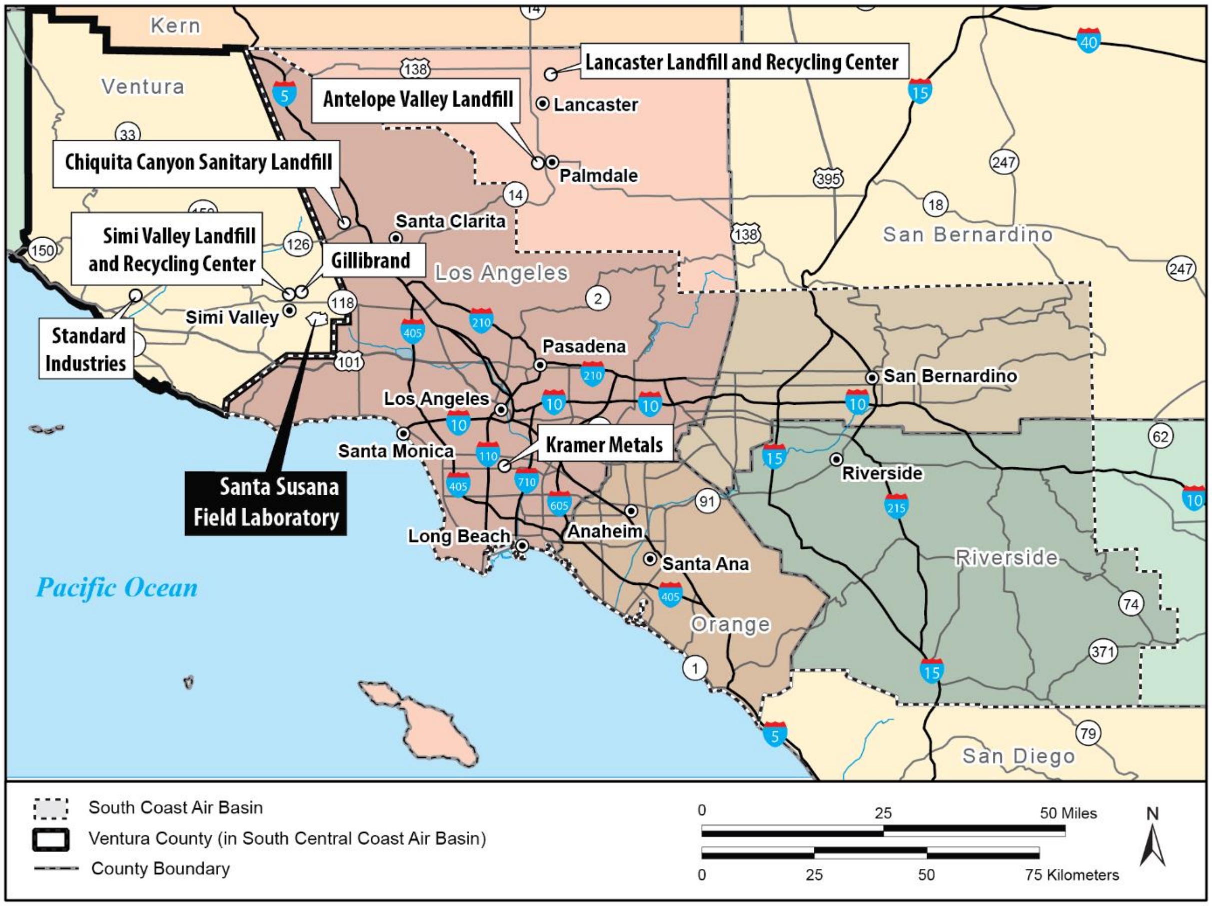

Figure 3–24 Air Impacts Analysis Region of Influence for Santa Susana Field Laboratory

The analysis domain for inert pollutants (such as carbon monoxide and particulates in the form of dust) is generally limited to a few miles downwind from a source. The analysis domain for reactive pollutants such as ozone could extend much farther downwind than for inert pollutants. Ozone is formed in the atmosphere by photochemical reactions of previously emitted pollutants called precursors. Ozone precursors are mainly nitrogen oxides and photochemically reactive volatile organic compounds. In the presence of sunlight, the maximum effect of precursor emissions on ozone levels usually occurs several hours after they have been emitted and many miles from their source.

In Ventura County, the Ventura County Air Pollution Control District (VCAPCD) has been delegated responsibility for enforcing Federal and state air pollution regulations. Chapter 8 of this EIS identifies applicable Federal, state, and VCAPCD rules and regulations.

3.6.1.2 Air Quality Setting

3.6.1.2.1 Regional Climate and Meteorology

The climate in the vicinity of SSFL is classified as Mediterranean, which is characterized by cool, dry summers and mild, relatively wet winters. The major influences on the regional climate are the Eastern Pacific High, a strong, persistent high-pressure system, and the moderating effects of the Pacific Ocean. Seasonal variations in the position and strength of the Eastern Pacific High are key factors in weather changes for the area. Climate and meteorological data collected at Canoga Park (about 5 miles east of SSFL) and SSFL are used to describe the climatic conditions of Area IV and the NBZ (WRCC 2014).

The Eastern Pacific High attains its greatest strength and most northerly position during the summer, when it is centered west of northern California. In this location, this high pressure system effectively shelters southern California from the effects of polar storm systems. Large-scale atmospheric subsidence (downward motion) associated with the Eastern Pacific High produces an elevated temperature inversion (increasing temperature with height) along the West Coast. The base of this subsidence inversion is generally 1,000 to 2,500 feet above mean sea level during the summer. Vertical mixing is often limited to the base of the inversion, and air pollutants are trapped in the lower atmosphere.

The proximity of the Eastern Pacific High and a thermal low pressure system in the desert interior to the east combine to produce a prevailing westerly wind across Ventura County for most of the year, particularly during the spring and summer months. During these months, breezes typically increase during the morning hours, reach a peak in the afternoon, and then decrease after sundown. During the warmest months of the year, however, breezes can persist well into the nighttime hours. Conversely, during the colder months of the year, easterly land breezes increase by sunset and extend into the morning hours. **Figure 3–25** shows a graphic of hourly wind speed and wind direction data (wind rose) recorded at the Boeing SSFL Area IV Station for years 2011 and 2012 (EMC 2012, 2013). These data show that winds at SSFL prevail from the northwest and southeast quadrants. These prevailing wind directions are in part due to the orientation of the slope of the terrain of SSFL, which in part forces winds upslope (blowing from the northwest) and downslope (blowing from the southeast).

During the fall and winter months, the Eastern Pacific High can combine with high pressure over the continent to produce light winds and extended inversion conditions in the region. These stagnant atmospheric conditions can produce elevated pollutant concentrations in the South Central Coast Air Basin. Excessive buildup of high pressure centered in Nevada can produce a "Santa Ana" condition, characterized by warm, dry, north to northeast winds in the region. This is a common weather pattern in the project area, and it produces some of the highest winds experienced at SSFL. Santa Ana events increase the potential for blowing dust from disturbed soil at the project site.

As winter approaches, the Eastern Pacific High begins to weaken and shift to the south, allowing polar storm systems to pass through the region. The number of days with precipitation varies substantially from year to year, resulting in a wide range of variability in annual precipitation totals. At Canoga Park, annual precipitation averages about 16.9 inches per year; the majority of rainfall occurs from late November through early April. This wet-dry seasonal pattern is characteristic of most of California. Precipitation can occur occasionally during the summer months as a result of tropical air masses originating in continental Mexico or tropical storms off the West Coast of Mexico.

The average high and low temperatures in Canoga Park in July are about 95 and 57 degrees Fahrenheit, respectively. January's average high and low temperatures are about 68 and 39 degrees Fahrenheit, respectively.

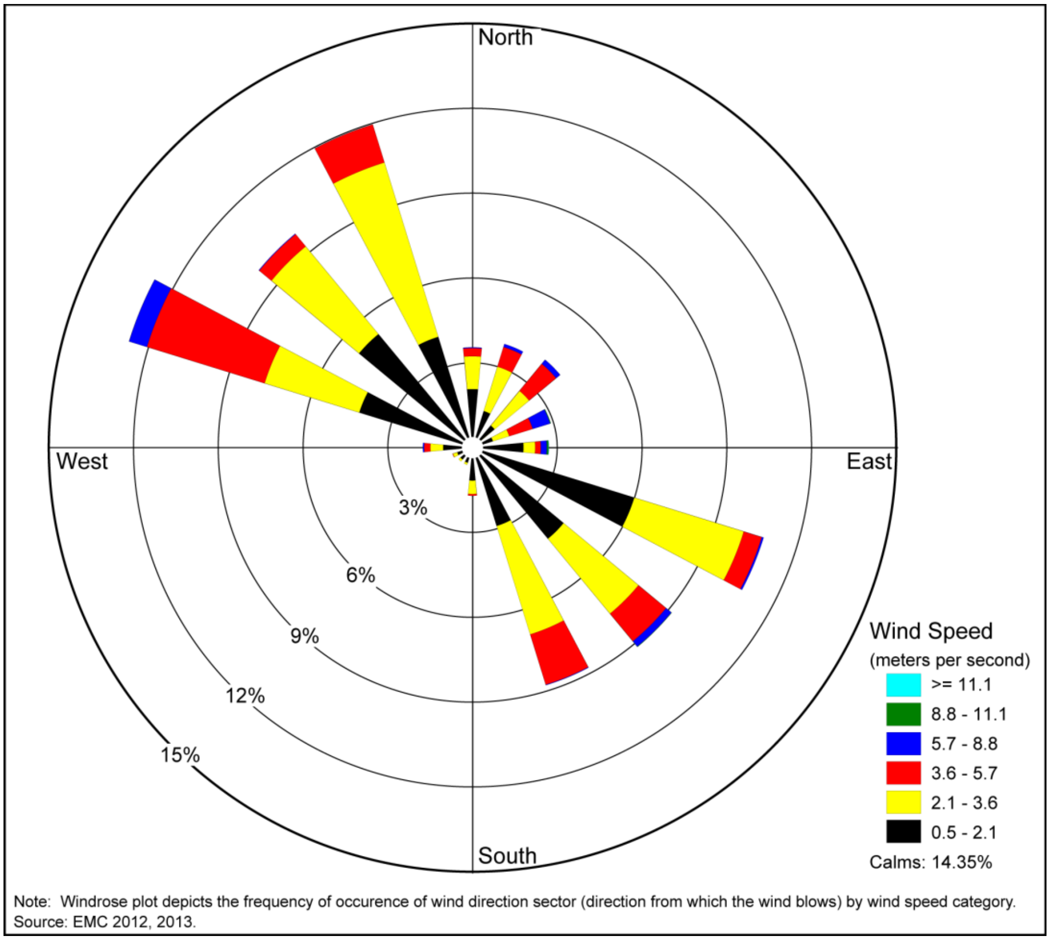

Figure 3–25 2011-2012 Area IV Wind Rose

3.6.1.2.2 Existing Air Quality

EPA designates all areas of the United States as having air quality better than (attainment) or worse than (nonattainment) the NAAQS. An area generally is in nonattainment for a pollutant if its NAAQS has been exceeded more than once per year. Former nonattainment areas that have attained the NAAQS are designated as maintenance areas. Presently, EPA categorizes Ventura County as in serious nonattainment of the 8-hour ozone standard and in attainment/unclassifiable for carbon monoxide, nitrogen dioxide, PM_{10}, $PM_{2.5}$, and lead (EPA 2015a). The South Coast Air Basin, which includes Los Angeles County, is designated as in extreme nonattainment of the 8-hour ozone standard, nonattainment for $PM_{2.5}$ and lead, and a maintenance area for carbon monoxide, nitrogen dioxide, and PM_{10}.

ARB designates areas of the state that are in attainment or nonattainment of the CAAQS. An area is in nonattainment for a pollutant if its CAAQS have been exceeded more than once in 3 years. ARB currently designates Ventura County as in nonattainment for ozone and PM_{10} and in attainment for carbon monoxide, nitrogen dioxide, sulfur dioxide, $PM_{2.5}$, and lead (ARB 2014a). ARB designates Los Angeles County as nonattainment for ozone, PM_{10}, and $PM_{2.5}$ and attainment for carbon monoxide, nitrogen dioxide, sulfur dioxide, and lead.

Several offsite facilities have been identified for potential treatment and disposal of wastes that would be generated under the proposed alternatives. **Table 3–10** summarizes the NAAQS attainment status for regions surrounding these waste management facilities.

Table 3–10 Attainment Status of National Ambient Air Quality Standards for Areas Surrounding Potential Waste Disposal Facilities

Location	Ozone	*CO*	*NO_2*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*Lead*
Antelope Valley (CA)	N	A	A	A	A	A	A
Chiquita Canyon (CA)	N	M	M	A	M	N	N
Mesquite Regional Landfill (CA)	N	A	A	A	N	N	A
Buttonwillow Landfill (CA)	N	A	A	A	M	N	A
Westmorland Landfill (CA)	N	A	A	A	N	N	A
McKittrick Waste Treatment Site (CA)	N	A	A	A	M	N	A
US Ecology (ID)	A	A	A	A	A	A	A
Energy*Solutions* (UT)	A	A	A	N	A	A	A
Nevada National Security Site (NV)	A	A	A	A	A	A	A
Kramer Metals (CA)	N	M	M	A	M	N	N
Standard Industries (CA)	N	A	A	A	A	A	A
Gillibrand (CA)	N	A	A	A	A	A	A

CA = California; CO = carbon monoxide; ID = Idaho; NO_2= nitrogen dioxide; NV = Nevada; PM_n = particulate matter less than or equal to *n* microns in aerodynamic diameter; SO_2 = sulfur dioxide; UT = Utah.
Status:
A = attainment; M = maintenance area; N = nonattainment of a standard.

Ozone concentrations are highest during the warmer months of the year and coincide with the period of maximum insolation. Maximum ozone concentrations tend to be homogeneously spread throughout a region because it often takes several hours to convert precursor emissions to ozone in the atmosphere. Ozone precursor emissions transported from the South Coast Air Basin also contribute to ozone levels within Ventura County. Inert pollutants such as carbon monoxide tend to have the highest concentrations during the colder months of the year, when light winds and nighttime/early morning surface-based temperature inversions inhibit atmospheric dispersion. Maximum inert pollutant concentrations are usually found near an emission source.

Ambient PM_{10} concentrations in the vicinity of SSFL result from emissions of fugitive dust and the combustion of fuel in vehicles. Maximum PM_{10} impacts occur in combination with fugitive dust generated by ground-disturbing activities (such as the operation of vehicles on unpaved surfaces) and high wind events.

Table 3–11 summarizes the maximum ambient pollutant concentrations at monitoring stations closest to SSFL in Ventura and Los Angeles Counties for the past 4 years. VCAPCD maintains a network of stations in Ventura County that monitor air quality and compliance with the ambient standards. The closest monitoring station to SSFL is Simi Valley–Cochran Street, about 3 miles north of SSFL. This station monitors ambient levels of ozone, nitrogen dioxide, PM_{10}, and $PM_{2.5}$. These data are included in Table 3–11 (ARB 2014b), and show that 1- and 8-hour ozone levels have exceeded their applicable NAAQS and CAAQS values at this location for each of the 4 years. In addition, annual PM_{10} levels approximate or slightly exceed the state standard.

The South Coast Air Quality Management District monitors air quality within the adjacent Los Angeles County. The closest monitoring stations in Los Angeles County to SSFL are in Reseda (about 11 miles to the east-southeast) and Burbank (about 20 miles to the east-southeast). Table 3–11 also includes the maximum ambient pollutant levels monitored at the Reseda and Burbank monitoring stations. Data collected at these locations show that in comparison to levels monitored at the Simi Valley–Cochran Street station, air quality levels (1) are higher and (2) include exceedances of the PM_{10} and $PM_{2.5}$ standards.

Table 3–11 Maximum Air Pollutant Concentrations Measured in Proximity to the Santa Susana Field Laboratory

Location/Air Pollutant	Averaging Period	National Standard	State Standard	Highest Monitored Concentration			
				2010	2011	2012	2013
Simi Valley–Cochran Street Monitoring Station (Ventura County)							
Ozone (ppm)	1-hour	n/a	0.09	**0.098**	**0.108**	**0.106**	**0.104**
	8-hour	0.075	0.07	**0.086**	**0.084**	**0.087**	**0.089**
NO_2 (ppm)	1-hour	0.10	0.18	0.07	0.04	0.06	0.04
	Annual	0.053	0.03	0.010	0.009	0.010	0.009
PM_{10} (μg/m^3)	24-hour	150	50	35	46	40	41
	Annual	n/a	20	19	20	20	**23**
$PM_{2.5}$ (μg/m^3)	24-hour	35	n/a	20	25	28	29
	Annual	12	12	10	9	10	9
Reseda/Burbank Monitoring Stations (Los Angeles County)[a]							
Ozone (ppm)	1-hour	n/a	0.09	**0.122**	**0.130**	**0.129**	**0.124**
	8-hour	0.075	0.07	**0.091**	**0.103**	**0.098**	**0.092**
NO_2 (ppm)	1-hour	0.10	0.18	0.08	0.07	0.07	0.06
	Annual	0.053	0.03	0.047	0.045	0.050	0.038
PM_{10} (μg/m^3)	24-hour	150	50	**51**	**97**	**55**	**53**
	Annual	n/a	20	–	–	**25.8**	**28.0**
$PM_{2.5}$ (μg/m^3)	24-hour	35	n/a	**50.3**	**52.7**	**41.6**	**44.5**
	Annual	12	12	–	10.1	10.4	9.8

μg/m^3 = micrograms per cubic meter; NO_2= nitrogen dioxide; PM_n = particulate matter less than or equal to *n* microns in aerodynamic diameter ppm = parts per million.

[a] All of the data presented for Los Angeles County were recorded at the Reseda station, except PM_{10} data are from the Burbank West Palm Avenue station because the Reseda station does not collect these data.

Note: Exceedance of a standard is presented in bold.

Source: ARB 2014b.

Secondary $PM_{2.5}$ Formation

Primary particles are emitted directly into the atmosphere by fossil fuel combustion sources, windblown soil, and dust. Secondary $PM_{2.5}$ forms in the atmosphere by complex reactions of precursor emissions of gaseous pollutants, such as nitrogen oxides, sulfur oxides, volatile organic compounds, and ammonia. Secondary $PM_{2.5}$ includes sulfates, nitrates, and complex carbon compounds. Emissions of nitrogen oxides, sulfur oxides, and volatile organic compounds generated by the proposed activities would contribute to secondary $PM_{2.5}$ formation some distance downwind of the emission sources. However, as it is hard to predict secondary $PM_{2.5}$ formation from an individual project, the air quality analysis in this document focuses on the effects of direct $PM_{2.5}$ emissions generated by the project.

3.6.1.2.3 Existing Emissions at SSFL

DOE currently conducts limited site investigation and maintenance activities in Area IV that produce minor emissions from the use of on- and off-road mobile sources and the occasional generation of fugitive dust. Emissions from the existing RMHF stack are subject to the requirements of VCAPCD Permit to Operate number 00232. This Permit to Operate also covers other stationary sources in Areas I and III of SSFL. In May 2007, DOE suspended all decontamination and decommissioning operations in Area IV and placed the entire RMHF into a safe shutdown mode. As a result, no effluents have been released to the atmosphere through the RMHF stack since that time (Boeing 2014c).

3.6.1.2.4 Sensitive Receptors

The impact of air emissions on sensitive members of the population is a special concern. According to VCAPCD guidance, sensitive receptor land use types include residences, schools (elementary through high schools), daycare centers, playgrounds, and medical facilities. The nearest sensitive receptors to the project site are residences, located about 1 mile south-southeast of Area IV in the Bell Canyon area. Sensitive receptors also reside along local roadways that would be used by trucks to transport materials to potential waste treatment and disposal facilities, such as Woolsey Canyon Road, Plummer Street, Valley Circle Boulevard, Roscoe Boulevard, and Topanga Canyon Boulevard. Section 3.14.1 of this EIS, Sensitive-aged Populations, describes the population in the vicinity of SSFL, including the distribution of children. Figure 3–48 shows the location of schools, parks, and open spaces near SSFL where children are likely to be present.

3.6.1.2.5 Valley Fever

Coccidioidomycosis, often referred to as San Joaquin Valley Fever or Valley Fever, is a disease that most commonly affects people who live in hot, dry areas with alkaline soil. This disease affects both humans and animals and is caused by the inhalation of spores of the fungus *Coccidioides immitis*. Spores from the fungus are found in the top few inches of soil. When weather and moisture conditions are favorable, the fungus "blooms" and forms tiny spores that lie dormant in the soil until they are stirred up by wind, vehicles, excavation, or other ground-disturbing activities. Agricultural workers, construction workers, and others who work outdoors and are exposed to windblown dust are more likely to contract Valley Fever. Children and adults whose outdoor activities expose them to windblown dust also are more likely to contract Valley Fever. The disease is considered to be endemic in both Ventura and Los Angeles Counties.

3.6.2 Climate Change

It is well documented that the Earth's climate has fluctuated throughout its history. However, recent scientific evidence indicates a correlation between increasing global temperatures over the past century and the worldwide proliferation of greenhouse gas (GHG) emissions by mankind. Climate change associated with global warming is predicted to produce negative environmental, economic, and social consequences across the globe.

Atmospheric levels of GHGs and their resulting effects on climate change are due to innumerable sources of GHGs across the globe. The direct environmental effect of GHG emissions is an increase in global temperatures, which indirectly causes numerous environmental and social effects. Therefore, the analysis domain for proposed GHG impacts would be global. These cumulative global impacts would be manifested as impacts on resources and ecosystems in California.

3.6.2.1 Greenhouse Gas Emissions and Effects

GHGs are gases that trap heat in the atmosphere by absorbing infrared radiation. GHG emissions occur from natural processes and human activities. Water vapor is the most important and abundant GHG in the atmosphere. However, human activities produce only a small amount of the total atmospheric water vapor. The most common GHGs emitted from natural processes and human activities include carbon dioxide, methane, and nitrous oxide. The main source of GHGs from human activities is the combustion of fossil fuels, such as crude oil and coal. Examples of GHGs created and emitted primarily through human activities include fluorinated gases (hydrofluorocarbons and perfluorocarbons) and sulfur hexafluoride. The main sources of man-made GHGs include refrigerants and electrical transformers.

Each GHG is assigned a global warming potential (GWP). The GWP is the ability of a gas or aerosol to trap heat in the atmosphere over a given period of time. The GWP rating system is standardized to carbon dioxide, which has a value of one. For example, methane has a GWP of 28 over 100 years, which means that it has a global warming effect 28 times greater than carbon dioxide on an equal-mass basis (IPCC 2013). To simplify GHG analyses, total GHG emissions from a source are often expressed as a carbon dioxide equivalent, which is calculated by multiplying the emissions of each GHG by its GWP and adding the results together to produce a single, combined emission rate representing all GHGs. While methane and nitrous oxide have much higher GWPs than carbon dioxide, carbon dioxide is emitted in such greater quantities that it is the overwhelming contributor to global carbon dioxide equivalent emissions from both natural processes and human activities.

Numerous studies document the recent trend of rising atmospheric concentrations of carbon dioxide. The longest continuous record of carbon dioxide monitoring extends back to 1958 (Keeling 1960; Scripps 2014). These data show that atmospheric carbon dioxide levels have risen an average of 1.5 parts per million per year over the last 56 years (NOAA 2014). As of 2014, carbon dioxide levels are about 30 percent higher than the highest levels estimated for the 800,000 years preceding the industrial revolution, as determined from carbon dioxide concentrations analyzed from air bubbles in Antarctic ice core samples (USGCRP 2014).

Recent observed changes due to global warming include rising temperatures, shrinking glaciers and sea ice, sea level rise, thawing permafrost, a lengthened growing season, and shifts in plant and animal ranges. International, national, and state organizations independently confirm these findings (California Energy Commission 2012; IPCC 2013; USGCRP 2014).

The most recent assessment of climate change impacts in California conducted by the State of California predicts that temperatures in California will increase between 4.1 and 8.6 degrees Fahrenheit by 2100, based on both low and high global GHG emission scenarios (California Energy Commission 2012). Predictions of long-term negative environmental impacts due to global warming include sea level rise; changing weather patterns, including increases in the severity of storms and droughts; changes to local and regional ecosystems, including the potential loss of species; and a substantial reduction in winter snowpack. In California, predictions of these effects include exacerbation of air quality problems; a reduction in municipal water supply from the Sierra snowpack; a rise in sea level that would displace coastal businesses and residences; an increase in wild fires; damage to marine and terrestrial ecosystems; and an increase in the incidence of infectious diseases, asthma, and other human health problems (California Energy Commission 2012).

3.7 Noise

This section provides basic definitions for noise evaluation, gives an overview of the general effects of noise, and describes the baseline noise conditions in the ROI. The ROI for noise includes the vicinity of SSFL Area IV and the haul routes used to transport materials to and from Area IV.

3.7.1 Definition of the Resource

Noise is defined as any unwanted sound. Defining characteristics of noise include sound level (amplitude), frequency (pitch), and duration. Each of these characteristics plays a role in determining a noise's intrusiveness and level of impact on a noise receptor. The term, "noise receptor," is used in this document to mean any person, animal, or object that hears or is affected by noise.

Sound levels are recorded on a logarithmic decibel scale, reflecting the relative way in which the ear perceives differences in sound energy levels. A sound level that is 10 decibels (dB) higher than another would normally be perceived as twice as loud, while a sound level that is 20 dB higher than another would be perceived as four times as loud. Under laboratory conditions, the healthy human ear can detect a change in sound level as small as 1 dB. Under most non-laboratory conditions, the typical human ear can detect changes of about 3 dB.

Sound measurement may be further refined through the use of frequency "weighting." The normal human ear can detect sounds that range in frequency from about 20 hertz to 20,000 hertz (FICON 1992). However, all sounds throughout this range are not heard equally well. In "A-weighted" measurements, the frequencies in the 1,000- to 4,000-hertz range are emphasized because these are the frequencies heard best by the human ear. Sound level measurements weighted in this way are termed "decibels A-weighted (dBA)." Unless otherwise noted, all sound levels referenced in this document can be assumed to be A-weighted.

Table 3–12 lists common outdoor and indoor activities, typical sound levels associated with these activities, and the subjective loudness as perceived by a listener.

Typically, sound levels at any given location change constantly; for example, the sound level changes continuously when a vehicle passes by. A passing vehicle noise starts at the ambient (background) level, increasing to a maximum when the vehicle passes closest to the receptor, and then decreasing to ambient levels when the vehicle goes into the distance. The term, "maximum sound level," or "L_{max}," represents the sound level at the instant during a vehicle drive-by when sound is at its maximum.

Table 3–12 Typical Noise Levels and Their Subjective Loudness

Common Outdoor Activities	***Common Indoor Activities***	***A-Weighted Sound Level (dBA)***	***Subjective Loudness***
Threshold of pain		140	**UNCOMFORTABLE**
Near jet engine		130	
		120	
Jet fly-over at 1,000 feet (300 meters)	Rock band	110	
Loud auto horn		100	**VERY NOISY**
Gas lawn mower at 3 feet (1 meter)		90	
Diesel truck at 50 feet (15 meters), at 50 miles per hour (80 kilometers per hour)	Food blender at 1 meter (3 feet)	80	
Noisy urban area, daytime	Vacuum cleaner at 3 meters (10 feet)	70	**LOUD**
Heavy traffic at 300 feet (90 meters)	Normal speech at 1 meter (3 feet)	60	
Quiet urban daytime	Large business office	50	**MODERATE**
Quiet urban, nighttime	Theater, large conference room (background)	40	
Quiet suburban, nighttime	Library	30	**FAINT**
Quiet rural nighttime	Bedroom at night, concert hall (background)	20	
	Broadcast/recording studio	10	**VERY FAINT**
Lowest threshold of human hearing	Lowest threshold of human hearing	0	

dBA = decibels A-weighted.

Because both the duration and frequency of noise events also play a role in determining overall noise impact, several metrics are used that account for these factors. Each metric discussed below is used in the assessment of noise impacts in this EIS.

- Equivalent sound level (L_{eq}) represents the average noise level over a specified time period. In this EIS, equivalent sound level over an 8-hour workday (denoted as $L_{eq\text{-}workday}$) is used to quantify overall noise from construction equipment. Similarly, $Leq_{\text{-}1/2\ hour}$ is used to provide a sampling of ambient noise level during one-half hour periods at several locations. It is important to note that L_{eq} does not represent the sound level heard at any given moment, but rather the average of variable noise levels experienced across the stated time period.
- Community noise equivalent level (CNEL) is the average noise level over a 24-hour period with decibel "penalties" applied to noise events during the "evening" and "night." Five decibels are added to the sound levels of noise events occurring between 7 PM and 10 PM, and 10 decibels are added to sound levels between 10 PM and 7 AM. These additions are made to account for the noise-sensitive time periods (evening and nighttime [sleeping] hours) when sounds seem louder. The CNEL metric is useful as a predictor of the percentage of the affected population that would be highly annoyed by noise.
- Day-night average sound level (DNL) is the same as CNEL except that no decibel "penalty" is applied for noise events between 7 PM and 10 PM. DNL and CNEL noise levels are very similar for any given noise environment.

3.7.2 Effects of Noise

Annoyance is the most common effect of noise on humans. Annoyance is often triggered when a noise interferes with activities that involve listening such as conversation or watching television. Whether or not an individual becomes annoyed by a particular noise is highly dependent on emotional and situational variables of the listener, as well as the physical properties of the noise (FAA 1985). When assessed over long periods of time and with large groups of people, however, a strong correlation exists between the percentage of people highly annoyed by noise and the time-averaged exposure level to noise. This finding is based on surveys of groups of people exposed to various intensities of transportation noise. Social surveys have found that at 65 DNL about 12 percent of the population can be expected to be highly annoyed by noise, while at 70 and 75 DNL, 22 and 37 percent, respectively are annoyed (Finegold et al. 1994).

A DNL of 55 dB was identified by EPA as a level "…requisite to protect the public health and welfare with an adequate margin of safety" (EPA 1974). EPA recommends that the noise level in sleeping areas be less than 45 dB DNL (EPA 1974). Standard construction provides a noise level reduction of 20 dB. Studies indicate a tendency for humans to habituate to regularly occurring nighttime noise over time, eventually reducing susceptibility to noise-induced sleep disturbance (Fidell et al. 1995; Pearsons et al. 1995; Kryter 1984).

EPA recommends that, to protect public health with an adequate margin of safety, exterior noise levels should not exceed 55 dB DNL and interior noise levels should not exceed 45 dB DNL in noise-sensitive locations (EPA 1974). The Federal Interagency Committee on Urban Noise took these recommendations into consideration when developing its recommendations on compatibility of land uses with noise impacts (FICUN 1980).

The *L.A. CEQA Thresholds Guide: Your Resource for Preparing CEQA Analyses in Los Angeles* (City of Los Angeles 2006) indicates that significant impacts from noise can occur when a given noise source causes the ambient noise level measured at the property line of an affected land use/area to increase by 3 dBA in CNEL to or within the "normally unacceptable" or "clearly unacceptable" category, or any 5 dBA or greater noise increase. The lowest "normally unacceptable" threshold for any of the land use categories listed in the guide, playgrounds and neighborhoods, is 67 dB CNEL.

A DNL of 75 dB is considered the threshold above which impacts to health may occur (CHABA 1977). It is well established, for example, that long-term exposure to high noise levels will damage human hearing (EPA 1974). Some studies have indicated that excessive exposure to intense noise might contribute to the development and aggravation of stress-related conditions such as high blood pressure, coronary disease, ulcers, colitis, and migraine headaches. Other studies have found no correlation between noise and various health conditions. Non-auditory health effects of noise are not well established at this time, and are likely only experienced at noise levels above those known to cause hearing loss (EPA 1981).

3.7.3 Existing Conditions

SSFL Area IV is located in a rural area of Ventura County. Demolition and cleanup activities would occur onsite. The nearest sensitive noise receptors are residences located in Bell Canyon to the south of SSFL and on Woolsey Canyon Road to the Northeast. Materials would be transported on local roadways by large trucks through rural and residential areas to interstate highways.

Figure 3–26 shows the main roads that are used currently or that would be used in the future for truck transport to and from SSFL. Currently, trucks leaving the site travel east along Woolsey Canyon Road, south on Valley Circle Boulevard, east on Roscoe Boulevard, and finally, north or south on Topanga Canyon Boulevard. From Topanga Canyon Boulevard, trucks reach Interstate 5 by way of State Route (SR) 118 (Ronald Reagan Freeway). DOE is also proposing several additional routes. One additional route is to travel northeast on Valley Circle Boulevard through Chatsworth Lake Manor to Plummer Street and finally, onto Topanga Canyon Boulevard. On reaching Topanga Canyon Boulevard by way of either Plummer Street or Roscoe Boulevard, trucks could also travel south to U.S. Highway 101 (Ventura Freeway). Trucks could also continue south bound on Valley Circle Boulevard to U.S. Highway 101 directly from Woolsey Canyon Road.

Figure 3–26 Current and Proposed Truck Haul Routes

The routes pass through residential areas with mostly single-family homes and general commercial uses. Receptors in the noise-sensitive residential zones are located at varying distances from roadway centerlines. Many of the homes are positioned such that the noise-sensitive rear yards are facing the adjacent roadway and are protected by existing noise barriers located along the property lines (Urban Crossroads 2011). The existing noise environment is dominated by traffic noise on Woolsey Canyon Road, Plummer Street, Valley Circle Boulevard, Roscoe Boulevard, and Topanga Canyon Boulevard. Baseline noise levels were measured at the five locations noted on Figure 3–26 for a 24-hour period in August 2011. The locations, hourly noise levels, and daily continuous noise levels are summarized in **Table 3–13**.

Table 3–13 Ambient Noise Level Measurements[a]

Receptor Location	*Receptor Description*	*Time of Measurement[b]*	*Primary Noise Source*	*Hourly Noise Levels (L_{eq} dBA)*	*Daily Noise Levels (dBA CNEL)*
L1	Located at the property line of 22401 Plummer Street, west of Shoup Avenue, 55 feet from the roadway centerline UTM coordinates: 351246e × 3790263n	Thursday 8/25/2011	Traffic on Plummer Street	50.7 – 67.6	68.1
L2	Located across from 23541 Lake Manor Drive in the Chatsworth Lake area approximately 60 feet from roadway centerline. UTM coordinates: 348896e × 3789706n	Thursday 8/25/2011	Traffic on Lake Manor Drive	47.4 – 71.0	64.8
L3	Located 30 feet from the Woolsey Canyon Road centerline west of Bang Road intersection. UTM coordinates: 346562e × 3789388n	Thursday 8/25/2011	Traffic on Woolsey Canyon	48.0 – 63.5	61.7
L4	Located approximately 50 feet south of the Roscoe Boulevard centerline west of Jason Avenue. UTM coordinates: 349281e × 3789388n	Thursday 8/25/2011	Traffic on Roscoe Boulevard	52.9 – 68.8	68.2
L5	Located 100 feet east of Topanga Canyon Boulevard at the existing Sunrise Assisted Living Complex. UTM coordinates: 352188e × 3789267n	Thursday 8/25/2011	Traffic on Topanga Canyon Boulevard	52.1 – 63.7	65.7

CNEL = Community noise equivalent level; dBA = decibels A-weighted; L_{eq} = equivalent sound level; UTM = Universal Transverse Mercator.

[a] Noise measurements taken by Urban Crossroads, Inc., from August 24 to August 28, 2011.

[b] All measurements at locations L1 through L5 were monitored for a period of 24-hours.

Source: Urban Crossroads 2011.

On the March 10, 2015, noise levels measurements were made at four residential locations near SSFL for one-half hour each (ESA 2015a). Three of the locations were within the Bell Canyon residential area and exhibited noise levels ranging from 44 to 53 dBA $Leq_{\text{-1/2 hour}}$. Common noise sources in these areas were automobile and small truck traffic, lawn mowing equipment, and natural sounds. The fourth measurement site, which was located along Woolsey Canyon Road, exhibited $Leq_{\text{-1/2 hour}}$ of 57 dBA with large trucks being the dominant noise source.

In addition to the continuous noise monitoring, individual vehicle noise levels were also measured. Between August 24 and August 27, 2011, measurements were made at 11 locations using hand held noise dosimeters (DOE 2011a). Maximum pass-by noise levels generated by various types of vehicles that operate along the proposed haul routes are listed in **Table 3–14**. The quietest vehicle pass-by was that of a distant passenger car that generated 65 dBA. The loudest vehicles measured were emergency vehicles, which generated up to 113 dBA while sirens were sounding. SSFL trucks currently operating on the haul routes generated between 80 and 95 dBA with the loudest noise levels associated with engine braking. Measurements taken along Woolsey Canyon Road during a one-half hour period on March 10, 2015 show maximum noise levels associated with large truck traffic as high as 78.3 dBA (ESA 2015a).

Table 3–14 Typical Vehicle Noise

Category	*Type of Noise Source*	*dB Range*
Aircraft	Passenger jet	65
	Small plane	65
Construction	3-axle truck	73 – 88
	Dump truck	73 – 88
	Large cement mixer	73
	SSFL truck	80 – 95
Emergency vehicles	Fire truck	81 – 113
	Emergency vehicle with siren	101
Lawn equipment	Commercial lawn mower	75
On-road vehicles	3-axle truck	78 – 81
	4-axle truck	77
	Box truck	74 – 91
	Bus	76 – 89
	Diesel truck	84 – 86
	Garbage truck	76 – 84
	Motorcycle	70 – 97
	Motor home	80
	Pickup truck	77 – 99
	Scooter	74
	Tractor trailer	75 – 93

dB = decibels.
Note: The decibel range provides the lowest and highest sound level for each vehicle type measured, unless only one noise level is shown, in which case one measurement was taken of that vehicle type. Data are summarized from DOE (2011a), Tables A-21 through A-29.
Source: DOE 2011a.

3.8 Transportation/Traffic

The affected environment and ROI for transportation includes all roadways and rail routes used to transport low-level radioactive waste (LLW), mixed low-level radioactive waste (MLLW), radiological waste, hazardous waste, and nonhazardous waste (including asphalt, concrete, and building materials) to offsite disposal facilities and delivery of materials (such as clean soil) for restoration efforts. It also includes local roadways used by personnel and contractors travelling to and from SSFL in passenger vehicle and light trucks (such as step vans and pickup trucks).

This section describes the baseline transportation conditions for onsite and regional roadways and traffic as well as railways. Section 3.8.1, "Onsite Transportation," discusses traffic on the roadway network within Area IV and the NBZ boundaries, while Section 3.8.2, "Local Offsite Transportation," discusses the local road networks surrounding Area IV and the NBZ and addresses "local" and "non-local" offsite transportation routes. For the purposes of this study, local routes include all roadways currently used and those proposed for transport between SSFL and the Interstate highway system via SR 118 (Ronald Reagan Freeway) and U.S. Highway 101 (Ventura Freeway). "Non-local" routes include Interstate 5 and any roadway used beyond SR 118 and U.S. Highway 101.

All SSFL materials, both within SSFL and off site, are transported in accordance with existing applicable laws and regulations governing approved methods of handling, type of vehicles and containers used, and routes used for transport and delivery of materials to offsite locations. A list with brief descriptions of applicable Federal laws and DOE Orders is provided in Section 8.1.10.

3.8.1 Onsite Transportation

3.8.1.1 Onsite Roadway Network and Traffic

SSFL is an industrial area served by a network of paved and dirt-graded roads that support heavy vehicles and connect the various facilities throughout four administrative areas and site buffer zones. **Figure 3–27** depicts the system of roadways within SSFL. Boeing and the U.S. Government hold easements for the roads within SSFL pursuant to the Grant Deed (Document Number 57603) of 1958 between the U.S. Government and North American Aviation (Boeing 2015a; MWH 2014).

All traffic to the SSFL facility passes through a security gate at the entrance on the northeast corner of SSFL (the "Main Gate"). Vehicular access to SSFL and onsite roadways is restricted to operations of DOE, NASA, and Boeing, and their subcontractors, vendors, and visitors. Onsite roads do not serve public through-traffic. Paved roadways generally provide one lane of travel in each direction with limited shoulder area. Unpaved roadways generally provide a single lane of travel with no shoulder. As shown in Figure 3–27, travel between Area IV and the Main Gate uses Facility Road, Service Area Road, F Street, leading into G Street. Several roads intersect G Street and provide access to facilities within Area IV. Other primary roads on SSFL include Skyline Road, Roca Road, and Test Area Road.

Activities generating traffic at SSFL include movement of workers to and from facilities, movement of heavy equipment to and from facilities, and movement of trucks hauling demolition debris and impacted soils. Currently the only ongoing activities at Area IV are those associated with site security and maintenance, and groundwater monitoring. Traffic volumes vary depending on the types of activities occurring at locations along each roadway, and whether the road serves as an internal collector or arterial road to the Main Gate.

No railroad infrastructure exists on SSFL, thus all transport of waste material is presently conducted on roadways using trucks.

3.8.1.2 Onsite Pavement Conditions

Onsite roadways currently used by SSFL as haul roads are asphaltic concrete roadways built in the 1940s and 1950s. The SSFL roadways were originally constructed to serve an industrial facility with some level of truck traffic. However, the trucks in common usage today are much heavier than those anticipated at the time of construction in the 1940s and 1950s. The asphaltic concrete surfaces of these roadways are generally in poor condition based on observation and are exhibiting cracks that indicate that the asphaltic concrete has lost flexibility. Such asphalt may perform poorly under truck loading, especially at the edges of the pavements.[8]

[8] This assessment is based on observation of Michael J. Smith, California Civil PE # 74292 based on review of photographic evidence from Google Earth and review of photographs contained in *Santa Susana Field Laboratory Area IV Preliminary Pavement Condition Survey and Potential Pavement Construction Impact Cost Evaluation*, January 13, 2012 (Urban Crossroads 2012).

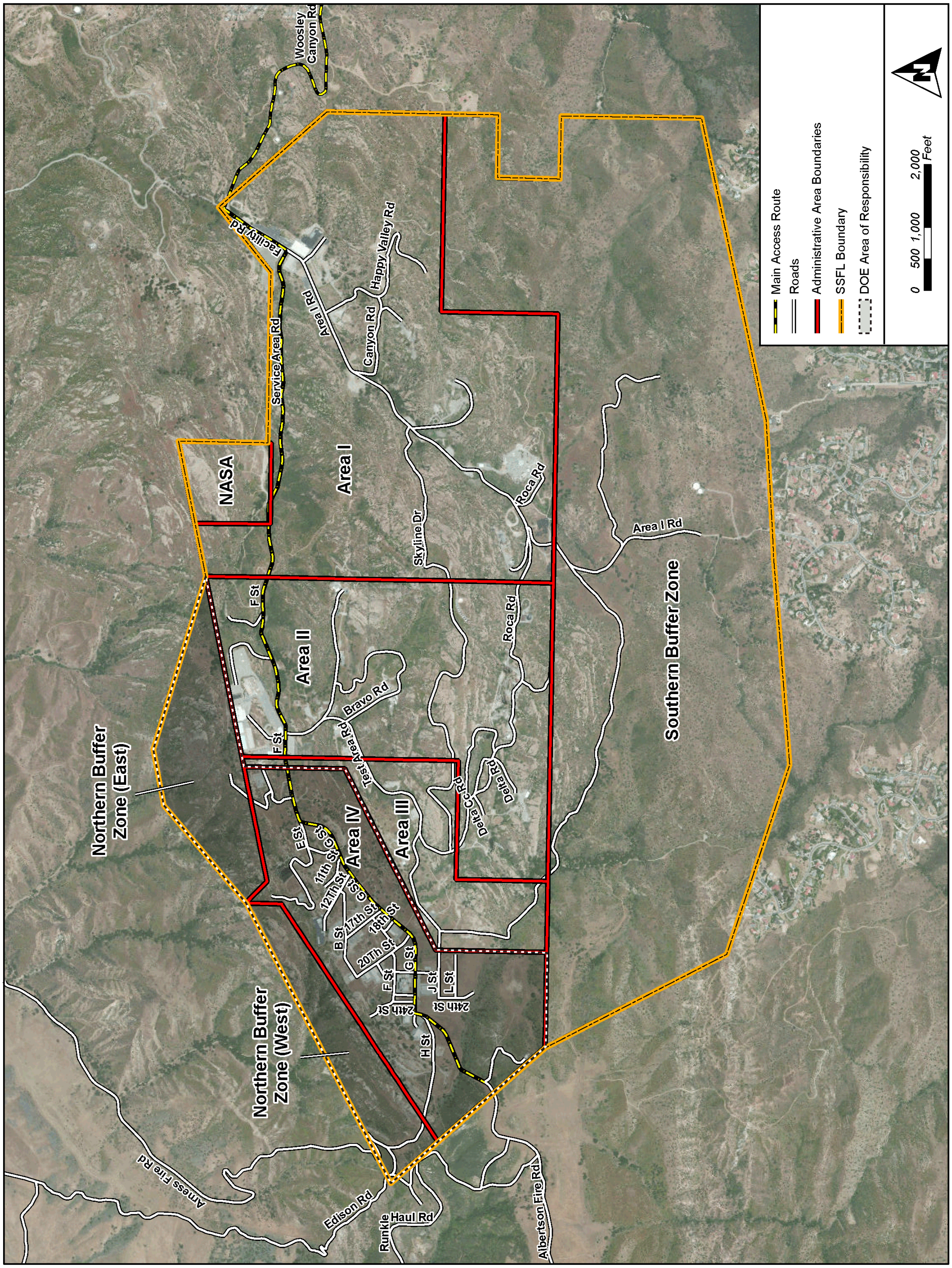

Figure 3–27 Santa Susana Field Laboratory Roadways

3.8.2 Local Offsite Transportation

Originally, SSFL was a remote site removed from urban and developed areas. Private roads were constructed to provide access to Area IV and the NBZ and other adjoining properties. Many of these small roads surrounding the SSFL are still private, although some have taken on a public function and in some cases, are managed by local jurisdictions.

For this analysis, "Access" roadways primarily provide access directly to adjoining properties and are not intended to provide routes for significant through traffic. "Collector" roadways are public roadways linking access roads to arterial roadways and also provide access to adjoining properties. "Arterial" roadways primarily serve through traffic and link collector and arterial roads but serve limited or no direct access to adjoining properties. Local arterials provide a network for local traffic and links to major arterials (highway systems serving regional and interstate traffic) with limited access to adjoining properties. Major arterials are freeways and interstate highways that do not allow access to adjoining properties and only provide for through traffic.

Figure 3–28 shows the local road network in the vicinity of SSFL, and the proposed local routes for trucks carrying waste materials from the SSFL. Currently, the only truck access to SSFL is by way of Woolsey Canyon Road from Chatsworth, CA; although some private vehicle traffic also accesses SSFL by Black Canyon Road from Simi Valley, CA. The current primary route for waste transportation vehicles traveling from SSFL is Woolsey Canyon, Valley Circle Boulevard, Roscoe Boulevard, and Topanga Canyon Boulevard to SR 118 (Ronald Reagan Freeway). SR 118 is the main local arterial linking into the major highway system, and leads to Interstate 405 and downtown Los Angeles, and to Interstate 5. Alternately, U.S. Highway 101 (Ventura Freeway) may be used, but is less desirable due to high traffic and day-time congestion.

3.8.2.1 Access Roadways

The SSFL Main Gate is accessible by the following access roadways:

- Woolsey Canyon Road
- Black Canyon Road
- North American Cutoff Road

Woolsey Canyon Road. Woolsey Canyon Road is the primary access road linking SSFL to the local collector road network. It is the only serviceable road for heavy truck traffic to and from SSFL. Woolsey Canyon Road is also used by homeowners living along the road.

Woolsey Canyon Road originates at Valley Circle Boulevard, near the communities of Lakeside Park and Chatsworth Lake Manor. From Valley Circle Boulevard, Woolsey Canyon Road ascends westward, gaining 1,200 vertical feet in a series of curves and switchbacks to meet Black Canyon Road, just northeast of the SSFL Main Gate. Woolsey Canyon Road is a two lane roadway, with typically 12 foot wide asphaltic concrete lanes and typically narrow or no shoulders. Truck passing lanes have been constructed on the steeper grades and several widened spots have been constructed to allow large vehicles to pull off the road. Many of the curves have been widened to aid in keeping traffic passing in opposite lanes safely apart.

The pavement of Woolsey Canyon Road shows few signs of structural failure, but is showing signs of age and brittleness indicating that the pavement is near the end of its useful life. Portions of the roadway have recently been repaired.

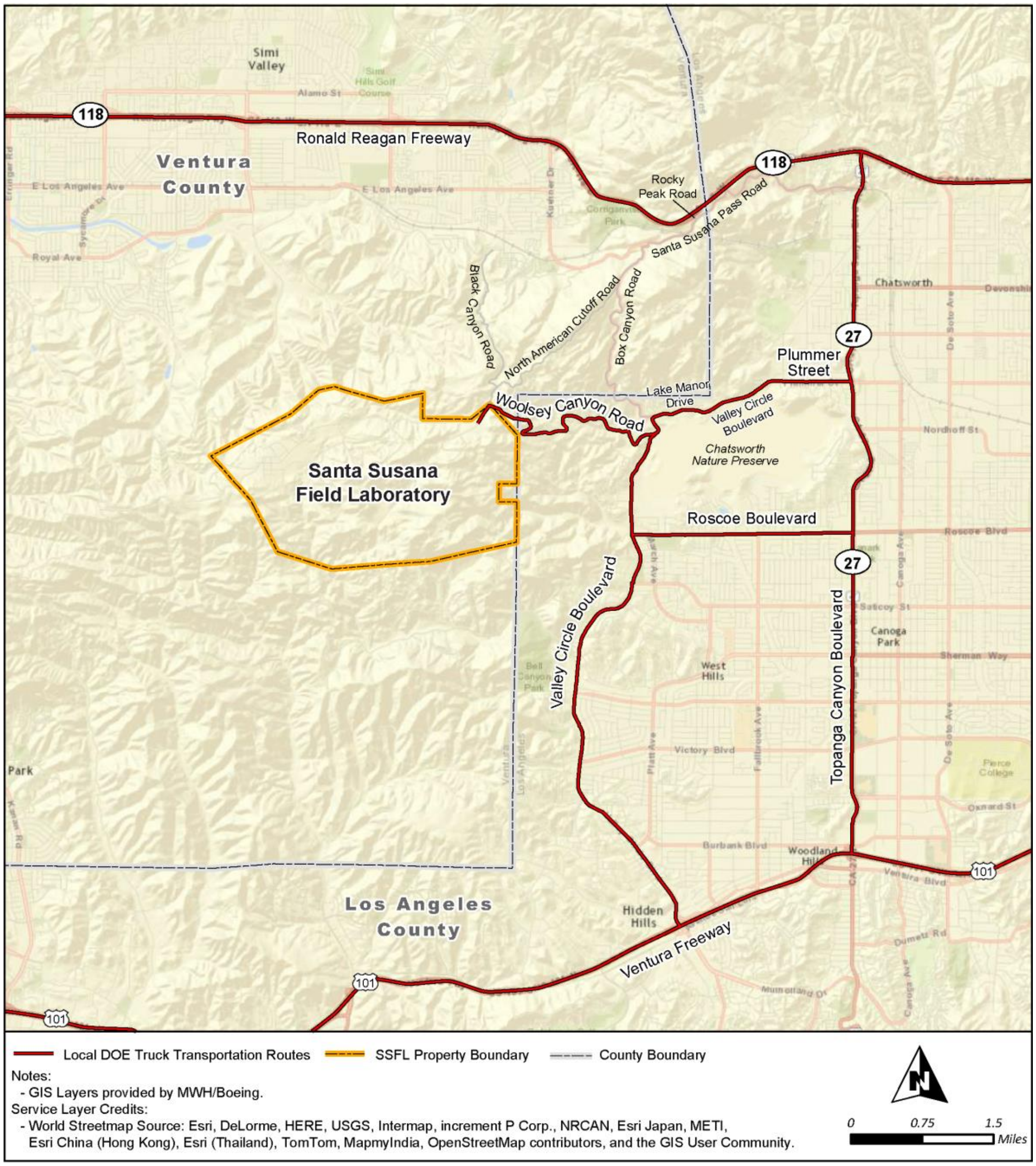

Figure 3–28 Local Transportation Routes for Waste Transportation Vehicles

Black Canyon Road. This roadway originates from the Santa Susana Knolls area located north of SSFL and on the southeastern side of Simi Valley. Black Canyon Road is not used for truck traffic as this road is not suitable due to narrow lanes, extensive sharp curves, and little to no shoulders along the roadway. The roadway provides access for SSFL employees and smaller commercial trucks. From Oak Knolls Road in Santa Susana Knolls, Black Canyon Road ascends approximately 1,000 vertical feet to the Simi Crest, to an intersection with North American Cutoff Road approximately 0.25 mile north of the SSFL main gate.

North American Cutoff Road. This road extends from Box Canyon Road (about 0.75 mile north of the intersection of Box Canyon Road and Santa Susana Pass Road) to Black Canyon Road about 0.4 miles north of the SSFL Main Gate. The roadway surface is a mix of earth, aggregate, and some asphaltic concrete surface. The roadway is approximately 18 feet in width. This road provides access to an electrical transmission line, a large water tank, and a few commercial/residential properties. There is a gate at the intersection of North American Cutoff Road and Black Canyon Road. Although this road connects to local connector roads, it is not used as a truck route to and from SSFL.

Other non-paved fire and haul roads traverse the area surrounding SSFL, including Arness Fire Road, Runkel Haul Road, and Albertson Fire Road. Roca Avenue on SSFL continues south from SSFL connecting into North Hacienda Road in Bell Canyon. None of these roads are used as transportation routes for SSFL operations.

3.8.2.2 Collector and Local Arterial Roadways and Traffic

The access roadways discussed above connect to collector and local arterial (public) roadways. These roadways are maintained and operated by local county or city governments and the State of California.

The primary access road, Woolsey Canyon Road, terminates at Valley Circle Boulevard. Current transport vehicles typically travel along Valley Circle Boulevard and Roscoe Boulevard (as shown in Figure 3–28), connecting to Topanga Canyon Boulevard, a local arterial roadway. Other local roads used by personnel and deliveries to and from SSFL include Plummer Street, Box Canyon Road, and Santa Susana Pass Road.

Valley Circle Boulevard. Valley Circle Boulevard is a two-lane collector street with a posted speed limit of 30 miles per hour located in Los Angeles County that intersects Woolsey Canyon Road, Roscoe Boulevard, Plummer Street, and Box Canyon Road. As Valley Circle Boulevard continues southward towards U.S. Highway 101 (Ventura Freeway), it expands into a five-lane road (one two-way left turn lane and four through lanes) that was repaved in 2014. The posted speed varies from a high of 45 miles per hour to a low of 25 miles per hour, in the vicinity of school zones, and 35 miles per hour, in the vicinity of the U.S. Highway 101 interchange.

Roscoe Boulevard. Roscoe Boulevard is an east-west collector street with a posted speed limit of 35 miles per hour located in Los Angeles County, which connects Valley Circle Boulevard with Topanga Canyon Boulevard. Over this distance, Roscoe Boulevard is a two- to-five-lane roadway.

Plummer Street. Plummer Street is an east-west collector street with a posted speed limit of 35 miles per hour located in Los Angeles County which connects Valley Circle Boulevard to Topanga Canyon Boulevard. Over this segment, Plummer Street is a three to-four-lane roadway.

Box Canyon Road. Box Canyon Road is a two-lane, north-south local street located in Los Angeles County which connects Valley Circle Boulevard in Los Angeles County to Santa Susana Pass Road in Ventura County.

Santa Susana Pass Road. Santa Susana Pass Road is a two-lane, east-west local street in Ventura County which connects Box Canyon Road to SR 118 (Ronald Reagan Freeway) at Rocky Peak Road.

Linkage between collector roadways and the non-local Interstate highway system is provided by Topanga Canyon Boulevard and SR 118 (Ronald Reagan Freeway). From SR 118 (Ronald Reagan Freeway) eastbound, transport vehicles can access Interstate 5 and the Interstate Highway System. An alternate route uses U.S. Highway 101 (Ventura Freeway) to connect to Interstate 5.

Topanga Canyon Boulevard. This road is a north-south route that connects with SR 118 (Ronald Reagan Freeway) to the north and U.S. Highway 101(Ventura Freeway) to the south. Topanga

Canyon Boulevard is generally a six-lane urban arterial roadway over this segment with a posted speed limit of 45 miles per hour.

SR 118 (Ronald Reagan Freeway). SR 118 is an 8- lane east-west urban freeway which connects with Interstate 210 to the east and terminates at the SR 126 interchange to the west.

U.S. Highway 101 (Ventura Freeway). U.S. Highway 101, which has an east-west alignment in the vicinity of SSFL, connects with Interstate 5 in downtown Los Angeles to the south and with San Luis Obispo, San Jose, and San Francisco to the north. U.S. Highway 101 is an 8- to 10-lane urban freeway.

Qualitative and quantitative information regarding the roadway conditions of the offsite local surface roads and freeways may impact transportation of wastes from SSFL. Traffic volumes, level of service (LOS), and crash rates are examined as measures of roadway demand.

LOS is a qualitative measurement of operational conditions within the traffic based on factors such as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience, and safety. The Highway Capacity Manual, published by the Transportation Research Board, defines six categories of LOS that reflect the amount of traffic congestion (TRB 2010). The six categories are given letter designations "A" to "F", with "A" representing the best operating conditions, and "F" representing the worst conditions. **Table 3–15** further describes traffic operating conditions for the LOS categories.

Table 3–15 Level of Service Descriptions

LOS	*Operating Conditions*	*Delay*
A	Highest quality of service; free traffic flow, low volumes and densities; little or no restriction on maneuverability or speed.	None
B	Stable traffic flow; speed becoming slightly restricted; low restriction on maneuverability.	None
C	Stable traffic flow, but less freedom to select speed, change lanes, or pass; density increasing. LOS A though C meet Ventura County LOS threshold of acceptability	Minimal
D	Approaching unstable flow; speeds tolerable but subject to sudden and considerable variation; less maneuverability and driver comfort. LOS A through D meet Caltrans LOS threshold of acceptability.	Minimal
E	Unstable traffic flow with rapidly fluctuating speeds and flow rates; short headways, low maneuverability, and lower driver comfort. LOS A through E meets Los Angeles County and City threshold of acceptability.	Significant
F	Forced traffic flow; speed and flow may drop to zero with high densities.	Considerable

Caltrans = California Department of Transportation; LOS = level of service.
Source: TRB 2010.

The Highway Capacity Manual describes specific procedures to determine the LOS based on type of facility, percent traffic occurring in the peak hour (K-factor), the peak and non-peak directional distribution of traffic (D-factor), number of lanes and average daily traffic volumes. In addition, in the case of urban freeways results reflect terrain (i.e., level, rolling, or mountainous) and in the case of urban streets results reflect posted speed limit. Service volume thresholds are established for the LOS based on these factors.

The current LOS operating conditions for various local roadways and urban freeway segments were determined using these threshold values and the results are presented in **Table 3–16**.

As shown, the traffic flow on Woolsey Canyon Road is currently stable, as is the traffic flow on Roscoe Boulevard. Valley Circle Boulevard, however, is currently approaching unstable traffic flow, as is Plummer Street. Traffic flow on U.S. Highway 101 (Ventura Freeway), operating at LOS F, experiences considerable delays, as does State Route 118 (Ronald Reagan Freeway), which operates at LOS E.

Table 3–16 Annual Average Daily Traffic and Level of Service for Selected Local Roadway and Urban Freeway Segments near the Santa Susana Field Laboratory

Road	Segment	Posted Speed Limit	Lanes	K-Factor	D-Factor	ADT	Current LOS [a]
Woolsey Canyon Road [b]	SSFL entrance to Valley Circle Blvd	30	2	0.08	0.55	2,002	LOS B
Valley Circle Blvd [c]	Woosley Canyon to Plummer Street	35	2	0.10	0.55	6,316	LOS D
Plummer Street [b]	Valley Circle Drive to Topanga Canyon Blvd	35	2 to 4	0.10	0.55	5,437	LOS D
Topanga Canyon [b]	Topanga Canyon Boulevard Plummer St to SR 118 (Ronald Regan Freeway)	45	6	0.10	0.55	42,500	LOS D
SR 118 (Ronald Reagan Freeway) [d]	Junction with Topanga Canyon Boulevard	55	8	0.11	0.55	130,000	LOS E
Valley Circle Blvd [c]	Woosley Canyon to Roscoe Blvd	35	2	0.10	0.55	9,000	LOS D
Roscoe Boulevard [b]	Valley Circle Blvd to Topanga Canyon Blvd	45	4	0.10	0.55	7,996	LOS C
Valley Circle Blvd [c]	Roscoe Blvd to Victory Blvd	35	4	0.10	0.55	20,341	LOS D
Valley Circle Blvd [c]	Victory Blvd to U.S. Highway 101	35	4	0.09	0.55	36,237	LOS E
U.S. Highway 101 (Ventura Freeway) [d]	Junction with Topanga Canyon Blvd	55	8	0.11	0.55	240,000	LOS F

ADT = average daily traffic, Blvd = Boulevard; LOS = level of service; SR = State Route.
[a] LOS estimated using Highway Capacity Manual 2010 Exhibit 16-14 or Exhibit 15-30 (TRB 2010).
[b] Data source Urban Crossroads 2011.
[c] Data source Caltrans 2013.
[d] Data source Caltrans 2012.

The California Highway Patrol collects data on collisions in the state, and maintains the information in the Statewide Integrated Traffic Records System. **Table 3–17** provides the collision data for local roadways used for DOE shipments from Area IV.

Table 3–17 Collision Data for Local Roadways (January 2012 through December 2012)

Roadway	Crashes	Crash Rate [a]
Roscoe Boulevard	14	2.65
Topanga Canyon Boulevard	59	1.53
Valley Circle Boulevard	8	2.04

[a] Per 1,000,000 vehicle-miles of travel.
Source: CHP 2012.

3.8.2.3 Pavement Condition–Offsite Local Roadways

Public roadways are designed to meet specific weight-bearing criteria. Standard three or four axle trucks are typically limited to 20 ton loads on public roadways. Tandem trailer five or six axle trucks are typically limited to 30 ton loads on public roadways. The condition of a roadway reflects its construction, history of its use, type of vehicles and amount of traffic, and maintenance history.

A study in 2012 evaluated the condition and performance potential for selected local offsite roadways used by DOE for transport to and from SSFL. The study was limited to a visual assessment of pavement roughness and structural distress to describe and rate the current condition. Roadways were assigned a performance serviceability rating. On a scale of zero to five, zero is the lowest rating and five is the best rating (Urban Crossroads 2012). Results of this study are summarized in **Table 3–18**. The study found that segments of both Woolsey Canyon Road and

Roscoe Boulevard are in poor to average condition, suggesting a need for road maintenance and improvements. Topanga Canyon Boulevard, which supports higher volumes of traffic, is also showing evident deterioration.

Table 3–18 Pavement Conditions of Selected Local Collector Streets

Roadway	*Distress Type*	*Rating*
Woolsey Canyon Road	Poor to average condition: fatigue cracking and longitudinal cracking in some segments; generally passable condition; poor condition west of Summerwind Court	1 to 3
Valley Circle Boulevard (North of Roscoe Boulevard)	Most segments in average to good condition; longitudinal cracking is evident in some segments of the local transportation route	3 to 4
Plummer Street	Generally average condition with minimal cracking and some surface wear; one segment in the local transportation route is in poor condition	2 to 3
Roscoe Boulevard	Segments west of Fallbrook Avenue are damaged with substantial fatigue (alligator) and longitudinal cracking; segments closer to Topanga Canyon Boulevard in average condition	1 to 3
Topanga Canyon Boulevard	Roadway in poor to average condition; some repaired segments with lateral and longitudinal cracking	2 to 3

Source: Urban Crossroads 2012.

3.8.3 Non-Local Offsite Transportation to Waste Management Facilities

Table 3–19 summarizes 12 representative waste management facilities that are analyzed in this EIS. Nearly all the facilities are located in rural areas characterized by low levels of congestion. However the three recycle facilities (Kramer Metals, Standard Industries, and Gillebrand) are located in developed urban areas where access roadways experience moderate levels of traffic congestion.

Table 3–19 Representative Waste Management Facilities

Site	*Facility Location*	*Level of Roadway Congestion*	*Distance From SSFL (miles)*	*Materials Accepted: Recycled Materials* [a]	*Materials Accepted: Nonhazardous Waste*	*Materials Accepted: Hazardous Waste*	*Materials Accepted: LLW/ MLLW*
Representative Waste Disposal Facilities in California							
McKittrick	McKittrick, CA	Low	88		x		
Chiquita Canyon	Castaic, CA	Low	32		x		
Antelope Valley	Palmdael, CA	Low	38		x		
Mesquite	El Centro, CA	Low	250		x		
Buttonwillow	Buttonwillow, CA	Low	120			x	
Westmorland	Westmorland, CA	Low	230			x	
Representative Waste Disposal Facilities Outside California							
US Ecology	Grandview, ID	Low	900			x	
Nevada National Security Site	Nye County, NV	Low	330				x
Energy*Solutions*	Clive, UT	Low	710				x
Representative Recycle Facilities [b]							
Kramer Metals	Los Angeles, CA	Moderate	44	x			
Standard Industries	Ventura, CA	Moderate	28	x			
Gillibrand	Simi Valley, CA	Moderate	Less than 10	x			

CA = California; ID = Idaho; LLW = low-level radioactive waste, MLLW = mixed low-level radioactive waste; NV = Nevada; UT = Utah.

[a] Materials such as recyclable metals from buildings with no radiological history.

[b] Waste disposal does not occur at the three listed recycle facilities; some of the listed waste disposal facilities also conduct recycle operations.

Major highway routes in proximity to the SSFL that may be used for waste transport include SR 118 (Ronald Reagan Freeway), Interstate 5 (north-south), Interstate 15 (north-south), U.S. Highway 101 (north), and Interstate 10 (east-west). **Figure 3–29** shows typical truck routes for soil and debris transport to the representative waste management facilities in California, including the intermodal (truck and train) route to the Mesquite landfill. Shown on **Figure 3–30** are truck routes to representative recycle facilities.

In previous years LLW was shipped approximately 270 miles to the DOE Nevada National Security Site (NNSS) (formerly Nevada Test Site) near Las Vegas Nevada, approximately 1,100 miles to the DOE Hanford Site in Richland, Washington, or 750 miles to Energy*Solutions* (formerly Envirocare, a permitted commercial radioactive disposal facility in Clive, Utah). Nonradioactive waste was shipped to Bradley landfill in Sun Valley, California (approximately 25 miles east of SSFL). **Figure 3–31** shows typical truck routes to the LLW, MLLW, and hazardous waste disposal facilities in Nevada, Utah, and Idaho. MLLW includes both LLW and hazardous chemicals. **Figure 3–32** shows intermodal routes to the same out of state facilities.

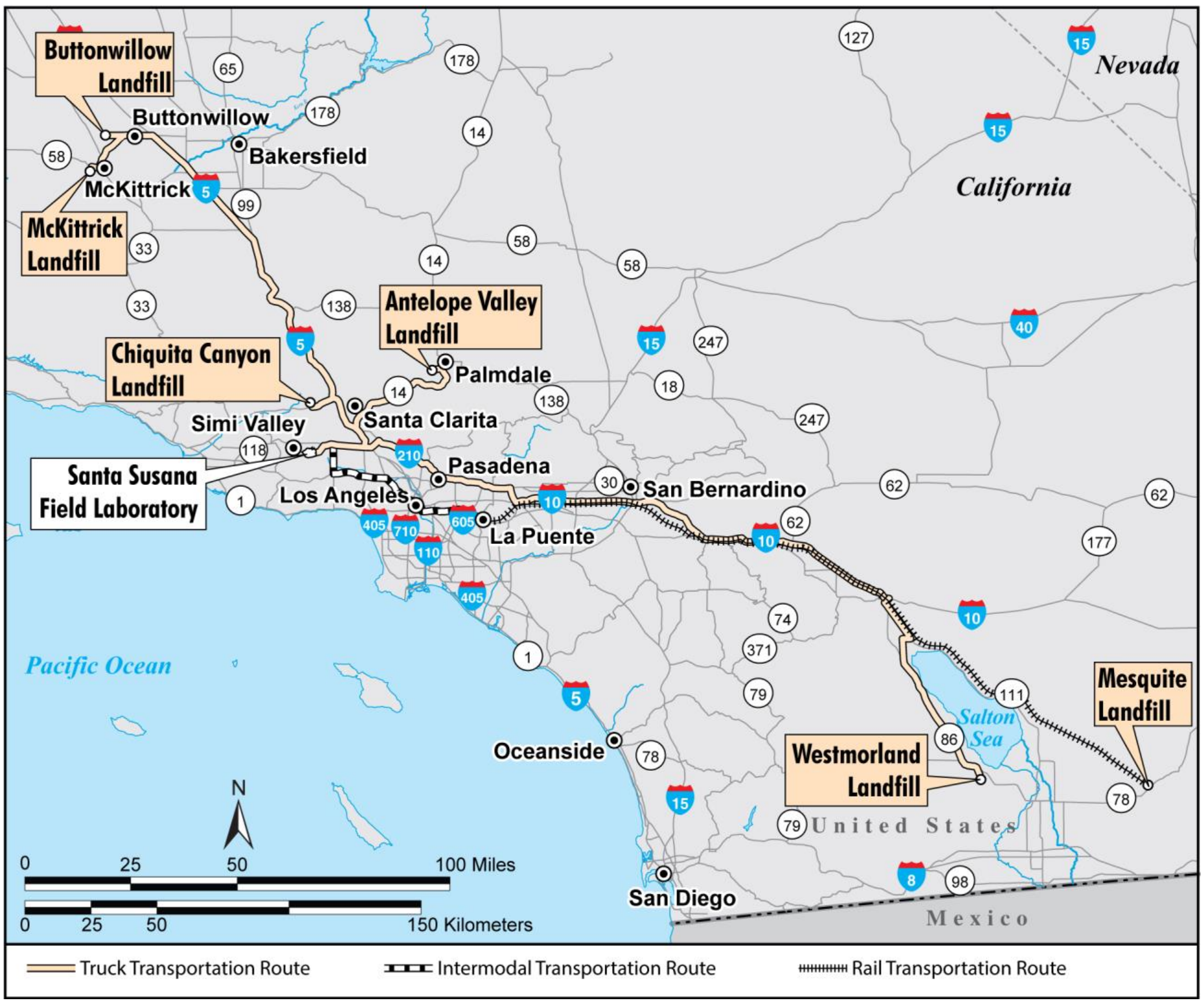

Figure 3–29 Truck and Intermodal (Truck and Rail) Routes to Representative California Waste Management Facilities

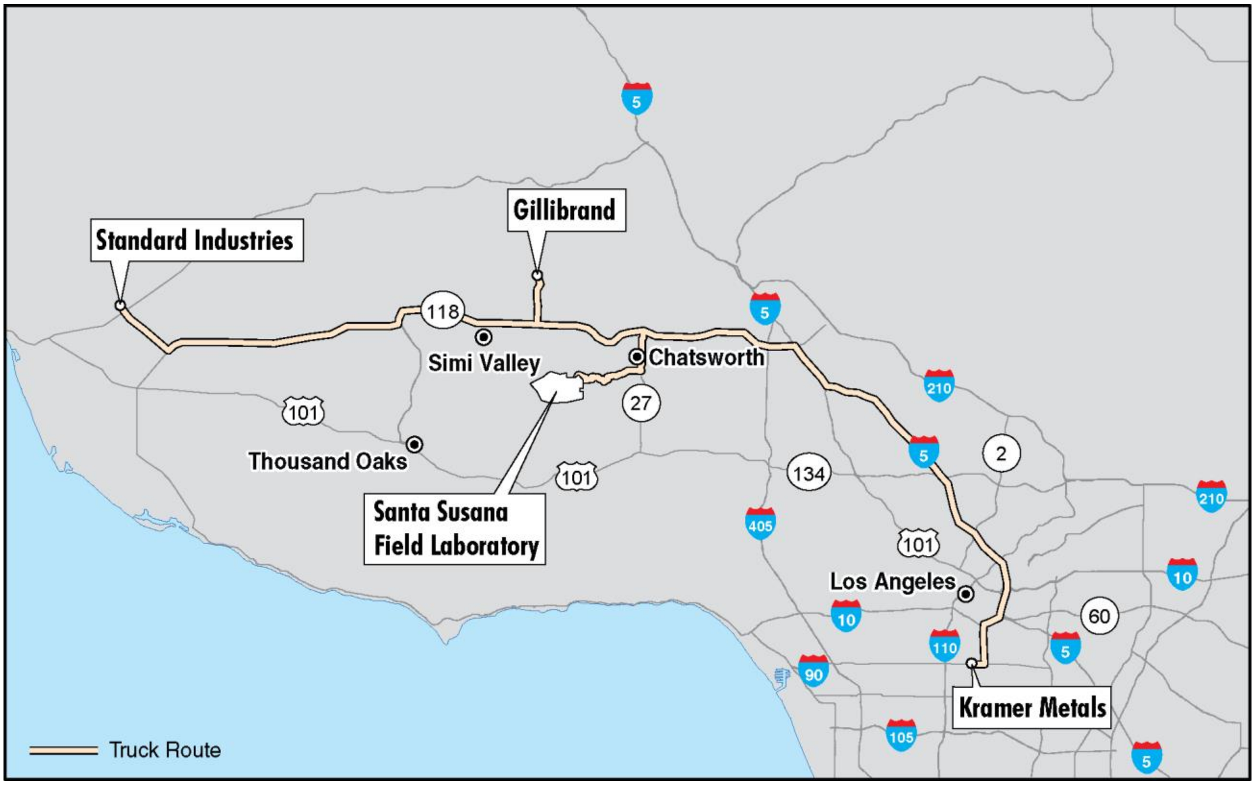

Figure 3–30 Truck Routes to Representative Recycle Facilities

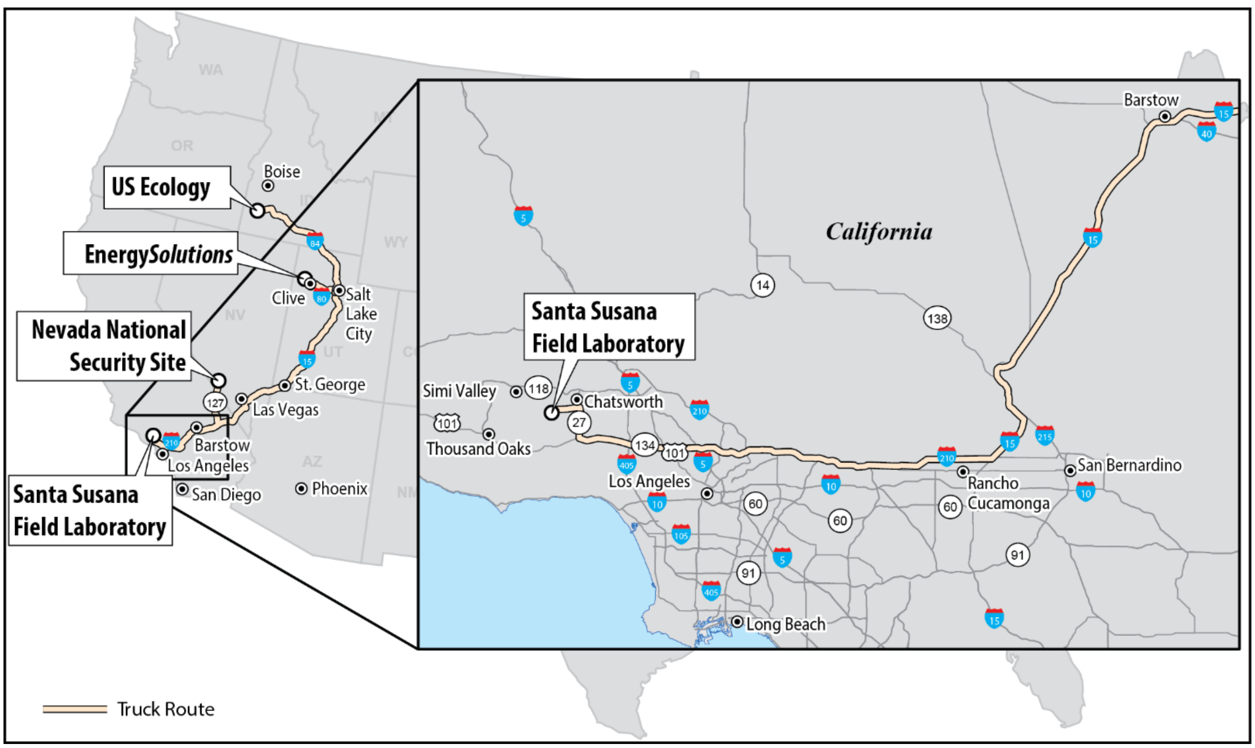

Figure 3–31 Truck Routes to Waste Management Facilities in Nevada, Utah, and Idaho

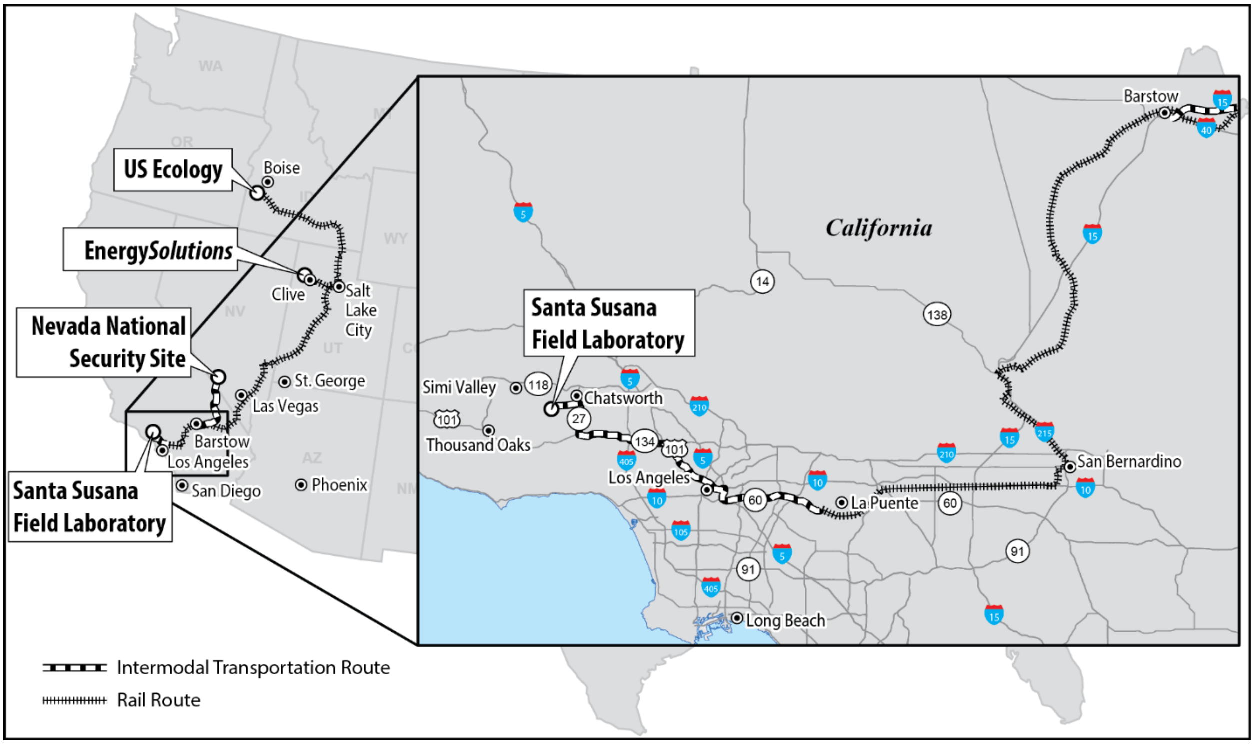

Figure 3–32 Intermodal (Truck and Rail) Routes to Waste Management Facilities in Nevada, Utah, and Idaho

3.8.4 Traffic and Level of Service on Non-Local Highways

Vehicles carrying shipments will access the interregional highway system. From Topanga Canyon Boulevard or Valley Circle, vehicles travel on a series of freeways and highways to reach the waste disposal sites. These roadways serve intraregional, interregional, and interstate travel and shipping.

Figures 3–33 and **3–34** illustrate freeway speeds during peak hours in 2008 and 2035, respectively, as reported in the Southern California Association of Governments' *Regional Transportation Plan 2012–2035, Sustainable Communities Strategy* report (SCAG 2012). Any Interstate freeway segment shown in this figure as red, orange, or yellow would function at degraded service levels, below the threshold criteria for all managing jurisdictions in the region. Comparing the two figures shows an anticipated reduction in speeds on highways used by DOE for transport of materials from SSFL. This report also indicates that truck traffic on many key corridors is anticipated to grow substantially between 2008 and the 2035 baseline forecast. Without an increase in capacity, truck and auto delay will increase substantially, truck-involved accidents will be more frequent, and the levels of harmful emissions will rise.

3.8.5 Railroads

The regional rail network is shown in **Figure 3–35**. Rail routes to representative waste management facilities are shown on Figures 3–29 and 3–32. Burlington Northern Santa Fe Railway and Union Pacific Railroad offer service from the intermodal terminal at the Port of Los Angeles to Las Vegas and Salt Lake City. Additionally a new intermodal terminal (Puente Hills Intermodal Facility) is under construction in the City of Industry, California. This facility anticipates opening in 2017.

The nearest existing rail line to the SSFL is a Los Angeles Metropolitan Transportation Authority/Union Pacific line located approximately two miles northeast of the SSFL. This is a high-speed public transportation line with no intermodal service.

Figure 3–33 Base Year 2008 Freeway Speed – PM Peak (3pm-7pm)

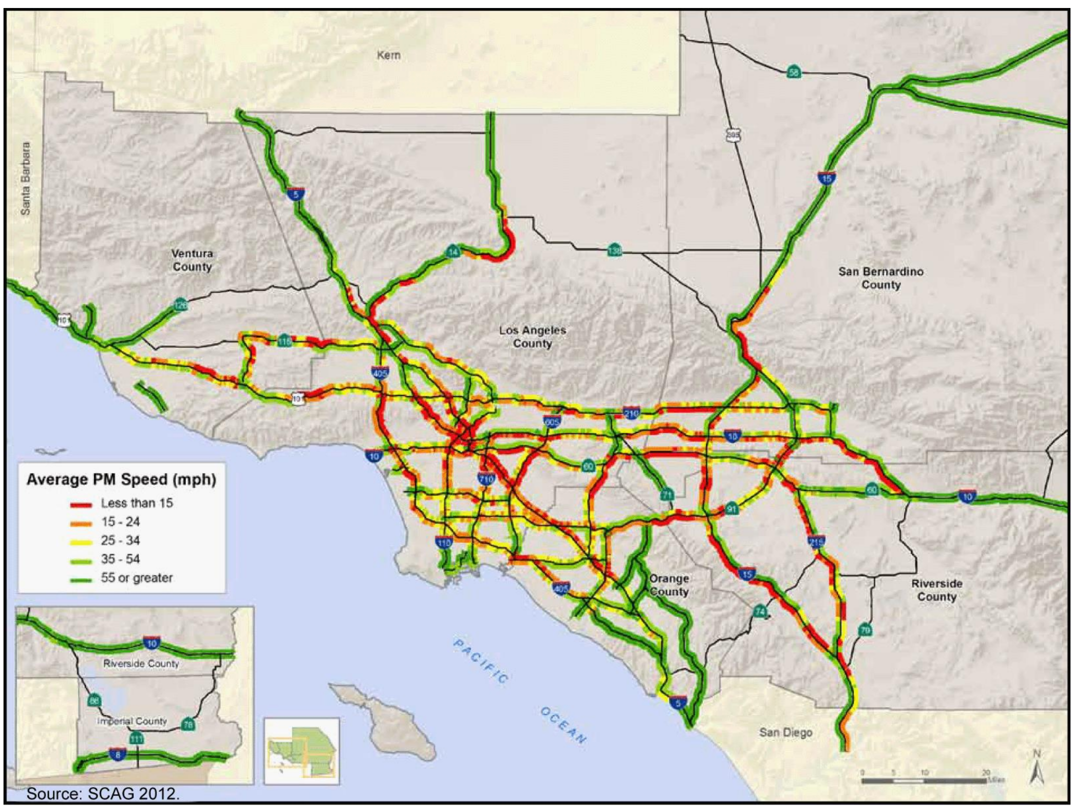

Figure 3–34 Baseline 2035 Freeway Speed – PM Peak (3pm-7pm)

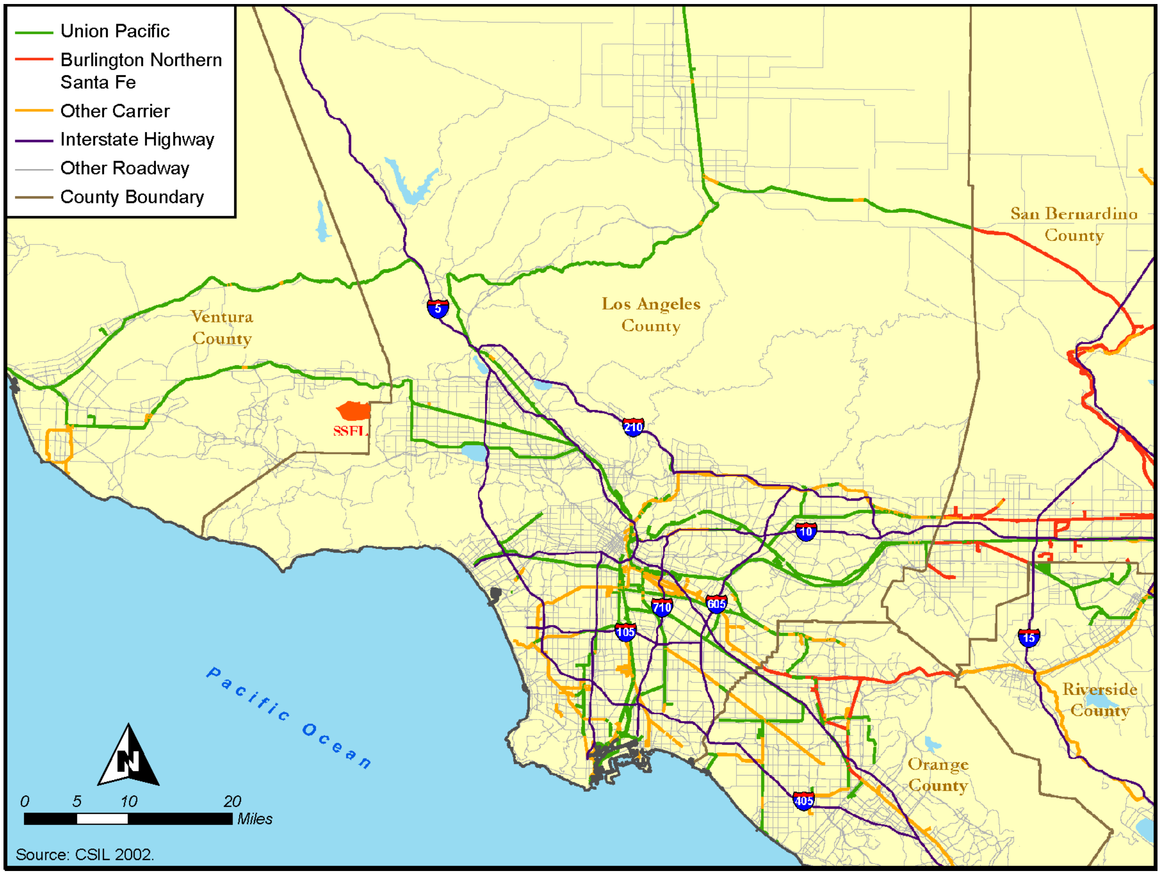

Figure 3–35 Regional Rail Network near the Santa Susana Field Laboratory

3.8.6 Santa Susana Field Laboratory Transportation Management

Onsite transportation for Area IV is governed by a Transportation Agreement between DOE, NASA and Boeing (Boeing 2015a). The agreement describes methods used to control truck traffic. A maximum of 96 truckloads can leave SSFL, between the hours of 7 AM and 5 PM, and with no less than 5-minute intervals between each departing truckload, in order to minimize traffic and local bottlenecks on Woolsey Canyon road. Each party (DOE, NASA, and Boeing) is allocated 32 truckloads per day, but may transfer these to the other parties. Traffic is reviewed monthly, and the parties may increase or decrease the maximum number of truckloads in order to support onsite activities and maintain adequate traffic flow on Woolsey Canyon Road.

3.9 Human Health and Safety

This section describes the current environment relative to site worker and public health and safety. This description includes a summary of the characterization data for buildings, soils, and bedrock subject to remediation. Because the topic of radiation exposure is of interest to the public, this section also presents data on the annual radiation exposure received by an average individual in the United States. For purposes of this EIS, the ROI for human health and safety consists of SSFL Area IV and the NBZ.

3.9.1 Occupational Health and Safety

There are no ongoing operations or decontamination and decommissioning activities in Area IV. Most of the personnel involved in Area IV activities over the last few years were performing site characterization and monitoring activities. Most of the doses as recorded by personnel dosimeters were reported at the minimal reporting level of 1 millirem, with the highest reported dose being 3 millirem (CDM Smith 2016b). These doses fall within the limits of DOE's occupational radiation protection regulations (10 CFR Part 835), which limit the maximum dose to an individual worker to 5,000 millirem in a year, with a further requirement to maintain radiological exposures to levels as low as reasonably achievable (ALARA). For ALARA purposes DOE has established an Administrative Control Level of 2,000 millirem per year per individual and site contractors set facility-specific administrative control levels below the DOE level.

Radiation Information

Alpha – Alpha particles consist of two protons and two neutrons. They can travel only a few centimeters in air and can be stopped easily by a sheet of paper or by the skin's surface.

Beta – Beta particles are smaller and lighter than alpha particles and have the mass of a single electron. A high-energy beta particle can travel a few meters in the air. Beta particles can pass through a sheet of paper, but may be stopped by a thin sheet of aluminum foil or glass.

Gamma – Gamma rays (and x-rays), unlike alpha or beta particles, are waves of pure energy. Gamma radiation is very penetrating and can travel several hundred feet in air. Gamma radiation requires a thick wall of concrete, lead, or steel to stop it.

Roentgen – A unit of exposure to ionizing radiation equal to the amount of gamma or x-rays that produces one electrostatic unit charge in a cubic centimeter of air.

Rem – A unit of radiation dose used to measure the biological effects of different types of radiation on humans. The dose in rem is estimated by a formula that accounts for the type of radiation, the total absorbed dose, and the tissues involved. One thousandth of a rem is a millirem.

Curie – The basis unit used to describe the intensity of radioactivity in a sample of material; it is equal to 37 billion disintegrations per second. One trillionth of a curie is a picocurie.

Workers at DOE facilities are subject to DOE requirements in 10 CFR Part 851 for occupational safety. DOE requirements in 10 CFR Part 851 for worker health and safety include compliance with safety and health standards promulgated by the Occupational Safety and Health Administration, the American Conference of Governmental Industrial Hygienists, and the American National Standards Institutes, and conduct of activities in accordance with written Worker Safety and Health Programs. The programs have been developed and are implemented by DOE contractors performing various activities at Area IV in support of site remediation and closure (e.g., Boeing 2012b; CDM Smith 2012). They include procedures that address possible chemical, physical, biological, and safety workplace hazards; worker training and monitoring; audits; and recordkeeping. Hazard controls are based on the following hierarchy: (1) elimination or substitution of hazardous materials, (2) engineering controls, (3) worker practices and administrative controls that limit worker exposure, and (4) personal protective equipment.

DOE's Computerized Accident/Incident Reporting System (CAIRS) provides statistics on worker injury and illness information, including accidents involving government-owned systems. From 2008 through the first half of 2014, a single worker injury was reported to CAIRS for ETEC (that occurred while moving a desk) (Macon 2014).

3.9.2 Public Radiation Exposure

Before decontamination and decommissioning (D&D) activities were suspended in 2007, members of the public received very small annual radiation doses due to airborne releases from the RMHF stack.[9] As indicated in annual site reports since 2006, the potential radiation dose to the public through airborne releases was zero, and the dose from direct radiation was indistinguishable from background. The latter can be attributed to the shielding provided by the high rocky terrain around the SSFL site (Boeing 2007b, 2008a, 2009b, 2010b, 2011b, 2012a, 2013b, 2014c).

DOE collects air samples and monitors ambient radiation at locations in and around Area IV and the NBZ. Air samplers run continuously and the filters are collected weekly for analysis. Offsite ambient radiation dosimeters are located at the SSFL Main Gate and at background locations in West Hills and West Lake Village. The ambient radiation dosimeters are collected for analysis quarterly.

A person visiting Area IV would be on site for a much shorter period of time than the Area IV and NBZ workers who perform routine monitoring and maintenance. Consequently, a site visitor's exposure to chemicals or radionuclides at Area IV and the NBZ would be much less than that of an Area IV and/or NBZ worker. Therefore, the radiation dose to a site visitor would be less than the 1 millirem per year that has been reported for workers in recent years.

This dose is small compared to other radiation doses a person may receive. Major sources and levels of background radiation exposure to members of the public in the vicinity of SSFL are assumed to be similar to those for the average individual in the United States population. As shown in **Table 3–20**, an average individual in the United States receives an annual radiation dose of approximately 311 millirem from natural background sources, plus about the same radiation dose from other sources, particularly diagnostic x-rays and nuclear medicine. Levels of background radiation received by members of the public may vary widely depending on environmental factors such as elevation and geology or other factors such as medical procedures or lifestyle choices.

Table 3–20 Average Annual Radiation Exposure of Individuals in the United States

Source	*Effective Dose (millirem per year)*
Natural background radiation	
Cosmic and external terrestrial radiation	54
Internal terrestrial radiation	29
Radon-220 and -222 in homes (inhaled)	228
Other background radiation	
Diagnostic x-rays and nuclear medicine	300
Occupational	0.5
Industrial, security, medical, educational, and research	0.3
Consumer products	13
Total (rounded)	**620**

Source: National Council on Radiation Protection (NCRP 2009).

[9] Based on estimated releases from the RMHF stack (Boeing 2007b, 2008a) and the standard risk conversion factor used by DOE (DOE 2003b), the annual risk of a latent cancer fatality for the maximally exposed individual in 2006 and 2007 was less than 1 in 1 trillion, or essentially zero.

Radiation Basics

What is radiation? Radiation is energy. Nuclear radiation is energy emitted from unstable (radioactive) atoms in the form of energetic atomic particles or electromagnetic waves. This type of radiation is also known as ionizing radiation because it can produce charged particles (ions) in matter.

What is radioactivity? Radioactivity is the process of unstable (radioactive) atoms trying to become stable and is the same as radioactive decay. Radiation is emitted in the process. In the United States, radioactivity is measured in units of curies (Ci). Smaller fractions of the curie are the millicurie (1 mCi = 1/1,000 Ci), the microcurie (1 μCi = 1/1,000,000 Ci), and the picocurie (1 pCi = 1/1,000,000,000,000 Ci).*What is radioactive material?* Radioactive material is any material containing unstable atoms that emits radiation.

What are the four basic types of ionizing radiation?

Alpha (α) – Alpha particles consist of two protons and two neutrons. They can travel only a few centimeters in air and can be stopped easily by a sheet of paper or by the dead layer of the skin's surface.

Beta (β) – Beta particles are smaller and lighter than alpha particles and have the mass of a single electron. A high-energy beta particle can travel a few meters in the air. Beta particles can pass through a sheet of paper, but may be stopped by a thin sheet of aluminum foil or glass.

Gamma (γ) – Gamma rays (and x-rays), unlike alpha or beta particles, are waves of pure energy. Gamma radiation is very penetrating and can travel several hundred feet in air. Gamma radiation requires several inches of concrete, lead, or steel to stop it.

Neutrons (n) – A neutron is an atomic particle that has about one-quarter the weight of an alpha particle. Like gamma radiation, it can easily travel several hundred feet in air. Neutron radiation is most effectively stopped by materials with high hydrogen content, such as water or plastic.

What are the sources of radiation?

Natural sources of radiation – (1) Cosmic radiation from the sun and outer space; (2) natural radioactive elements in the Earth's crust; (3) natural radioactive elements in the human body; and (4) radon gas from the radioactive decay of uranium naturally present in the soil.

Man-made sources of radiation – Medical radiation (x-rays, medical isotopes), consumer products (smoke detectors), nuclear technology (nuclear power plants, industrial x-ray machines), and worldwide fallout from past nuclear weapons tests or accidents.

What is radiation dose? Radiation dose is the amount of energy from ionizing radiation absorbed per unit mass of any material. For people, radiation dose is the amount of energy absorbed in human tissue. In the United States, radiation dose is usually measured in units of rad (radiation absorbed dose) or rem (roentgen equivalent man). A smaller fraction of the rem is the millirem (1 millirem = 1/1,000 rem).

3.9.3 Radiological and Chemical Site Characterization

Investigation of releases of radionuclides began in the 1960s as part of routine monitoring of all facilities. When observed, radioactively contaminated soil and bedrock was removed in accordance with then-current standards, either as part of an interim removal action or when a facility was demolished. Since that time, various other investigations of historical chemical and radioactive constituents were undertaken, the most recent and comprehensive being the soil characterization studies described in Section 3.9.3.2 undertaken by DOE and EPA.

3.9.3.1 Building Radiological Characteristics

There are 18 DOE structures remaining in SSFL Area IV, including 2 open-walled roofed structures, and six paved yards and concrete slabs proposed for demolition. Based on process knowledge and/or prior free-release determinations, three of the structures are radiologically contaminated, and 15 are not considered to be radiologically impacted. For the RMHF and 4019 paved/concrete areas, no surface contamination data were available. Of the remaining 10 structures, 2 have subgrade structures containing vaults and test cells.

Characterization data for the structures that are radiologically contaminated are shown in **Table 3–21**. These data, including the building footprint, the interior surface areas, levels of alpha and beta activity on interior surfaces, and doses rate in the structures, were obtained from various building survey reports (AREVA 2008; Boeing 2007d, 2007e, 2014d; HGL 2012a). The structure dimensions were used to estimate the total contaminated surface area of each building (assuming exterior surfaces of buildings were insignificantly contaminated). The levels of alpha and beta activity were determined through surveys of the structures. Total activity represents the activity measured on a building surface using a radiation survey instrument; it includes fixed and removable activity. Removable activity represents the activity that can readily be removed from the building surface and is determined by swiping or smearing a section of the surface with a test paper while applying moderate pressure, then measuring the activity on the test paper.

Table 3–21 Summary of Radiological Characteristics of Santa Susana Field Laboratory Area IV Buildings

Building	***Footprint Floor Area (square meters)*** [a]	***Surface Area Represented (square meters)*** [a]	***Total Alpha Activity*** [b] ***(dpm per 100 cm²)***	***Removable Alpha Activity*** [b] ***(dpm per 100 cm²)***	***Total Beta Activity*** [b] ***(dpm per 100 cm²)***	***Removable Beta Activity*** [b] ***(dpm per 100 cm²)***	***Maximum External Dose Rate (microR per hour)***
4021 – RMHF Decontamination Facility	325	1,951	**400**	20	420,000	685	**4,000**
4022 – RMHF	362	1,812	153	20	6,932	100	**60**
4022 – RMHF Sub-grade Vaults	201	1,374	74	**20**	95,834	1,500	**0**
4024 – Including Test Cells and core bores	491	3,117	**0**	**0**	3,294	**0**	**0**
4024 – Paved Yard and Concrete Slabs	2,676	2,676	41	**0**	844	**0**	**0**

cm^2 = square centimeters; dpm = disintegrations per minute; R = roentgen; RMHF = Radioactive Materials Handling Facility.

[a] Footprint and surface area represented are estimated from building dimensions. The footprint approximates the land area occupied by the structure. The surface area represents interior surfaces (walls, floors, ceilings) assumed to be contaminated.

[b] Activity values presented are the maximum if shown in bold or the median (the middle-most result of all of the samples collected for the structure) if shown in plain text. Some alpha and beta activity values are estimates developed by applying a ratio to other presented data.

3.9.3.2 Area IV Soil Chemical and Radiological Characterization

Prior to 2010, soil investigations were governed by the 2007 CO (DTSC 2007) issued by the California DTSC. In 2010, DOE and DTSC signed the 2010 AOC (DTSC 2010a), which changed the manner in which DOE completed the investigation of soil contamination. The 2010 AOC specified that EPA would perform radiological characterization, an effort that had already been initiated. DOE was responsible for characterizing the chemical constituents in the soil.

In June 2009, DOE provided EPA with funding to perform a radiological study of Area IV and the NBZ. EPA's work produced the definitive characterization of radionuclides within Area IV and the NBZ. According to EPA, this effort is one of the most comprehensive technical investigations ever undertaken for low-level radioactive contamination (EPA 2012). There are three parts to EPA's work:

Historical Site Assessment (HSA). EPA conducted an independent review of documents and aerial photographs concerning past radiological operations and past spills and releases of radioactive materials at SSFL. The goal of this project was to identify the universe of potential radiological contaminants and locations where radiological contaminants remaining in Area IV and the NBZ might be located. The extensive historical research performed by EPA during the HSA found no evidence that DOE conducted operations or used land in the NBZ. The results of the HSA were compiled in the *Final Historical Site Assessment Report* (HGL 2012a).

Gamma Radiation Scan. EPA used sensitive survey instruments to scan the accessible areas of Area IV and the NBZ to identify locations of elevated gamma radiation. Locations having elevated levels of gamma radiation were identified by EPA for sampling and analysis for a full range of potential radiological contaminants.

Radiological Site Characterization. EPA's final site characterization task included analyzing the soil, groundwater, and surface water for a broad range of potential radiological contaminants. In all, EPA collected 3,487 soil samples and 55 sediment samples for radiological characterization. Cesium-137 and strontium-90 were the two site-related radionuclides most frequently observed in the samples. Results of the radiological characterization effort are presented in the *Final Radiological Characterization of Soils, Area IV and the Northern Buffer Zone, Area IV Radiological Study, Santa Susana Field Laboratory, Ventura County, California* (HGL 2012b).

Soil samples were analyzed for up to 55 radionuclides, depending on the operational history of the area being sampled; not all samples were analyzed for all radionuclides. Of the 55 radionuclides analyzed, 28 were reported as exceeding EPA's instrument detection limits, and 17 of those radionuclides were naturally occurring radionuclides. The remaining 11 radionuclides reported by EPA, therefore, could be attributed to site operations. These 11 radionuclides include americium-241, cesium-137, cobalt-60, curium-243/244, europium-152, europium-154, nickel-59 plutonium-238, plutonium-239/240, strontium-90 and tritium (HGL 2012b). EPA conducted an extensive background study for the presence of radionuclides in the region of SSFL that demonstrated the variability in the levels of activity of naturally occurring radionuclides. Therefore, EPA noted that activity levels of some radionuclides could exceed background levels without being attributed to site operation. EPA identified potassium-40, thorium-232, uranium-235 and uranium-238 as the naturally occurring radionuclides. EPA determined that only four locations required further evaluation of natural occurring radionuclides and also recommended that DOE review decay series and radionuclide ratios before determining the origin of the radionuclides (HGL 2012b).

DOE's soil sampling for chemical analysis was conducted in three phases. In Phase 1, EPA collected two soil samples at its sampling locations, providing one to DOE for chemical analysis. This phase included sampling the drainages leading into the NBZ and drainages in Area III. Phase 2 involved random soil sampling with EPA in the NBZ.

Phase 3 soil sampling was based on a data gap analysis using the information collected for Area IV to determine where additional soil sampling was needed. DOE's Phase 3 sampling only involved analysis of samples for chemicals because EPA conducted its own independent Phase 3 radiological soil sampling. During the three 2010 AOC (DTSC 2010a) sampling phases, 5,854 soil samples were collected for chemical analysis. These samples, when added to the 2,000 samples collected during RFIs, means that nearly 8,000 soil samples have been collected and analyzed for chemical constituents in Area IV. The most frequently observed chemicals in soils were PCBs (from electrical components), PAHs (from fuels and burning of wastes), dioxins (from burning of wastes), petroleum chemicals (mostly from diesel fuel), mercury (from electrical components and energy transfer medium), and silver (from photographic wastes).

The soil characterization data are summarized in **Table 3–22** for chemicals and **Table 3–23** for radionuclides. Table entries are representative concentrations for each of the sub-areas of SSFL Area IV shown on **Figure 3–36**. In order to focus on the primary chemicals of concern from a health impacts perspective, Table 3–22 presents the principal chemical risk drivers. These are chemicals constituents with concentrations that represent a greater-than-1 in 1 million risk of developing a cancer and/or have a toxicity hazard quotient[10] greater than 1 based on a suburban residential exposure scenario. A list of all of the chemicals detected from the field investigations is included in Appendix G.

To provide perspective on the concentrations of chemicals and radionuclides in the soil, Tables 3-22 and 3–23 also show risk-based screening levels (RBSLs) and the LUT values for each constituent. The RBSLs presented are the lower of the concentration that would result in a cancer risk of 1 in 1 million or a hazard quotient of 0.1. Soil exposures used for the RBSL are based on the suburban residential scenarios presented in the *Final Standard Risk Assessment Methodology Revision 2 Addendum, Santa Susana Field Laboratory, Ventura, California* (MWH 2014), which includes a 30-year exposure duration. The LUT values are the AOC-stipulated remediation concentrations and are based on the higher of either the background threshold values or the reporting limits for chemicals and radiological reference concentrations for radionuclides.

3.9.3.3 Radiological Characterization of Groundwater Seep and Bedrock

As discussed in Section 3.4.2.6, there is a tritium groundwater plume beneath about 4.4 acres of land southwest of the RMHF, west of Building 4010 (SNAP 8ER), and east of former Building 4059. As long as the tritium remains below ground and on the SSFL, it does not result in any exposure of humans or other biological receptors. However, some level of tritium contamination has been measured in groundwater seeps at the ground surface on the slope to the northwest of the plume.

The concentration of tritium in seep water as reported in the *SSFL Area IV RCRA Facility Investigation Groundwater Work Plan* ranged from less than 260 to 2,500 picocuries per liter (CDM Smith 2015a). The highest value reported of 2,500 picocuries per liter is a factor of 8 less than the EPA drinking water MCL for drinking water of 20,000 picocuries per liter (40 CFR 141.66).

Section 3.4.2.7 discusses concentrations of strontium-90 and TCE that have been detected in the groundwater in the vicinity of the RMHF and identifies the source as a former leach field associated with RMHF operations. In 1978, contaminated soil from the leach field was removed to bedrock and a portion of the underlying bedrock containing radioactive material was also removed. The environmental report on the removal of the leach field states that after excavation, on average, 300 picocuries per gram of strontium-90 and traces of cesium-137 remained in bedrock cracks (Rockwell 1982). The bedrock was sealed with a bituminous asphalt mastic material and Area IV and the NBZ were backfilled with 10 feet of soil.

[10] A hazard quotient is a unitless value determined by (1) dividing the exposure concentration by the reference concentration reported in the EPA Integrated Risk Information System for direct inhalation exposures, or (2) dividing the average daily dose by the reference dose for oral exposures. The reference concentration is an estimate of a continuous exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime.

Table 3–22 Mean Chemical Concentrations in Soil at Santa Susana Field Laboratory Area IV and the Northern Buffer Zone

Constituent	Sub-area									RBSL Value [a]	LUT Value [b]
	3	5A	5B	5C	5D	6	7	8	NBZ		
	Concentrations of chemicals in milligrams per kilogram of soil										
Aluminum	13,000	17,000	16,000	17,000	24,000	15,000	14,000	22,000	12,000	75,300	58,600
Antimony	0.16	0.26	0.15	0.32	0.46	0.20	8.6	0.78	0.31	26	0.86
Arsenic	4.7	5.8	5.6	5.7	7.9	5.9	7.4	5.9	6.1	0.0658	46
Barium	89	110	110	110	130	100	96	110	83	11,000	371
Beryllium	0.56	0.71	0.64	0.69	0.86	0.65	0.60	0.75	0.52	31	2.2
Chromium	18	25	23	23	34	22	22	28	16	37,200	94
Chromium, hexavalent	–	0.61	0.53	0.71	0.67	0.66	0.76	0.55	0.84	1.29	2.0
Cobalt	5.5	6.7	6.6	7.0	10	7.0	6.3	8.5	5.4	22.8	44
Copper	71	14	12	12	17	13	13	16	15	3,040	119
Cyanide	–	–	–	1.2	0.22	–	0.57	0.27	0.81	45.6	0.6
Lithium	21	24	24	22	26	24	24	24	25	152	91
Manganese	250	300	290	280	380	280	280	360	290	6,130	1120
Mercury	0.04	0.062	0.071	0.087	0.42	0.19	0.036	0.055	0.83	16.8	0.13
Molybdenum	0.55	0.85	0.67	0.63	0.63	0.74	0.73	0.62	0.56	380	3.2
Nickel	11	15	14	14	23	15	13	17	10	908	132
Thallium	0.26	0.30	0.28	0.28	0.36	0.28	0.28	0.31	0.25	0.76	1.2
Vanadium	36	42	40	42	62	39	40	52	32	188	175
Zinc	77	81	75	79	80	82	100	71	62	22,800	215
Zirconium	1.8	2.7	2.5	3.8	4.6	2.4	2.6	3.9	3.5	6.09	19
Benzo(a)anthracene	0.023	0.041	0.078	0.035	0.076	0.036	0.29	0.018	0.014	0.387	c
Benzo(a)pyrene	0.011	0.028	0.12	0.029	0.059	0.034	0.22	0.014	0.013	0.0387	c
Benzo(b)fluoranthene	0.020	0.040	0.12	0.038	0.064	0.047	0.26	0.014	0.012	0.387	c
Benzo(k)fluoranthene	0.016	0.020	0.044	0.023	0.055	0.024	0.16	0.0098	0.0096	0.387	c
Dibenzo(a,h)anthracene	0.0033	0.010	0.039	0.011	0.027	0.0094	0.025	0.0061	0.0077	0.113	c
Indeno (1,2,3-cd)pyrene	0.0063	0.013	0.26	0.020	0.045	0.019	0.044	0.0056	0.0084	0.387	c
N-Nitrosodimethylamine	–	0.00074	0.0044	0.0079	0.0021	0.058	0.029	--	0.0035	0.0325	0.010
Aroclor 1248	–	0.0052	0.37	0.0037	0.061	0.26	0.0020	0.31	1.3	0.23	0.017
Aroclor 1254	0.037	0.012	0.047	0.031	0.040	0.15	0.029	0.043	0.083	0.23	0.017

Constituent	Sub-area 3	5A	5B	5C	5D	6	7	8	NBZ	RBSL Value [a]	LUT Value [b]
	Concentrations of chemicals in milligrams per kilogram of soil										
Aroclor 1260	0.039	0.030	0.036	0.025	0.0088	0.048	0.024	0.0081	0.14	0.23	0.017
Aroclor 5460	0.056	0.016	0.020	0.018	0.0060	0.17	0.034	0.079	0.036	0.23	0.050
Total TCDD TEQ	0.0000035	0.0000071	0.0000063	0.0000067	0.0000044	0.000015	0.0000065	0.0000018	0.0000030	0.0000048	0.000000912 [d]

LUT = Look-Up Table; NBZ = Northern Buffer Zone; RBSL = risk-based screening level; TCDD = 2,3,7,8-Tetrachlorodibenzodioxin; TEQ = toxicity equivalence.

[a] RBSLs are concentrations based on a suburban residential scenario in which exposure is through direct inhalation, incidental ingestion, and dermal contact of/with soil and a 1×10^{-6} risk of developing a cancer (for carcinogens) or a hazard quotient of 1 (for noncarcinogens). They do not include the suburban resident garden pathway.

[b] LUT values are the lower of the background threshold value for soil or the method detection limit.

[c] LUT identifies a benzo(a)pyrene equivalent value of 0.00447 milligrams per kilogram based on a sum of carcinogenic polycyclic aromatic hydrocarbons.

[d] LUT identifies a 2,3,7,8-TCDD equivalent value of 0.00000481 milligrams per kilogram. Toxic equivalency factors relative to 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) were developed for evaluation of dioxins, furans, and dioxin-like polychlorinated biphenyls.

Note: This summary list of chemical analytes is based on all constituents contributing >1% to the total risk or hazard index to the onsite suburban resident through direct soil exposure pathways for the sub-area with the greatest chemical cancer risks. Reported concentrations are the rounded mean values of all the samples collected in each sub-area.

Table 3–23 Median Radionuclide Concentrations in Soil at Santa Susana Field Laboratory Area IV and the Northern Buffer Zone

Constituent	*Sub-area*									*RBSL Value* [a]	*LUT Value* [b]
	3	*5A*	*5B*	*5C*	*5D*	*6*	*7*	*8*	*NBZ*		
	Concentrations in picocuries per gram of soil										
Americium-241	--	--	--	--	0.059	--	--	0.050	--	1.99	0.039
number of results above FAL					(1)			(2)			
Cesium-137	--	0.66	0.32	0.57	1.2	0.51	0.66	0.21	0.24	0.0547	0.225
number of results above FAL		(8)	(14)	(2)	(8)	(92)	(155)	(8)	(4)		
Cobalt-60	--	--	0.023	0.025	--	0.048	0.026	--	--	0.0326	0.0363
number of results above FAL			(1)	(1)		(1)	(1)				
Curium-243/244 [c]	--	--	0.018	--	--	--	--	--	0.065	0.317	0.040
number of results above FAL			(1)						(1)		
Europium-152	--	0.12	0.054	--	--	--	--	--	--	0.0363	0.0739
number of results above FAL		(2)	(3)								
Europium -154	--	--	--	--	0.14	--	--	--	--	0.0455	0.198
number of results above FAL					(1)						
Nickel-59	--	24	--	--	--	--	--	--	--	653	0.875
number of results above FAL		(1)									
Plutonium-238	--	0.014	--	--	0.049	--	--	--	--	3.86	0.0254
number of results above FAL		(1)			(1)						
Plutonium -239/240	--	--	--	0.036	0.053	0.038	0.059	0.079	0.038	3.37	0.023
number of results above FAL				(2)	(2)	(3)	(4)	(8)	(1)		
Strontium-90	0.44	0.58	0.12	0.098	0.60	0.62	0.81	1.0	0.59	3.85	0.117
number of results above FAL	(1)	(3)	(5)	(1)	(27)	(6)	(62)	(27)	(11)		
Tritium [c]	--	--	7.4	--	--	--	--	--	--	0.220	8.6
number of results above FAL			(1)								

FAL = field action level; LUT = Look-Up Table; NBZ = Northern Buffer Zone; RBSL = risk-based screening level.

[a] RBSLs are concentrations based on a suburban residential scenario in which exposure is through direct inhalation, incidental ingestion, and external exposure of/to soil and a 1×10^{-6} risk of developing a cancer. They do not include the suburban resident garden pathway.

[b] Provisional radionuclide LUT values are based on the higher of the background threshold value for soil or minimum detectable concentration in accordance with the *Final Technical Memorandum Look-Up Table Recommendations Santa Susana Field Laboratory Area IV Radiological Study* (HGL 2012c).

[c] This radionuclide was detected above the FAL only once in their respective sub-areas. These radionuclides are not included in the provisional radionuclide LUT in Appendix D.

Notes:

– This summary list of analytes is based on all constituents that had 1 or more exceedances of the FAL by sub-area with the exception of uranium and thorium decay chain radionuclides. In its characterization report, EPA determined that many of the uranium and thorium decay chain radionuclides detected above the FALs were not attributable to site-related activities, but were naturally occurring; however, there were other detections for which they recommended further evaluation.

– Reported concentrations are the rounded median values for all results above the FAL, that is, the middle-most result of all of results above the FAL in each sub-area.

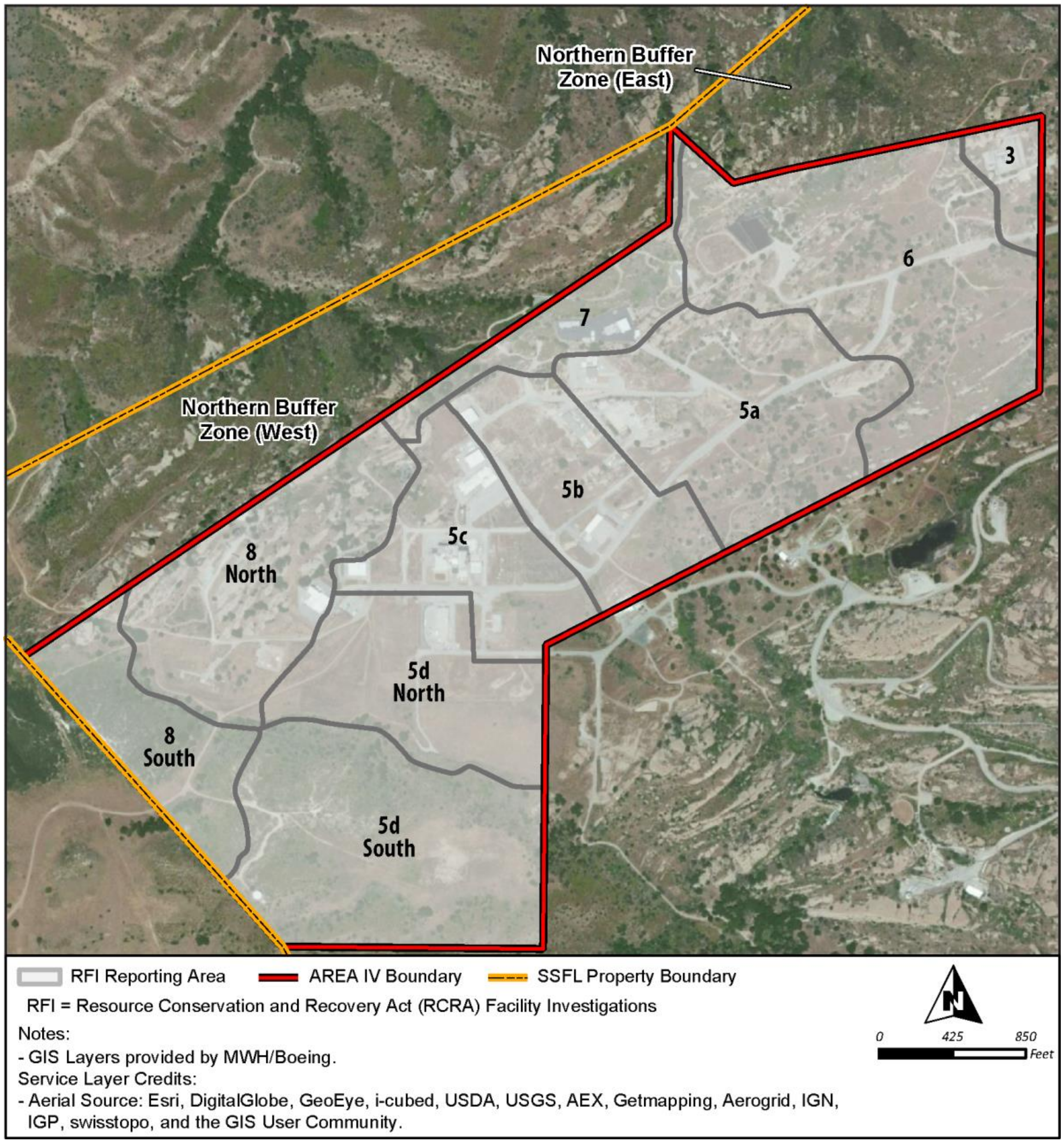

Figure 3–36 Santa Susana Field Laboratory Area IV Soil Characterization Sub-areas

As indicated in the *SSFL Area IV RCRA Facility Investigation Groundwater Work Plan* (CDM Smith 2015a), other studies have provided different information or estimates of the activity in the bedrock. One study reported a sample taken from a crack in the bedrock (prior to remediation) with a measured concentration of 2,500 picocuries per gram in 1978. Another study estimated the inventory remaining below the excavated zone to be about 0.05 curies.

Based on these reports, an updated estimate of the inventory of strontium-90 remaining in the bedrock was made using the more conservative (higher) estimates of inventory (0.05 curies or 50 millicuries) and concentration, (2,500 picocuries per gram). The 2,500 picocuries per gram activity is identified as mostly strontium-90 and its short-lived decay product, yttrium-90. Accounting for the relationship between strontium-90 and yttrium-90, in the 37 years since 1982, the concentration of strontium-90 has decayed to about 516 picocuries per gram. This concentration was used to calculate the source term from bedrock excavation.

3.9.4 Health Effects Studies

A number of studies have examined the potential for health effects on the public and workers related to historical activities at SSFL. These studies include those summarized in this section. This section also includes a comparison of cancer mortality and incidence rates reported in recent years for the United States, the State of California, and Los Angeles and Ventura Counties.

Public Health Studies

An October 10, 1990, report by the California Department of Health Services on cancer incidence rates in five Los Angeles County census tracts within a 5-mile radius of SSFL stated that age-adjusted incidence rates were consistent with random variations, although one census track showed a significantly higher age-adjusted rate of bladder cancer (Wright and Perkins 1990). Two years later, the Department issued a report stating that its analysis suggested the people living near SSFL were not at increased risk for cancers associated with radiation exposure. A later report from the Department stated that the increase in bladder cancer in the 1990 study appeared to be restricted to men in Los Angeles County, and there was an increase in lung cancer among Ventura County men. Lack of an increase in the most strongly radiosensitive cancers suggested causes other than exposure to radiation (DHS 1992)[11].

In September 1997, the Tri-Counties Regional Cancer Registry, covering San Luis Obispo, Santa Barbara, and Ventura Counties in California, issued a report of a preliminary analysis on cancer incidence among residents within a 5-mile radius of SSFL. The conclusion of the report was that residents of the study area had a cancer incidence risk similar to that of the other residents of the Tri-Counties region, except for incidence of leukemia in women, which was much lower, and cancer of the lung and bronchus, which was higher (Nasseri 1997).

A June 1999 study issued by an expert panel convened by DTSC reviewed three studies under the auspices of the State of California that investigated cancer incidence in the vicinity of SSFL. The expert panel concluded that, although the studies addressed different geographic areas, time periods, case definitions, and levels of significance, the combined evidence did not indicate an increased rate of cancer incidence in the regions of interest (Los Angeles and Ventura Counties). The panel also concluded that the extremely modest increases in cancer incidence rates associated with known radiosensitive tumors could be explained by uncontrolled confounding[12] or imprecision in the data, and that the results did not support the presence of any major environmental hazard (DTSC 1999a). A second DTSC report issued in August 1999 found no evidence of elevated cancer rates surrounding SSFL (DTSC 1999b).

In 2006, the Tri-Counties Cancer Surveillance Program conducted a study of Census Tract 75.03, encompassing a 2- to 3-mile radius surrounding SSFL in Ventura County. The conclusion, which was documented in an October 20, 2006, letter from the Public Health Institute, was that the occurrence of newly diagnosed invasive cancers in the subject census tract did not show any unusual pattern and had actually decreased by 7.5 percent from 1988 through 2004 (Public Health Institute 2006).

[11] Lung and bladder cancers tend to be cancers strongly associated with other risk factors such as smoking and non-radiation-occupational exposures.

[12] A statistical term describing how interactions of certain variables may lead to inaccurate conclusions.

In March 2007, the University of Michigan, School of Public Health, issued a study commissioned by the Agency for Toxic Substances and Disease Registry (ATSDR). ATSDR compared incidence rates for residents living (1) less than 2 miles from SSFL and (2) from 2 to 5 miles away with incidence rates for residents living more than 5 miles from SSFL. The study concluded that associations between distance and cancer incidence differed by type of cancer. The incidence rates for total cancers among adults were not elevated; however, between 1996 and 2002, incidence rates were slightly elevated for some specific cancers for persons living within 2 miles of SSFL. The strongest and most consistent association was for thyroid cancer, which was associated with distance from SSFL.[13] That is, the incidence rate for thyroid cancer was somewhat elevated for residents living within 2 to 5 miles of SSFL, compared to the incidence rate for residents living beyond 5 miles, and still larger for residents living within 2 miles of SSFL. The ATSDR study identified perchlorate and radioactive cesium and iodine as possible constituents of concern (the cesium and iodine may have been released from the July 26, 1959, SRE accident described later in this section). The ATSDR study recognized that the associations observed between distance from SSFL and the incidences of specific cancers were based on small numbers of cases in the region closest to SSFL, and that these associations were estimated imprecisely and may represent chance findings. The study also indicated that observed associations may have been biased by methodological limitations, such as use of distance from SSFL as a crude proxy measure for environmental exposures, residential population mobility before and during the follow-up period, and lack of information on other cancer risk factors (such as cigarette smoking and socioeconomic status) that might distort the observed associations (UM 2007).

The ATSDR study also stated that, despite the methodological limitations of the study, the findings suggested there may be elevated incidence rates of certain cancers near SSFL that were linked in previous studies with hazardous substances used at Rocketdyne, some of which have been observed or projected to exist off site. There was no direct evidence from this investigation, however, that the observed associations reflected the effects of environmental exposures originating at SSFL. Given these findings and unanswered questions, the report author was tempted to recommend further analyses or future studies to address the health concerns of the community, but stated it was unclear whether such additional analyses or studies would be sufficient to determine whether operations and activities at Rocketdyne affected, or would affect, the risk of cancer in the surrounding neighborhoods (UM 2007).

In 2007, the University of Southern California Cancer Surveillance Program (CSP) reviewed the incidence of retinoblastoma in Los Angeles and Ventura Counties, focusing on the area around SSFL. Because of community concern that the risk of retinoblastoma was increased in children due to cancer-causing contaminants in the SSFL vicinity, CSP updated its 2005 analysis that included cases diagnosed between 1972 and 2002, and the results showed no excess incidence of retinoblastoma in the area. For the 2007 study, CSP concluded that the 2007 analysis was consistent with the 2005 report; that the incidence of retinoblastoma among children under age 5 residing in the area around SSFL between 1988 and 2005 was slightly, although statistically not significantly, higher than expected based on incidence statewide; and that the relatively young age of the cases and the high proportion of cases with bilateral disease was suggestive of a genetic origin (CSP 2007).

[13] Other identified cancers include those for the upper aerodigestive tract (oral and nasal cavities, pharynx, larynx, and esophagus), bladder, and blood and lymph tissue (leukemias, lymphomas, and multiple myelomas).

On August 29, 2009, DOE hosted an informational workshop to explore diverse expert and community perspectives on the consequences of the July 26, 1959, SRE accident described in more detail in Section 3.9.5. DOE conducted the workshop in response to stakeholder concerns and requests for more information about the SRE accident. At the time of the accident, it was estimated that the accident resulted in the release, over a 2-month period, of about 28 curies of radioactive noble gases such as krypton-85, resulting in a maximum offsite radiation dose of 0.099 millirem and a dose at the location of the nearest resident of 0.018 millirem (Boeing 2007a). In 1999, ATSDR independently assessed the potential impacts resulting from the accident. Conservatively assuming all radioactive noble gases were released instantaneously, ATSDR estimated a dose to a maximally exposed individual of 0.005 millirem and stated that, due to residential locations and meteorological conditions, it was unlikely that anyone had actually received this estimated dose (ATSDR 1999). In 2006, however, the Report of the Santa Susana Field Laboratory Advisory Panel postulated that the accident caused the release of large quantities of cesium-137 and iodine-131, resulting in large doses to the surrounding population and about 260 cancers, with a range of zero to 1,800 cancers (SSFLAP 2006).

After presentations on the accident by three independent experts (Dr. Paul Pickard, Sandia National Laboratories; Dr. Thomas Cochran, Natural Resources Defense Council; and Dr. Richard Denning, Ohio State University), attendees had the opportunity to ask questions and provide their own perspective about what had occurred. Two of the three experts supported the estimate made at the time of the accident that releases from the accident should have primarily involved noble gases, with only small releases of volatile fission products, including iodine and cesium isotopes (Denning 2009; Pickard 2009). One of these two experts was skeptical of the estimates of large health effects potentially experienced by individuals and populations (Denning 2009). The third expert concluded that available information was inadequate to resolve the fraction of the noble gases and volatile fission products that had remained in the fuel and the fraction that was released to the environment. This expert did not quantify an individual risk from the accident or collective population radiation exposure, but thought that it was likely that the risk to the maximally exposed individual was smaller than the risk of cancer from other causes, but that the collective exposure could have resulted in some cancers in the population (Cochran 2009).[14]

In November 2012, the California Breast Cancer Mapping Project issued a report that, using data from 2000 to 2008 from the California Cancer Registry, mapped two areas in the San Francisco Bay region and two areas in the Los Angeles – Orange County region for which the age-adjusted incidence of invasive breast cancer appeared to be 10 to 20 percent higher than that for the rest of the state. One of the areas consisted of a western portion of Los Angeles County (including Santa Clarita, Beverly Hills, and Malibu) and an eastern portion of Ventura County, including SSFL and its vicinity. The report mapped a broad area within the two counties that have had elevated incidence rates over these years and provided time-series maps for all years from 2000 to 2008 that showed how areas of elevated incidence rates changed in size and shape from year to year and shifted within the broad area. None of the maps for specific years showed the entire broad area and, for 2 years, the maps identified elevated areas that were entirely within Los Angeles County. The report noted that age-adjusted rates of female invasive breast cancer declined in California from 2000 to 2008, but were always higher in the West Los Angeles – East Ventura area of concern compared to statewide rates. The report also noted that cancer incident rates varied by race and ethnicity. From 2000 to 2008, white women accounted for 73 percent of the diagnosed incidents of

[14] Videos documenting the workshop can be viewed at http://www.etec.energy.gov/Community_Involvement/Public%20Meetings/SRE_Workshop.html, along with copies of the experts' presentations, links to workshop posters, and a library of documents, articles, symposium proceedings, and other information about the 1959 accident.

breast cancers, but represented 48 percent of the female population in the West Los Angeles – East Ventura area of concern in 2010. Comparable statistics for other races and ethnicities were 12 percent of the incidences and 32 percent of the population for Hispanic/Latino women; 6 percent of the incidences and 6 percent of the population for African-American women; and 8 percent of the incidences and 11 percent of the population for Asian women. Additional information included the cancer stage at diagnosis, the insurance status of the affected women, and population demographic shifts between 2000 and 2010 (CBCMP 2012).

At an April 9, 2014, Santa Susana Field Laboratory Community Meeting, Dr. Thomas Mack of the University of Southern California, Keck School of Medicine, addressed cancer occurrence in offsite neighborhoods near SSFL.[15] Dr. Mack reviewed the results of the previous studies and cancer occurrences in the region surrounding SSFL. He stated that, although it was not possible to completely rule out offsite carcinogenic effects from SSFL, no evidence was found of measurable offsite cancer causation resulting from emissions from SSFL or cancer causation from any environmental factor (Mack 2014).

At a May 21, 2014, meeting of the Santa Susana Field Laboratory Community Advisory Group, representatives of DTSC and LARWQCB addressed the potential for perchlorate contamination in Simi Valley resulting from activities at SSFL. The potential for such contamination had been previously raised (SSFLAP 2006; UM 2007). DTSC discussed the extensive groundwater monitoring network at SSFL and the surrounding area, as well as the monitoring results, and concluded that its evaluation of the offsite surface and groundwater pathways of perchlorate (i.e., the western end of Simi Valley) did not indicate a connection between perchlorate detected in Simi Valley and perchlorate present in the soil and groundwater at SSFL (DTSC and LARWQCB 2014).

At a July 23, 2014, meeting of the Santa Susana Field Laboratory Community Advisory Group, Dr. Ramon Guevara, Master of Public Health, an epidemiologist and Los Angeles County public health officer, presented a discussion about Valley Fever in Los Angeles County. Valley Fever is the initial form of coccidioidomycosis infection caused by coccidioides fungi found in the soil, which can be stirred into the air (e.g., by farming, construction, or wind) and then breathed into the lungs. Initial symptoms are flu-like, generally mild, and often clear up with little to no treatment; however, a small percentage of cases can develop into more serious diseases, including chronic and disseminated coccidioidomycosis. Chronic coccidioidomycosis is a form of pneumonia and is most common in people with weakened immune systems. Disseminated coccidioidomycosis is the most serious, and sometimes deadly, form of the disease and occurs when the infection spreads to other parts of the body. Those most at risk for disseminated disease include males, African-American/Black and Filipino people, pregnant women in the third trimester, and persons with weak immune systems. Since the early 1990s, the number of Valley Fever cases in Los Angeles County has grown, with the largest increase seen in the Antelope Valley health district (Guevara 2014).

Cancer Mortality and Incidence Rates

The National Cancer Institute publishes national, state, and county mortality and incidence rates of various types of cancer.[16] The published information, however, does not provide an association of these rates with their causes (e.g., specific facility operations or human lifestyles). **Table 3–24**

[15] Dr. Mack possesses expertise in the epidemiology of both infectious and chronic disease. He has served as director of the Los Angeles County Cancer Surveillance Program, where he conducted analytic studies of specific cancers.

[16] Information is available for all cancers, as well as for the following 21 specific cancers: bladder, brain and other nervous system, breast (female), cervix, childhood (ages less than 15 years, all sites), childhood (ages less than 20 years, all sites), colon and rectum, esophagus, kidney and renal pelvis, leukemia, liver and bile duct, lung and bronchus, melanoma of the skin, non-Hodgkin lymphoma, oral cavity and pharynx, ovary, pancreas, prostate, stomach, thyroid, and uterus.

presents mortality and incidence rates (per 100,000 persons) for selected cancers for the United States, California, and Los Angeles and Ventura Counties for the years 2007 through 2011. Also shown are the ranges in mortality and incidence rates for those years across all California counties (NCI 2015). The mortality and incidence rates in Los Angeles and Ventura Counties for the listed cancers are sometimes larger or smaller than the California average; however, with the exception of thyroid mortality rates in Los Angeles County, these rates are all within the range of cancer rates (neither the highest nor lowest rates) reported across all California counties reporting more than three cancer deaths or incidents per cancer type. The thyroid mortality rate for Los Angeles County (0.7 per 100,000 persons at a 95 percent confidence interval) is the same as that for four other California counties (San Bernardino, Santa Clara, San Francisco, and Sonoma).

Table 3–24 Cancer Mortality and Incidence Rates[a] for the United States, California, and Los Angeles and Ventura Counties, 2008 through 2012

Location	*All Cancers*	*Thyroid*	*Breast*	*Lung and Bronchus*	*Leukemia*	*Bladder*	*Oral Cavity and Pharynx*
Mortality Rates							
United States	171.2	0.5	21.9	47.2	7.0	4.4	2.5
California	155.1	0.6	21.2	36.2	6.6	3.9	2.5
Los Angeles County	151.3	0.7	21.6	32.4	6.6	3.6	2.3
Ventura County	147.2	0.5	21.7	32.5	6.2	3.5	2.0
California County range [b]	104.3–196.0	0.5–0.7	14.0–29.4	28.9–61.2	4.3–8.7	2.5–6.2	1.9–3.8
Incidence Rates							
United States	453.8	13.6	123.0	63.7	13.2	20.8	11.3
California	424.9	12.0	122.1	48.0	12.5	18.5	10.4
Los Angeles County	405.5	12.5	116.9	41.6	12.3	16.7	9.3
Ventura County	432.7	16.2	132.8	42.7	11.9	18.7	10.3
California County range [b]	312.8–499.5	6.4–16.2	98.5–158.2	28.1–84.7	10.2–19.2	11.2–31	8.7–16.3

[a] Mortality and incidence rates per 100,000 persons, over all races and ages and both sexes (except for breast cancer).

[b] Mortality and incidence rate range across all reporting California counties; no rates are reported for counties reporting three or fewer cancer deaths or incidents per cancer type.

Source: NCI 2015.

National Cancer Institute data are provided nationally and for states and counties for all cancers, for specific types of cancers, by race and ethnicity, and by sex (male, female, and all). The data shown in Table 3–24 are for all races and ethnicities and all sexes and ages. To illustrate the more detailed data, **Table 3–25** lists female breast cancer for all ages and the races and ethnicities included in the National Cancer Institute database for the years 2008 through 2012. Over these years, the mortality rate for female breast cancer in Los Angeles County was higher than the California average for all reporting categories except American Indian/Alaskan Native women. The mortality rate was higher in Ventura County than the California average for White Non-Hispanic women. Over these same years, the incidence rate of female breast cancer in Ventura and Los Angeles Counties for White Non-Hispanic women was higher than the California average and higher than the rates for other races and ethnicities within these two counties. The incidence rates for all races and ethnicities, however, were below the highest rates of incidences across all California counties reporting more than three cancer deaths or incidents per cancer types.

Table 3–25 Female Breast Cancer Rates[a] (All Ages) for the United States, California, and Los Angeles and Ventura Counties, by Race and Ethnicity,[b] 2008 – 2012

Location	*All Races and Ethnicities*	*White Hispanic*	*White Non-Hispanic*	*Black (includes Hispanic)*	*Hispanic (any race)*	*American Indian/ Alaskan Native (includes Hispanic)*	*Asian or Pacific Islander (includes Hispanic)*
Mortality Rates							
United States	21.9	15.4	21.9	30.2	14.5	11.6	11.4
California	21.2	15.6	24.2	31.4	14.9	7.7	12.9
Los Angeles County	21.6	16.0	26.2	34.3	15.3	6.6	13.5
Ventura County	21.7	13.6	25.9	d	12.9	d	11.3
California county range [c]	14.0–29.4	9.6–17.7	15.6–28.7	24.2–37.8	8.9–17.7	6.6 [e]	11.3–22.2
Incidence Rates							
United States	123.0	f	f	121.4	92.1	67.5	87.8
California	122.1	93.3	140.5	123.7	89.2	43.0	95
Los Angeles County	116.9	86.1	148.6	127.1	83.1	17.1	98.8
Ventura County	132.8	98.3	150.5	109.4	94.2	d	97.8
California county range [c]	98.5–158.2	75.9–243.0	99.1–158.0	83.3–242.3	71.5–225.0	17.1–136.9	53.3–144.6

[a] Mortality and incidence rates per 100,000 persons, over all ages.
[b] The terminology is as reported in the National Cancer Institute database.
[c] Mortality and incidence rate range across all reporting California counties; no rates are reported for counties reporting three or fewer cancer deaths or incidents per cancer type.
[d] There were three or fewer average deaths or incidents per year over the rate period.
[e] Only one county had data meeting the reporting threshold.
[f] Data not available.
Source: NCI 2015.

Worker Health Studies

In 1993, the California Public Health Foundation initiated a study to assess the possible health effects from exposure to radiation and chemicals at SSFL by employees of Rocketdyne/Atomics International. Researchers at the University of California at Los Angeles, School of Public Health, working with the California Department of Health Services and funded by DOE, conducted an epidemiologic study to determine whether there was a relationship between exposure to radiation or chemicals and a particular disease (DOE 2014a). In June 1997, the University of California at Los Angeles issued a report that concluded that the mortality rates for all causes, and in particular, heart disease, were lower for monitored Rocketdyne/Atomics International workers than those for the general population of the United States or the National Institute for Occupational Safety and Health population of other worker cohorts. This finding was attributed to the "healthy worker effect," where healthier workers are more likely to be employed at Rocketdyne/Atomics International and stay in the radiation monitoring program than less healthy individuals. The report also found, however, that occupational exposure to ionizing radiation among nuclear workers increased the risk of dying from cancers of the blood and lymph systems, lung cancers, and cancers of the upper-aerodigestive tract. Regarding cancer risk for the blood and lymph systems, the report noted the small number of deaths from these cancers for workers receiving relatively high radiation doses. Regarding lung and upper-aerodigestive cancers, the report indicated that confounding factors (e.g., smoking; asbestos; hydrazine exposures for lung cancers; and alcohol consumption, dietary factors, and other factors for upper-aerodigestive cancers) could not be ruled out (UCLA 1997).

In January 1999, the University of California at Los Angeles issued an addendum report addressing possible adverse effects on Rocketdyne/Atomics International workers from exposure to selected chemicals. This report suggested that occupational exposure to hydrazine or other chemicals associated with rocket-engine-test jobs increased the risk of dying from lung cancer, and possibly other cancers, in the population of aerospace workers. The report cautioned, however, that causal inference was limited, and the results needed to be replicated in other populations (UCLA 1999).

In July 2005, the International Epidemiology Institute issued the results of a 4-year study of SSFL workers to determine whether mortality rates from cancer and other diseases were elevated. The study identified no statistically significant internal cohort dose-response relationships between leukemia; lymphoma; or cancers of the esophagus, liver, bladder, kidney; or any other cancer with categories of radiation dose or years of potential chemical exposure. The report concluded that radiation exposure had not caused a detectable increase in cancer deaths in the worker population and that work at the SSFL rocket engine test facility, or as a test stand mechanic, was not associated with a statistically significant increase in cancer mortality overall or for any specific cancer. A slight non-significant increase in leukemia and another malignancy (chronic lymphocytic leukemia) not associated with cancer was observed among radiation workers, however, as well as a slight non-significant increase in kidney cancer and a slight non-significant decrease in bladder cancer. The report called for additional work to clarify an inconsistent finding with regard to radiation and kidney cancer (a cancer not generally found to be increased in radiation-exposed populations), as well as a non-significant association observed for kidney cancer and potential trichloroethylene exposure and a non-significant elevated risk of lung cancer among workers potentially exposed to hydrazine (IEI 2005).

3.9.5 Accident History

This section summarizes the major accidents or hazardous situations that have occurred to date, including the July 26, 1959, SRE accident and other radiological incidents in Area IV, additional environmental contamination incidents, and the September 2005 Topanga fire.

Radiological Incidents in Area IV

Selected incidents identified from past research of records of ETEC operations, including the historical site assessments conducted by EPA as part of the radiological characterization of Area IV (HGL 2012a), as well as a draft preliminary site evaluation prepared by ATSDR (ATSDR 1999) are summarized below:

- During a March 25, 1959, power excursion at AE-6, a low-power research reactor with a solution of uranyl sulfate in a spherical tank, the normal power level of 3 kilowatts-thermal approached 4 kilowatts-thermal, releasing approximately 10 millicuries of fission products, mostly xenon-135.
- During a June 4, 1959, wash cell explosion at SRE (Building 4143), a graphite-moderated, liquid-sodium-metal-cooled, 20-megawatt power reactor, the fuel cluster remained in the wash cell, but the fuel element shield plug and hanger rod were expelled from the cell and onto the reactor room floor, and a fire erupted. High levels of contamination in the reactor room resulted. Surveys outside the building showed results ranging from normal to four times normal.
- A July 13, 1959, power excursion at SRE prompted an emergency shutdown of the reactor; it was later determined that the power excursion had not adversely affected the reactor.

- A July 26, 1959, SRE accident resulted in fuel damage and a measureable release of radioactive material into the environment (discussed in more detail below).
- During a March 1960 steam-cleaning pad contamination incident at SRE, decontamination of a valve containing radioactively contaminated sodium resulted in the spread of sodium across the pad. The pad was hosed down, washing the contaminated sodium onto the soil.
- In the early 1960s, it was determined that the shield water cooling lines and reactor containment vessel cooling lines had leaked to the soil at Building 4010.
- A May 31, 1962, discharge (overflow) from a portable radioactive liquid holdup tank to the pad and soil outside Building 4020 released an estimated 420 microcuries of beta-gamma activity in 50 gallons of liquid.
- During a January 1, 1964, incident involving fuel element failures at SNAP-8, a small, sodium-cooled reactor designed for space applications, mixed fission products were released to the cover gas and coolant.
- A March 24, 1964, 13-foot drop of a 24.8-millicurie radium-226 source capsule released loose radium-226. The contamination was primarily confined to the source storage well and the source thimble.
- A 1969 incident involving fuel element failures at SNAP-8 released hydrogen and fission products. The reactor operated for a year with failing fuel.
- A May 19, 1971, sodium-potassium fire in the Hot Laboratory decontamination room resulted in a release of mixed fission products, some of which were released through the Building 4020 stack.
- A November 3, 1976, incident resulted in contamination of the radioactive material disposal facility leach field.
- During an August 1977 leak from a water-filled storage pit used at the SRE for temporary storage of activated material removed from the reactor vessel during decontamination and disposition, an estimated 2,200 gallons of water were leaked from August 9 to August 22, 1977. Soil and groundwater samples showed elevated levels of radioactivity.
- During a November 14, 1977, overflow spill from the 500-gallon radioactive liquid transfer tank, one of two on the hillside near Building 4653, an estimated 25 gallons were released, along with 11 millicuries of activity, primarily from cobalt-60, strontium-90, and cesium-137.

In addition, fires involving reactive metals (sodium and/or potassium) and/or radioactive materials have occurred at a number of facilities. In response to accidental releases, routine surveys that identified contaminated areas, or decommissioning of facilities, soil remediation activities have occurred in and around Area IV. Section 3.2.5.3 includes a summary of selected prior removal actions.

Of these incidents, only the July 26, 1959, SRE accident caused a measureable release of radioactive material (ATSDR 1999). A clogged coolant channel caused partial melting of 13 of 43 reactor fuel assemblies and release of 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, the reactor was safely shut down, and the primary pressure vessel containing the reactor core and sodium coolant remained intact. The building was decontaminated, and the reactor fuel assemblies were removed and replaced. Personnel operating the reactor and those employed during post-accident recovery, decontamination, and refurbishment were continually monitored for external and internal radiation exposure, and no personnel exceeded annual exposure limits for radiation workers.

The reactor resumed operation until it was shut down permanently in February 1964 (Boeing 2007a).

At the time of the accident, it was determined that most of the radioactive material was contained in the sodium coolant, which was subsequently removed from the reactor. Some of the radioactive material, however, collected as a cover gas in the volume above the sodium coolant inside the reactor vessel; this material consisted primarily of the noble gases krypton-85, xenon-133, and xenon-135. The contaminated reactor cover gas was transferred to holding tanks and held long enough for the xenon-135 (9.1-hour half-life) to decay, and then released to the atmosphere through the facility stack over a 2-month period, in low, controlled concentrations that met Federal requirements. It was estimated that about 28 curies of krypton-85 (10.7-year half-life) and xenon-133 (5.25-day half-life) were released (Boeing 2007a). As noted in Section 3.9.4, however, it has been postulated that the radionuclide release from the accident could have been much larger—zero to several thousand curies of cesium-137, with a best estimate of about 400 curies, and zero to more than 10,000 curies of iodine-131, with a best estimate of 1,500 to 4,000 curies (SSFLAP 2006).

September 2005 Topanga Fire

On September 28, 2005, a fire in the Chatsworth area (a City of Los Angeles neighborhood) spread to brush in neighboring areas, ultimately affecting 24,000 acres, including 2,000 of the 2,850 acres of the SSFL site. Some brush was burned in Area IV. Ten structures at SSFL were damaged, and seven were destroyed. Facilities in Area IV and hazardous material storage facilities elsewhere on SSFL were not damaged by the fire. No anthropogenic radioactive materials were detected in air samples taken during and after the fire, and sampling showed that burned vegetation contained no radioactive contamination (Boeing 2005). A later report analyzed post-fire samples collected in rainwater collected at SSFL, onsite and offsite soil, and stormwater runoff from SSFL. Rainwater samples from SSFL showed dioxin concentrations exceeding SSFL permit limits for storm flows and mercury concentrations at or near SSFL permit limits. Soil samples from SSFL and off site showed regulated constituents (e.g., dioxin, metals) that were similar in magnitude and variability. Concentrations of metals and dioxins in stormwater runoff from SSFL were similar to (and often lower than) concentrations in stormwater runoff samples in other locations in the Los Angeles area (Flow Science 2007).

3.10 Waste Management

This section describes the general categories of wastes that would be generated by proposed building demolition, soil removal, and groundwater cleanup activities, and identifies a universe of candidate facilities both within California and outside the state that could accept the wastes. DOE has selected a reduced number of these candidate facilities as representative for accepting DOE waste, consisting of facilities authorized for receipt of LLW or MLLW, hazardous waste, or nonhazardous waste. Three facilities that accept nonhazardous materials for recycle are also included as representative facilities. Section 4.10 evaluates the representative waste management facilities with respect to capacity and ability (or appropriateness) to accept waste from the remediation alternatives. Appendix D describes the process used to identify the universe of candidate facilities and subsequently select a reduced number of representative facilities for detailed analysis in Chapter 4.

Large volumes of wastes would be generated as a result of the proposed alternatives and determining and evaluating the final disposition of these wastes is an important element of the proposed remediation. Wastes generated during remediation of Area IV and the NBZ would be disposed of at offsite facilities licensed or permitted for the specific type of waste. Building debris, excavated soil, and other wastes would be thoroughly characterized when generated to determine the proper methods and facilities for disposal. Wastes would only be sent to facilities permitted or licensed to accept the specific type of waste.

Primary Waste Types Evaluated in the *SSFL Area IV EIS*

Nonhazardous waste—Discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations or from community activities. This category does not include source, special nuclear, or byproduct material as defined by the Atomic Energy Act (Title 42, *United States Code*, Section 2011 [42 U.S.C. 2011] et seq.)

Hazardous waste—Waste that is defined as hazardous waste under the Resource Conservation and Recovery Act (RCRA) (42 U.S.C. 6901 et seq.) or state statute or regulation. State regulations may define a larger spectrum of materials as hazardous waste than Federal regulations.

Low-level radioactive waste—Waste that contains radioactive material and is not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or the tailings or wastes produced by the extraction or concentration of uranium or thorium from ore processed primarily for its source material. Test specimens of fissionable material that are irradiated for research and development only, not for the production of power or plutonium, may be classified as low-level radioactive waste, provided the transuranic concentration is less than 100 nanocuries per gram of waste (DOE Order 435.1).

Mixed low-level radioactive waste—Low-level radioactive waste that contains hazardous components regulated under RCRA (42 U.S.C. 69-1 et seq.) or state statute or regulation. State regulations may define a larger spectrum of materials as hazardous waste than Federal RCRA regulations.

3.10.1 Historical Waste Management Activities

After the 1988 suspension of DOE test and research operations at ETEC, the focus at Area IV and the NBZ shifted toward disposition of Government property, investigation and remediation of soil and groundwater, D&D of facilities, and site restoration. Soil, debris, and other wastes were sampled for presence of radioactive materials by DOE, Boeing, and California regulatory agencies to determine whether these wastes met Federal and state cleanup standards. Wastes containing radioactive materials were characterized, packaged, and shipped off site to licensed or DOE-authorized disposal facilities. Facilities receiving LLW or MLLW included the Hanford Site near Richland, Washington; the Nevada Test Site (now called the Nevada National Security Site [NNSS]) near Las Vegas, Nevada; and the Envirocare (now Energy*Solutions*) facility at Clive, Utah. MLLW is LLW that also contains hazardous chemical waste. A small quantity of transuranic waste was generated that was sent to the Hanford Site in Richland, Washington for characterization and repackaging, and then to the Waste Isolation Pilot Plant near Carlsbad, New Mexico, for disposal (Boeing 2007b; DOE 2014a).

Small quantities of hazardous waste were generated along with nonhazardous debris such as asphalt, concrete, and building materials. After surveying and sampling these wastes to confirm the absence of radioactive materials, the wastes were shipped off site to California landfills permitted to receive the materials. In September 2002, however, California Executive Order D-62-02 imposed a moratorium on the disposal in California Class III or unclassified waste management units of decommissioned material meeting Federal and state cleanup standards. After September 2002, decommissioned material from Area IV was sent to California Class I facilities, which are permitted for disposal of hazardous waste. The State of California landfill classification system is summarized in **Table 3–26**.

Table 3–26 Classification of Landfills in California

Class [a]	Type of Waste	Waste Description
I	Hazardous	Waste that poses a threat in the absence of regulation and typically exhibits a hazardous waste characteristic or contains chemicals that render it hazardous. It may be a listed waste, have a hazardous characteristic pursuant to RCRA, or otherwise require regulation. It may contain or be contaminated with chemicals such as VOCs, SVOCs, PAHs, dioxins, herbicides, pesticides, perchlorate, or PCBs or with metals such as lead, mercury, or silver.
II	Designated nonhazardous	Waste that has been granted a variance from hazardous waste management requirements or nonhazardous waste that, under ambient environmental conditions at a waste management unit, could be released in concentrations exceeding water quality objectives or affecting beneficial uses of the Waters of the State. For example, such waste could require disposal at a Class II site if it contains a constituent (e.g., arsenic) in concentrations that are insufficient to require disposal in a Class I facility, but could threaten groundwater quality if disposed of improperly.
III	Nonhazardous	Waste consisting of solid, semi-solid, or liquid materials that need not be managed as hazardous waste or waste that does not contain soluble pollutants in concentrations that exceed applicable water quality objectives or could cause degradation of the Waters of the State (i.e., designated waste). Typical materials include garbage from handling or preparing food products; rubbish such as paper, cardboard, cans, cloth, or glass; or construction and demolition materials such as paper, cardboard, wood, scrap metal, glass, rubber, or shingles. Class III sites often accept waste that is acceptable at unclassified (inert waste) landfills.
Unclassified	Inert	Inert waste is a subset of nonhazardous waste that does not contain soluble pollutants at concentrations in excess of applicable water objectives and does not contain significant quantities of decomposable waste. Typical materials include non-water-soluble, non-decomposable, inert solids such as construction and demolition debris (e.g., earth, rock, concrete rubble, and asphalt paving fragments); tires; or inert industrial wastes such as glass, rubber, or plastic.

PAH=polycyclic aromatic hydrocarbon; PCB=polychlorinated biphenyl; RCRA = Resource Conservation and Recovery Act; SVOC = semi volatile organic compound; VOC=volatile organic compound.

[a] Siting and construction requirements for Class I landfills are similar to those for landfills permitted under Subtitle C of RCRA (e.g., double composite liners and leachate collection systems). Siting and construction requirements for Class II and Class III landfills are similar to those permitted under Subtitle D of RCRA (e.g., liners and leachate collection systems), except additional requirements exist for Class II landfills compared to those for Class III landfills.

DOE suspended D&D and remediation operations at Area IV in May 2007, but environmental monitoring and characterization programs have continued (Boeing 2014c).

3.10.2 Current Waste Management Activities

A Waste Management Plan serves as guidance for waste generation in Area IV and the NBZ. This plan emphasizes a proactive policy of waste minimization and pollution prevention and outlines processes, and waste minimization techniques to be considered for all waste streams. Activities related to waste minimization and pollution prevention include recycling of oils from motor vehicles and compressors, reuse of hazardous waste containers when in acceptable condition, and return of empty product drums to vendors when practical (North Wind 2015a).

Small quantities of wastes are generated at Area IV and the NBZ. In recent years, these wastes have included LLW and nonradioactive wastes such as miscellaneous groundwater well equipment, debris, purge water from sampling monitoring wells, and rinse water (Boeing 2012a, 2013b, 2014c). The LLW, which was sent to NNSS for disposal, was generated from collection and solidification of rainwater that, during 2009 and 2010, had infiltrated the vaults and sumps at Building 4022 of the RMHF and contained low levels of cesium-137 and strontium-90 (Boeing 2011b). The nonradioactive wastes were surveyed and shipped to appropriate disposal facilities (Boeing 2012a, 2013b, 2014c). Finally, very small quantities of solid nonhazardous municipal trash (e.g., paper and beverage cans) and sanitary wastes are generated and shipped off site for recycling or disposal at a nonhazardous waste facility.

Two DOE facilities in Area IV are permitted under RCRA: RMHF and the Hazardous Waste Management Facility (HWMF). RMHF, which is permitted as an Interim Status (Part A) facility, was used primarily for handling and packaging of LLW and MLLW. RMHF has been in a safe shutdown mode since May 2007 and is inactive pending closure plan approval. HWMF includes an inactive storage facility (Building 4029) and an inactive facility (Building 4133) that was used for treatment of reactive metal such as sodium. HMHF is no longer used and awaits final closure.

3.10.3 Facilities for Receipt of Waste

Remediation and D&D of Area IV and the NBZ would primarily generate radioactive and nonradioactive waste in the categories shown in **Table 3–27**. These wastes would be shipped off site for disposition in accordance with U.S. Department of Transportation regulations and the acceptance criteria for the receiving disposition facilities. Waste would be disposed of in offsite facilities, including nonhazardous waste landfills, hazardous waste landfills, and LLW and MLLW disposal facilities. Some nonhazardous material may be sent to appropriate recycling facilities.

Table 3–27 Categories of Solid Waste Expected to be Generated During Area IV Remediation Activities

Waste Category	*Typical Materials*
Nonhazardous	Soil/Demolition debris [a]
Hazardous	Soil [b]/Demolition debris [a, c]
LLW – radioactive contamination only	Soil/Demolition debris [a]
MLLW – radioactive and hazardous material	Soil [b]/Demolition debris [a, c]

LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste.

[a] Including materials such as asphalt, concrete, steel, wire, and machinery.

[b] Containing nonradioactive contaminants, such as PCBs, PAHs, and TPH, and metals such as lead, mercury, and silver, all of which are regulated under Federal or state statute.

[c] Containing nonradioactive contaminants, such as lead, lead-based paint, asbestos, and PCB light ballasts, all of which are regulated under Federal or state statute.

As described in the text box, Federal regulations require treatment of RCRA-regulated hazardous waste before disposal; treatment before disposal may also be required for waste regulated by Federal statutes other than RCRA (e.g., PCB waste regulated under the Toxic Substances and Control Act) or by state statute or regulation. Depending on the waste stream and its characteristics, offsite treatment capacity may be available at the disposal facility or at a standalone facility. Treated waste from a standalone facility would be shipped to an appropriate disposal facility.

Several nonhazardous waste landfills in California, Class I and hazardous waste treatment and disposal sites in California and other nearby states, and LLW and MLLW disposal facilities (all of which are located outside of California) have been identified as candidates for accepting nonradioactive waste from SSFL remediation and D&D activities.

Candidate nonhazardous waste landfills with favorable attributes for disposal of waste from Area IV and the NBZ were identified from lists of landfills issued by the California State Water Resources Control Board (SWRCB) (SWRCB 2014). These favorable attributes include: (1) reasonable proximity to SSFL (within a few hundred miles), (2) range of waste materials accepted, and (3) presence of composite-lined disposal units. Many landfills in the SWRCB list were not considered to be reasonable candidates because they only accept waste from specific counties or communities, are closed, have restrictions on the types of waste accepted, or are much farther from SSFL than other candidate sites. Candidate Class I and hazardous waste landfills within and outside of California were identified using SWRCB lists and Internet searches. Candidate LLW and MLLW disposal facilities were identified using Internet searches. Operators of candidate landfills and disposal facilities were contacted to obtain waste acceptance information.

Land Disposal Restrictions for RCRA-Hazardous Waste

Because the Hazardous and Solid Waste Amendments to the Resource Conservation and Recovery Act (RCRA) prohibit land disposal of untreated RCRA-hazardous wastes, the U.S. Environmental Protection Agency (EPA) established a land disposal restriction program that identifies treatment requirements for hazardous waste. Treatment standards (Title 40, *Code of Federal Regulations*, Section 268.40 [40 CFR 268.40]) are expressed as numerical standards or required treatment methods. If numerical standards are specified for a waste (common for listed wastes), hazardous constituents must be at or below prescribed treatment standard concentrations (by any method other than dilution, which is not allowed) before the waste may be disposed of (numerical standards may be specified as "totals" or as an "extract" or "toxicity characteristic leaching procedure" measurement. If treatment methods are specified, a prescribed technology must be used (e.g., chemical oxidation, combustion, encapsulation). For example, macroencapsulation and amalgamation, respectively, are the treatment technologies specified for radioactive lead solids and elemental mercury contaminated with radioactive material.

EPA has issued alternative treatment standards for contaminated soil and debris. These standards are optional, and generators or treatment facility operators can comply with either the "as generated" treatment standards specified for each contaminant or the alternative standards. Under the alternative treatment standards for soil (see 40 CFR 268.49):
(1) hazardous constituents must be reduced by at least 90 percent through treatment so that no more than 10 percent of their initial concentration remains (or comparable reductions in mobility for metals), **OR** (2) hazardous constituents must not exceed 10 times the universal treatment standards listed at 40 CFR 268.48. Constituents in contaminated soils are not required to be reduced to levels lower than 10 times the universal treatment standards, unless specified under a site-specific cleanup requirement.

Alternative treatment standards for hazardous debris are divided into three technology types: extraction, destruction, and immobilization technologies. Hazardous debris that has been treated by immobilization remains hazardous and must be disposed of in a hazardous waste unit.

Regardless of which treatment standard is used, treated soil would require disposal as hazardous waste unless an authorized regulatory authority determined through a specific regulatory process that the soil does not "contain" sufficient listed constituents to warrant handling as hazardous waste.

Table 3–28 lists the Class II landfills under consideration for disposal of nonhazardous waste from Area IV and the NBZ. **Table 3–29** lists the Class III and unclassified (inert) waste landfills. These facilities are listed for information and analysis purposes and to document the materials the facilities are authorized to accept, the services provided by the facilities, and the estimated capacities for disposal of waste. None of the facilities in either table would receive LLW or MLLW from SSFL.

Because of the large number of nonhazardous waste landfills permitted in California, many of which are available and could be considered for disposal of SSFL waste, only a few are listed.[17] These tables were developed based primarily on the following considerations: (1) landfills that are located within a few hundred miles of SSFL, (2) landfills that accept a range of waste materials and are not clearly restricted to waste from a specific community or county,[18] and (3) Class II landfills, even if at greater distances than a few hundred miles from SSFL. These landfills are considered to be nominally capable of accepting nonhazardous waste from SSFL. (In the past, nonhazardous waste from Area IV and the NBZ was shipped to the Bradley Landfill in Sun Valley, California; this landfill no longer receives waste for onsite disposal.) Waste acceptance at the listed Class III and inert waste landfills would be contingent on compliance with California Executive Order D-62-02.

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[17] As of November 2014, the California State Water Resources Board listed 6 Class II, 131 Class III, 7 Class II and III, and 24 Inert Waste landfills as permitted for operation in the State (SWRCB 2014).

[18] The Mesquite Regional Landfill is listed in Table 3–27 as a candidate site despite its distance from SSFL and its current waste acceptance restrictions because it was developed for disposal of nonhazardous waste generated from the Los Angeles area by intermodal rail delivery. Operation of the landfill has been delayed indefinitely because of reduced nonhazardous waste generation rates in the Los Angeles area.

Table 3–28 Candidate Class II Nonhazardous Waste Disposal Facilities in California

Site [a]	*Location*	*Road Distance (miles)* [b]	*Waste Types Accepted and Services*	*Disposal Capacity*
Facilities Analyzed as Representative				
McKittrick Waste Treatment Site (Waste Management)	McKittrick, California	140	Class II landfill. Accepts construction and demolition debris, industrial and special waste,[c] auto shredder fluff, and nonfriable asbestos for disposal. Services include liquid solidification and drum management. Pre-approval is required for all waste streams.	About 5,500,000 cubic yards of disposal capacity. Waste acceptance limit of 4,000 tons/day.
Additional Facilities				
Altamont Landfill (Waste Management)	Livermore, California	330	Class II and III landfill. Permitted to accept municipal solid waste, yard waste, construction and demolition debris, auto shredder residue, bio-solids, sludge, friable and nonfriable asbestos, and industrial and special wastes.	Remaining permitted capacity is 42.4 million tons. Waste acceptance limit of 11,150 tons/day.
Hay Road Landfill (Recology)	Vacaville, California	380	Class II and III landfill. Permitted to accept municipal solid waste, wastewater treatment sludge, construction and demolition debris, green and food waste, contaminated soil, friable and nonfriable asbestos, and other designated waste.	Design capacity is 37 million cubic yards. Waste acceptance limit of 2,400 tons/day; asbestos acceptance limit of 2,500 tons/month.
Ostrom Road Landfill (Recology)	Wheatland, California	420	Class II landfill. Permitted to accept municipal solid waste, wastewater treatment sludge, construction and demolition debris, green and food waste, contaminated soil, nonfriable asbestos, and other designated waste.	Total design capacity is over 41 million tons; expected closure date of 2066. Waste acceptance limit of 3,000 tons/day.

[a] Names provided in parentheses indicate the operators of the facility.

[b] Road distances are longer than straight-line distances and were estimated assuming that all shipments would depart SSFL via Woolsey Canyon to Topanga Canyon Boulevard, and would end at the listed treatment and/or disposal facilities. Other routes than those assumed could be used, resulting in somewhat different travel distances.

[c] Waste such as that defined in the *California Code of Regulations*, Title 22, as waste that is hazardous only because it contains an inorganic substance or substances that pose a chronic toxicity hazard to human health or the environment; meet all the criteria and requirements of the *California Code of Regulations*, Title 22, Section 66261.122; and has been classified as a special waste pursuant to Section 66261.124.

Note: Capacity estimates and road distances are approximate.

Source: Payton 2014; Recology 2014a, 2014b; Waste Management 2014; WMI 2014, 2015, 2016.

Table 3–29 Candidate Class III and Inert Nonhazardous Waste Disposal Facilities in California

Site [a]	*Location*	*Road Distance (miles)* [b]	*Waste Types Accepted and Services* [c]	*Disposal Capacity*
Facilities Analyzed as Representative				
Antelope Valley (Waste Management)	Palmdale, California	59	Class III landfill. Disposal of clean, nonhazardous soil (restrictions on plant matter content), construction and demolition waste (e.g., asphalt, concrete), and municipal solid waste. Services include recycling of concrete, asphalt, wood, and green waste. Pre-approval is required for industrial waste, large soil volumes, nonfriable asbestos, and treated wood.	20,050,000 cubic yards as of February 2013. Waste acceptance limit of 3,564 tons/day.
Chiquita Canyon Sanitary Landfill (Waste Connections)	Castaic, California	37	Class III landfill. Accepts municipal solid waste, green materials for composting or recycling, construction and demolition debris, inert waste, and nonhazardous soil. Not permitted for liquids or semi-solid wastes (containing 50 percent solids or less). Services include recycling of green waste, asphalt, concrete, and metal.	Greater than 96,000,000 cubic yards as of May 2014. Waste acceptance limit of 6,500 tons/day.
Mesquite Regional Landfill	El Centro, California	270	Class III landfill. Established to receive nonhazardous municipal solid waste from Southern California Counties by intermodal rail delivery. The intermodal transfer station at the landfill has been constructed; an intermodal transfer station in Southern California is under construction (Puente Hills Intermodal Facility in City of Industry, California) with expected station completion in 2017.[d] Operation of the landfill has been delayed indefinitely because of reduced nonhazardous waste generation rates in the Los Angeles area.	Capacity of 600 million tons. 20,000 tons of solid waste per day, including a truck delivery limit of 1,000 tons per day from Imperial County generators and 4,000 tons per day from Los Angeles County generators.
Additional Facilities				
NuWay Arrow Landfill (Waste Management)	Irwindale, California	55	Class III landfill. Accepts construction and demolition waste for disposal.	Waste acceptance limits of 7,500 tons/day (2,750 cubic yards/day) and 780,000 cubic yards/year.
Azusa Land Reclamation (Waste Management)	Azusa, California	56	Unclassified (inert waste) landfill. Accepts solid nonhazardous waste for disposal, including construction and demolition debris and inert waste such as soil, concrete, and asphalt, as well as friable and nonfriable asbestos. Pre-approval is required for industrial waste, large soil volumes, and friable and nonfriable asbestos. An onsite thermal desorption unit provides for remediation of soil containing organic and petroleum materials.	52,000,000 cubic yards as of January 2014. Waste acceptance limit of 6,500 tons/day.
Lancaster Landfill and Recycling Center (Waste Management)	Lancaster, California	64	Class III landfill. Disposal of clean, nonhazardous soil (restrictions on plant matter content), construction and demolition waste (e.g., asphalt, concrete), and municipal solid waste. Pre-approval required for industrial waste, large soil volumes, nonfriable asbestos, treated wood, and municipal wastewater treatment plant sludge. Services include recycling of concrete, asphalt, wood, and green waste.	14,500,000 cubic yards as of February 2014. Waste acceptance limit of 5,100 tons/day.

Site [a]	*Location*	*Road Distance (miles)* [b]	*Waste Types Accepted and Services* [c]	*Disposal Capacity*
El Sobrante (Waste Management)	Corona, California	97	Class III landfill. Accepts solid nonhazardous waste for disposal, including construction and demolition debris and inert waste such as soil, concrete, and asphalt, as well as nonfriable asbestos. Services include recycling of glass, paper, cardboard, plastic, metal, and green waste such as grass and small tree branches. Pre-approval is required for industrial waste, large soil volumes, nonfriable asbestos, and treated wood.	172,000,000 tons as of February 2013. Waste acceptance limit of 16,054 tons/day.

[a] Names provided in parentheses indicate the operators of the facility.
[b] Road distances are longer than straight-line distances and were estimated assuming all shipments would depart SSFL via Woolsey Canyon Road to Topanga Canyon Boulevard, and would end at the listed treatment and/or disposal facilities. Other routes than those assumed could be used, resulting in somewhat different travel distances.
[c] Waste acceptance is contingent on compliance with California Executive Order D-62-02.
[d] The Puente Hills Intermodal Facility in City of Industry, California, is located about 60 road miles from SSFL.
Note: Capacity estimates and road distances are approximate.
Source: SDLAC 2014; Waste Management 2014; WCI 2014a, 2014b; WMI 2014.

Table 3–28 lists four facilities identified as candidates for disposal of waste from Area IV and the NBZ, of which one (McKittrick Waste Treatment Site) was selected as a representative facility for detailed analysis (hence, Table 3–28 lists one representative facility and three additional facilities). Similarly, Table 3–29 lists seven facilities that were identified as candidates for disposal of waste from Area IV, of which three (Antelope Valley, Chiquita Canyon, and Mesquite Regional Landfill) were selected as representative facilities for detailed analysis. Note that operation of the Mesquite Regional Landfill has been delayed indefinitely because of low demand for nonhazardous waste disposal capacity. It was nonetheless selected as a representative facility because nonhazardous waste from SSFL remediation may be generated in large volumes over several years and because the landfill is designed and intended for receipt of nonhazardous waste by direct rail delivery (see Appendix D, Section D.4).

Figure 3–37 shows Class II, Class III, and unclassified waste facilities located within 150 road miles of SSFL. **Figure 3–38** shows additional nonhazardous waste facilities farther from SSFL, including one Class II facility (Ostrom Road Landfill), two Class II and III facilities (Hay Road and Altamont Landfills), and one Class III facility (Mesquite Regional Landfill). Note that the distances indicated on these figures represent straight-line mileage; distances indicated in the tables are road miles. The distances traveled by road are generally farther.

Figure 3–37 Candidate Nonhazardous Waste Landfills in the Vicinity of the Santa Susana Field Laboratory

Figure 3–38 Candidate Nonhazardous Waste Landfills beyond the Vicinity of the Santa Susana Field Laboratory

Recycling is an option for nonradioactive and nonhazardous material from building demolition such as concrete, asphalt, and steel. Several of the Class III landfills listed in Table 3–29 also provide recycling services for this material; a number of standalone recycling facilities also exist in the vicinity of SSFL. **Table 3–30** lists three standalone facilities in the vicinity of SSFL, their approximate road distances from SSFL, and the material accepted for recycling. These facilities are analyzed in Chapter 4 of this EIS as representative facilities for receipt and recycle of material from SSFL.

Table 3–30 Candidate Nonhazardous Material Recycling Facilities[a]

Site	*Location*	*Approximate Road Distance (miles)*	*Materials Recycled*
Kramer Metals	Los Angeles, California	46	Iron and steel scrap, nonferrous metal and alloy scrap, electronic waste, appliances
Standard Industries	Ventura, California	41	Ferrous and nonferrous scrap, paper products, and most plastic
P.W. Gillibrand, Inc.	Simi Valley, California	18	Concrete, asphalt

[a] These three facilities are analyzed as representative.

There are limited numbers of facilities in operation and potentially suitable for disposal of hazardous waste, LLW, or MLLW. **Table 3–31** lists three candidate hazardous waste landfills located in California, one of which is currently not operating and another that does not currently accept waste from SSFL; five additional candidate hazardous waste landfills located in nearby states within 1,100 miles of SSFL; **Table 3–32** lists four candidate radioactive waste disposal facilities, all located outside California.[19] The tables also indicate the representative facilities selected for detailed analysis. The candidate landfills and disposal facilities are shown in **Figures 3–39** and **3–40**. Additional hazardous waste landfills are permitted in the United States at greater distances from SSFL. With certain limitations and exceptions, the DOE facility at the Hanford Site in Washington does not currently accept LLW or MLLW generated from offsite sources, but may do so in the future after the onsite Waste Treatment Plant is in operation.[20]

Some wastes may require thermal destruction or other treatment that cannot be provided at SSFL or at landfills or radioactive waste disposal facilities listed in Tables 3–31 and 3–32. The closest facility permitted for thermal destruction of hazardous constituents is the Clean Harbors facility in Aragonite, Utah, about 710 road miles from SSFL (see Table 3–31). This facility is not permitted to accept LLW or MLLW for treatment. Additional treatment facilities are located at greater distances from SSFL, including facilities that are licensed and permitted for thermal destruction of the hazardous or toxic constituents.

Disposal of radioactive waste containing RCRA-regulated constituents or other regulated materials would be conditional at all sites on treatment to meet land disposal restrictions and other regulatory requirements. NNSS does not at this time provide waste treatment capacity for RCRA-regulated constituents in MLLW generated outside of the State of Nevada; however, as stated in the December 30, 2014, Record of Decision (ROD) for the *Final Site-Wide Environmental Impact Statement for the Continued Operation of the Department of Energy National Nuclear Security Administration Nevada National Security Site and Off-Site Locations in the State of Nevada* (79 FR 78421), DOE is planning for limited MLLW treatment capacity in the future. Energy*Solutions* in Clive, Utah, and Waste Control Specialists in Andrews, Texas, provide treatment capacity for a number of waste streams. Additional LLW and MLLW processing facilities are in operation and are located farther from SSFL than the Energy*Solutions* and Waste Control Specialists.

[19] In Table 3–29, the Waste Control Specialists facility in Andrews, Texas, accepts hazardous waste for disposal as well as LLW and MLLW.

[20] In DOE's December 13, 2013, ROD (78 FR 75913) for the *Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington* (DOE/EIS-0391) (DOE 2013b), DOE deferred a decision on importing wastes from other sites (with limited exceptions) for disposal at Hanford at least until the Waste Treatment Plant at Hanford was operational.

Table 3–31 Candidate Hazardous Waste Facilities

Site [a]	Location	Road Distance (miles) [b]	Waste Types Accepted and Services	Disposal Capacity
HAZARDOUS WASTE TREATMENT AND DISPOSAL FACILITIES Facilities Analyzed as Representative				
Buttonwillow Landfill (Clean Harbors)	Buttonwillow, California	120	Class I landfill. Accepts hazardous and nonhazardous waste for disposal, including contaminated soil, NORM, and TENORM. Services include treatment of metals and liquids, solidification, and microencapsulation.	Permitted capacity is greater than 10 million cubic yards; waste acceptance limit of 10,500 tons/day.
Westmorland Landfill (Clean Harbors)	Westmorland, California	230	Class I landfill. Permitted to accept a wide variety of regulated materials including RCRA hazardous waste, NORM waste from geothermal operations, APHIS soils, and California-regulated waste materials. Treatment services include stabilization, microencapsulation, and neutralization.	Design capacity is 5 million cubic yards. The Westmorland facility is currently not accepting waste due to low demand in the California market, but could accept waste in the future if market conditions improve. Waste acceptance limit of 440,000 cubic yards/year.
Grand View (US Ecology)	Grand View, Idaho	1,020	RCRA Subtitle C landfill. Accepts hazardous, PCB, NORM, TENORM, and exempt [c] waste for disposal. Treatment services include inorganic waste (e.g., metal) stabilization, organic waste chemical oxidation, debris encapsulation, PCB transformer processing, and liquid waste evaporation. The broad permit allows acceptance of hundreds of waste codes, and the facility is also operated as a transfer facility for material that cannot be treated and disposed of on site. The facility can accept waste by truck and/or rail.	1.5 million cubic yards are available as of May 2014, with about 10 million cubic yards permitted. About 28 million cubic yards are cited for future expansion. There are no permit limitations on daily quantities of waste that may be accepted, although there are hourly and yearly limits on some waste treatment processes.
Additional Hazardous Waste Facilities				
Kettleman Hills (Waste Management)	Kettleman City, California	170	Class I and II landfill. Accepts hazardous and nonhazardous waste for disposal, including RCRA and CERCLA waste, PCBs, asbestos, construction and demolition debris, industrial and special waste, NORM, and municipal solid waste. Services include macroencapsulation, metal stabilization, and PCB processing.	Kettleman Hills is currently unable to accept waste from SSFL, but may be able to do so in the future. Waste acceptance limit of 8,000 tons per day.
Beatty (US Ecology)	Beatty, Nevada	330	RCRA Subtitle C landfill. Accepts a variety of wastes for disposal in bulk solid, bulk liquid, or containerized forms, including: RCRA hazardous waste; asbestos and PCBs; California hazardous wastes; VOC-contaminated materials; corrosive wastes and acids; NORM and TENORM materials; nonhazardous solid industrial, commercial, and agricultural wastes; and bulk liquids for solidification. Treatment services include liquid solidification, stabilization of metals and other inorganic wastes, chemical oxidation, encapsulation, thermal desorption of oil-bearing hazardous waste, and PCB transformer processing and recycling. The facility is permitted to accept hundreds of waste codes and is also operated as a transfer facility for material that cannot be treated and disposed of on site.	715,000 cubic yards are available as of May 2014. Plans are in place to develop additional capacity. There are no permit limitations on daily quantities of waste that may be accepted.

Site [a]	*Location*	*Road Distance (miles)* [b]	*Waste Types Accepted and Services*	*Disposal Capacity*
Grassy Mountain Landfill (Clean Harbors)	Grantsville, Utah	710	RCRA Subtitle C landfill. Accepts a variety of wastes for disposal, including PCB-contaminated soils and materials, nonhazardous soils and industrial wastes, asbestos, metal treatment and plating wastes, acidic or caustic wastes, hazardous debris, and non-PCB liquid waste for solidification. Treatment services include solidification and metals fixation. The facility can accept waste by truck and/or rail.	RCRA landfill capacity is 711,000 cubic yards. TSCA landfill capacity is 774,000 cubic yards.
Aragonite Incineration Facility (Clean Harbors)	Aragonite, Utah	710	Rotary kiln incinerator for RCRA and other hazardous wastes. Accepts wastewaters, laboratory packs, inorganic cleaning solutions, oils, flammable solvents, organic and inorganic laboratory chemicals, PCBs, paint residues, debris, off-specification commercial products, compressed gas cylinders, household hazardous waste, and infectious and medical waste. Services include drum, liquid tank, sludge tank, and bulk solid tank storage capacity. The facility can accept waste by truck and/or rail.	N/A
Deer Trail Landfill (Clean Harbors)	Deer Trail, Colorado	1,100	RCRA Subtitle C landfill. Accepts a variety of hazardous and industrial wastes for disposal, as well as NORM and TENORM waste. Treatment services include stabilization of toxic metals, custom treatment of organic wastes, chemical reduction, liquid waste solidification, deactivation and neutralization, and micro- and macroencapsulation.	2.5 million cubic yards of permitted cell space.
Waste Control Specialists	Andrews, Texas	1,100	Accepts hazardous waste for disposal, including inorganic (acids, bases, metals), organic, water-reactive, and exempt [c] waste. Treatment services include stabilization, shredding, repackaging, dewatering, chemical oxidation/reduction, deactivation, encapsulation, neutralization, and controlled reaction. The facility also accepts LLW and MLLW for disposal (see listing under "LLW or MLLW Treatment and Disposal Facilities"). The facility can accept waste by truck and/or rail.	5,423,000 cubic yards of permitted space in the hazardous waste facility.

APHIS = Animal and Plant Health Inspection Services; CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act; LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; N/A = not applicable; NNSS = Nevada National Security Site; NORM = naturally occurring radioactive material; PCB = polychlorinated biphenyl; RCRA = Resource Conservation and Recovery Act; TENORM = technologically enhanced naturally occurring radioactive material; TSCA = Toxic Substances Control Act; VOC = volatile organic compound.

[a] Names provided in parentheses indicate the operators of the facility.

[b] Road distances are longer than straight-line distances and were estimated assuming all shipments would depart SSFL via Woolsey Canyon Road to Topanga Canyon Boulevard, and would end at the listed treatment and/or disposal facilities. Other routes than those assumed could be used, resulting in somewhat different travel distances.

[c] Frequently called low-activity waste, exempt waste refers to waste containing so little radioactive material that it can be disposed of by methods other than those used at an LLW disposal facility licensed under 10 CFR Part 61 or equivalent Agreement State regulation. Disposal of this waste is licensed under 10 CFR 20.2002 or equivalent Agreement State regulation. DOE would dispose of only hazardous waste at the US Ecology site in Idaho.

Note: Capacity estimates and distances are approximate.

Source: Clean Harbors 2014a, 2014b, 2014c, 2014d, 2015; Gordon 2014; Halstrom 2014; Hubbard 2014; WCS 2016.

Table 3–32 Candidate Radioactive Waste Facilities

Site [a]	*Location*	*Road Distance (miles)* [b]	*Waste Types Accepted and Services*	*Disposal Capacity*
LLW OR MLLW TREATMENT AND DISPOSAL FACILITIES **Facilities Analyzed as Representative**				
Clive (Energy*Solutions*)	Clive, Utah	780	Accepts Class A LLW, Class A MLLW, 11e(2) byproduct material, NORM waste, and NARM waste for disposal. Waste types include decommissioning debris, metal, soil and debris, PCBs, asbestos, and liquids. Treatment services include thermal desorption, oxidation/reduction, macroencapsulation, chemical stabilization, mercury amalgamation, neutralization/deactivation, and debris spray washing. The facility can accept waste by truck and/or rail.	Greater than 8 million cubic yards of licensed/permitted capacity. Additional capacity exists subject to licensing/permitting. There are no permit limitations on daily quantities of waste that may be accepted.
Nevada National Security Site (DOE)	Nye County, Nevada	330	Accepts LLW and MLLW for disposal, including wastes containing or contaminated with asbestos or PCBs, from approved DOE waste generators. All MLLW must meet RCRA land disposal restrictions, and limited MLLW treatment services are provided for out-of-state waste.[c] Soil containing hazardous constituents is acceptable if it meets alternative treatment standards for contaminated soil or if the state of origin makes a "contained-in" determination. The facility can accept waste by truck.	6.4 million cubic feet (237,000 cubic yards) as of April 2014; up to 1,950,000 cubic yards of projected capacity.[c]
Additional LLW or MLLW Facilities				
Waste Control Specialists	Andrews, Texas	1,100	Accepts LLW and MLLW for disposal. Treatment services include chemical oxidation/reduction, deactivation, micro- and macroencapsulation, neutralization, stabilization, and controlled reaction. The facility can accept waste by truck and/or rail. The facility also accepts hazardous waste for disposal (see the listing under "Additional Treatment and Disposal Facilities").	2,100,000 cubic yards in the DOE LLW and MLLW facility, including 1,200,000 cubic yards of bulk waste.
Hanford Site (DOE)	Richland, Washington	1,100	Disposal of DOE LLW and MLLW.	Hanford does not currently accept LLW or MLLW from other DOE sites, but may do so in the future after the Hanford Waste Treatment Plant is in operation.[d]

LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; NARM = naturally occurring and accelerator-produced radioactive material; NORM = naturally occurring radioactive material; PCB = polychlorinated biphenyl; RCRA = Resource Conservation and Recovery Act.

[a] Names provided in parentheses indicate the operators of the facility.

[b] Road distances are longer than straight-line distances and were estimated assuming all shipments would depart SSFL via Woolsey Canyon Road to Topanga Canyon Boulevard, and would end at the listed treatment and/or disposal facilities. Other routes than those assumed could be used, resulting in somewhat different travel distances.

[c] In DOE's December 30, 2014, ROD (79 FR 78421) for the *Final Site-Wide Environmental Impact Statement for the Continued Operation of the Department of Energy/National Nuclear Security Administration Nevada National Security Site and Off-Site Locations in the State of Nevada* (DOE 2013a), DOE decided to dispose of up to 48 million cubic feet of LLW and up to 4 million cubic feet of MLLW at the NNSS Area 5 Radioactive Waste Management Complex (RWMC); store MLLW (received from on- and offsite [including out-of-state] generators) at the Area 5 RWMC pending treatment by micro- and macro-encapsulation (i.e., repackaging); and conduct sorting and segregation of MLLW, bench-scale mercury amalgamation of MLLW, and/or disposal of this waste at the Area 5 RWMC, as appropriate.

[d] In DOE's December 13, 2013, ROD (78 FR 75913) for the *Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington* (DOE/EIS-0391) (DOE 2013b), DOE deferred a decision on importing wastes from other sites (with limited exceptions) for disposal at Hanford at least until the Waste Treatment Plant at Hanford was operational.

Note: Capacity estimates and distances are approximate.

Source: Clean Harbors 2014a, 2014b, 2014c, 2014d, 2015; Gordon 2014; Halstrom 2014; Hubbard 2014; WCS 2016.

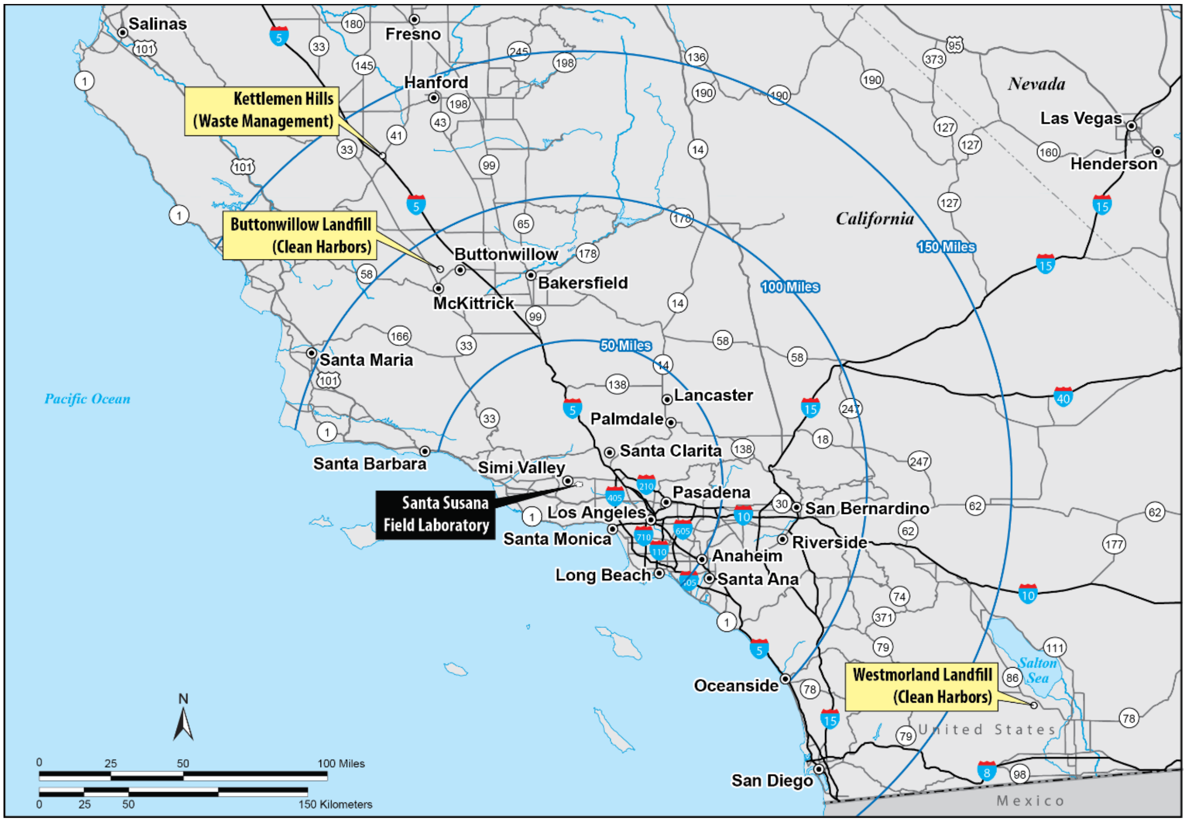

Figure 3–39 Candidate Hazardous Waste Landfills in California

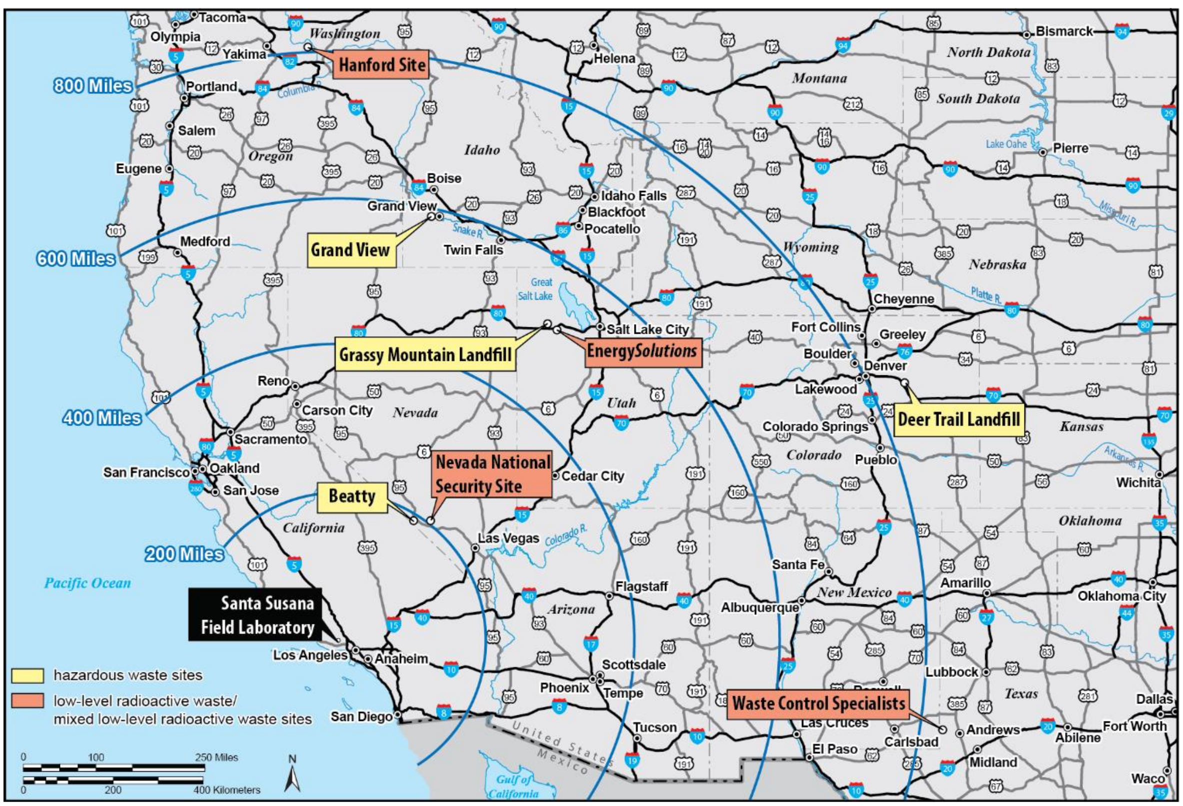

Figure 3–40 Candidate Hazardous Waste Landfills and Radioactive Waste Disposal Sites Located Outside of California

3.11 Cultural Resources

3.11.1 Introduction

Cultural resources are districts, buildings, sites, structures, areas of traditional use, or objects with historical, architectural, archaeological, cultural, or scientific importance. Cultural resources include archaeological resources (both pre-contact and post-contact eras); historic architectural resources (physical properties, structures, or built items); and traditional cultural resources.

The National Historic Preservation Act (NHPA) of 1966, as amended, establishes national policy for protecting historic properties (i.e., cultural resources listed or eligible for listing on the *National Register of Historic Places* (NRHP) [refer to Appendix B, Section B.11.4]). Compliance with Section 106 of the NHPA, which directs Federal agencies to take into account the effect[21] of a proposed Federal undertaking[22] on a historic property, is outlined in the Advisory Council on Historic Preservation's regulations, "Protection of Historic Properties" (36 CFR Part 800). Only historic properties (including traditional cultural properties) are considered for potential adverse impacts from a Federal action under the NHPA. NEPA requires consideration of impacts on all cultural resources, including those that are not eligible for the NRHP.

Several laws, regulations, and other documents address the requirement of Federal agencies to notify or consult with Native American tribes or otherwise consider their interests when planning and implementing Federal undertakings. These include the NHPA; American

Types of Cultural Resources

Archaeological resources occur in places where people altered the ground surface or left artifacts or other physical remains (e.g., arrowheads, glass bottles, pottery). Archaeological resources can be classified as either sites or isolates. ***Isolates*** generally cover a small area and often contain only one or two artifacts, while ***sites*** are usually larger in size, contain more artifacts, and sometimes contain features or structures. Archaeological resources can date to either the pre-contact, ethnographic, or post-contact eras (NPS 1995).

Architectural or structural resources are standing buildings, facilities, wells, canals, bridges, and other such structures (NPS 1995). In the Santa Susana Field Laboratory (SSFL) region, they are generally affiliated with the historic era.

Historic properties are any pre-contact or post-contact districts, sites, buildings, structures, or objects included in, or eligible for inclusion in, the *National Register of Historic Places* (NRHP) (Title 36, *Code of Federal Regulations*, Sections 800.16(l)(1) and (2) [36 CFR 800.16(l)(1) and (2)]). Pre-contact and post-contact refer to the periods before and since an indigenous people encounter an outside culture. In California, 1769, when the Spanish first arrived, is considered to be the turning point from pre-contact to post-contact. Ethnographic refers to the time during which specific cultures are systematically studied and the information recorded. Formal study of Native American culture in the United States is considered to have begun in the late 1800s.

Traditional cultural properties are resources that are associated with the cultural practices or beliefs of a living community, that link the community to its past and are "important in maintaining the continuing cultural identity of the community", and that are eligible for or are listed on the NRHP (DOI 1998). Most traditional cultural resources or sacred sites in the SSFL region are associated with Native Americans. Traditional cultural properties or resources may also be associated with other traditional lifeways, such as agriculture. Traditional cultural properties can include archaeological resources, locations of pre-contact or post-contact events, sacred areas, sources of raw materials used in the manufacture of tools and/or sacred objects, certain plants, traditional hunting and gathering areas, or landscapes (NPS 1998).

Traditional cultural resources are associated with the cultural practices or beliefs of a living community, that link the community to its past and help maintain its cultural identity, but have not been evaluated for NRHP eligibility or may not meet the NRHP eligibility criteria.

Sacred sites are any specific, discrete, narrowly delineated location on Federal land that is identified by a Native American tribe or an individual determined to be an appropriately authoritative representative of a Native American religion as sacred by virtue of its established religious significance to, or ceremonial use by, a Native American religion, provided that the tribe or appropriately authoritative representative of a Native American religion has informed the agency of the existence of such a site (Executive Order 13007).

Cultural landscapes are geographic areas where cultural and natural resources and wildlife have been associated with historic events, activities, or people, or which serve as an example of cultural or aesthetic value. The four types of cultural landscapes are: ***historic sites*** (e.g., battlefields, properties of famous historical figures); ***historic designed landscapes*** (e.g., parks, estates, gardens); ***historic vernacular landscapes*** (e.g., industrial parks, agricultural landscapes, villages); and ***ethnographic landscapes*** (contemporary settlements, religious sites, massive geological structures) (Birnbaum 1994). Although there is no formal definition for "traditional cultural landscapes" (ACHP 2012a, 2012b), they would be included in this latter category.

[21] An "effect" under Section 106 means an alteration to the characteristics of a historic property that qualify it for inclusion in or eligibility for the NRHP. A Federal agency must assess the effects of the proposed undertaking on historic properties prior to applying the criteria of adverse effect (CEQ and ACHP 2013).

[22] An "undertaking" "means a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; and those requiring a Federal permit, license or approval" (36 CFR 800.16(y)).

Indian Religious Freedom Act; Presidential *Memorandum on Government-to-Government Relations with Native American Tribal Governments*; Executive Orders 13007, *Indian Sacred Sites*, and 13175, *Consultation and Coordination with Indian Tribal Governments*; and DOE Order 144.1, *Department of Energy American Indian Tribal Government Interactions and Policy*. Chapter 8, Section 8.1.8, provides the regulatory requirements for preservation of cultural and traditional cultural resources and consultation with Native Americans.

The area of potential effects (APE) of an undertaking is "the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist" (36 CFR 800.16(d)). The APE for the proposed action consists of the area within the boundaries of Area IV and the NBZ. In compliance with NHPA, Section 106, DOE consulted with the California State Historic Preservation Officer (SHPO) and the associated Office of Historic Preservation regarding the APE; in a letter dated February 25, 2015, SHPO agreed with DOE's definition of the APE (OHP 2015).

The review of cultural resources (including historic properties and traditional cultural properties) for analysis in this EIS goes beyond the APE in order to provide a wider context within which to understand the cultural resources located within the APE. This is important in considering potential and cumulative effects on cultural resources. This expanded area, termed the ROI, includes the APE (i.e., Area IV and the NBZ), as well as the rest of SSFL and the area within a 1-mile radius of SSFL. This section of this EIS describes the cultural resources and history of southern California and the ROI, including the APE. Appendix F provides more-detailed information than is included in this section.

3.11.2 Regional History

Human prehistory (defined as that time before written records) in the Simi Valley area extends back some 10,000 to 12,000 years. This long time span is typically divided into the Paleo-Coastal period (11,000 to 7,000 Before Common Era [B.C.E.]); the Millingstone Horizon (7,000 to 5,000 B.C.E.); and the Early, Middle, and Late periods (5,000 B.C.E. to 1,840 Common Era [C.E.]). It was during the Late period that populations settled into the groups we know as the Chumash, Fernandeño Tataviam, Gabrielino Tongva, and others. The Late period overlaps the Ethnographic period (which begins in approximately 1769 C.E.), when contact was made by the Spanish, followed by other Euro-Americans.

3.11.2.1 Ethnography

As shown in **Figure 3–41**, SSFL is located near the boundary of the Chumash, Fernandeño Tataviam, and Gabrielino Tongva ethnographic groups. The APE is located within what is commonly considered Chumash territory, near the borders of Fernandeño Tataviam and Gabrielino Tongva territories (NAHC 2015). The boundaries depicted in Figure 3–41 are conceptual and are disputed by some tribes. Chapter 9 of this EIS is written by the Chumash, Fernandeño Tataviam, and Gabrielino Tongva Tribes and provides the Native American perspective.

Chumash

Chumash refers to a group of people who shared a language belonging to the Hokan linguistic family. The Chumash settlement pattern consisted of a main settlement or village with one or more outlying seasonally occupied camps. A typical village consisted of several houses, a semi-subterranean sweathouse (*temescal*), store houses, a ceremonial enclosure, a gaming area, and a cemetery (Grant 1978; Landberg 1965).

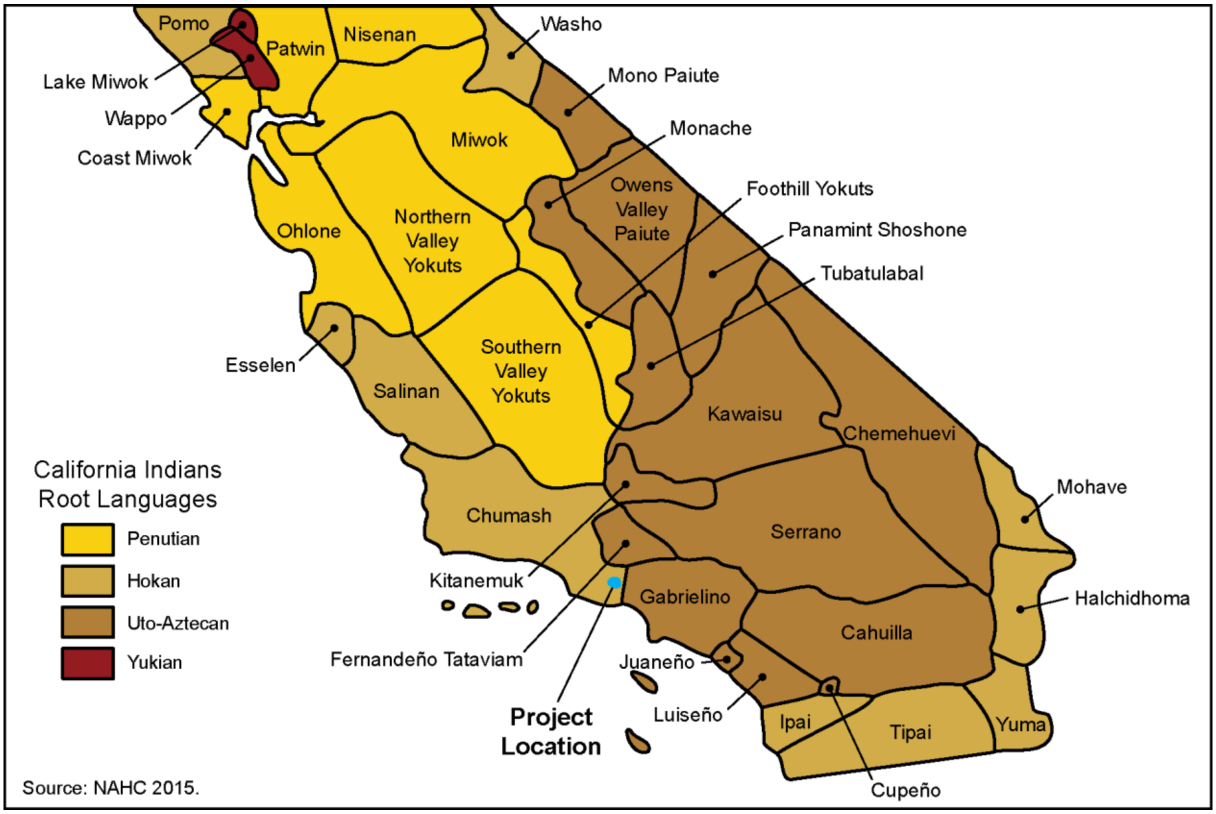

Figure 3–41 Historic Tribal Boundaries in Relation to Santa Susana Field Laboratory

Simi takes its name from the Chumash village of Shimiyi (Applegate 1974; Kroeber 1925). This village was a capital, or a more populous and important town, where festivals, feasts, and perhaps councils were held (King and Parsons 1999). At least two other Chumash villages, Ta'apu and Kimishax, were also located in the Simi Valley (Johnson 1997). Chumash descendants are numerous in the area today and they have been involved in cultural revitalization throughout the 20th century (Glassow et al. 2007).

Fernandeño Tataviam

The Tataviam lived on the upper reaches of the Santa Clara River east of Piru Creek. Their territory extended over the Sawmill Mountains to the north and included the southwestern portion of the Antelope Valley (King and Blackburn 1978). To the west, the Tataviam territory bordered Chumash territory. To the south, in the vicinity of the Santa Susana Mountains, Tataviam territory bordered various Gabrielino-speaking groups (King and Blackburn 1978). The Fernandeño Tataviam dispute some of these boundary descriptions, claiming a broader territory (Johnson and Earle 1990).

Tataviam settlements ranged from small villages with populations of 10 to 15 people to large centers with more than 200 people (King and Blackburn 1978). The name Fernandeño refers to the Spanish mission established in their territory: San Fernando (Bean and Smith 1978). The village of Momonga is associated with the Fernandeño, who lived somewhere on the eastern slope of the Simi Hills in the vicinity of Santa Susana Pass. Several locations have been suggested for Momonga: near a major trail that crossed over the original Santa Susana Pass into the Simi Valley that may be represented by the Chatsworth site; a site surrounding Stony Point; or a complex of sites located within the Santa Susana Pass State Historic Park (Johnson 2006).

Gabrielino Tongva

The name Gabrielino refers to the Spanish mission established in their territory: San Gabriel (Bean and Smith 1978). The Gabrielino Tongva occupied much of present-day Los Angeles and Orange counties (McCawley 1996), southeast of the Chumash and south of the Fernandeño Tataviam. The Gabrielino Tongva dispute this boundary description. At the time of European contact, the Gabrielino Tongva population was estimated to reside in 50 to 100 villages, each with 50 to 100 inhabitants (Bean and Smith 1978).

3.11.2.2 Post-Contact History

The first known contact by Euro-Americans in this area occurred when the Gaspar de Portolá expedition passed through the area in 1769. With 65 soldiers and two Franciscan friars, Portolá marched north from San Diego; although Portolá did not pass through Simi, scouts from his expedition reportedly crossed "the Hogback" (the Santa Susana Mountains) between Camulos and Tapo and camped near present-day Simi (Cameron 1963).

In the early 1800s, farming and ranching were the area's primary economic mainstays. By the early 1830s, there were 19 ranches in Ventura County covering nearly half a million acres. Cattle, sheep, horses, and mules were raised. After 1848, ranching declined and the production of wheat, barley, corn, and other dry-farmed crops expanded. The first commercial citrus grove in the county was planted near Santa Paula in 1874 (Edwards et al. 1970).

During the 1860s, a few Euro-American settlers moved into the Simi Valley. A precarious passage was cut through the rocks of Santa Susana Pass in 1860, and this route became the new coast stage route (Roderick 2001). The Overland Mail Company stage began using the new pass in September 1861, and the Pacific Coast Stage Line began running over the Santa Susana Pass into the Simi Valley in 1861 on its route between Los Angeles and San Francisco (Havens 1997; Roderick 2001).

Farming was the main occupation in the Simi Valley for almost a century, from the 1860s until the 1950s (Havens 1997). Agriculture in the Simi Valley consisted almost exclusively of raising grain (Cameron 1963).

The stagecoach road known as Devil's Slide was used through the 1860s and 1870s. The completion of the railroad tunnel in 1905 and the construction of the Santa Susana Pass road in 1895 led to the abandonment of the Devil's Slide stage route (Mealy and Brodie 2005). The stage route, stage station, and various features related to historic uses, as well as portions of pre-contact sites, are listed on the NRHP, and the stage route was also declared a Los Angeles City Historical Cultural Monument (Number 92) and Ventura County Historical Landmark (Number 104) (Mealy and Brodie 2005).

Prior to its development, the land encompassing SSFL was ranch land. By the early 20th century, the land had been acquired by the Dundas and Silvernale families, who used the land for cattle grazing (Post/Hazeltine Associates 2009). In the 1920s and 1930s, Hollywood film studios shot a number of westerns on the property (Post/Hazeltine Associates 2009).

SSFL is primarily an outcome of the post-World War II space race. SSFL was developed as a remote site to test rocket engines to support the growing aerospace industry of southern California. Established in 1947 by North American Aviation (which later became the Rocketdyne Division of Rockwell International), SSFL was first used to test rocket engines for the U.S. Department of Defense, then later for NASA. SSFL is noted for the testing of rocket engines for the Atlas, Thor, Jupiter, Apollo, and Saturn missions and the Space Shuttle program.

In the early 1950s, Rockwell International acquired ownership of the land that became the western portion of SSFL and created Atomics International to conduct nuclear research in what would become Area IV of SSFL. Starting in the mid-1950s, the Atomic Energy Commission (AEC), a predecessor agency of DOE, leased a 90-acre portion of Area IV from Rocketdyne and funded nuclear energy research that primarily involved testing of small pilot-scale reactors. From 1955 to 1980, DOE funded operation of 10 reactors. Nuclear research was also performed in Area IV by commercial entities. In the early 1960s, AEC created ETEC as a "center of excellence" for liquid metals research. This work involved testing the properties of liquid sodium and potassium in a variety of non-nuclear programs. Other operations at ETEC focused on applied engineering and development of emerging energy technologies, including solar and fossil energy, as well as development of an energy conservation methodology.

By 1980, all reactor operations had ceased, and nuclear research within Area IV was terminated in 1988. At the height of research activities in the late 1960s, there were over 200 numbered structures in Area IV. When the mission of each experimental activity ended, DOE began decontamination, decommissioning, and demolition of the structures. In 1996, Rockwell International sold its aerospace and defense business, including Areas I, III, and IV of SSFL, to Boeing, the current land owner. At present, only 22 structures remain in Area IV: 18 owned by DOE and 4 by Boeing.

3.11.2.3 Cultural Resources

The information presented in this section summarizes the detailed descriptions of the records search results and documented cultural resources review, including historic properties, at SSFL within the APE and the ROI. Details of the review may be found in Appendix F, Section F.2.1.

3.11.2.3.1 Previous Cultural Resources Studies within the Region of Influence

A records search was conducted to identify cultural resources surveys and previously recorded sites within the ROI. As shown in **Table 3–33**, cultural resources at SSFL have been the subject of many investigations by cultural anthropologists, archaeologists, and cultural resource managers since the 1950s.

Table 3–33 Summary of Previous Studies within the Region of Influence

Resource summaries directly relevant to SSFL cultural resources	4 studies, from 1985 to 1999
Archaeological surveys outside of SSFL, but within 1 mile of SSFL	12 studies, from 1973 to 2007
Archaeological surveys within SSFL, but outside the APE	8 studies, from 1953 to 2014
Archaeological surveys within the APE (Area IV and the NBZ)	10 studies, from 1999 to 2014

APE = area of potential effects (or Area IV and the NBZ); NBZ = Northern Buffer Zone.
Note: Complete citations are presented in Appendix F, Table F–1.

3.11.2.3.2 Archaeological Resources

As shown in **Table 3–34**, archaeological evidence is common in the vicinity of SSFL (Appendix F contains a complete listing of archaeological sites). Fifty archaeological sites have been located outside of, but within 1 mile of SSFL. Rockshelters with artifacts, features, or rock art dominate the recorded sites, but site types include lithic scatters and inscribed boulders. Only one site from the post-contact era has been recorded. A survey of Area IV and the NBZ (the APE) combined yielded 26 archaeological sites and 53 isolates, only one of which is from the post-contact era (SCCIC 2009, 2014; see Appendix F). Archaeological sites in Area IV include bedrock mortars, lithic scatters, and a number of rockshelters with artifacts. The NBZ has a similar complement of open-air lithic scatters and rockshelters with artifacts; the abundance of rockshelters reflects the more rugged nature of this portion of the APE. Isolated artifacts found throughout Area IV and the NBZ indicate the widespread use of the area. As explained in Appendix F, consultation with SHPO is ongoing regarding NHRP eligibility of archaeological sites. As of October 2016, no determinations have been made.

Table 3–34 Summary of Known Archaeological Sites and Isolates within the Region of Influence[a]

Cultural Resource Type	*Area IV*	*NBZ*	*Other SSFL Locations*	*Outside SSFL*
Native American, eligible	Unknown	Unknown	16 [b]	Unknown
Native American, not eligible	Unknown	Unknown	Unknown	Unknown
Native American, unevaluated	15	10	2	49
Native American isolate, not eligible	15	38	28	5
Historic, eligible	0	0	0	0
Historic, not eligible	0	0	0	0
Historic, unevaluated	1	0	0	1
Historic isolate, not eligible	0	0	0	0
Traditional	See note c	See note c	See note c	Unknown
Total Recorded Resources [a]	**16 sites 15 isolates**	**10 sites 38 isolates**	**18 sites 28 isolates**	**50 sites 5 isolates**

NBZ = Northern Buffer Zone.

[a] Based on June 2014 record search and research on file at SSFL; refer to Appendix F for a complete listing of known cultural resources. Resource identification, determination of *National Register of Historic Places* eligibility (including State Historic Preservation Officer consultation) and description of traditional cultural resources is ongoing.

[b] Burro Flats Painted Cave and associated locations and features.

[c] The Santa Susana Sacred Sites encompasses all of SSFL (see Section 3.11.2.3.4).

Source: Appendix F, Tables F–2 and F–3.

Within the boundaries of SSFL, but outside the APE, a 25-acre NRHP-listed site complex (Burro Flats Painted Cave) dominates the assemblage. Burro Flats Painted Cave (CA-VEN-1072; NRHP #76000539, listed May 5, 1976) encompasses 15 individually recorded additional sites in Area II, which is administered by NASA. The Burro Flats Painted Cave site is considered "one of the most elaborate, and probably the best preserved painted petroglyph [sic] in California" (Fenenga 1973) and "the most spectacular pictograph site in the Santa Susana Mountains" (Knight 2001). The individual rock art components at the Burro Flats Painted Cave site include polychrome pictographs, red-only pictographs, black-only pictographs, white-only pictographs, orange-only pictographs, blue-only pictographs, four petroglyphs, cupules, and multiple crude grooves (Knight 2001). The pictographs include motifs such as circles, segmented worms or centipedes, and stick-like anthropomorphic and zoomorphic figures (Rozaire 1959). The site includes a large midden area, fire-cracked rocks, two boulders with linear pecked and engraved cupules, five locations of bedrock milling or mortars, and a network of paths worn into the soft sandstone by generations of people using the site (Fenenga 1973). Additional detail concerning the Burro Flats Painted Cave is included in Appendix F.

3.11.2.3.3 Architectural or Structural Resources within the APE

All standing structures in SSFL Area IV have been inventoried and evaluated for NRHP eligibility. There are no structures in the NBZ. A 2009 study indicates that the decommissioning and demolition process (ongoing since the mid-1970s) has significantly impacted the setting of Area IV by removing buildings, structures, and features. At the time of the study, more than 75 percent of the buildings, structures, and features associated with Area IV during its period of significance had been demolished (Post/Hazeltine Associates 2009).

The study did not recommend Area IV as eligible for listing on the NRHP or the *California Register of Historical Resources* (California Register) as a historic district based on its architectural resources, primarily because it lacks sufficient integrity to convey its historic appearance or association with the history of nuclear power research and development in the United States and the post-World War II transformation of California. The study also did not recommend the buildings, structures, or features within Area IV as individually eligible for listing on the NRHP or the California Register (Post/Hazeltine Associates 2009). SHPO concurred with these findings regarding the architectural and structural resources in Area IV (OHP 2010).

3.11.2.3.4 Traditional Cultural Properties, Resources, and Sacred Sites

No traditional cultural properties have been identified in Area IV or the NBZ, based on a review of information available from the South Central Coastal Information Center, the California Register, and the NRHP. Although the Burro Flats Painted Cave site (located outside the APE, but still on SSFL) is listed on the NRHP (#76000539) and could be considered a traditional cultural property, it has not been formally designated as one. The Burro Flats Painted Cave site is located in Area II on land owned by the U.S. Government and managed by NASA.

The Santa Ynez Band of Chumash Indians, a federally recognized tribe, has designated the entire SSFL as a Native American sacred site (referred to herein as the Santa Susana Sacred Site) and believes that the site is eligible for inclusion on the NRHP as a traditional cultural property. In 2014, the tribe filed paperwork nominating the site to be included in the *State of California Native American Heritage Commission Sacred Lands Inventory* (NAHC 2014). Executive Order 13007 requires that, in managing Federal lands and activities, Federal agencies "shall, to the extent practicable, permitted by law, and not clearly inconsistent with essential agency function . . . accommodate access to and ceremonial use of Indian sacred sites" and avoid adversely affecting the physical integrity of the sacred sites. While DOE does not own property at Area IV, DOE is working with the Native American tribes with ties to the SSFL area to preserve the cultural resources and the sacred nature of SSFL Area IV.

The draft nomination form states, in part:

> All of those who have had the opportunity to visit agree that the Burro Flats Painted Cave and the surrounding Santa Susana Field Laboratory (where numerous Native American sites are now known to exist) are part of a large and important Traditional Cultural Landscape. Today, many indigenous people consider the Burro Flats Painted Cave to be a very important shrine site, and feel strongly that it and the surrounding area are important to their culture. It is for this reason that the Elder's Council of the Santa Ynez Band of Chumash Indians has requested that the entire former Santa Susana Field Lab be described as <u>the Santa Susana Sacred Sites and Traditional Cultural Property</u>, by the State of California.

Currently, DOE, the Santa Ynez Band of Chumash Indians, and the California Office of Historic Preservation are in consultation as to how this nomination affects management of cultural resources on SSFL Area IV. DTSC is considering whether or not to recommend to SHPO and Federal agencies that the entire SSFL, including Area IV and the NBZ, should be considered a historic district that would be eligible for listing on the NRHP, based primarily on the archaeological and traditional resources there.

DOE is consulting with SHPO, the Santa Ynez Band of Chumash Indians, and the Santa Susana Field Laboratory Sacred Sites Council (SSFL Sacred Sites Council), a group that includes representatives of the federally recognized Santa Ynez Band of Chumash Indians, and the non-federally-recognized Fernandeño Tataviam and Gabrielino Tongva to develop an agreement intended to resolve adverse impacts through avoidance, minimization, or mitigation of impacts during and subsequent to cleanup activities.

3.11.3 Consultation and Public Involvement

DOE began consultation efforts with appropriate agencies, tribes, and members of the public that have interests in cultural resources at SSFL even before the Notice of Intent for this EIS was published in 2008 and has continued consultation in accordance with NEPA, Section 106 of the NHPA, appropriate Executive Orders and Executive Memoranda. Details of these efforts are provided in Appendix E, Section E.1.

3.11.3.1 Native American Consultation

DOE conducts consultation with federally recognized tribes under Section 106 of the NHPA; NEPA; Executive Order 13175, *Government-to-Government Consultation*; Executive Order 13007, *Indian Sacred Sites;* the Presidential *Memorandum on Government-to-Government Relations with Native American Tribal Governments;* and DOE Order 144.1, *Department of Energy American Indian Tribal Government Interactions and Policy*; and is guided by principles described by the Advisory Council on Historic Preservation (ACHP 2008, 2012a, 2012b). The Santa Ynez Band of Chumash Indians is the only federally recognized tribe that attaches religious and cultural significance to affected historic properties at SSFL, although informal consultation has been ongoing between DOE and tribes that are not federally recognized (including representatives of the Fernandeño Tataviam, Gabrielino Tongva, and other Chumash bands) throughout the NEPA and NHPA, Section 106, processes. DOE initiated Government-to-Government consultation with the Santa Ynez Band of Chumash Indians in January 2014, in compliance with Executive Order 13175, and at the same time initiated consultation in compliance with Section 106 of the NHPA. At that time, DOE also formally issued an invitation to the Santa Ynez Band of Chumash Indians to be a cooperating agency in DOE's SSFL NEPA process for this EIS, and the invitation was accepted (Santa Ynez Band of Chumash Indians 2014).

DOE also consults with the SSFL Sacred Sites Council. Tribes that are not federally recognized are not covered by the requirements of Federal statutes, Executive Orders, and guidance.

3.11.3.2 Federal, State, and Local Agency Consultation and Public Involvement

DOE identified Federal and local agencies that might have cultural resources concerns. Primary contacts and DOE activities in compliance with Section 106 of the NHPA (36 CFR 800.2(c)) are listed in Appendix E. Correspondence with SHPO initiated formal consultation for the proposed action in 2009; the consultation relationship was renewed in 2014. In compliance with Section 106 of the NHPA, consultation is ongoing and will continue until the process is complete.

As required by the Section 106 process (36 CFR 800.2(d) and 800.3(e)), members of the public have been involved through special meetings for SSFL stakeholders and through avenues provided by the NEPA process.

3.12 Socioeconomics

This section describes the regional economies of the area surrounding SSFL and the regions surrounding the representative recycle and waste disposal facilities and presents current data on industry sectors, employment, and housing in the regional economies. Socioeconomic data pertaining to environmental justice concerns (Native American tribes and minority and low-income populations) are included in Section 3.13, Environmental Justice.

Multiple ROIs for socioeconomics have been identified. One ROI comprises Los Angeles and Ventura Counties, where SSFL is located. Additional ROIs comprise the counties where the representative recycle and waste disposal facilities are located, including Los Angeles, Ventura, Imperial, and Kern Counties in California; Owyhee County in ID; Nye County in Nevada; and Tooele County in Utah. Data are presented first for Los Angeles and Ventura Counties, then for the counties where the recycle and disposal facilities are located.

3.12.1 Los Angeles and Ventura Counties

Los Angeles and Ventura Counties have developed policies and initiatives to protect and develop regional economies.

The 2016-2020 Los Angeles County Strategic Plan for Economic Development (LAEDC 2016), prepared by the Los Angeles County Economic Development Corporation, lists seven key components for successful economic development. These components are: 1) Invest in our people to provide greater opportunity; 2) Strengthen our leading export-oriented industry clusters; 3) Accelerate innovation and entrepreneurship; 4) Be more business-friendly; 5) Remove barriers to critical infrastructure development, financing and delivery; 6) Increase global connectedness; and 7) Build more livable communities. Each component has a specific set of objectives to assist in the implementation of these goals. The Plan is Los Angeles County's consensus "blueprint" for a strong economy, that defines priorities and actionable strategies to foster creation of well-paying jobs, help key industries and the workforce succeed, and increase shared prosperity and standards of living for the diverse residents throughout the county.

Policy goals presented in the Los Angeles County Economic Development Corporation's *2012–2013 Policy Booklet* (LAEDC 2012) include boosting advanced manufacturing, creative and export-oriented sectors; fixing the broken infrastructure delivery, development, and funding process; and building more livable communities.

The city of Ventura lists six economic focus areas in its *Economic Development Strategy 2013–2018* (City of Ventura 2013): responsive and effective government; tourism, retail, and quality of life; entrepreneurship and economic gardening; healthcare and biomedical; manufacturing; and regional agriculture and food. Each focus area includes multiple goals and objectives that further explain the intention of the focus area. The goal of this document is to "retain existing businesses in Ventura, create opportunities for expansion, provide for entrepreneurs to make the jump from employee to employers, and attract complementary businesses to the City."

The *Ventura County Strategic Plan* (Ventura County 2011b) addresses five focus areas, including good government; financial stability; county workforce; environment, land use, and infrastructure; community well-being; and public safety.

3.12.1.1 Population

Table 3–35 presents past and projected population data for Los Angeles and Ventura Counties. Both counties have experienced increased population growth and are projected to keep growing. Between the years 2000 and 2010, the Los Angeles County population grew by 3.1 percent and the

Ventura County population grew by 9.3 percent. In 2013, the population of Los Angeles County was estimated to be 10,017,068 and the population of Ventura County was 839,620 (Census 2013a).

Projected population estimates to 2030 show that the growth rate is expected to be similar between the two counties. The total population for both counties combined in 2030 is expected to be around 11.8 million.

Table 3–35 Population and Population Projections for Los Angeles and Ventura Counties, 2000 to 2030

County	Population (persons)			
	2000 [a]	2010 [b]	2020 [c]	2030 [c]
Los Angeles	9,519,338	9,818,605	10,435,991	10,930,986
Ventura	753,197	823,318	876,124	927,304
Total	**10,272,535**	**10,641,923**	**11,312,115**	**11,858,290**

[a] Census 2000.
[b] Census 2010a.
[c] California Department of Finance 2014.

3.12.1.2 Industry and Employment

Figure 3–42 shows the zip codes along the proposed local truck routes from SSFL to the major highways. The local roadways include the surface streets, including Topanga Canyon Boulevard, where trucks would travel from SSFL to the highways, and U.S. Highway 101 and SR 118, which would be used to take materials to the recycle and disposal facilities. The local surface roads are all located in Los Angeles County. **Table 3–36** shows the number of establishments[23] by industry in areas of Los Angeles along these local truck routes and the total number of employees. There are 6,471 establishments within these zip codes. Professional, scientific, and technical services have the most establishments within the area, with a total of 956. Retail trade is second, with 745 establishments.

Tables 3–37 and **3–38** respectively provide details on the construction and transportation industries in Los Angeles and Ventura Counties that would be providing workers and truck drivers for the construction activities under the proposed alternatives. The data shown include the number of establishments; employment during the week including March 12 (a standard date used by the U.S. Census Bureau); first quarter payroll; and annual payroll for construction and transportation sectors and relevant subsectors.

Construction under the proposed alternatives would require site preparation contractors for building demolition, excavation, dirt moving, and land clearing. In 2012, in Los Angeles County, there were 334 site preparation establishments employing 3,582 workers (Census 2014). In 2012, in Ventura County, there were 78 site preparation establishments employing 605 workers (Census 2014).

Transport of materials under the proposed alternatives would require freight trucking. In Los Angeles County, there were 2,488 truck transportation establishments with 25,375 workers in 2012 (Census 2014). In Ventura County, there were 166 truck transportation establishments with 1,271 workers in 2012 (Census 2014). Tables 3–37 and 3–38 also show specialized freight trucking establishments in Los Angeles and Ventura Counties, which includes trucking of hazardous waste over long distances.

[23] An establishment is a single physical location at which business is conducted or services or industrial operations are performed.

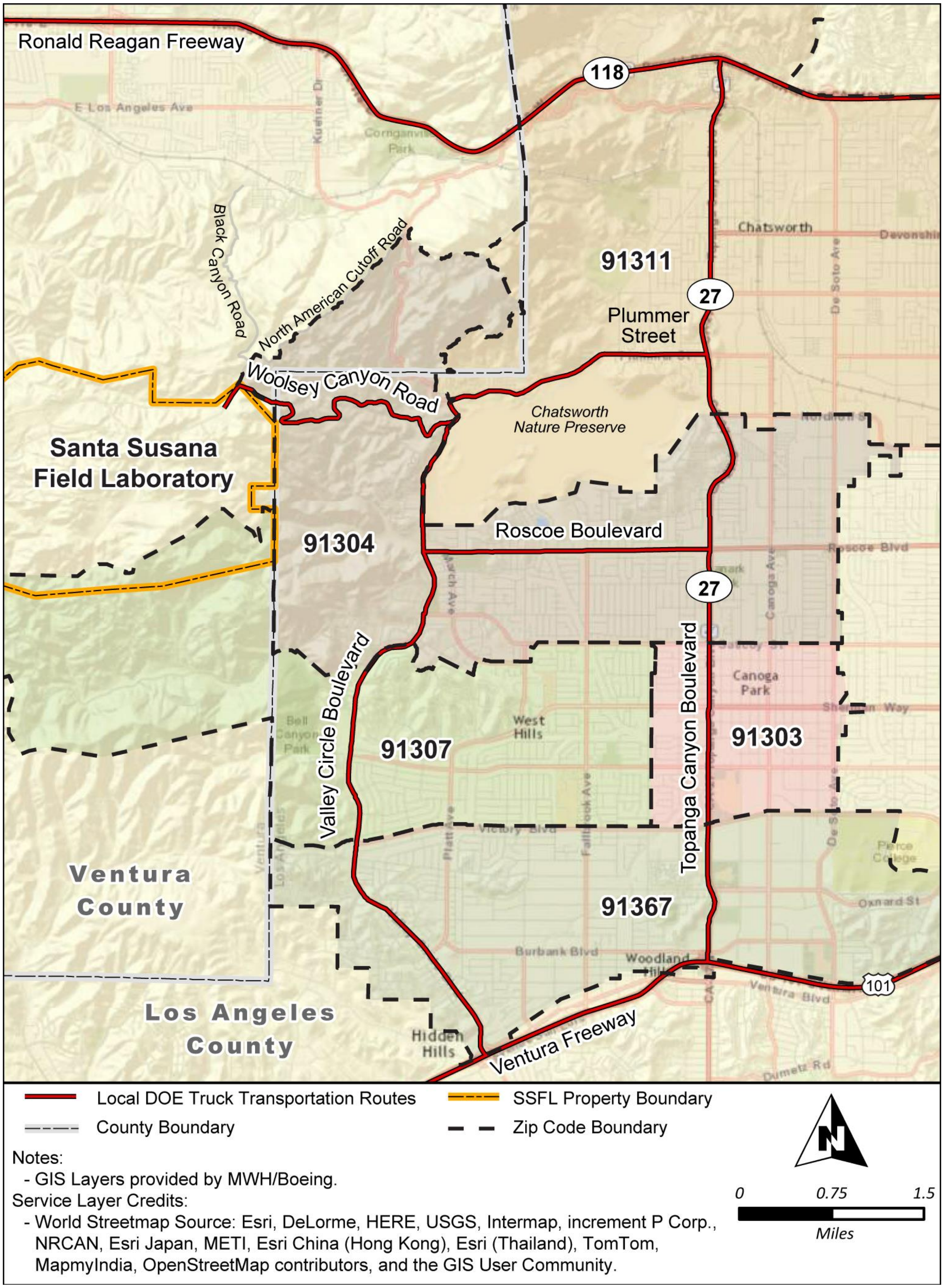

Figure 3–42 Zip Codes along Proposed Local Truck Routes

Table 3–36 Number of Establishments by Industry and Total Employees along Local Truck Routes, 2012

	Zip Code				
	91311 (Chatsworth)	***91304 (Canoga Park)***	***91303 (Canoga Park)***	***91307 (West Hills)***	***91367 (Woodland Hills)***
Agriculture, Forestry, Fishing and Hunting	4	1	–	2	–
Mining, Quarrying and Oil and Gas Extraction	2	–	–	–	1
Utilities	1	1	–	–	2
Construction	158	100	83	69	116
Manufacturing	335	83	34	4	22
Wholesale Trade	318	105	43	28	115
Retail Trade	165	103	299	56	122
Transportation and Warehousing	32	9	13	6	8
Information	65	22	14	20	118
Finance and Insurance	79	33	45	24	274
Real Estate and Rental and Leasing	75	50	37	20	126
Professional, Scientific, and Technical Services	184	77	89	82	524
Management of Companies and Enterprises	14	–	9	–	19
Administrative and Support and Waste Management and Remediation Services	98	46	30	38	107
Educational Services	20	14	11	13	30
Health Care and Social Assistance	96	68	91	181	175
Arts, Entertainment, and Recreation	46	17	7	23	141
Accommodation and Food Services	91	57	100	41	85
Other Services (except Public Administration)	118	57	111	33	81
Industries not classified	–	2	-	2	1
Total establishments for all sectors	**1901**	**845**	**1016**	**642**	**2067**
Total employees for all sectors	**34,594**	**12,190**	**13,212**	**6,066**	**45,970**

Source: Census 2014.

Table 3–37 Construction and Transportation and Warehousing Employment, Payroll and Establishments in Los Angeles County, 2012

NAICS Code	Industry Description	Paid Employees for Pay Period Including March 12 (persons)	First-quarter Payroll ($1,000)	Annual Payroll ($1,000)	Total Establishments (number)
23	**Construction**	105,725	1,284,664	5,485,728	12,718
237	Heavy and Civil Engineering Construction	10,103	197,224	795,327	446
238	Specialty Trade Contractors	70,131	787,870	3,385,691	7,838
2389	Other Specialty Trade Contractors	8,913	100,259	423,269	819
23891	Site Preparation Contractors	3,582	42,986	178,323	334
23892	All Other Specialty Trade Contractors	5,331	57,273	244,946	485
48	**Transportation and Warehousing**	156,024	1,861,673	7,461,900	6,695
484	Truck Transportation	25,375	251,219	1,055,004	2,488
4842	Specialized Freight Trucking	6,664	58,879	251,248	747
48422	Specialized Freight (except Used Goods) Trucking, Local	3,378	31,946	134,472	381
48423	Specialized Freight (except Used Goods) Trucking, Long-Distance	998	12,495	51,717	101

NAICS = North American Industry Classification System (the standard used by Federal statistical agencies in classifying business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. business economy).
Source: Census 2014.

Table 3–38 Construction and Transportation and Warehousing Employment, Payroll and Establishments in Ventura County, 2012

NAICS Code	Industry Description	Paid Employees for Pay Period Including March 12 (persons)	First-quarter Payroll ($1,000)	Annual Payroll ($1,000)	Total Establishments (number)
23	**Construction**	11,734	123,921	550,195	1,870
237	Heavy and Civil Engineering Construction	1,173	15,574	68,650	70
238	Specialty Trade Contractors	8,114	81,761	369,772	1,269
2389	Other Specialty Trade Contractors	1,236	15,467	71,074	171
23891	Site Preparation Contractors	605	8,323	35,778	78
23892	All Other Specialty Trade Contractors	631	7,144	35,296	93
48	**Transportation and Warehousing**	4,993	44,842	180,189	357
484	Truck Transportation	1,271	14,110	56,839	166
4842	Specialized Freight Trucking	515	5,352	21,680	83
48422	Specialized Freight (except Used Goods) Trucking, Local	275	3,479	13,419	49
48423	Specialized Freight (except Used Goods) Trucking, Long-Distance	92	1,151	4,858	12

NAICS = North American Industry Classification System (the standard used by Federal statistical agencies in classifying business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. business economy).
Source: Census 2014.

Figures 3–43 and **3–44** display the employment trends for specialty trade contractors and general freight trucking in Los Angeles and Ventura Counties from 2008 to 2012, respectively. As shown, specialty trade contractor and general freight trucking employment decreased in both counties during this time. However, both counties experienced a small rise in employment from 2011 to 2012.

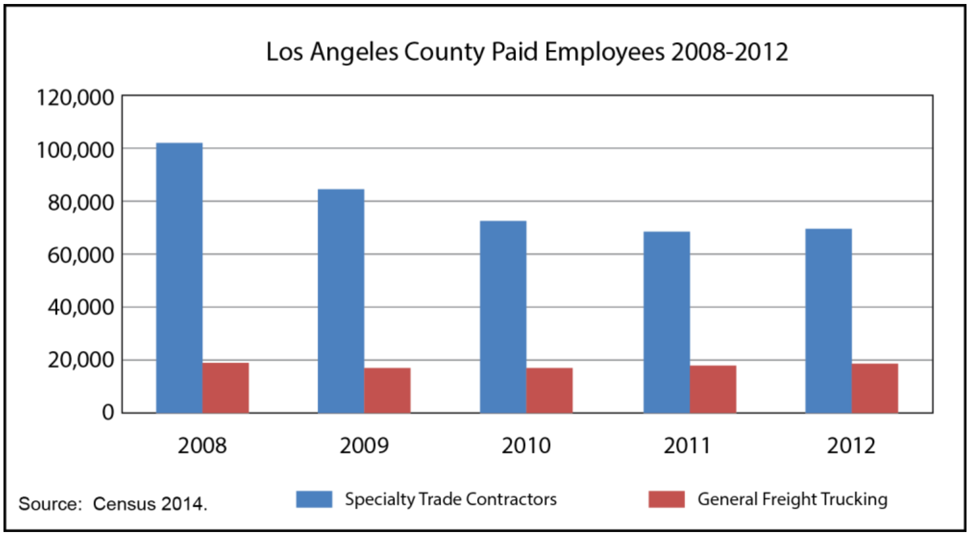

Figure 3–43 Specialty Trade Contractors and General Freight Trucking Employees in Los Angeles County, 2008 to 2012

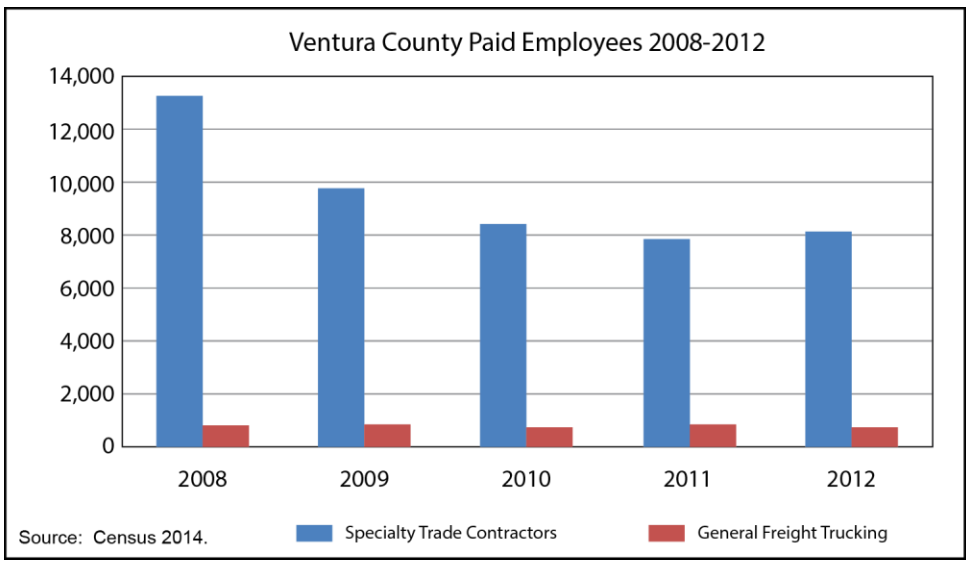

Figure 3–44 Specialty Trade Contractors and General Freight Trucking Employees in Ventura County, 2008 to 2012

3.12.1.3 Housing

From 2009 to 2013, Los Angeles County had over 3.4 million housing units, with 222,518 vacant units (Census 2013b). The homeowner vacancy rate was 1.5 percent, and the rental vacancy rate was 4.4 percent (Census 2013b). Homeowners occupied over 1.5 million units, and renters occupied over 1.7 million units (Census 2013b). In Los Angeles County, 50 percent of houses were single family residences, 48 percent were multi-family residences, and 2 percent were mobile homes (Census 2013b).

From 2009 to 2013, Ventura County had 282,231 housing units, with 15,155 vacant units (Census 2013b). The homeowner vacancy rate was 1.1 percent, and the rental vacancy rate was 3.8 percent (Census 2013b). Homeowners occupied 173,340 units, and renters occupied 93,736 units (Census 2013b). In Ventura County, 64 percent of houses were single family residences, 32 percent were multi-family residences, and 4 percent were mobile homes (Census 2013b).

Table 3–39 shows the number of owner-occupied houses by value and median value at the zip code level for the proposed local truck routes from SSFL to the major highways, U.S. Highway 101 and SR 118. The surface roads that trucks would use to travel to the highways are all in Los Angeles County. For comparison, the median home values in Los Angeles County, Ventura County, and California as a whole were $420,200, $442,400, and $366,400, respectively (Census 2013b).

Table 3–39 Number of Owner-Occupied Houses by Value along Local Truck Routes, 2009 to 2013

	Zip Code				
	91311 (Chatsworth)	***91304 (Canoga Park)***	***91303 (Canoga Park)***	***91307 (West Hills)***	***91367 (Woodland Hills)***
	9,411	8,848	2,329	7,226	9,487
Less than $50,000	183	350	34	149	151
$50,000 to $99,000	274	399	0	53	39
$100,000 to $149,000	114	223	137	15	134
$150,000 to $199,000	376	331	241	65	264
$200,000 to $299,000	1252	558	495	252	755
$300,000 to $499,000	3736	3650	1307	3178	2585
$500,000 to $999,000	3114	3114	125	2860	5150
$1,000,000 or more	362	223	0	646	409
Median Value	$438,500	$442,900	$330,900	$495,300	$552,000

Source: Census 2013b.

3.12.1.4 Local Government Finances

Based on the Year-End Financial Status Report for fiscal year 2013 to 2014, the city of Los Angeles had a revised general fund revenue budget of $4,887.1 million (City of Los Angeles 2014). Property tax is the largest portion of the general fund revenue, contributing $1,541.1 million, or about 32 percent. Other major revenue sources were Licenses, Permits, Fees and Fines ($829.8 million); Utility Users' Tax ($626.6 million); Business Tax ($465.0 million); Sales Tax ($357.6 million); Power Revenue Transfers ($253.0 million); and Transient Occupancy Tax ($185.0 million). The City's reserve fund balance at the end of fiscal year 2013 to 2014 was $346.7 million, including $133.8 million emergency reserve and $212.9 million contingency reserve (City of Los Angeles 2014). The City of Los Angeles Bureau of Street Services has an annual pavement preservation program with total funding in 2013 to 2014 of $102 million (Bureau of Street Services 2015).

3.12.2 Regional Economy for the Representative Recycle and Disposal Facilities

This section presents regional population, industry, and employment data for the counties and cities where the representative recycle and disposal facilities analyzed in this EIS are located. These facilities are representative of the facilities that would be used because DOE has not made a decision regarding which specific facilities would be used. The 12 representative facilities, 9 of which are in California, are listed in **Table 3–40**. Chapter 3, Sections 3.8, Transportation; 3.10, Waste Management; and 3.13, Environmental Justice, include maps showing facility locations and/or routes from SSFL to those facilities. Housing near the representative facilities would not be affected; therefore, this section does not discuss housing or home values near these facilities.

Table 3–40 Population near Representative Recycle and Disposal Facilities, 2013

Facility	*Location (city, county, state)*	*County Population*	*City Population*
Recycle Facilities in California [a]			
Standard Industries	Ventura, Ventura County	829,017	112,444
P.W. Gillibrand, Inc.	Simi Valley, Ventura County	829,017	124,803
Kramer Metals	Los Angeles, Los Angeles County	9,893,481	3,827,261
Waste Disposal Facilities in California			
Chiquita Canyon Sanitary Landfill	Castaic, Los Angeles County	9,893,481	18,415
Antelope Valley Recycling and Disposal Facility	Palmdale, Los Angeles County	9,893,481	153,885
Mesquite Regional Landfill	El Centro, Imperial County	175,201	42,888
Westmorland Landfill	Westmorland, Imperial County	175,201	1,606
Buttonwillow Landfill	Buttonwillow, Kern County	828,204	1,379
McKittrick Waste Treatment Site	McKittrick, Kern County	848,204	84
Waste Disposal Facilities Outside California			
US Ecology	Grand View, Owyhee County, ID	11,474	543
Nevada National Security Site	Nye County, NV	43,368	Not applicable
Energy*Solutions*	Tooele County,[b] UT	59,120	8,931

ID = Idaho; NV = Nevada; UT = Utah.

[a] No waste disposal is performed at the three listed recycle facilities in California; however, some of the listed California disposal facilities also conduct recycle operations.

[b] The Energy*Solutions* facility is in Clive in Utah's West Desert. The nearest city with available American Community Survey data is Grantsville, Utah.

Source: Census 2013a.

3.12.2.1 Population

Table 3–40 summarizes population at the representative recycle and disposal facilities at the county and city level. The majority of the listed facilities are located several miles away from residential areas. Three facilities, however, are located near residential areas. Standard Industries and Kramer Metals are located in urban industrial areas, less than 1 mile from residential areas. The Antelope Valley Recycling and Disposal Facility is in an isolated area on the outskirts of Palmdale, also within 1 mile from a residential area. The remaining facilities are located in isolated regions outside of cities or towns. Clive is an unincorporated community in Utah's West Desert near the city of Grantsville.

3.12.2.2 Industry Employment and Income

Table 3–41 summarizes industry employment, and **Table 3–42** provides the median household income in 2013 for the counties and cities where the representative recycle and disposal facilities are located. Industry employment represents the types of businesses near the disposal facilities.

Nine of the representative recycle and disposal facilities are located in California. Two recycle facilities are located in Ventura County: Standard Industries is located in an industrial region of the city of Ventura, and P.W. Gillibrand, Inc. is located in an isolated area approximately 3 miles outside of Simi Valley. The city of Ventura had a civilian labor force of 57,320 workers with 51,648 employed; Simi Valley had a civilian labor force of 69,582 workers with 63,607 employed. The majority of workers in Ventura County are in educational services, health care, and social assistance; professional, scientific, management and administrative services; finance and insurance; and retail trade.

Table 3–41 Employment by Industry near Representative Recycle and Disposal Facilities, 2013

Counties and Cities where Representative Recycle and Disposal Facilities are Located	Number of Workers/ Percent of Total Employment	Civilian Employed Population 16 Years and Over (total number of workers)	Industry												
			Agriculture, forestry, fishing, hunting, mining	Construction	Manufacturing	Wholesale trade	Retail trade	Transportation, warehousing, utilities	Information	Finance, insurance, real estate, rental, leasing	Professional, scientific, management, administrative, waste management services	Educational services, health care, social assistance	Arts, entertainment, recreation, accommodation, food services	Other services, except public administration	Public administration
California															
Ventura County	Estimate	389,297	19,046	22,234	40,371	13,372	43,974	12,224	10,123	31,693	48,633	73,274	35,778	19,440	19,135
	Percent	–	4.9	5.7	10.4	3.4	11.3	3.1	2.6	8.1	12.5	18.8	9.2	5.0	4.9
Ventura *Standard Industries* [a]	Estimate	53,824	1,199	3,475	4,296	1,704	6,329	2,197	1,320	2,833	6,778	11,962	5,315	2,810	3,606
	Percent	–	2.2	6.5	8.0	3.2	11.8	4.1	2.5	5.3	12.6	22.2	9.9	5.2	6.7
Simi Valley *P.W. Gillibrand, Inc.* [a]	Estimate	63,607	386	3,753	7,558	2,053	7,714	1,724	2,184	7,796	8,103	11,198	5,829	2,692	2,617
	Percent	–	0.6	5.9	11.9	3.2	12.1	2.7	3.4	12.3	12.7	17.6	9.2	4.2	4.1
Los Angeles County	Estimate	4,489,974	22,433	255,359	483,592	162,995	478,076	235,944	195,741	286,163	551,858	930,098	457,287	278,039	152,389
	Percent	–	0.5	5.7	10.8	3.6	10.6	5.3	4.4	6.4	12.3	20.7	10.2	6.2	3.4
Castaic *Chiquita Canyon Sanitary Landfill*	Estimate	9,453	27	634	1,264	251	815	694	559	579	854	1,832	1,019	461	464
	Percent	–	0.3	6.7	13.4	2.7	8.6	7.3	5.9	6.1	9.0	19.4	10.8	4.9	4.9
Los Angeles *Kramer Metals* [a]	Estimate	1,787,083	8,273	107,969	163,336	51,433	184,895	73,396	103,400	114,028	243,804	352,970	211,740	128,454	43,385
	Percent	–	0.5	6.0	9.1	2.9	10.3	4.1	5.8	6.4	13.6	19.8	11.8	7.2	2.4
Palmdale *Antelope Valley Recycling and Disposal Facility*	Estimate	55,890	368	4,344	6,974	1,162	7,459	3,365	1,439	3,099	4,452	11,746	4,860	3,475	3,147
	Percent	–	0.7	7.8	12.5	2.1	13.3	6.0	2.6	5.5	8.0	21.0	8.7	6.2	5.6
Imperial County	Estimate	58,169	5,541	2,994	3,228	1,685	7,600	4,023	724	2,345	3,392	14,017	3,887	2,306	6,427
	Percent	–	9.5	5.1	5.5	2.9	13.1	6.9	1.2	4.0	5.8	24.1	6.7	4.0	11.0
El Centro *Mesquite Regional Landfill*	Estimate	16,028	1,052	823	677	355	2,039	1,082	235	784	930	4,584	922	553	1,992
	Percent	–	6.6	5.1	4.2	2.2	12.7	6.8	1.5	4.9	5.8	28.6	5.8	3.5	12.4
Westmorland *Westmorland Landfill*	Estimate	473	101	13	31	9	29	33	7	9	28	103	56	26	28
	Percent	–	21.4	2.7	6.6	1.9	6.1	7.0	1.5	1.9	5.9	21.8	11.8	5.5	5.9

Counties and Cities where Representative Recycle and Disposal Facilities are Located	Number of Workers/ Percent of Total Employment	Civilian Employed Population 16 Years and Over (total number of workers)	Industry												
			Agriculture, forestry, fishing, hunting, mining	Construction	Manufacturing	Wholesale trade	Retail trade	Transportation, warehousing, utilities	Information	Finance, insurance, real estate, rental, leasing	Professional, scientific, management, administrative, waste management services	Educational services, health care, social assistance	Arts, entertainment, recreation, accommodation, food services	Other services, except public administration	Public administration
Kern County	Estimate	317,047	50,488	19,232	18,133	9,550	34,479	16,459	3,483	13,335	24,651	62,026	26,371	14,803	24,037
	Percent	–	15.9	6.1	5.7	3.0	10.9	5.2	1.1	4.2	7.8	19.6	8.3	4.7	7.6
Buttonwillow *Buttonwillow Landfill*	Estimate	492	158	10	63	4	52	39	6	0	23	23	74	30	10
	Percent	–	32.1	2.0	12.8	0.8	10.6	7.9	1.2	0.0	4.7	4.7	15.0	6.1	2.0
McKittrick *McKittrick Waste Treatment Site*	Estimate	22	8	0	0	0	0	0	0	0	0	0	0	2	2
	Percent	–	36.4	45.5	0	0	0	0	0	0	0	0	0	9.1	9.1
Idaho															
Owyhee County	Estimate	4,286	1,065	405	468	130	464	188	20	142	148	611	256	135	254
	Percent	–	24.8	9.4	10.9	3.0	10.8	4.4	0.5	3.3	3.5	14.3	6.0	3.1	5.9
Grand View US Ecology	Estimate	156	59	16	5	0	13	5	0	0	1	24	26	6	1
	Percent	–	37.8	10.3	3.2	0	8.3	3.2	0	0	0.6	15.4	16.7	3.8	0.6
Nevada															
Nye County *Nevada National Security Site*	Estimate	13,846	1,083	1,489	445	234	1,491	740	223	374	1,168	2,101	2,684	849	965
	Percent	–	7.8	10.8	3.2	1.7	10.8	5.3	1.6	2.7	8.4	15.2	19.4	6.1	7.0
Utah															
Tooele County	Estimate	25,376	712	1,593	2,850	536	3,162	1,861	449	1,356	3,007	4,450	2,003	1,102	2,295
	Percent	–	2.8	6.3	11.2	2.1	12.5	7.3	1.8	5.3	11.8	17.5	7.9	4.3	9.0
Grantsville [b] Energy*Solutions*	Estimate	3,924	139	267	409	159	567	361	76	171	507	683	239	57	289
	Percent	–	3.5	6.8	10.4	4.1	14.4	9.2	1.9	4.4	12.9	17.4	6.1	1.5	7.4

[a] No waste disposal occurs at the Standard Industries, P.W. Gillibrand, and Kramer Metals recycle facilities.

[b] The Energy*Solutions* facility is in Clive in Utah's West Desert. The nearest city with available American Community Survey data is Grantsville, Utah.

Source: Census 2013c.

Table 3–42 Median Household Income near Representative Recycle and Disposal Facilities (2013 inflation-adjusted dollars)

Counties and Cities where Representative Recycle and Disposal Facilities are Located	*Median Household Income (dollars)*
California	
Ventura County	76,544
Ventura, *Standard Industries* [a]	65,207
Simi Valley, *P.W. Gillibrand, Inc.* [a]	87,269
Los Angeles County	55,909
Castaic, *Chiquita Canyon Sanitary Landfill*	103,811
Los Angeles, *Kramer Metals* [a]	49,497
Palmdale, *Antelope Valley Recycling and Disposal Facility*	53,922
Imperial County	41,807
El Centro, *Mesquite Regional Landfill*	42,166
Westmorland, *Westmorland Landfill*	26,000
Kern County	48,552
Buttonwillow, *Buttonwillow Landfill*	34,723
McKittrick, *McKittrick Waste Treatment Site*	33,125
Idaho	
Owyhee County	32,175
Grand View, US Ecology	23,036
Nevada	
Nye County, *Nevada National Security Site*	39,876
Utah	
Tooele County	61,412
Grantsville, Energy*Solutions* [b]	63,202

[a] No waste disposal occurs at the Standard Industries, P.W. Gillibrand, and Kramer Metals recycle facilities.
[b] The Energy*Solutions* facility is in Clive in Utah's West Desert. The nearest city with available American Community Survey data is Grantsville, Utah.
Source: Census 2013c.

Three representative facilities are located in Los Angeles County: Chiquita Canyon Sanitary Landfill (located in an isolated area called Castaic); Kramer Metals (a recycle facility located in an industrial area of Los Angeles); and Antelope Valley Recycling and Disposal Facility (located in an isolated area near Palmdale). Los Angeles County had a civilian employed population of approximately 4.5 million, of which approximately 1.8 million workers were employed in the city of Los Angeles. These workers are mainly employed in professional, scientific, management and administrative services; educational services, health care, and social assistance; manufacturing; and arts, entertainment, recreation, accommodation, and food services. The Castaic area had a civilian labor force of 10,272 workers, with 9,453 employed; Palmdale had a civilian labor force of 65,813 workers, with 55,890 employed. Workers were mainly employed in similar industries as listed for the city of Los Angeles.

The Buttonwillow Landfill and the McKittrick Waste Treatment Site are both located in isolated areas of Kern County, California. Buttonwillow had a civilian labor force of 591 individuals with 492 employed. McKittrick had a civilian labor force of 35 individuals with 22 employed. The majority of these workers were employed in agriculture and construction.

The Westmorland and Mesquite Regional Landfills are both in Imperial County, California. Westmorland Landfill is approximately 4 miles from the city of Westmorland. The city of Westmorland had an employed population of 473, with a total civilian labor force of 584. Mesquite

Regional Landfill is located in an isolated area approximately 5 miles northeast of Glamis and has a local office in El Centro. El Centro had a civilian labor force of 19,351 individuals, with 16,028 employed.

Three representative disposal facilities are located outside of California. US Ecology is located in an isolated area outside of the city of Grand View, Idaho, in Owyhee County. Grand View had a civilian labor force of 203 individuals, with 156 employed. The majority of these employees worked in the field of agriculture. One representative disposal facility, NNSS, is located in Nye County, Nevada, comprising a large portion of the county. Energy*Solutions* is in Clive, Utah, in Tooele County. Clive is an unincorporated community near the city of Grantsville. Grantsville had an employed population of 3,924, with a total labor force of 4,169. The majority of employees were in the fields of educational services, health care, and social assistance; retail trade; and professional, scientific, and management.

3.13 Environmental Justice

Environmental justice is the fair treatment of people of all races, income levels, and cultures with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Environmental justice further requires meaningful consideration of these groups in the decision-making processes of the Government. Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (1994), requires Federal agencies to identify and address "disproportionately high and adverse human health or environmental effects" of programs on Native American tribes and minority and low-income populations. This section of this EIS identifies populations of concern (Native American tribes and minority and low-income groups) in the ROIs that could be potentially affected by the proposed activities. Sensitive-aged groups (children and persons 65 years and over) are addressed in Section 3.14.

United States Census Bureau Definitions

Census tracts are defined as small, permanent, statistical subdivisions of a county delineated by local participants as part of the United States Census Bureau's Participant Statistical Areas Program. These areas generally consist of between 1,500 and 8,000 people and are designed to be homogeneous with respect to population characteristics, economic status, and living conditions. The size of census tracts can vary widely depending on the density of a settlement.

Block groups are defined as statistical divisions of census tracts. These areas are generally defined to contain between 600 and 3,000 people and are used to present data and control block numbering. A census tract may contain more than one block group.

Source: Census 2010c.

The environmental justice analysis addresses a single site-specific ROI, as well as multiple ROIs, for the representative recycle and waste disposal facilities. The site-specific ROI comprises the census tracts and block groups encompassing and adjacent to the SSFL property and local roadways to and from the site. The site-specific ROI includes the census tracts and block groups within approximately 1 mile of the SSFL boundary, including local roadways. The ROIs for the representative recycle and waste disposal facilities comprise those census tracts in closest proximity (approximately 1 mile) to the representative facilities and along truck routes (major highways) between SSFL and those disposal facilities.

The most recently available demographic and economic data from the 2010 census, and the American Community Survey, 2013 1- and 5-Year Estimates have been used to identify Native American tribes and minority and low-income populations, as well as children and persons 65 years and over within the ROIs (Census 2010b). The American Community Survey was established by the U.S. Census Bureau in 2005 and in non-census years samples the population and projects the findings to the population as a whole. The American Community Survey data are available on an annual basis for areas with a population of 65,000 or more. For smaller areas, data is only reported every 3 to 5 years (Census 2010b). Because the ROIs include areas with populations both smaller and larger than 65,000 persons, the most recent data available occurs in different years. Therefore, data used to characterize the ROIs range in date from 2010 through 2013.

3.13.1 Site-Specific Region of Influence

The 35 census tracts, consisting of 69 block groups, in Ventura and Los Angeles Counties that either include or are located adjacent to SSFL or near local roads that could be affected by additional project-related traffic compose the site-specific ROI shown in **Figures 3–45** and **3–46**. The census tracts are shown in Figure 3–45 and the block groups in Figure 3–46. The total population of these 69 block groups is 124,211 persons. This analysis includes the block group containing Summit and Mountain View Mobile Home Communities at 24425 Woolsey Canyon Road, Canoga Park, California, through which trucks accessing SSFL would pass. The block group occupies the entire census tract 1132.35.

3.13.1.1 Minority Population

The Council on Environmental Quality (CEQ) NEPA guidelines define the term, "minority," as persons from any of the following U.S. census categories for race: American Indian or Alaskan Native; Asian or Pacific Islander; Black/African American (non-Hispanic); and Hispanic (CEQ 1997). Additionally, for the purposes of this analysis, "minority" also includes all other nonwhite racial categories, such as "some other race" and "two or more races." Hispanic origin is considered to be an ethnic category separate from race, according to the U.S. Census Bureau; however, CEQ mandates that persons identified through the U.S. census as ethnically Hispanic, regardless of race, be included in minority counts.

CEQ guidance indicates that minority populations should be identified where either (1) the total minority population exceeds 50 percent, or (2) the total minority population is meaningfully greater than the general population (CEQ 1997). The total minority populations in both Los Angeles and Ventura Counties exceed 50 percent. The total minority population for the ROI is approximately 46.1 percent. For this analysis, "meaningfully greater" is also defined as any census tract or block group with a total minority population that exceeds 50 percent.

Seventeen of the 69 block groups in the ROI meet the 50 percent total minority threshold. All of those block groups are located in Los Angeles County. Several of the block groups identified as minority communities have total minority populations well above the 50 percent threshold, including six block groups with total minority populations of at least 80 percent. Demographic data indicate that the block group (the entirety of census tract 1132.35) containing the Summit and Mountain View Mobile Home Communities (and other conventional housing) is 25 percent minority. **Table 3–43** lists the block groups and their respective total and total minority populations. Demographic characteristic data for Ventura and Los Angeles Counties and the state are included for comparison.

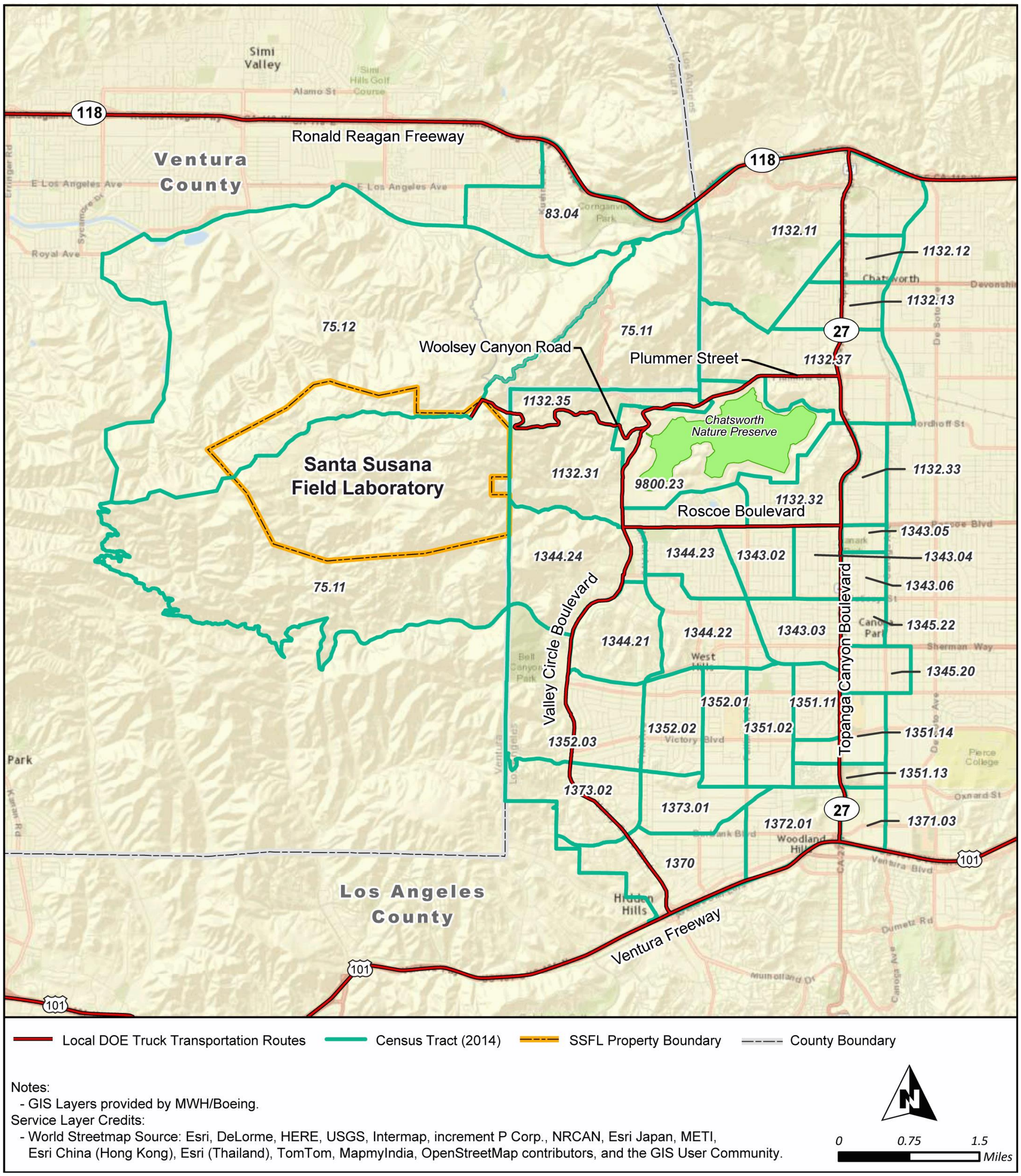

Figure 3–45 Site-Specific Region of Influence Census Tracts

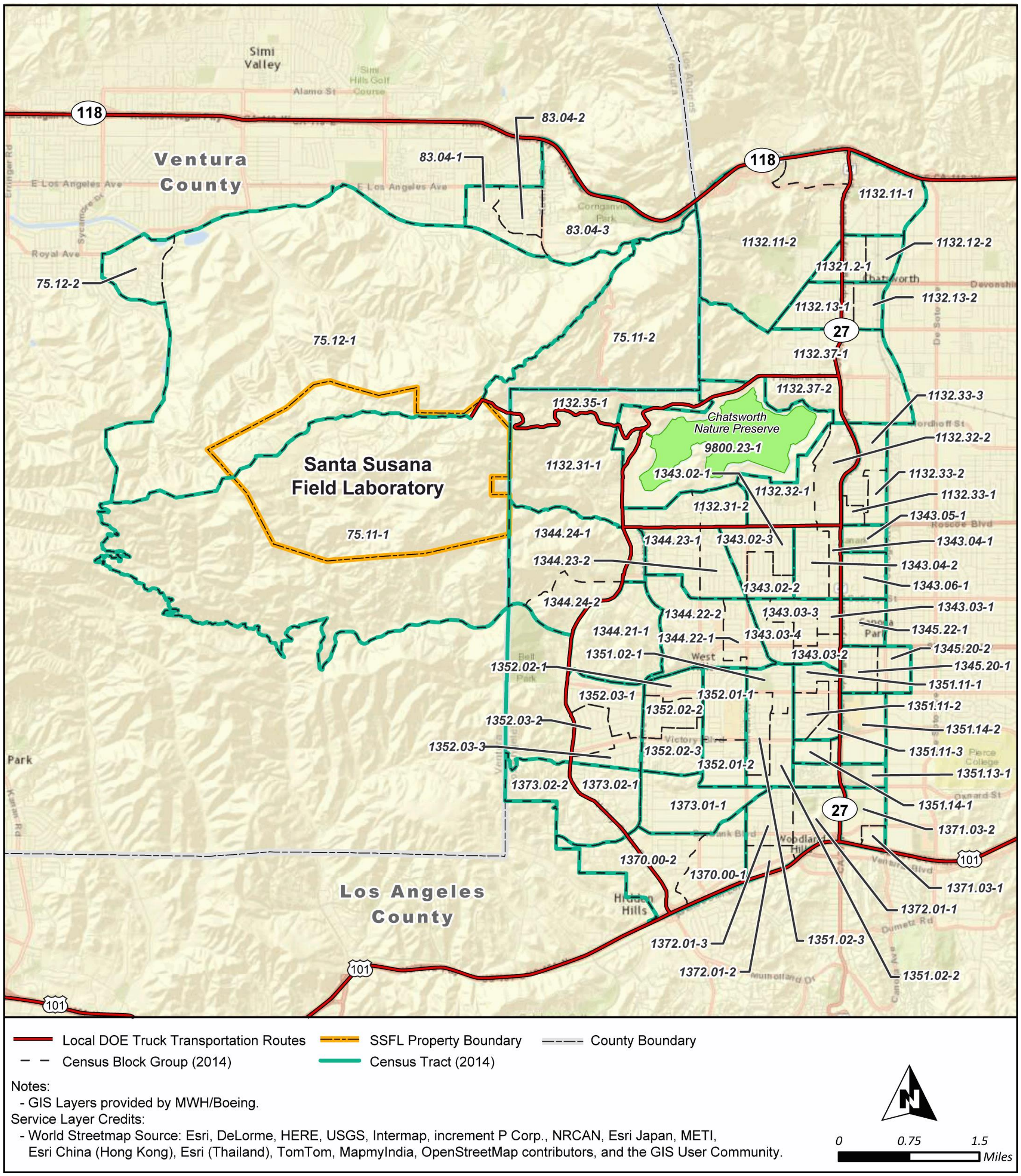

Figure 3–46 Site-Specific Region of Influence Block Groups

Table 3–43 Demographic Characteristics for the Site-Specific Region of Influence, 2010 to 2013

Location		*Total Population*	*White Alone, Non-Hispanic* [a] *(percent)*	*Total Minority Population* [b,c] *(percent)*
Ventura County				
CT 75.11	BG 1	1,600	1,476 (92.3)	124 (7.8)
	BG 2	622	543 (87.3)	79 (12.7)
CT 75.12	BG 1	3,062	1,988 (64.9)	1,074 (35.1)
CT 83.04	BG 3	1,712	1,130 (66.0)	582 (34.0)
Los Angeles County				
CT 1132.11	BG 1	1,754	1,204 (68.6)	550 (31.4)
	BG 2	2,033	1,424 (70.0)	609 (30.0)
CT 1132.12	BG 1	1,291	668 (51.7)	623 (48.3)
	BG 2	1,778	901 (50.7)	877 (49.3)
CT 1132.13	BG 1	2,510	1,363 (54.3)	1,147 (45.7)
	BG 2 [d]	**1,806**	**677 (37.5)**	**1,129 (62.5)**
CT 1132.31	BG 1	1,534	1,105 (72.0)	429 (28.0)
	BG 2	591	391 (66.2)	200 (33.8)
CT 1132.32	BG 1	2,104	1,351 (64.2)	753 (35.8)
	BG 2	1,790	1,029 (57.5)	761 (42.5)
CT 1132.33	**BG 1** [d]	**1,673**	**291 (17.4)**	**1,382 (82.6)**
	BG 2 [d]	**2,101**	**373 (17.8)**	**1,728 (82.2)**
	BG 3 [d]	**2,881**	**944 (32.8)**	**1,937 (67.2)**
CT 1132.35	BG 1	1,602	1,199 (74.8)	403 (25.2)
CT 1132.37	BG 1	2,552	1,511 (59.2)	1,041 (40.8)
	BG 2	1,109	570 (51.4)	539 (48.6)
CT 1343.02	BG 1	850	446 (52.5)	404 (47.5)
	BG 2	1,534	888 (57.9)	646 (42.1)
	BG 3	1,348	697 (51.7)	651 (48.3)
CT 1343.03	**BG 1** [d]	**1,064**	**132 (12.4)**	**932 (87.6)**
	BG 2 [d]	**1,093**	**480 (43.9)**	**613 (56.1)**
	BG 3 [d]	**1,251**	**608 (48.6)**	**643 (51.4)**
	BG 4	1,649	926 (56.2)	723 (43.8)
CT 1343.04	**BG 1** [d]	**1,028**	**417 (40.6)**	**611 (59.4)**
	BG 2 [d]	**1,854**	**909 (49.0)**	**945 (51.0)**
CT 1343.05	**BG 1** [d]	**3,847**	**329 (8.6)**	**3,518 (91.4)**
CT 1343.06	**BG 1** [d]	**3,498**	**931 (26.6)**	**2,567 (73.4)**
CT 1344.21	BG 1	3,921	2,909 (74.2)	1,012 (25.8)
CT 1344.22	BG 1	1,325	824 (62.2)	501 (37.8)
	BG 2	3,428	2,088 (60.9)	1,340 (39.1)
CT 1344.23	BG 1	1,517	1,106 (72.9)	411 (27.1)
	BG 2	1,897	1,195 (63.0)	702 (37.0)
CT 1344.24	BG 1	1,588	1,156 (72.8)	432 (27.2)
	BG 2	1,299	907 (69.8)	392 (30.2)
CT 1345.20	**BG 1** [d]	**3,286**	**589 (17.9)**	**2,697 (82.1)**
	BG 2 [d]	**2,167**	**206 (9.5)**	**1,961 (90.5)**
CT 1345.22	**BG 1** [d]	**3,954**	**613 (15.5)**	**3,341 (84.5)**
CT 1351.02	BG 1	1,282	782 (61.0)	500 (39.0)
	BG 2	1,213	885 (73.0)	328 (27.0)
	BG 3	1,018	593 (58.3)	425 (41.7)
CT 1351.11	BG 1	796	402 (50.5)	394 (49.5)
	BG 2	1,259	815 (64.7)	444 (35.3)
	BG 3	912	514 (56.4)	398 (43.6)
CT 1351.13	BG 1	2,795	1,467 (52.5)	1,328 (47.5)

Location		Total Population	White Alone, Non-Hispanic [a] (percent)	Total Minority Population [b,c] (percent)
CT 1351.14	**BG 1 [d]**	**2,973**	**1,457 (49.0)**	**1,516 (51.0)**
	BG 2	1,472	817 (55.5)	655 (44.5)
CT 1352.01	BG 1	1,921	1,220 (63.5)	701 (36.5)
	BG 2	728	573 (78.7)	155 (21.3)
CT 1352.02	BG 1	915	710 (77.6)	205 (22.4)
	BG 2	1,636	1,036 (63.3)	600 (36.7)
	BG 3	1,813	1,331 (73.4)	482 (26.6)
CT 1352.03	BG 1	2,195	1,206 (54.9)	989 (45.1)
	BG 2 [d]	**860**	**256 (29.8)**	**604 (70.2)**
	BG 3	1,708	1,099 (64.3)	609 (35.7)
CT 1370	BG 1	2,041	1,625 (79.6)	416 (20.4)
	BG 2	2,839	2,137 (75.3)	702 (24.7)
CT 1371.03	BG 1	1,716	983 (57.3)	733 (42.7)
	BG 2	2,483	1,597 (64.3)	886 (35.7)
CT 1372.01	BG 1	2,866	1,769 (61.7)	1,097 (38.3)
	BG 2	966	555 (57.5)	411 (42.5)
	BG 3	1,438	1,048 (72.9)	390 (27.1)
CT 1373.01	BG 1	2,284	1,474 (64.5)	810 (35.5)
CT 1373.02	BG 1	1,720	1,516 (88.1)	204 (11.9)
	BG 2	2,851	2,365 (83.0)	486 (17.0)
CT 9800.23	**BG 1 [d]**	**8**	**4 (50.0)**	**4 (50.0)**
Total for Region of Influence		**124,211**	**67,133 (54.0)**	**57,278 (46.0)**
Total for Ventura County		**835,981**	**396,882 (47.5)**	**439,099 (52.5)**
Total for Los Angeles County		**9,962,789**	**2,704,343 (27.1)**	**7,258,446 (72.9)**
Total for California		**38,041,430**	**14,904,055 (39.2)**	**23,137,375 (60.8)**

BG = block group; CT = census tract.

[a] The term, "Hispanic," is an ethnic category and can apply to members of any race, including respondents who self-identified as "White." The total numbers of Hispanic residents for each geographic region are tabulated separately from the racial distribution by the U.S. Census Bureau.

[b] In accordance with Council on Environmental Quality guidelines, "Total Minority" is the aggregation of all non-white racial groups with the addition of all Hispanics, regardless of race, with the total for "Not Hispanic or Latino: White Alone" subtracted from the total population.

[c] A minority is defined as a member of the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black/African American (non-Hispanic); or Hispanic.

[d] **Boldface** and shaded cells denotes areas with meaningfully greater total minority proportion (more than 50 percent).

Source: Census 2010b, 2013d.

3.13.1.2 Low-Income Population

The U.S. Census Bureau uses a set of money income thresholds that vary by family size and composition to establish those within the poverty level or "low-income." If a family's total income is less than the family's poverty threshold, that family and every individual in it is considered in poverty. The official poverty thresholds do not vary geographically, but are updated for inflation using the Consumer Price Index. The official poverty definition uses money income before taxes and does not include capital gains or noncash benefits (such as public housing, Medicaid, and food stamps). A "poverty area" or low-income population is where 20 percent or more of the population lives in poverty. An "extreme poverty area" or area of concentrated poverty is where 40 percent or more of the population lives in poverty (Census 2010c). **Table 3–44** shows poverty levels by census tract in the ROI. Economic characteristic data for Ventura and Los Angeles Counties and the state are included for comparison purposes.

Table 3–44 Economic Characteristics for the Site-Specific Region of Influence, 2012 to 2013

Location	*Percent of Population Below Poverty [a] Threshold*	*Location*	*Percent of Population Below Poverty [a] Threshold*
Ventura County			
CT 75.11	3.0	CT 83.04	3.1
CT 75.12	4.2		
Los Angeles County			
CT 1132.11	1.8	CT 1344.24	0.0
CT 1132.12	1.5	CT 1345.20	**21.6** [b]
CT 1132.13	8.3	CT 1345.22	17.9
CT 1132.31	1.2	CT 1351.02	17.4
CT 1132.32	6.6	CT 1351.11	9.4
CT 1132.33	10.0	CT 1351.13	5.0
CT 1132.35	7.5	CT 1351.14	3.9
CT 1132.37	7.9	CT 1352.01	8.2
CT 1343.02	2.5	CT 1352.02.	6.6
CT 1343.03	3.2	CT 1352.03.	8.7
CT 1343.04	13.3	CT 1370.	3.1
CT 1343.05	17.2	CT 1371.03	5.7
CT 1343.06	10.9	CT 1372.01	6.5
CT 1344.21	5.3	CT 1373.01	6.1
CT 1344.22	10.0	CT 1373.02	6.3
CT 1344.23	4.0	CT 9800.23	– [c]
Region of Influence			**7.0**
Ventura County			**8.9**
Los Angeles County			**15.2**
California			**12.9**

CT = census tract.

[a] A "poverty area" or low-income population is where 20 percent or more of the population lives in poverty. An "extreme poverty area" or area of concentrated poverty is where 40 percent or more of the population lives in poverty.

[b] **Boldface and shaded cells** denote areas with greater total low-income proportion (20 percent or more).

[c] No sample observations or too few sample observations were available to compute an estimate.

Source: Census 2010c.

Of the 35 census tracts in the ROI, only census tract 1345.20 in Los Angeles County exceeds the 20 percent poverty rate threshold, with a poverty rate of 21.6 percent. This census tract is located along the eastern side of North Topanga Canyon Boulevard, which is bordered by Sherman Way to the north, Hartland Street to the south, and Variel Avenue to the east. None of the census tracts in Ventura County exceeds the 20 percent poverty rate threshold (Census 2013b). As a whole, the ROI has an average poverty level of 7.0 percent.

3.13.2 Region of Influence for Representative Recycle and Waste Disposal Facilities

Table 3–45 lists the 12 representative recycle and waste disposal facilities analyzed in this EIS and their locations, distance from SSFL, census tracts, and total populations. Nine of these facilities are in California; there is one facility each in Nevada, Utah, and Idaho. DOE is not proposing to construct or cause to be constructed any new recycle or disposal facilities as part of the proposed action in this EIS; all of the facilities considered are currently operating waste disposal or recycle facilities. These facilities are representative of the facilities that would be used because DOE has not made a decision regarding which specific facilities it would use. **Figure 3–47** shows the locations of these facilities.

Table 3–45 Census Tracts for Representative Recycle and Waste Disposal Facilities

Facility	*Location*	*Distance from SSFL (miles)*	*Census Tract*	*Total Population*
Recycle Facilities in California [a]				
P.W. Gillibrand, Inc.	Simi Valley, CA	<10	85	8,661
Standard Industries	Ventura, CA	28	13.01	8,557
Kramer Metals	Los Angeles, CA	44	5327	2,742
Waste Disposal Facilities in California				
Chiquita Canyon Sanitary Landfill	Castaic, CA	32	9201.06	3,031
Antelope Valley	Palmdale, CA	38	9104.01	6,549
McKittrick Waste Treatment Site	McKittrick, CA	88	33.04	4,607
Buttonwillow Landfill	Buttonwillow, CA	120	33.04	– [b]
Westmoreland Landfill	Westmorland, CA	230	123.01	5,308
Mesquite Regional Landfill	El Centro, CA	250	124	642
Waste Disposal Facilities Outside California				
Nevada National Security Site	Nye County, NV	330	9603	2,140
			9604.01	5,462
			9805	0
Energy*Solutions*	Clive, UT	710	1306	2,344
US Ecology	Grand View, ID	900	9502	3,965
			Total Population	**54,008**

< = less than; CA = California, ID = Idaho, NV = Nevada, UT = Utah.

[a] Waste disposal does not occur at the three listed recycle facilities; some of the listed waste disposal facilities also conduct recycle operations.

[b] Total population for Census Tract 33.04 is already listed under McKittrick Waste Treatment Site.

Source: Census 2013d.

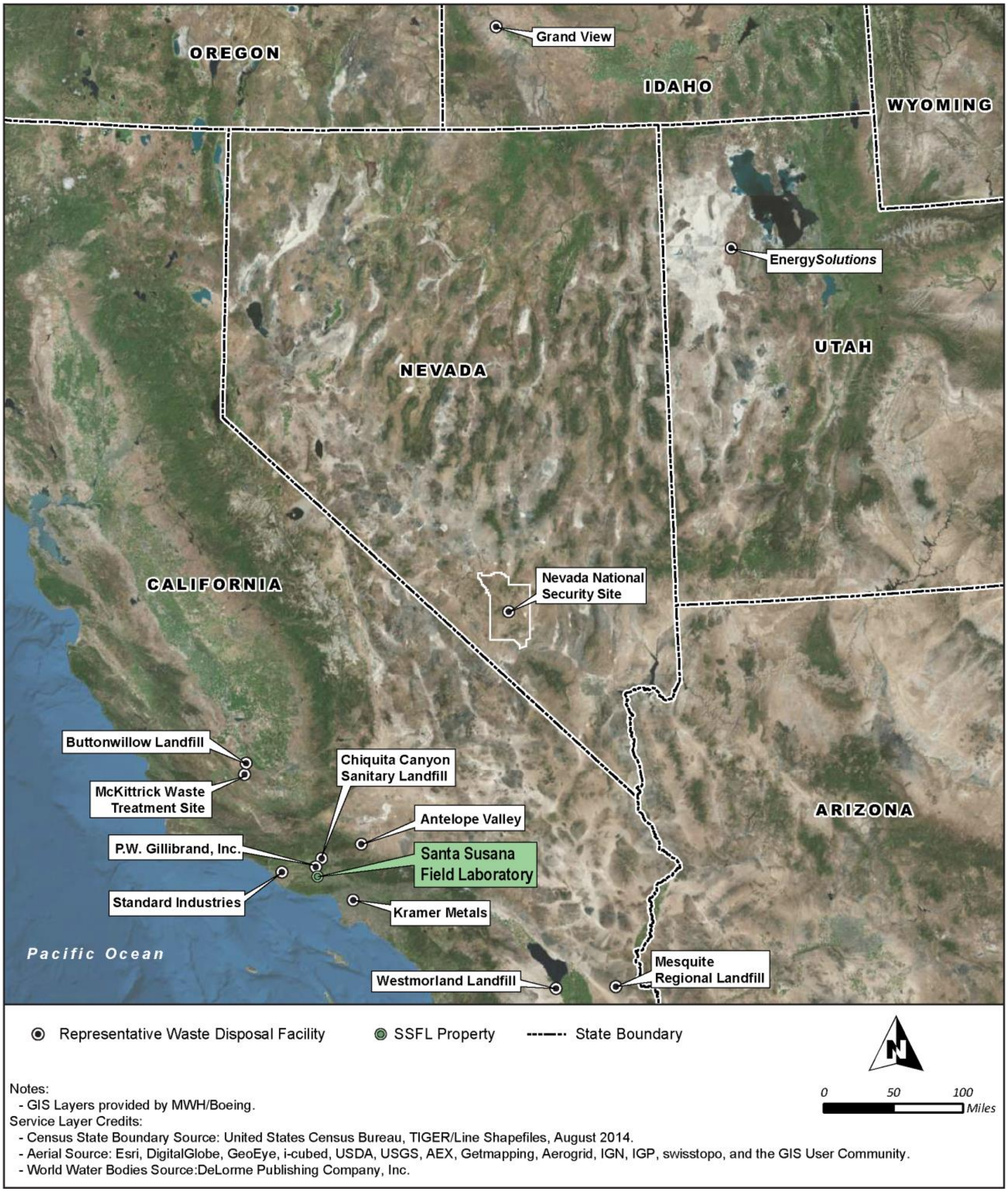

Figure 3–47 Representative Waste Disposal Facilities

The total population of these census tracts is 54,008 persons. Three census tracts (9603, 9604.01 and 9805) represent the NNSS. Census tract 9805, however, is comprised of the NNSS and part of the Nevada Test and Training Range (an Air Force range surrounding the NNSS on three sides), and the U.S. census indicates that the population for census tract 9805 is zero, i.e., no residents. Therefore, census tract 9805 is not described further in this section.

Since numerous communities exist along the major highways that would be used to transport waste from SSFL to the disposal facilities, it was assumed that both general populations and minority and low-income communities exist along the routes between SSFL and the representative disposal facilities and that they would be exposed equally to potential impacts; however, although all communities would be exposed equally, potential consequences for minority and low-income communities may be different. Since the project traffic is anticipated to be a small portion of the highway traffic already occurring on these highways, the project traffic should not impact these communities regardless of race or income any differently than the traffic levels already experienced. Communities along the transportation routes are not further characterized in this section.

3.13.2.1 Minority

Table 3–46 summaries the minority characteristics for the areas surrounding the representative recycle and waste disposal facilities. Census tracts 13.01, 9201.06, 9104.01, 5327, 123.01 have minority population exceeding the 50 percent minority threshold. Census tract 1306 has a minority population of 49.3 percent, just short of the 50 percent minority threshold. Census tract 5327 has a minority population of 99 percent.

Table 3–46 Demographic Characteristics for the Areas Surrounding the Representative Recycle and Waste Disposal Facilities, 2013

Facility	*Census Tract*	*Total Population*	*White Alone, Non-Hispanic* [a,b]	*Total Minority Population* [c]
Recycle Facilities in California [d]				
P.W. Gillibrand, Inc.	85	8,661	5,904 (68.1)	2,757 (31.8)
Standard Industries [e]	**13.01**	**8,557**	**4,190 (48.9)**	**4,367 (51.0)**
Kramer Metals [e]	**5327**	**2,742**	**26 (0.9)**	**2,716 (99.0)**
Waste Disposal Facilities in California				
Chiquita Canyon Sanitary Landfill [e]	**9201.06**	**3,031**	**1,093 (36.1)**	**1,938 (63.9)**
Antelope Valley [e]	**9104.01**	**6,549**	**2,431 (37.1)**	**4,118 (62.8)**
McKittrick Waste Treatment Site and Buttonwillow Landfill	33.04	4,607	2,723 (44.7)	1,874 (40.6)
Westmoreland Landfill [e]	**123.01**	**5,308**	**1,016 (19.1)**	**4,292 (80.8)**
Mesquite Regional Landfill	124	642	603 (93.9)	39 (6.0)
Waste Disposal Facilities Outside California				
Nevada National Security Site	9603	2,140	1,505 (70.3)	635 (29.6)
	9604.01	5,462	4,769 (87.3)	693 (12.6)
Energy*Solutions*	1306	2,344	1,187 (50.6)	1,157 (49.3)
US Ecology	9502	3,965	2,723 (68.7)	1,242 (31.3)

[a] A minority is defined as a member of the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black (non-Hispanic); or Hispanic.

[b] The term, "Hispanic," is an ethnic category and can apply to members of any race, including respondents who self-identified as "White." The total numbers of Hispanic residents for each geographic region are tabulated separately from the racial distribution by the U.S. Census Bureau.

[c] In accordance with Council on Environmental Quality guidelines, "Total Minority" is the aggregation of all non-white racial groups with the addition of all Hispanics, regardless of race, with the total for "Not Hispanic or Latino: White Alone" subtracted from the total population.

[d] Waste disposal does not occur at the three listed recycle facilities; some of the listed waste disposal facilities also conduct recycle operations.

[e] **Boldface** denotes areas with meaningfully greater total minority proportion (more than 50 percent).

Source: Census 2013d.

3.13.2.2 Low-income

Table 3–47 shows poverty levels by census tract in the ROIs of the representative recycle and waste disposal facilities. Census tracts 9201.06, 5327, 123.01, 124, 9603, and 1306 are considered poverty areas. There are no extreme poverty areas within the ROIs of the representative recycle and waste disposal facilities.

Table 3–47 Economic Characteristics of the Areas Surrounding the Representative Recycle and Waste Disposal Facilities, 2013

Facility	*Census Tract*	*Percent of Population Below Poverty [a] Threshold*
Recycle Facilities in California [b]		
P.W. Gillibrand, Inc.	85	6.45
Standard Industries	13.01	7.6
Kramer Metals [c]	**5327**	**26.2**
Waste Disposal Facilities in California		
Chiquita Canyon Sanitary Landfill [c]	**9201.06**	**20.4**
Antelope Valley	9104.01	6.8
McKittrick Waste Treatment Site and Buttonwillow Landfill	33.04	9.1
Westmoreland Landfill [c]	**123.01**	**23.7**
Mesquite Regional Landfill [c]	**124**	**32.3**
Waste Disposal Facilities Outside California		
Nevada National Security Site	**9603**	**31.9**
	9604.01	9.7
Energy*Solutions* [c]	**1306**	**23.0**
US Ecology	9502	19.2

[a] A "poverty area" or low-income population is where 20 percent or more of the population lives in poverty. An "extreme poverty area" or area of concentrated poverty is where 40 percent or more of the population lives in poverty (Census 2010c).
[b] Waste disposal does not occur at the three listed recycle facilities; some of the listed waste disposal facilities also conduct recycle operations.
[c] **Boldface** denotes areas with greater total low-income proportion (20 percent or more).

3.14 Sensitive-aged Populations

This section of this EIS identifies populations of concern in addition to those identified in Section 3.13, Environmental Justice, including sensitive-aged groups (children [under 18 years] and persons 65 years and over) in the ROIs that could be potentially affected by the proposed project.

A growing body of scientific knowledge has demonstrated that children might suffer disproportionately from environmental health and safety risks. These risks arise because children are still developing; children eat more food, drink more fluids, and breathe more air in proportion to their body weight than adults; children's size and weight might diminish their protection by standard safety features; and children's behavior patterns could make them more susceptible to accidents. Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, addresses these potential health and safety risks to children. It was also assumed that, due to increasing age and potentially declining health, persons 65 years or older may experience similar disadvantages compared to the remainder of the population; therefore, this age group is also analyzed in this section. See Section 3.9, Human Health and Safety, for detailed information on public health and safety existing conditions.

Similar to the environmental justice analysis, analysis for the sensitive-aged groups addresses a single site-specific ROI, as well as multiple ROIs, for the representative recycle and waste disposal facilities. The site-specific ROI comprises the block groups encompassing and adjacent to the SSFL property and local roadways to and from the site, within approximately 1 mile of the SSFL boundary. The ROIs for the representative recycle and waste disposal facilities comprise those census tracts in closest proximity to (approximately 1 mile from) the representative facilities and along truck routes (major highways) between SSFL and those facilities.

The most recently available demographic and economic data from the 2010 census and the American Community Survey, 2013 1- and 5-Year Estimates, were used to identify children and persons 65 years and over within the ROIs (Census 2010b). The American Community Survey was established by the U.S. Census Bureau in 2005 and, in non-census years, samples the population and projects the findings for the population as a whole. The American Community Survey data are available on an annual basis for areas with populations of 65,000 or more. For smaller areas, data are only reported every 3 to 5 years (Census 2010b). Because the ROIs include areas with populations both smaller and larger than 65,000 persons, the most recent data available occur in different years. Therefore, data used to characterize the ROIs range from 2010 through 2013.

3.14.1 Site-Specific Region of Influence

3.14.1.1 Children

Table 3–48 shows the number of children residing in the ROI by block group. Approximately 27,314 children under the age of 18 live in the site-specific ROI. Of these, 7,295 are younger than 5 years. The block group containing the Summit and Mountain View Mobile Home Communities (and other conventional housing) is home to 292 children under the age of 18, including 73 children younger than 5 years.

Figure 3–48 shows the locations of schools, parks, and open space areas near SSFL and the identified local roads. These facilities are shown to identify locations in the site-specific ROI where children are likely to be present.

Table 3–48 Children Residing in the Site-Specific Region of Influence, 2010 to 2013

Location		Children under the Age of 18	Children under the Age of 5	Location		Children under the Age of 18	Children under the Age of 5
Ventura County							
CT 75.11	BG 1	406	55	CT 75.12	BG 1	795	192
	BG 2	106	27	CT 83.04	BG 3	359	100
Los Angeles County							
CT 1132.11	BG 1	298	77	CT 1345.20	BG 1	901	304
	BG 2	333	99		BG 2	585	179
CT 1132.12	BG 1	52	274	CT 1345.22	BG 1	1,220	315
	BG 2	337	79	CT 1351.02	BG 1	271	73
CT 1132.13	BG 1	502	114		BG 2	223	54
	BG 2	380	114		BG 3	215	57
CT 1132.31	BG 1	245	49	CT 1351.11	BG 1	196	54
	BG 2	218	35		BG 2	269	49
CT 1132.32	BG 1	396	82		BG 3	150	58
	BG 2	340	75	CT 1351.13	BG 1	198	546
CT 1132.33	BG 1	464	125	CT 1351.14	BG 1	415	199
	BG 2	650	185		BG 2	162	54
	BG 3	680	205	CT 1352.01	BG 1	373	68
CT 1132.35	BG 1	292	73		BG 2	265	34
CT 1132.37	BG 1	470	121	CT 1352.02	BG 1	132	28
	BG 2	197	47		BG 2	525	81
CT 1343.02	BG 1	185	46		BG 3	349	68
	BG 2	313	84	CT1352.03	BG 1	510	74
	BG 3	300	76		BG 2	151	0
CT 1343.03	BG 1	315	86		BG 3	509	61
	BG 2	192	58	CT 1370	BG 1	528	93
	BG 3	266	75		BG 2	591	68
	BG 4	302	83	CT 1371.03	BG 1	217	93
CT 1343.04	BG 1	332	51		BG 2	367	126
	BG 2	410	106	CT 1372.01	BG 1	481	177
CT 1343.05	BG 1	1,227	354		BG 2	244	54
CT 1343.06	BG 1	863	292		BG 3	303	82
CT 1344.21	BG 1	976	79	CT 1373.01	BG 1	567	85
CT1344.22	BG 1	252	49	CT 1373.02	BG 1	294	97
	BG 2	787	137		BG 2	616	171
CT 1344.23	BG 1	311	42	CT 9800.23	BG 1	1	0
	BG 2	396	91		**Total**	**27,314**	**7,295**
CT 1344.24	BG 1	321	38				
	BG 2	218	18				

BG = block group; CT = census tract.
Source: Census 2010b, 2013d.

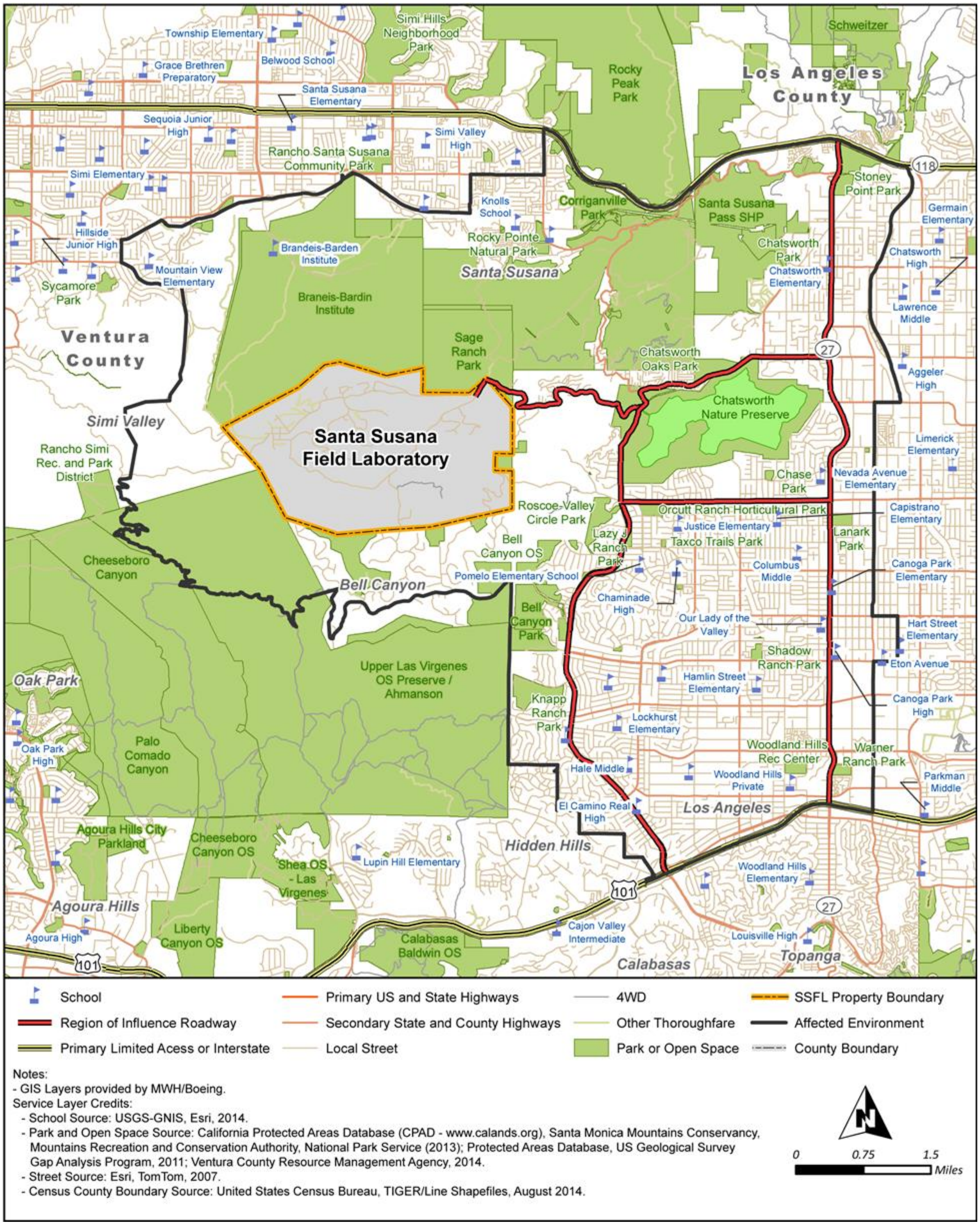

Figure 3–48 Schools, Parks, and Open Space within and Adjacent to the Site-Specific Region of Influence

3.14.1.2 Persons 65 Years and Over

Table 3–49 shows the number of persons 65 years and over residing in the site-specific ROI by census block group, based on the 2010 U.S. census and updated information for 2013 (Census 2010b, 2013d). Approximately 17,716 persons aged 65 years and over, representing 14 percent of the population, reside in the ROI.

The block group containing the Summit and Mountain View Mobile Home Communities (and other conventional housing) is home to 189 persons aged 65 years and over, representing 0.1 percent of the ROI population.

Table 3–49 Persons 65 Years and Over Residing in the Site-Specific Region of Influence, 2010 to 2013

Location		*Total Population*	*Persons 65 Years and Over*	*Percent of Population 65 Years and Over*	*Location*		*Total Population*	*Persons 65 Years and Over*	*Percent of Population 65 Years and Over*
Ventura County									
CT 75.11	BG 1	1,600	196	12.2	CT 75.12	BG 1	3,062	217	7.0
	BG 2	622	75	12.0	CT 83.04	BG 3	1,824	139	7.6
Los Angeles County									
CT 1132.11	BG 1	1,754	293	16.8	CT 1345.20	BG 1	3,286	306	9.3
	BG 2	2,033	423	20.8		BG 2	2,167	91	4.1
CT 1132.12	BG 1	1,291	157	12.1	CT 1345.22	BG 1	3,954	198	5.0
	BG 2	1,778	312	17.5	CT 1351.02	BG 1	1,282	210	16.3
CT 1132.13	BG 1	2,510	439	17.4		BG 2	1,213	239	19.7
	BG 2	1,806	152	8.4		BG 3	1,018	195	19.1
CT 1132.31	BG 1	1,534	287	18.7	CT 1351.11	BG 1	796	99	12.4
	BG 2	591	102	17.2		BG 2	1,259	181	14.3
CT 1132.32	BG 1	2,104	401	19.0		BG 3	912	88	9.6
	BG 2	1,709	288	16.8	CT 1351.13	BG 1	2,795	287	10.2
CT 1132.33	BG 1	1,673	93	5.5	CT 1351.14	BG 1	2,973	419	14.0
	BG 2	2,101	82	3.9		BG 2	1,472	322	21.8
	BG 3	2,881	426	14.7	CT 1352.01	BG 1	1,921	337	17.5
CT 1132.35	BG 1	1,602	189	11.7		BG 2	728	132	18.1
CT 1132.37	BG 1	2,552	411	16.1	CT 1352.02	BG 1	915	245	26.7
	BG 2	1,109	229	20.6		BG 2	1,636	149	9.1
CT 1343.02	BG 1	850	130	15.2		BG 3	1,813	256	14.1
	BG 2	1,534	221	14.4	CT 1352.03	BG 1	2,195	325	14.8
	BG 3	1,348	166	12.3		BG 2	860	184	21.3
CT 1343.03	BG 1	1,064	73	6.8		BG 3	1,708	203	11.8
	BG 2	1,093	137	12.5	CT 1370	BG 1	2,041	172	8.4
	BG 3	1,251	182	14.5		BG 2	2,839	649	22.8
	BG 4	1,649	360	21.8	CT 1371.03	BG 1	1,716	147	8.5
CT 1343.04	BG 1	1,028	309	30.0		BG 2	2,483	378	15.2
	BG 2	1,854	253	13.6	CT 1372.01	BG 1	2,866	397	13.8
CT 1343.05	BG 1	3,847	143	3.7		BG 2	966	84	8.6
CT 1343.06	BG 1	3,498	318	9.0		BG 3	1,438	250	17.3
CT 1344.21	BG 1	3,921	582	14.8	CT 1373.01	BG 1	2,284	282	12.3
CT 1344.22	BG 1	1,325	288	21.7	CT 1373.02	BG 1	1,720	485	28.1
	BG 2	3,428	537	15.6		BG 2	2,851	591	20.7
CT 1344.23	BG 1	1,517	293	19.3	CT 9800.23	BG 1	8	1	12.5
	BG 2	1,897	344	18.1			**Total**	**126,192**	**17,716**
CT 1344.24	BG 1	1,619	351	21.6				**Percent of Population**	**14.0**
	BG 2	1,218	216	17.7					

BG = block group; CT = census tract.
Source: Census 2010b, 2013d.

3.14.2 Region of Influence for Representative Recycle and Waste Disposal Facilities

Table 3–50 lists the 12 representative recycle and waste disposal facilities analyzed in this EIS and their locations, distance from SSFL, census tracts, and total populations. As described in Chapter 2, these facilities are representative of the facilities that would be used because DOE has not made a decision regarding which specific facilities it would use. Figure 3–47 shows the locations of these facilities.

Table 3–50 Census Tracts for Representative Recycle and Waste Disposal Facilities

Facility	*Location*	*Distance from SSFL (miles)*	*Census Tract*	*Total Population*
Recycle Facilities in California [a]				
P.W. Gillibrand, Inc.	Simi Valley, CA	<10	85	8,661
Standard Industries	Ventura, CA	28	13.01	8,557
Kramer Metals	Los Angeles, CA	44	5327	2,742
Waste Disposal Facilities in California				
Chiquita Canyon Sanitary Landfill	Castaic, CA	32	9201.06	3,031
Antelope Valley	Palmdale, CA	38	9104.01	6,549
McKittrick Waste Treatment Site	McKittrick, CA	88	33.04	4,607
Buttonwillow Landfill	Buttonwillow, CA	120	33.04	–[b]
Westmoreland Landfill	Westmorland, CA	230	123.01	5,308
Mesquite Regional Landfill	El Centro, CA	250	124	642
Waste Disposal Facilities Outside California				
Nevada National Security Site	Nye County, NV	330	9603	2,140
			9604.01	5,462
			9805	0
Energy*Solutions*	Clive, UT	710	1306	2,344
US Ecology	Grand View, ID	900	9502	3,965
			Total Population	**54,008**

< = less than; CA = California, ID = Idaho, NH = nonhazardous, NV = Nevada, UT = Utah.
[a] Waste disposal does not occur at the three listed recycle facilities; some of the listed waste disposal facilities also conduct recycle operations.
[b] Total population for Census Tract 33.04 is already listed under McKittrick Waste Treatment Site.
Source: Census 2013d.

The combined population nearby the representative recycle and waste disposal facilities is 54,008 persons. Three census tracts (9603, 9604.01 and 9805) represent the NNSS. Census tract 9805, however, is comprised of the NNSS and part of the Nevada Test and Training Range (an Air Force range surrounding the NNSS on three sides), and the U.S. census indicates that the population for census tract 9805 is zero, i.e., no residents. Therefore, census tract 9805 is not described further in this section.

Because numerous communities exist along the major highways that would be used to transport waste from SSFL to the recycle and waste disposal facilities, it was assumed that sensitive-aged populations exist along the routes between SSFL and the disposal facilities and that they would be exposed equally to potential impacts. Although all communities would be exposed equally, potential consequences for children and persons 65 years and over may be different when compared to the remainder of the population. Since the project traffic is anticipated to be a small portion of the highway traffic already occurring on these highways, the project traffic should not impact these sensitive communities any differently than the traffic levels already experienced. Communities along the transportation routes are not further characterized in this section.

3.14.2.1 Children

Table 3–51 shows that approximately 11,343 children under the age of 18 reside in the census tracts near the representative recycle and waste disposal facilities. Of these, 2,822 are younger than 5 years.

Table 3–51 Children Residing in Areas Surrounding the Representative Recycle and Waste Disposal Facilities, 2013

Facility	*Census Tract*	*Children under the Age of 18*	*Children under the Age of 5*
Recycle Facilities in California [a]			
P.W. Gillibrand, Inc.	85	1,944	520
Standard Industries	13.01	2,200	628
Kramer Metals	5327	901	234
Waste Disposal Facilities in California			
Chiquita Canyon Sanitary Landfill	9201.06	833	155
Antelope Valley	9104.01	1,629	403
McKittrick Waste Treatment Site and Buttonwillow Landfill	33.04	585	112
Westmoreland Landfill	123.01	241	25
Mesquite Regional Landfill	124	88	52
Waste Disposal Facilities Outside California			
Nevada National Security Site	9603	343	72
	9604.01	876	183
Energy*Solutions*	1306	610	187
US Ecology	9502	1,093	251
Total		**11,343**	**2,822**

[a] Waste disposal does not occur at the three listed recycle facilities; some of the listed waste disposal facilities also conduct recycle operations.
Source: Census 2013d.

Each of the representative facilities was analyzed to determine the locations of the closest schools, parks, and open space areas where children may be present in comparison to the locations of each of the sites. Most of these facilities are located several miles from residential areas, schools, parks, or open space areas where children may be present. A few facilities; however, are located near residential areas. Standard Industries and Kramer Metals are recycle facilities located in industrial areas, less than 1 mile from urban residential areas. The Antelope Valley Recycling and Disposal Facility is located in an isolated area on the outskirts of the City of Palmdale in Los Angeles County, within 1 mile of a residential area. These three recycle and disposal facilities and P.W. Gillibrand, Inc., a recycle facility, are located within 1 mile of a school, park, or open space facility. The McKittrick Waste Treatment Site, although not located in a census tract with a large population, is also located in close proximity to a school facility.

3.14.2.2 Persons 65 Years and Over

Table 3–52 shows that approximately 6,710 persons aged 65 years and over, representing 12.4 percent of the population, reside in the census tracts near the representative recycle and waste disposal facilities.

Table 3–52 Persons 65 Years and Over Residing in Areas Surrounding the Representative Recycle and Wastes Disposal Facilities, 2013

Facility	*Census Tract*	*Total Population*	*Persons 65 Years and Over*	*Percent of Population 65 Years and Over*
Recycle Facilities in California [a]				
P.W. Gillibrand, Inc.	85	8,661	1,023	11.8
Standard Industries	13.01	8,557	862	10.0
Kramer Metals	5327	2,742	197	7.1
Waste Disposal Facilities in California				
Chiquita Canyon Sanitary Landfill	9201.06	3,031	159	5.2
Antelope Valley	9104.01	6,549	568	8.6
McKittrick Waste Treatment Site and Buttonwillow Landfill	33.04	4,607	344	7.4
Westmoreland Landfill	124	5,308	245	4.6
Mesquite Regional Landfill	123.01	642	207	3.8
Waste Disposal Facilities Outside California				
Nevada National Security Site	9603	2,140	322	15.0
	9604.01	5,462	1,975	36.1
Energy*Solutions*	1306	2,344	93	3.9
US Ecology	9502	3,965	715	18.0
Percent of Population				**12.4**
Total		**54,008**	**6,710**	

[a] Waste disposal does not occur at the three listed recycle facilities; some of the listed waste disposal facilities also conduct recycle operations.
Source: Census 2013d.

Chapter 4
Environmental Consequences

4.0 ENVIRONMENTAL CONSEQUENCES

This chapter of the *Draft Environmental Impact Statement for Remediation of Area IV and the Northern Buffer Zone of the Santa Susana Field Laboratory (Draft SSFL Area IV EIS)* presents the scientific and analytical basis for the comparison of environmental consequences of the alternatives evaluated in this environmental impact statement (EIS). Environmental consequences are presented for the following resource areas and their respective regions of influence (ROIs) as defined in Chapter 3:

- Land Resources
- Geology and Soil
- Surface Water
- Groundwater Resources
- Biological Resources
- Air Quality and Climate Change
- Noise
- Transportation and Traffic
- Human Health
- Waste Management
- Cultural Resources
- Socioeconomics
- Environmental Justice
- Sensitive-Aged Populations

Action Alternative Groups and Combinations

Potential environmental consequences are presented for three groups of alternatives addressing soil remediation, building demolition, and groundwater remediation. Grouping the alternatives in this manner allows comparison of the impacts among the alternatives evaluated for each of these three activities. In addition, potential environmental consequences are presented for combinations of action alternatives where each combination addresses all three activities. There are three action alternatives among the soil remediation alternatives, one action alternative among the building demolition alternatives, and two action alternatives among the groundwater remediation alternatives. This means there are six combinations of action alternatives, as summarized in the text box below, assuming each combination includes *one* soil remediation action alternative, *one* building demolition action alternative, and *one* groundwater remediation action alternative (also see below).

For most resource areas, the largest potential impacts (e.g., most waste generated, most truck round trips) occur under the combination of the Cleanup to AOC (*Administrative Order on Consent for Remedial Action* [2010 AOC] [DTSC 2010a]) LUT (Look-Up Table) Values, Building Removal, and Groundwater Treatment Alternatives. This combination of action alternatives is termed the "High Impact Combination." Conversely, for most resource areas, the smallest potential impacts occur under the combination of the Conservation of Natural Resources, Building Removal, and Groundwater Monitored Natural Attenuation Alternatives. This combination of action alternatives is termed the "Low Impact Combination." To avoid repetition, these terms are used as a shorthand way to refer to the above combinations of action alternatives. For those resource areas, however, where the largest and smallest potential impacts are not necessarily encompassed by these combinations of action alternatives, the applicable combination is specified and evaluated.

Action Alternative Combination	Designation
Cleanup to AOC LUT Values + Building Removal + Groundwater Monitored Natural Attenuation	–
Cleanup to AOC LUT Values + Building Removal + Groundwater Treatment	Action Alternative Combination with the Largest Potential Environmental Consequences (High Impact Combination)
Cleanup to Revised LUT Values + Building Removal + Groundwater Monitored Natural Attenuation	–
Cleanup to Revised LUT Values + Building Removal + Groundwater Treatment	–
Conservation of Natural Resources + Building Removal + Groundwater Monitored Natural Attenuation	Action Alternative Combination with the Smallest Potential Environmental Consequences (Low Impact Combination)
Conservation of Natural Resources + Building Removal + Groundwater Treatment	–

AOC = *Administrative Order on Consent for Remedial Action*; LUT = Look-Up Table.

The suite of groundwater treatment technologies to be implemented will be determined independently of this EIS by means of a Resource Conservation and Recovery Act (RCRA) Corrective Measures Study (see Chapter 2, Section 2.6). Because the results of this Corrective Measures Study are yet to be determined, this EIS evaluates the impacts that could occur during groundwater remediation activities assuming the implementation of those technologies planned for inclusion in the Corrective Measure Study that would result in the largest potential impacts. In addition, the U.S. Department of Energy (DOE) could decide to implement both groundwater remediation action alternatives (Groundwater Monitored Natural Attenuation and Groundwater Treatment) rather than one alternative or the other. In this event, the impacts for some resource areas could be slightly larger than those under the High Impact Combination (which includes potential impacts from the Groundwater Treatment Alternative, but not the Groundwater Monitored Natural Attenuation Alternative). These potential incremental impacts are addressed as appropriate in the following subsections.

California Department of Toxic Substances Control Environmental Impact Report

The California Department of Toxic Substances Control (DTSC) is preparing a separate program environmental impact report (EIR) for the entire Santa Susana Field Laboratory (SSFL) site, pursuant to California Environmental Quality Act (CEQA) statutory requirements, regulations, and guidance. Although the National Environmental Policy Act (NEPA) and CEQA are similar in intent and review processes (e.g., analyses, public engagement, and document preparation and review), there are differences in their requirements and in the determinations to be made by lead agencies. Differences include how alternatives, significance, and mitigation issues are addressed in the respective statutes and regulatory programs (see **Table 4–1**).

Table 4–1 NEPA and CEQA Uses of the Terms "Alternatives," "Significance," and "Mitigation"

Issue	*NEPA*	*CEQA*
Alternatives	CEQ NEPA regulations require evaluation of all reasonable alternatives, with substantial treatment devoted to each alternative and an identification of an agency's preferred alternative where one or more exists in an EIS (40 CFR 1502.14(a)). The environmental impacts of a proposed action and alternatives should be presented in a comparative form to define the issues and provide a clear basis for a choice among the alternatives (40 CFR 1502.14). Other requirements include the inclusion of a no action alternative (40 CFR 1502.14(d)), an explanation of why any alternatives were eliminated from detailed analysis (40 CFR 1502.14(1), and identification of the environmentally preferred alternative(s) in an EIS ROD (40 CFR 1505.2(b)).	CEQA requires evaluation of a reasonable range of alternatives to a proposed project. Sufficient information must be provided about each alternative to allow meaningful evaluation and comparison with the proposed project. If an alternative would cause one or more significant effects in addition to those caused by the proposed project, the significant effects of the alternative must be discussed, but may be discussed in less detail than the significant effects of the proposed project. Other requirements include a no project alternative, an explanation why rejected alternatives are considered infeasible, and an identification of an agency's environmentally superior alternative.
Significance	NEPA requires preparation of an EIS when a proposed Federal action has the potential to significantly affect the quality of the human environment. In accordance with CEQ NEPA regulations, significance is based on context and intensity. The significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of the proposed action. For instance, in the case of a site-specific action, significance would usually depend upon the effects in the site locale rather than in the world as a whole. Both short and long-term effects are relevant. Intensity refers to the severity of the impact (40 CFR 1508.27).	CEQA requires identification of each significant effect on the environment resulting from the whole of the action, as well as ways to mitigate each significant effect. An EIR must be prepared if a proposed action may have a significant effect on any environmental resource.[a] A significant effect or impact [b] is defined as a substantial or potentially substantial adverse change within the area affected by the project. CEQA guidelines call for agencies to adopt thresholds for what is considered a significant impact.[c] In the absence of adopted thresholds, CEQA requires an evaluation of the factual and scientific data to determine whether an impact may be significant. A determination of significance may depend to some degree on the project's context.
Mitigation	Mitigation includes avoiding, minimizing, rectifying, reducing over time, or compensating for an impact (40 CFR 1508.20). Mitigation measures must be considered even for impacts that by themselves would not be considered "significant" (CEQ 1981). An agency must state whether all practical means to avoid or minimize environmental harm from a selected alternative have been adopted, and if not, why they were not. A monitoring and enforcement program must be adopted and summarized where applicable for any mitigation (40 CFR 1505.2(c)). DOE would publish a Mitigation Action Plan (10 CFR 1021.331), describing its plan for implementing commitments made in a DOE EIS and ROD, to mitigate adverse environmental impacts from an action.	CEQA defines mitigation the same as NEPA. An EIR must describe mitigation measures for significant adverse impacts, and an agency must adopt feasible [d] mitigation measures or alternatives to substantially lessen the significant effect before approving the project. CEQA requires adoption of any feasible mitigation measures that can reduce a significant impact; CEQA mitigation requirements apply only to adverse environmental impacts found to be significant.

CEQ = Council on Environmental Quality; CEQA = California Environmental Quality Act; CFR = *Code of Federal Regulations*; EIR = environmental impact report; EIS = environmental impact statement; NEPA = National Environmental Policy Act; ROD = Record of Decision.

[a] Some impacts determined to be significant under CEQA may not necessarily be determined significant under NEPA.

[b] CEQA and NEPA guidance both use the terms "effects" and "impacts" interchangeably.

[c] A threshold of significance is an identifiable quantitative, qualitative, or performance level of a particular environmental effect. Noncompliance with any of these levels means the effect normally would be determined to be significant by the agency, and compliance with these levels means the effect normally would be determined to be less than significant.

[d] "Feasible" means capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors.

Source: CEQ 1981; CEQ/OPR 2014; 10 CFR 1021; 40 CFR 1502; 40 CFR 1505; 40 CFR 1508.

Mitigation involves taking steps to minimize, avoid, rectify, reduce, eliminate, or compensate for the impact of an analyzed alternative (Title 40, *Code of Federal Regulations*, Section 1508.20 [40 CFR 1508.20]). Mitigation could include development of design alternatives that would decrease pollution emissions, construction impacts, and aesthetic intrusion; possible land use controls; or other efforts (CEQ 1981). Mitigation measures discussed in an EIS must cover the range of impacts for the analyzed alternatives, and such measures should be considered even for impacts that by themselves would not be considered significant (CEQ 1981). If DOE commits to implementing one or more measures to reduce or mitigate adverse environmental impacts associated with an action, it prepares, issues, and monitors the conduct of a Mitigation Action Plan (10 CFR 1021.331) for implementing these commitments.

Under CEQA, environmental impacts are evaluated for a proposed project, and if the projected impacts from the proposed project are below an identified significance threshold, no mitigation is required. If the projected impacts exceed the significance threshold, feasible mitigation measures are identified and assumed to be implemented. If, after all feasible mitigation is incorporated, the projected impacts are below the significance threshold, a determination may be made that impacts would be mitigated to less than a significant level. If projected impacts would still exceed the significance threshold, the unavoidable significant impact must be documented.

To assist a reader who examines the respective analyses in this EIS and the forthcoming DTSC draft program EIR, this EIS has been prepared in a manner intended to provide a bridge to the DTSC draft program EIR. NEPA and CEQA requirements and guidance were reviewed (e.g., CEQ 1981, CEQ/OPR 2014, DOE 2004), as were other CEQA analyses for projects proposed for the Los Angeles area (e.g., LA 2006). Considering the concept of significance thresholds which under CEQA would be included in the forthcoming DTSC draft program EIR, an "impact threshold" is identified for each resource area in this EIS as summarized in **Table 4–2**. As used in this EIS, an impact threshold for a resource area is a criterion (quantitative, qualitative, or a combination) used to identify when there is a potential for adverse impacts that cannot be avoided or completely eliminated when implementing the alternatives as proposed, including applicable mitigation measures as summarized for the applicable resource area in this chapter and addressed in more detail in Chapter 6.

Table 4–2 Impact Thresholds Assumed per Resource Area

Section	*Resource Area*	*Impact Threshold*
4.1	Land resources	An impact threshold is one where an alternative could cause adverse changes in land use, recreation, infrastructure, or aesthetic or visual quality at SSFL as evaluated using the analysis considerations (impact drivers) listed in Appendix B, Section B.1.2, and Section 4.1.
4.2	Geology and soils	An impact threshold is one where an alternative results in: • loss of, or loss of access to, a known mineral resource (aggregate or petroleum deposit) or the loss of a known paleontological (fossil) resource; • permanent loss of an aesthetic geologic feature; • permanent increase in a geologic hazard to another property or temporary hazard to workers that could not be mitigated through measures to minimize impacts; or • loss of soil with unique mineralogical and organic properties (including seed bank, regenerative structures, and beneficial soil organisms) to provide numerous soil functions including habitat for soil organisms, substrate for plants to grow, storage and cycling of nutrients, and filtration of pollutants.
4.3	Surface water resources	An impact threshold is one where an alternative results in: • a discharge of water to surface water bodies exceeding water quality thresholds established in the *State General Permit for Storm Water Discharges Associated with Construction Activities* (SWRCB 2009); or • an expected increase in runoff volume and velocity from Area IV that would adversely impact or overwhelm stormwater control structures on site and within the ROI.

Section	Resource Area	Impact Threshold
4.4	Groundwater resources	An impact threshold is one where the quantity and quality of water available to recharge adjacent groundwater basins would be affected to the point that: • the ability of a water utility to use the groundwater basin for public water supply or other designated uses would be reduced; • the yields of supply wells would be reduced; • a permanent change in the rate or direction of groundwater flow would be created; or • there would be a demonstrable and sustained reduction of groundwater recharge capacity. The quality of groundwater is measured by the concentrations of chemicals and radionuclides in the groundwater available to recharge the adjacent basins. A significant impact would occur if the concentrations of chemicals or radionuclides in the groundwater increased from below MCLs to above MCLs (an adverse impact) or decreased from above MCLs to below MCLs (a positive impact).
4.5	Biological resources	For biological resources regulated under the ESA, an impact threshold includes adverse modification of critical habitat, impacts on wildlife species reaching the level of "take," or substantial impacts on listed plant species. Each of these conditions would trigger the need for a biological assessment and consultation between DOE and USFWS. For jurisdictional wetlands and waters regulated under the Clean Water Act, an impact threshold is one where cut or fill impacts on jurisdictional wetlands or waters would be sufficient to trigger regulatory mitigation requirements in addition to *in situ* restoration through the Section 404 Clean Water Act Permit Process. For biological resources lacking specific regulatory thresholds, such as vegetation and wildlife habitat, an impact threshold is determined based on the intensity of the impact and its context. Intensity takes into account how severely the resource is affected. Context takes into account several factors, including the proportion of the resource affected, the importance of the resource (the rarity of the habitat or its interaction with or support of other species), and how difficult it is to restore. For plant communities, for example, context takes into account the abundance and geographic range in comparison to the size of the affected area and the likely ease with which component species can be re-established after remediation from local seed or other propagule sources. For wildlife, context takes into account the overall abundance and distribution of the species and the likely speed of its repopulation after disturbance.
4.6	Air quality and greenhouse gases	An impact threshold is one or more of the following impacts: • For ROIs that attain a NAAQS, emissions exceeding the EPA PSD threshold of 250 tons per year of an attainment pollutant. • For ROIs that do not attain or are in maintenance of a NAAQS, emissions exceeding the applicable annual threshold for a pollutant that requires a conformity determination. • Emissions contributing to an exceedance of a NAAQS or nonconformance of an approved State Implementation Plan. • Generation of fugitive dust that would exceed offsite ambient concentration limitations of VCAPCD Rule 55.
4.7	Noise	An impact threshold is one where time-averaged noise levels at the nearest residence to Area IV or along a truck route in the SSFL vicinity are projected to increase by 5 dBA and the resulting noise is less than 65 dBA CNEL, or increase by 3 dBA CNEL and the resulting noise exceeds 65 dBA CNEL.
4.8	Transportation and traffic	An impact threshold for transportation impacts is one where shipments of radioactive waste could exceed regulatory requirements for radiation protection of the public. An impact threshold for traffic impacts is one where increased traffic from implementing an alternative could: (1) change the level of service on an evaluated traffic route; (2) result in increased potential for pavement deterioration of roads in the SSFL vicinity; or (3) result in a safety hazard.
4.9	Human health	An impact threshold is one where the risk of developing a cancer exceeds the risk evaluation range of 1×10^{-6} to 1×10^{-4} (1 chance in 1 million to 1 chance in 10,000), or the hazard index for noncarcinogenic chemicals exceeds 1.
4.10	Waste management	An impact threshold is one where offsite waste management capacity could be constrained for one or more waste streams, requiring measures such as: (1) reducing annual waste generation rates (extending activities to reduce the daily or annual number of offsite waste shipments), or (2) storing waste pending development of capacity.
4.11	Cultural resources	An impact threshold is one where an adverse effect on a resource could occur that alters the significance of the resource relative to NRHP or similar applicable criteria, such as that issued for purposes of NEPA analysis or by the California Office of Historic Preservation. An impact threshold for traditional Native American resources would be determined through application of the NHPA criteria of adverse effect, or through consultation with the Santa Ynez Band of Chumash Indians and the Santa Susana Field Laboratory Sacred Sites Council.

Section	Resource Area	Impact Threshold
4.12	Socioeconomics	An impact threshold for the SSFL ROI (Los Angeles and Ventura Counties) is one where adverse impacts could occur due to: • site worker employment; • truck driver employment and increased truck traffic that could impact the sales volumes and revenues of businesses along truck routes; • deterioration of local infrastructure and increased demands on social services; • reduced availability of local housing due to the import of workers from outside the SSFL ROI; or • reduced revenues or increased expenses for local governments. An impact threshold for the evaluated recycle and disposal facilities is one where increased truck traffic could adversely impact the sales and revenues of local businesses.
4.13	Environmental justice	An impact threshold is one where disproportionately high and adverse impacts could occur on Native American, minority, or low-income populations.
4.14	Sensitive-aged populations	An impact threshold is one where disparate (i.e., markedly distinct) impacts could occur on sensitive-aged populations, including children under the age of 18 and persons 65 years and over.

CNEL = community noise equivalent level; dBA = decibels A-weighted; EPA = U.S. Environmental Protection Agency; ESA = Endangered Species Act; MCL = Maximum Contaminant Level; NAAQS = National Ambient Air Quality Standards; NEPA = National Environmental Policy Act; NHPA = National Historic Preservation Act; NRHP = *National Register of Historic Places*; PSD = prevention of significant deterioration; ROI = region of influence; SSFL = Santa Susana Field Laboratory; USFWS = U.S. Fish and Wildlife Service; VCAPCD = Ventura County Air Pollution Control District.

4.1 Land Resources

This section describes the impacts on land resources, including land use, recreation, infrastructure, and aesthetic and visual quality, within and adjacent to Area IV and the Northern Buffer Zone (NBZ) that could occur from implementing the alternatives. Chapter 3, Section 3.1, provides an overview of the affected environment for land resources. Appendix B, Section B.1, addresses land resource elements and their analysis considerations (impact drivers). These elements and analysis considerations are summarized in **Table 4–3**.

Table 4–3 Land Resource Analysis Elements and Considerations

Resource	Analysis Considerations
Land use	• Potential change in land use that would conflict with any applicable land use plan, policy, or regulation of Ventura County, including the *Ventura County General Plan* (Ventura County 2015a), any specific or area plans, and zoning ordinances. • Potential physical division of an existing community.
Recreation	• Potential to increase the use or demand of existing neighborhood and/or regional parks. • Impediment on future development of recreation facilities. • Impediment to access to or use of existing recreation facilities.
Infrastructure	• Potential to cause a disruption or re-routing of an existing utility facility. • Potential to cause an increased demand on a utility that could cause shortages or disruption to services that would result in expansion of an existing facility that could have the potential for secondary environmental impacts. • Potential increase of water consumption because California is experiencing drought conditions and is under a California Executive Order to reduce water consumption.
Aesthetics and visual quality	• Potential to cause substantial adverse impacts on a scenic vista. • Potential to substantially damage or alter scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings alongside a state scenic highway. • Potential to substantially degrade the existing visual character or quality of the site and its surroundings. • Potential to create a new source of light or glare that would adversely affect day or nighttime views in the area.

Some of the analysis considerations listed in Table 4–3 are not applicable to this EIS and were not evaluated further, including:

- Land use – No alternative would physically divide an existing community.
- Recreation – Because Area IV and the NBZ are not open to the public, no alternative would impact the quality of onsite recreation. Because the projected employment requirements for remediation activities at Area IV and the NBZ are small and expected to be met primarily by workers from local areas (see Section 4.12), recreation areas in the SSFL vicinity would not experience an increase in use due to a large influx of site workers.
- Infrastructure – Potable water, natural gas, sewage, and communication services to all Area IV buildings have been severed. Electrical power is being severed to the buildings, but will remain in Area IV. The underground natural gas pipeline traversing SSFL will remain and be unaffected. No alternative would cause a disruption or re-routing of an existing utility facility.
- Aesthetics and visual quality – There is no potential to substantially damage or alter scenic resources alongside a state scenic highway or to cause substantial adverse impacts on a scenic vista. SSFL is not located alongside a state scenic highway and sits on top of a ridge, so that foreground and mid-ground scenic views occur only from the site. There are no publicly accessible viewpoints from which to view Area IV.

In addition, light pollution would be minimal under any alternative because work would take place during daytime hours, and any need for nighttime lighting (e.g., repairs to equipment) would be infrequent and temporary.

Analysis of aesthetics and visual quality is conducted using concepts and a visual modification classification system that are presented in Appendix B, Section B.1.3.4, and summarized in the text box below. To assist in the evaluation of Area IV aesthetics, three representative viewing points within Area IV were identified (see Chapter 3, Section 3.1.2, and Figure 3–5):

- **Viewing Point 1** is northwest of SSFL on top of a ridge overlooking Area IV and the Simi Hills (see Figure 3–6).
- **Viewing Point 2** is at the former L85 site and offers direct east-to-west views of the existing Area IV infrastructure (see Figure 3–7).
- **Viewing Point 3** is centrally located within Area IV and offers on-the-ground, south-to-north views of the existing Sodium Pump Test Facility (see Figure 3–8).

The views are typical of those that could be experienced by persons in Area IV and are characterized as urban industrial—that is, views of or bordered by urban and industrial land uses within foreground distance zones. The existing public sensitivity level and visual modification class for each viewing point are summarized in **Table 4–4**.

Table 4–4 Existing Conditions at the Evaluated Viewing Points

Viewing Point [a]	*Public Sensitivity* [b]	*Visual Modification Class* [b]
1	No Sensitivity	3
2	No Sensitivity	3
3	No Sensitivity	4

[a] See Chapter 3, Section 3.1.2, for descriptions of each of the viewing points.
[b] See Appendix B, Section B.1.3.4, for detailed definitions of aesthetics and visual quality and a description of the methodology used to assess them.

Concepts and a visual modification classification system for evaluated impacts on aesthetics and visual quality are summarized here as applied to the *SSFL Area IV EIS*:

Landscape character – Determined by assessing the basic characteristic elements of form, line, color, and texture of landform, vegetation, and structures.

Public sensitivity – A classification based on expected sensitivity to the following changes in visual conditions:

High – Great potential for the public to react strongly to any lessening of visual quality.

Moderate – Substantial potential for the public to voice some concern over visual impacts of moderate to high intensity.

Low – Small minority of the public may have a concern over scenic and visual resource impacts on the affected area.

No sensitivity – The potentially affected areas are not accessible to the general public or there are no indications that the affected views are valued by the public.

Visual modification class – The following classifications are based on the overall congruence and coherence of the affected area and associated space:

Class 1 – Not noticeable. Landscapes are of the highest quality. All noticeable features in view appear congruent and are coherently arrayed. Any adverse changes of landscape features in the past would not be noticed unless pointed out.

Class 2 – Noticeable, visually subordinate. Adverse changes to landscape features that have occurred in the past attract some attention, but do not compete for attention with other features in the field of view.

Class 3 – Distracting, visually co-dominant. Adverse changes in landscape features that have occurred in the past appear incongruous or incoherently arrayed to the point that they are distracting and compete for attention with other features in view.

Class 4 – Visually dominant, demands attention. Landscapes are of the lowest quality. Adverse changes in landscape features that have occurred in the past appear incongruous or incoherently arrayed to the point that they are the focus of attention.

4.1.1 Soil Remediation Alternatives

Impacts under the soil remediation alternatives are summarized and compared in **Table 4–5**.

4.1.1.1 Soil No Action Alternative

Under the Soil No Action Alternative, soil cleanup would not occur, and there would be no change from existing conditions and thus, no additional impacts on land resources.

Land Use

The land use designation for Area IV and the NBZ would be consistent with Ventura County requirements. As indicated in Chapter 3, Section 3.1.1, the current general plan designation for SSFL is open space, although it is zoned rural agriculture and open space, with a special use permit to allow industrial uses (Ventura County 2011a, 2015a).

Recreation

There would be no restrictions in access to, or reductions in the quality of recreation at, Sage Ranch Park or other recreation areas in the SSFL vicinity because there would be no increase in traffic to or from SSFL due to DOE activities.

Infrastructure

Existing electrical service to Area IV would remain. Water for drinking, washing, or other services would continue to be supplied using portable facilities.

Table 4–5 Land Resources Impacts under the Soil Remediation Alternatives

Resource	Soil No Action Alternative	Soil Remediation Action Alternatives: Cleanup to AOC LUT Values	Soil Remediation Action Alternatives: Cleanup to Revised LUT Values	Soil Remediation Action Alternatives: Conservation of Natural Resources
Land use	The land use designation for Area IV and the NBZ would be consistent with Ventura County requirements.	Remediation would be consistent with the landowner's (Boeing's) intent to maintain its land as undeveloped open space (Boeing 2016b).	Same as the Cleanup to AOC LUT Values Alternative.	Same as the Cleanup to AOC LUT Values Alternative
Recreation	No impacts are expected on use of Sage Ranch Park or other recreation areas in the SSFL vicinity.	During 10 years of soil removal, the average daily traffic on Woolsey Canyon Road would increase by up to 7.3 percent, which could discourage weekday use of Sage Ranch Park. Traffic on other evaluated roads is not expected to increase by more than 2.7 percent with no expected impacts on use of other recreation areas in the SSFL vicinity. Traffic past recreation areas along other roads than Woolsey Canyon Road may be reduced by using multiple routes between SSFL and major highways.	Similar to the Cleanup to AOC LUT Values Alternative, except that increased traffic due to soil removal would last for slightly more than 2 years.	Similar to the Cleanup to Revised LUT Values Alternative, except that increased traffic due to soil removal would last for 2 years.
Infrastructure	Electricity use would be minimal. Minimal water requirements would continue to be met through use of portable facilities.	Electricity use would be minimal. About 4 million gallons of water from CMWD would be annually used, representing about 0.007 percent of CMWD's combined imported and local water supply (40 million gallons total). Water use is an important consideration because of California's current drought conditions, California Executive Order B-29-15 requiring a statewide 25 percent reduction in water use (CA EO 2015), and a CMWD resolution calling for a 20 percent reduction in water use in its service area (CMWD 2014).	Electricity use would be minimal. About 4 million gallons of water from CMWD would be annually used, representing about 0.007 percent of CMWD's combined imported and local water supply (8.3 million gallons total). Water use is an important consideration for the same reasons as those under the Cleanup to AOC LUT Values Alternative.	Electricity use would be minimal. About 4 million gallons of water from CMWD would be annually used, representing about 0.007 percent of CMWD's combined imported and local water supply. Although the total water use (8 million gallons) would be less than that under either of the other soil remediation action alternatives, water use is an important consideration for the same reasons as those under the Cleanup to AOC LUT Values Alternative.
Aesthetics and visual quality	No change from baseline conditions	There would be impacts on aesthetics and visual quality during the 10 years of soil removal, but long-term improvements to aesthetics and visual quality from returning Area IV to a stabilized, revegetated state. The terrain would retain the appearance of an open space crossed by roads.	Impacts would be similar to those under the previous Cleanup to AOC LUT Values Alternative, but the impact duration would be less because soil removal would last for slightly more than 2 years rather than 10 years.	Impacts would be similar to those under the Cleanup to Revised LUT Values Alternative, but the impact duration would be less because soil removal would last for 2 years rather than 10 years.

AOC = *Administrative Order on Consent for Remedial Action*; CMWD = Calleguas Municipal Water District; LUT = Look-Up Table; NBZ = Northern Buffer Zone.

Aesthetics and Visual Quality

The visual modification classes at the evaluated viewing points would not change from the baseline conditions summarized in Table 4–4. This alternative would not cause additional long-term adverse impacts on landscape type or character, visual congruence, or coherence. There would be no additional adverse impacts on a scenic vista and no additional degradation of the existing visual character or quality of Area IV and its surroundings.

4.1.1.2 Cleanup to AOC LUT Values Alternative

Land Use

Under the Cleanup to AOC LUT Values Alternative, remediation of Area IV and the NBZ would be consistent with the landowner's (The Boeing Company's [Boeing's]) intent to maintain its land as undeveloped open space (Boeing 2016b).

Recreation

The alternative would require approximately 116,000 heavy-duty truck round trips to haul excavated soil off site, deliver backfill, equipment, and supplies to Area IV, and remove equipment after soil removal is complete (see Appendix H, Table H–15). There would be an average of about 48 daily round trips over the first 9 years of soil removal, and about 31 daily round trips during the last year of soil removal. Consistent with the Transportation Agreement between DOE, the National Aeronautics and Space Administration (NASA), and The Boeing Company (Boeing) (Boeing 2015a), there could occasionally be additional DOE daily heavy-duty truck round trips, provided the total number of heavy-duty truckloads departing SSFL from DOE, NASA, and Boeing activities did not exceed 96 daily shipments. Trucks would be dispatched from the site only during weekdays (Boeing 2015a) (see Chapter 2, Section 2.4.3).

The local transportation routes would include Woolsey Canyon Road, which at the SSFL entrance intersects with the North American Cutoff Road which accesses the southern entrance to Sage Ranch Park. The Sage Ranch Loop Trail can be accessed at the SSFL entrance, and the terrain along Woolsey Canyon Road mostly consists of open space. Additional recreation areas exist along other roads evaluated in this EIS for transporting waste and material (see Figure 3–28 for a map of the proposed transport routes).

As discussed in Section 4.8.2.1.2, the largest impacts on traffic would occur on Woolsey Canyon Road. The weekday average daily traffic on this winding, two-lane road would increase over baseline conditions by 7.2 to 7.3 percent during 9 years of soil remediation and 5.6 percent during the final year of soil remediation. Motorists on Woolsey Canyon Road could experience delays compared to baseline conditions on weekdays during the hours when heavy-duty trucks would be traveling to and from SSFL. In addition to an increase in traffic volume, the average traffic speed on the road could be reduced due to the increased number of heavy-duty trucks, which would be expected to be slow-moving when shipping soil from SSFL and even slower when delivering backfill to SSFL. Traffic volumes and speed restrictions could be more pronounced on some days if DOE shipments during those days exceed average values. There could also be weekday traffic delays at the intersection of Woolsey Canyon Road with Valley Circle Boulevard. Other evaluated roads would experience smaller increases in average daily traffic (no more than 2.7 percent) (see Section 4.8.2.1.2).

Traffic delays or their perception could discourage weekday use of Woolsey Canyon Road to access Sage Ranch Park, although once arriving there, no reduction in the quality of recreational activities would be expected. In addition, Sage Ranch Park can be accessed using other routes than Woolsey Canyon Road. Weekday access to other recreational areas such as Chatsworth Nature Preserve, as well as the quality of recreational activities at these areas, would likely not be affected, because the projected increases in traffic on roads past these recreation areas would be less than 3 percent (see Appendix H, Table H–20), and thus likely unnoticeable. In addition, from Woolsey Canyon Road, trucks could turn north or south on Valley Circle Boulevard to access highways via four evaluated local routes. Distributing truck traffic among the four routes would reduce traffic on roads (other than Woolsey Canyon Road) past other recreation areas in the SSFL vicinity such as Chatsworth Nature Preserve. See Section 4.8 for additional information about transportation and traffic impacts.

Infrastructure

Electrical service to Area IV would be available to support soil remediation operations – e.g., for occasional lighting of work areas for equipment repair and for supplying power to one or more remediation contractor trailers. Because electricity use is expected to be minimal, no electrical shortages or service disruptions are expected, nor expansions of existing utility facilities.

The alternative would require water for dust suppression during soil excavation and backfilling. An estimated 16,000 gallons of water per day, 250 days per year, would result in an annual water use of about 4 million gallons, and a total water use of 40 million gallons. This annual water use also equates to about 12 acre-feet of water per year, which would represent about 0.007 percent of the Calleguas Municipal Water District's (CMWD) combined imported and local water supply (177,644 acre-feet, see Chapter 3, Section 3.1.1.2). This annual water use would also be equivalent to the annual water use in 2010 of approximately 21 households in the Los Angeles area, assuming four persons per household and an annual per capita water use in Metropolitan Los Angeles of 133 gallons per day (CDWR 2014). Since then, water conservation efforts in the Los Angeles area have increased.[1]

Water use is an important consideration because of California's current drought conditions and the need, as expressed by California and CMWD officials, to significantly reduce water consumption. On July 2, 2014, the CMWD Board of Directors passed a resolution appealing for extraordinary water conservation efforts and a minimum 20 percent reduction in water use within its service area (CMWD 2014). Furthermore, after twice proclaiming in 2014 that severe drought conditions in California had resulted in states of emergency, on April 1, 2015, Governor Brown issued Executive Order B-29-15, which directs the State Water Resources Control Board to impose restrictions that would achieve a statewide 25 percent reduction in potable water usage (CA EO 2015). Water use under the alternative could be potentially reduced through measures such as surfactant application to assist in dust control.

Aesthetics and Visual Quality

Approximately 933,000 cubic yards of soil would be removed from SSFL. Soil would be backfilled at the excavated areas and re-graded and re-contoured as necessary. Disturbed areas would be stabilized and revegetated. Potential impacts from this alternative are summarized in **Table 4–6** and described below.

[1] For example, in 2015, total water consumption in the month of December in the Los Angeles Department of Water and Power was 11.942 billion gallons, as compared to 13.842 billion gallons consumed in the same month in 2013 (LADWP 2016). The current per capita water use in the CMWD service area is about 123 gallons per day, considering imported water only. This estimate excludes entities such as businesses or agricultural water users that have private wells, as well as recycled water use (CMWD 2016).

Table 4–6 Aesthetics and Visual Quality Impacts under the Cleanup to AOC LUT Values Alternative

Viewing Point Identification [a]	*Public Sensitivity*	*Existing Visual Modification Class* [b]	*Cleanup to AOC LUT Values Alternative Visual Modification Class* [b]	*Impact*
1	No Sensitivity	3	3	Beneficial
2	No Sensitivity	3	3	Beneficial
3	No Sensitivity	4	4	Beneficial

AOC = *Administrative Order on Consent for Remedial Action*; LUT = Look-Up Table.
[a] See Chapter 3, Section 3.1.2, for descriptions of the three viewing points.
[b] See Appendix B, Section B.1.3.4, for detailed definitions of aesthetics and visual quality and a description of the methodology used to assess them.

Viewing Point 1. During the 10 years of soil removal, soil cleanup could degrade views overlooking Area IV; however, soil cleanup requires use of heavy equipment which would have an industrial appearance. Therefore, there would be minimal change in visual quality from existing conditions and no change in the visual modification class at the viewing point.

Although soil cleanup would alter the existing aesthetic and visual quality of Area IV by disturbing native vegetation, stabilization and revegetation of the affected areas would introduce new, long-term surface texture and color in areas that were previously barren. New vegetation alone would not likely be sufficiently beneficial to improve the visual modification class rating of the viewing point and associated areas—that is, the view would consist of open space crossed by roads before and after remediation. However, new vegetation would still benefit the aesthetics and visual quality of the area and would not cause an adverse effect.

Viewing Point 2. Aesthetic and visual quality effects at Viewing Point 2 would be similar to those experienced at Viewing Point 1.

Viewing Point 3. Aesthetic and visual quality effects at Viewing Point 3 would be similar to those experienced at Viewing Point 1.

4.1.1.3 Cleanup to Revised LUT Values Alternative

Land Use

As under the Cleanup to AOC LUT Values Alternative, remediation of Area IV and the NBZ would be consistent with the landowner's (Boeing's) intent to maintain its land as undeveloped open space (Boeing 2016b).

Recreation

The alternative would require about 23,800 heavy-duty truck round trips to haul excavated soil off site, deliver backfill and equipment to Area IV, and remove equipment after soil remediation is complete (see Appendix H, Table H–15). Potential recreation impacts from soil cleanup would be comparable on an annual basis to those under the Cleanup to AOC LUT Values Alternative, but would occur over slightly more than 2 years rather than 10 years. Daily heavy-duty truck round trips under this alternative would average about 48 during the first 2 years and much less than 1 during the last year. During the first 2 years, the weekday average daily traffic on Woolsey Canyon Road would increase over baseline conditions by 7.2 to 7.3 percent, and by about 0.23 percent during the final year; other evaluated roads would experience smaller increases (see Section 4.8.2.1.3).

Similar to the Cleanup to AOC LUT Values Alternatives, traffic delays or their perception during the first 2 years of soil of removal could discourage weekday use of Woolsey Canyon Road to access Sage Ranch Park. Access to other recreational areas in the SSFL vicinity, such as Chatsworth Nature Preserve, as well as the quality of recreational activities at these areas, would likely not be affected, for the same reason as that for the Cleanup to AOC LUT Values Alternative (Section 4.1.1.2). Nonetheless, distributing truck traffic among the four evaluated routes would reduce truck traffic on roads (other than Woolsey Canyon Road) past these recreation areas.

Infrastructure

As with the Cleanup to AOC LUT Values Alternative, electrical requirements would be minimal; however, because soil removal would require slightly more than 2 years rather than 10 years, total electricity use would be much less than that for the Cleanup to AOC LUT Values Alternative.

The Cleanup to Revised LUT Values Alternative would use water for dust suppression or other activities similar to the Cleanup to AOC LUT Values Alternative. The annual water use would be up to about 4 million gallons, which would equate to about 12 acre-feet of water per year and would represent about 0.007 percent of CMWD's combined imported and local water supply (177,644 acre-feet, see Chapter 3, Section 3.1.1.2). However, the peak annual water use would occur over about 2 years rather than 10 years, and only about 300,000 gallons would be used during the third year; the total water use would be about 8.3 million gallons.

Water use is an important consideration because of California's current drought conditions and the need, as expressed by California and CMWD officials, to significantly reduce water consumption (see Section 4.1.1.2). As previously discussed, water use under this alternative could be potentially reduced through measures such as application of surfactants to assist in dust control.

Aesthetics and Visual Quality

Aesthetics and visual quality impacts would be similar to those under the Cleanup to AOC LUT Values Alternative, except that 192,000 cubic yards of soil would be removed rather than 933,000 cubic yards; therefore, less native vegetation would be disturbed, and visual impacts during soil removal would last for slightly more than 2 years rather than 10 years.

4.1.1.4 Conservation of Natural Resources Alternative

Land Use

As under the Cleanup to AOC LUT Values Alternative, remediation of Area IV and the NBZ would be consistent with the landowner's (Boeing's) intent to maintain its land as undeveloped open space (Boeing 2016b).

Recreation

The alternative would require about 18,400 heavy-duty truck round trips to haul excavated soil off site, deliver backfill and equipment to Area IV, and remove equipment after soil remediation is complete (see Appendix H, Table H–15). Recreation impacts from soil cleanup would be comparable on an annual basis to those under the Cleanup to AOC LUT Values Alternative, but would have a much shorter duration. During the 2 years required for soil removal, daily heavy-duty truck round trips under this alternative would average about 47 during the first year and 26 during the last year. The weekday average daily traffic on Woolsey Canyon Road would increase over baseline conditions by 7.2 percent during the first year of soil removal and 5.1 percent during the second year; other evaluated roads would experience smaller increases (see Section 4.8.2.1.4).

Similar to the Cleanup to AOC LUT Values Alternatives, traffic delays or their perception during the 2 years of soil removal could discourage weekday use of Woolsey Canyon Road to access Sage Ranch Park. Access to other recreational areas in the SSFL vicinity, such as Chatsworth Nature Preserve, as well as the quality of recreational activities at these areas, would likely not be affected, for the same reason as that for the Cleanup to AOC LUT Values Alternative (Section 4.1.1.2). Nonetheless, distributing truck traffic among the four evaluated routes would reduce truck traffic on roads (other than Woolsey Canyon Road) past these recreation areas.

Infrastructure

As with the Cleanup to AOC LUT Values Alternative, electrical requirements would be minimal; however, because soil removal would require 2 years rather than 10 years, total electricity use would be much less than that for the Cleanup to AOC LUT Values Alternative and slightly less than that for the Cleanup to Revised LUT Values Alternative.

The Conservation of Natural Resources Alternative would use water for dust suppression or other activities. The annual water use (about 4 million gallons) is the same as that for the Cleanup to AOC Values Alternative and would thus represent the same annual percentage of CMWD's combined imported and local water supply (see Section 4.1.1.2). However, this annual water use would occur over 2 years rather than 10 years; total water use would be about 8 million gallons.

Nonetheless, water use is an important consideration because California's current drought conditions and the need, as expressed by California and CMWD officials, to significantly reduce water consumption (see Section 4.1.1.2). As previously discussed, water use under the alternative could be potentially reduced through measures such as using surfactants to assist in dust control.

Aesthetics and Visual Quality

Aesthetics and visual quality impacts would be similar to those under the Cleanup to AOC LUT Values Alternative, except that 148,000 cubic yards of soil would be removed rather than 933,000 cubic yards; therefore, less native vegetation would be disturbed, and short-term visual impacts would last for 2 years rather than 10 years.

4.1.2 Building Demolition Alternatives

Impacts under the building demolition alternatives are summarized and compared in **Table 4–7**.

4.1.2.1 Building No Action Alternative

Under the Building No Action Alternative, removal of DOE buildings would not occur and there would be no change from existing conditions and no additional impacts on land resources.

Land Use

The land use designation for Area IV would be consistent with Ventura County requirements (see Section 4.1.1.1).

Recreation

There would be no restrictions in access to, or reductions in the quality of recreation at, Sage Ranch Park or other recreation areas in the SSFL vicinity because there would be no increase in traffic to or from SSFL due to DOE activities.

Table 4–7 Land Resources Impacts under the Building Demolition Alternatives

Resource	Building No Action Alternative	Building Removal Alternative
Land use	The land use designation for Area IV would be consistent with Ventura County requirements. The current general plan designation for SSFL is open space, although it is zoned rural agriculture and open space. The land use is currently modified by a special use permit to allow industrial uses (Ventura County 2011a).	After removal of DOE-owned buildings, the remediated area would be consistent with the landowner's (Boeing's) intent to maintain its land as undeveloped open space (Boeing 2016b).
Recreation	No impacts are expected on use of Sage Ranch Park or other recreation areas in the SSFL vicinity.	If waste and backfill were shipped during a 2- to 5-month period in each working year, the average daily traffic on Woolsey Canyon Road would increase by up to 5.3 percent which could discourage weekday use of Sage Ranch Park. But if waste and backfill were instead shipped throughout each working year, the average daily traffic on Woolsey Canyon Road would increase by less than 1 percent, which would be unlikely to discourage weekday use of Sage Ranch Park. No impacts on the use of other recreation areas in the SSFL vicinity are expected; nonetheless, traffic on other roads past other recreation areas may be reduced by routing truck traffic among multiple routes between SSFL and major highways.
Infrastructure	Existing electrical service to DOE-owned buildings in Area IV would be severed, but electrical service would remain in Area IV. Electricity and water requirements would continue to be minimal.	Annual electricity requirements would be minimal. About 315,000 gallons of water from CMWD would be annually used during 2 years (see Appendix D), representing about 0.0005 percent of CMWD's combined imported and local water supply. Water use is an important consideration because of California's current drought conditions, California Executive Order B-29-15 requiring a statewide 25 percent reduction in potable water use (CA EO 2015), and a CMWD resolution calling for a 20 percent reduction in water use in its service area (CMWD 2014).
Aesthetics and visual quality	There would be no short-term changes to the aesthetics and visual quality of Area IV. DOE-owned buildings could dilapidate over the long-term, decreasing aesthetics and visual quality.	There would be impacts on views of Area IV during the 2 years of demolition activities, but long-term improvements to Area IV visual quality from returning the area to a stabilized, revegetated state.

CMWD = Calleguas Municipal Water District.

Infrastructure

Existing electrical service to buildings in Area IV would be severed, but electrical service would remain in Area IV. Area IV electricity requirements would continue to be minimal. Water for drinking, washing, or other services would continue to be supplied by portable facilities (e.g., 5-gallon drinking water dispensers).

Aesthetics and Visual Quality

In the short term, no changes to the existing aesthetics and visual quality of Area IV are expected. In the long term, if existing onsite infrastructure remains unattended, DOE-owned buildings could eventually dilapidate, contributing to a decrease in aesthetic and visual quality, but likely not resulting in substantial additional adverse impacts compared to existing conditions. That is, the visual setting would continue to consist of steel and concrete structures within an open space. The visual modification classes at the evaluated viewing points are thus not expected to change from the conditions summarized in Table 4–4.

4.1.2.2 Building Removal Alternative

Land Use

Under the Building Removal Alternative, DOE would remove all DOE-owned buildings in Area IV, disturbing about 8.4 acres of land (see Section 4.3.2.2). After these buildings are removed, the remediated area would be consistent with the landowner's (Boeing's) intent to maintain its land as undeveloped open space (Boeing 2016b).

Recreation

During a 2-year period, the alternative would require about 2,420 heavy-duty truck round trips to haul demolition materials from Area IV, deliver backfill and equipment to Area IV, and to remove equipment after building demolition is complete (see Appendix H, Table H–15). Waste and backfill shipments were assumed to occur during a 2- to 5-month period in each working year. During these months, average daily truck round trips could range from about 8 to 27, although there could occasionally be additional DOE daily heavy-duty truck round trips, provided that the total daily truckloads offsite by DOE, NASA, and Boeing did not exceed 96 shipments per the Transportation Agreement (Boeing 2015a) (see Chapter 2, Section 2.4.3).

As discussed in Section 4.1.1.2, the local transportation routes would include Woolsey Canyon Road, which at the SSFL entrance intersects with the North American Cutoff Road which accesses the southern entrance to Sage Ranch Park. Additional recreation areas exist along other roads evaluated in this EIS between SSFL and major highways.

As stated in Section 4.8.2.2.2, the largest impacts on weekday traffic volume would occur on Woolsey Canyon Road. The average daily traffic on this road would increase over baseline conditions by 3.4 percent in the first year of building removal and 5.3 percent in the second year. These increases were estimated assuming that waste shipment and backfill delivery would only occur during a few months in each year. Given these scheduling assumptions, motorists on Woolsey Canyon Road could experience delays compared to baseline conditions on weekdays during the hours when heavy-duty trucks would be traveling to and from SSFL; there could also be delays at the intersection of Woolsey Canyon Road with Valley Circle Boulevard. Traffic delays or their perception could discourage weekday use of Woolsey Canyon Road to access Sage Ranch Park, although once arriving there, no reduction in the quality of recreational activities would be expected. Access to other recreational areas in the SSFL vicinity, such as the Chatsworth Nature Preserve, as well as the quality of recreational activities at these areas, would likely not be affected, because projected increases in traffic on roads past these recreation areas would be less than 2 percent (see Appendix H, Table H–20), and thus likely unnoticeable. Nonetheless, distributing truck traffic among the four evaluated routes would reduce truck traffic on roads (other than Woolsey Canyon Road) past these recreation areas.

Traffic can be significantly reduced by making shipments over longer periods than 2 to 5 months. If shipments were made throughout each working year, the increase in average daily traffic on Woolsey Canyon Road would be less than 1 percent. The projected traffic increase in this case would be unlikely to discourage use of Sage Ranch Park. This shipment schedule would also reduce traffic past other recreational areas in the SSFL vicinity such as Chatsworth Nature Preserve.

Infrastructure

Although electrical services to DOE-owned buildings would be severed, electrical services to Area IV would be used as needed to support building demolition—e.g., for lighting, powering contractor trailers, powering equipment such as concrete saws, or other applications. Annual electricity requirements are expected to be minimal, so that no electrical shortages or service disruptions are expected, nor expansions of existing utility facilities.

This alternative would use water for activities such as dust suppression. This activity would require up to 3,000 gallons per day for 2 years. The total volume of water would be 315,000 gallons per year (630,000 gallons over 2 years), which is equivalent to the annual water use of approximately 1.6 households in the Los Angeles area in 2010 (see Section 4.1.1.2). This also equates to an annual use of about 1 acre-foot of water, which would represent about 0.0005 percent of CMWD's combined imported and local water supply (177,644 acre feet, see Chapter 3, Section 3.1.1.2). Although the projected water use is numerically small, water use is an important consideration because of California's current drought conditions and the need, as expressed by California and CMWD officials, to significantly reduce water consumption (see Section 4.1.1.2). Water use under the alternative could be potentially reduced through measures such as surfactant application to assist in dust control.

Aesthetics and Visual Quality

After building removal, Area IV would have the appearance of open space. As described in Chapter 2, DOE plans to stabilize and revegetate areas disturbed by demolition activities; however, some existing paved and dirt roads and some concrete pads would be left to support other onsite remediation activities. Impacts from implementing the Building Removal Alternative are summarized in **Table 4–8** and described below.

Table 4–8 Aesthetics and Visual Quality Impacts under the Building Removal Alternative

Viewing Point Identification [a]	*Public Sensitivity*	*Existing Visual Modification Class* [b]	*Building Removal Alternative Visual Modification Class* [b]	*Impact*
1	No Sensitivity	3	2	Beneficial
2	No Sensitivity	3	2	Beneficial
3	No Sensitivity	4	3	Beneficial

[a] See Chapter 3, Section 3.1.2, for descriptions of each of the three viewing points.

[b] See Appendix B, Section B.1.3.4, for detailed definitions of aesthetics and visual quality and a description of the methodology used to assess them.

Viewing Point 1. During the 2 years of building removal, views overlooking Area IV could be degraded. But because building removal would have the appearance of an industrial operation, there would be minimal change in visual quality from existing conditions and no change in the visual modification class.

In the long term, building removal would improve foreground views of the Simi Hills, reducing obstruction for persons traveling along the viewing point. Expanded views of the background resulting from building removal could improve a viewer's perception of existing landscape features in the foreground and background. Stabilization and revegetation of the demolition area would introduce a new surface texture and color in areas that were previously barren, which would benefit the expanded view from the viewing point. Building removal would improve the visual modification class rating of Viewing Point 1, and would cause no adverse effects on aesthetics and visual quality. **Figure 4–1** simulates views from Viewing Point 1 before and after implementing the alternative; clearly, building removal would result in a noticeable change in visual quality at the viewing point.

Figure 4–1 Viewing Point 1 Before and After Implementing the Building Removal Alternative

Viewing Point 2. During the 2 years of building removal, workers were assumed to be present at the viewing point, but not focused on visual resources while engaging in daily activities. Because building removal would have the appearance of an industrial operation, there would be minimal change in views from existing conditions and no change in visual modification class.

In the long term, building removal would improve background views of the Simi Hills and natural rock outcrops, reducing obstruction of views from the viewing point. Expanded views of the background resulting from building removal could improve a viewer's perception of existing landscape features in the foreground and background. Stabilization and revegetation of the demolition area would introduce a new surface texture and color in areas that were previously barren and would benefit the expanded view from the viewing point. Implementing the alternative would improve the visual modification class rating of the viewing point and associated areas and would cause no adverse impacts on aesthetics and visual quality. **Figure 4–2** simulates views from Viewing Point 2 before and after implementing the alternative; clearly, building removal would result in a noticeable change in visual quality at the viewing point.

Figure 4–2 Viewing Point 2 Before and After Implementing the Building Removal Alternative

Viewing Point 3. During the 2 years of building removal, workers were assumed to be present at the viewing point, but not focused on visual resources while engaging in daily activities. Because building removal would have the appearance of an industrial operation, there would be minimal change in views from existing conditions and no short-term change in visual modification class.

In the long term, building removal would improve foreground views on site at Area IV, reducing obstruction of views from the viewing point. Due to the relatively flat nature of Area IV, building removal would not greatly increase expanded views of the background; nonetheless, the absence of buildings could improve a viewer's perception of existing landscape features in the foreground and background. Stabilization and revegetation of the demolition area would introduce a new surface texture and color in areas that were previously barren and would benefit the expanded view from the viewing point. The alternative would improve the visual modification class rating of the viewing point and associated areas and would cause no adverse effects on aesthetics and visual quality. **Figure 4–3** simulates views from Viewing Point 3 before and after implementing the alternative; clearly, building removal would result in a noticeable change in visual quality at the viewing point.

Figure 4–3 Viewing Point 3 Before and After Implementing the Building Removal Alternative

4.1.3 Groundwater Remediation Alternatives

Impacts under the groundwater remediation alternatives are summarized and compared in **Table 4–9**.

Table 4–9 Land Resources Impacts under the Groundwater Remediation Alternatives

Resource	*Groundwater No Action Alternative*	*Groundwater Monitored Natural Attenuation Alternative*	*Groundwater Treatment Alternative*
Land Use	The land use designation for Area IV and the NBZ would be consistent with Ventura County requirements.	No change is expected in land use designation.	Same as the Groundwater Monitored Natural Attenuation Alternative.
Recreation	No impacts are expected on use of Sage Ranch Park or other recreation areas in the SSFL vicinity.	Minimally increased traffic to and from SSFL would not restrict access to, or reduce the quality of recreation at, Sage Ranch Park or other recreation areas in the SSFL vicinity.	Traffic would be greater than that under the Groundwater Monitored Natural Attenuation Alternative, but would not restrict access to, or reduce the quality of recreation at, Sage Ranch Park or other recreation areas in the SSFL vicinity.
Infrastructure	Electricity and water requirements would be minimal.	Electricity requirements would be minimal. A total of 5,000 gallons of water from CMWD would be used during installation of five monitoring wells, which would represent about 9×10^{-6} percent of CMWD's combined imported and local water supply.	Electricity requirements would be minimal. A total of 8,000 gallons of water from CMWD would be used to support bedrock removal, which would represent about 1×10^{-5} percent of CMWD's combined imported and local water supply.
Aesthetics and visual quality	No change from baseline conditions.	There would be visual impacts during well installation due to views of drill rigs and supporting equipment. These impacts would occur for less than 1 year. Monitoring activities would not alter Area IV aesthetics or visual quality compared to baseline conditions.	There would be visual impacts during groundwater treatment system construction and operation due to the presence of water storage tanks, treatment units and other structures, and overland piping. These impacts would occur during 6 months of treatment system installation followed by 5 years of treatment system operation. Long-term views at Area IV would be similar to baseline conditions.

CMWD = Calleguas Municipal Water District; NBZ = Northern Buffer Zone.

4.1.3.1 Groundwater No Action Alternative

Under the Groundwater No Action Alternative, groundwater monitoring would continue pursuant to the 2007 *Consent Order for Corrective Action* (2007 CO) (DTSC 2007).

Land Use

The land use designation for Area IV and the NBZ would be consistent with Ventura County requirements (see Section 4.1.1.1).

Recreation

There would be no restrictions in access to, or reductions in the quality of recreation at, Sage Ranch Park or other recreation areas in the SSFL vicinity because there would be no increase in traffic to or from SSFL due to DOE activities.

Infrastructure

Electricity requirements would be minimal. Minimal water requirements would continue to be met through use of portable facilities.

Aesthetics and Visual Quality

The visual modification classes at the evaluated viewing points would not change from the baseline conditions summarized in Table 4–4. This alternative would not cause additional long-term adverse impacts on landscape type or character, visual congruence, or coherence. There would be no additional adverse impacts on a scenic vista and no additional degradation of the existing visual character or quality of Area IV and its surroundings.

4.1.3.2 Groundwater Monitored Natural Attenuation Alternative

Land Use

Under the Groundwater Monitored Natural Attenuation Alternative, minor (less than an acre) land disturbance would occur. Groundwater monitoring would not change the land use designation.

Recreation

Well installation would require use of truck-mounted drill rigs and delivery of drilling supplies to SSFL. Assuming five wells were installed in a single year, there would be only five round trips of truck-mounted drill rigs, with approximately 15 deliveries of drilling supplies in medium-duty trucks, 5 offsite shipments of well installation water in tanker trucks, and 5 offsite shipments of well installation cuttings (nonhazardous waste) in medium-duty trucks. Traffic to and from SSFL due to well monitoring activities at Area IV would include a single annual shipment in a tanker truck of well monitoring purge water to permitted offsite wastewater treatment facilities and about 20 annual deliveries in light-duty trucks or cars of monitoring samples to offsite laboratories. Because of the minimal increase in traffic that would occur under this alternative, there would be no restrictions in access to, or reductions in the quality of recreation at, Sage Ranch Park or other recreation areas in the SSFL vicinity.

Infrastructure

This alternative would require minimal use of electricity. Installation of five wells would require a total of about 5,000 gallons of water (0.02 acre-feet) from CMWD. This water use would be enough to supply water for a four-person household in the Los Angeles area (as of 2010) for about five weeks, and would represent about 9×10^{-6} percent of CMWD's combined imported and local water supply (see Chapter 3, Section 3.1.1.2).

Aesthetics and Visual Quality

There would be visual impacts from use of drill rigs and supporting equipment to install five additional monitoring wells. These impacts would last for less than a year. Continued monitoring activities would not alter the aesthetic or visual quality at any of the three identified viewing points, compared to existing conditions. There would be no impacts on scenic vistas, resources, the visual character or quality of the site and its surroundings, or its visual modification class.

4.1.3.3 Groundwater Treatment Alternative

Land Use

Under the Groundwater Treatment Alternative, less than one acre of land would be disturbed. Land use impacts would be the same as those under the Groundwater Monitored Natural Attenuation Alternative.

Recreation

There would be 211 round trip truck shipments of waste bedrock and backfill, plus 15 deliveries of water treatment equipment in heavy-duty trucks (see Appendix H, Table H–15). Shipments or deliveries in heavy-duty trucks would be constrained in accordance with the Transportation Agreement between DOE, NASA, and Boeing (Boeing 2015a) and would likely average less than one round trip per day. In addition, over 5 years, there would be about 16 annual deliveries of groundwater treatment system supplies in light-duty trucks and 48 annual round trips of trucks (assumed to be medium-duty) transporting exchanged treatment system media. Because of the minimal (less than 1 percent) increase in average daily traffic, there would be no restrictions in access to, or reductions in the quality of recreation at, Sage Ranch Park or other recreation areas in the SSFL vicinity. See Section 4.8 for an analysis of potential transportation and traffic impacts.

Infrastructure

Impacts would be similar to those under the Groundwater Monitored Natural Attenuation Alternative. Electricity requirements would be minimal, but somewhat larger under the Groundwater Treatment Alternative because of the need to support groundwater treatment systems, and there would be a minor additional requirement for water.

The Groundwater Treatment Alternative would use water primarily for dust suppression assuming bedrock was removed at the strontium-90 source; water would be used for suppressing dust along haul roads, at the working face of the bedrock excavation, and near truck loading. The total water requirement would be about 8,000 gallons (see Appendix D), which would be enough to supply water for a four-person household in the Los Angeles Area (as of 2010) for about 2 months (see Section 4.1.1.2). This water use equates to about 0.2 acre-feet of water, which would represent about 1×10^{-5} percent of CMWD's combined imported and local water supply (see Chapter 3, Section 3.1.1.2). This projected water use would be much less on an annual and a total basis than that under the Building Removal Alternative or any of the soil remediation action alternatives (see Section 4.1.1).

Aesthetics and Visual Quality

A variety of groundwater treatment technologies could be implemented, including pump and treat, enhanced groundwater treatment, soil vapor extraction, and bedrock removal. Impacts from implementing the alternative are summarized in **Table 4–10**.

Table 4–10 Aesthetics and Visual Quality Impacts under the Groundwater Treatment Alternative

Viewing Point Identification [a]	*Public Sensitivity*	*Existing Visual Modification Class* [b]	*Groundwater Treatment Alternative Visual Modification Class* [b]	*Impact*
1	No Sensitivity	3	3	No expected adverse impacts.
2	No Sensitivity	3	3	No expected adverse impacts.
3	No Sensitivity	4	4	No expected adverse impacts.

[a] See Chapter 3, Section 3.1.2, for descriptions of each of the three viewing points.

[b] See Appendix B, Section B.1.3.4, for detailed definitions of aesthetics and visual quality and a description of the methodology used to assess them.

For all three viewing points, groundwater treatment would have an industrial appearance due to the installation of water storage tanks, treatment units and other structures, and overland piping which could degrade the views of individuals at Area IV. These impacts would last for about 6 months during treatment system installation followed by 5 years during treatment system operation. Over the long term, the appearance of the locations where groundwater treatment would occur would have the appearance of open space crossed by roads, which would change minimally from current conditions. There would be minimal change in visual quality from existing conditions, and there would be no change in visual modification class at any of the viewing points.

4.1.4 Land Resource Impacts under All Action Alternative Combinations

Land Use

No combination of action alternatives would cause a change in the land use designation; after remediation, Area IV and the NBZ would be consistent with the landowner's (Boeing's) intent to maintain its land as undeveloped open space (Boeing 2016b).

Recreation

The High Impact Combination would result in heavy-duty truck traffic over 12 years. The number of average daily heavy-duty truck round trips would range from about 8 to 48. If both groundwater remediation action alternatives were implemented, the total number of truck round trips would slightly increase, but there would be essentially no change in the average daily number of round trips (i.e., up to 48). The weekday average daily traffic on Woolsey Canyon Road would conservatively increase by 3.4 to 5.3 percent during the first 2 years, by 7.3 percent to 7.6 percent during the next 9 years, and by 5.6 percent during the final year (see Appendix H, Table H-21). There would be smaller increases in traffic on other evaluated roads. There would be no noticeable further increases in traffic if both groundwater remediation action alternatives were implemented.

The Low Impact Combination would result in heavy-duty truck traffic which would primarily occur over 4 years. The average daily truck trips during these years would range from about 8 to 47, and the weekday average daily traffic on Woolsey Canyon Road would increase by 3.5 to 7.4 percent. There would be smaller increases in traffic on other evaluated roads. Following these 4 years, there would be minor increases in average daily traffic (e.g., less than 0.1 percent on Woolsey Canyon Road), primarily associated with shipments of monitoring well purge water and environmental monitoring samples.

Under all action alternative combinations, motorists could experience or perceive delays in accessing Sage Ranch Park using Woolsey Canyon Road, which could reduce its weekday use during the years of site remediation. Increased traffic, however, would occur for about three times as many years under the High Impact Combination as those under the Low Impact Combination. Except for Woolsey Canyon Road, traffic on any evaluated road that may pass a recreation area in the SSFL vicinity can be reduced by distributing truck traffic among the four evaluated routes between SSFL and major highways. See Section 4.8 for additional information about transportation and traffic impacts.

Infrastructure

Because potable water, natural gas, sewage, and communication services to all Area IV buildings have been severed, over all combinations of action alternatives, the only utility on site that would be affected is electrical service. Electrical delivery would be eliminated to Area IV buildings but would be available for site remediation. Electricity requirements under any combination of action alternatives would be minimal.

CMWD is the expected primary source for water for site activities such as dust suppression. Over 12 years, about 41 million gallons of water would be used under the High Impact Combination. The maximum annual water use would be about 4.0 million gallons, representing about 0.007 percent of CMWD's combined imported and local water supply. If both groundwater remediation action alternatives were implemented, both the maximum annual and total water use would increase by about 5,000 gallons. Over 4 years, about 8.6 million gallons of water would be used under the Low Impact Combination. The maximum annual water use would be about 4.0 million gallons, representing about 0.007 percent of CMWD's combined imported and local water supply.

Under either combination of action alternatives, water use is an important consideration because of California's current drought conditions, California Executive Order B-29-15 requiring a statewide 25 percent reduction in potable water use (CA EO 2015), and a CMWD resolution calling for a 20 percent reduction in water use in its service area (CMWD 2014). Water use could be potentially reduced through measures such as using surfactants to assist in dust control.

Aesthetics and Visual Quality

Over all combinations of action alternatives, all DOE-owned buildings and considerable quantities of soil would be removed. Soils would be backfilled on the excavated areas and re-graded and re-contoured as necessary, and disturbed areas would be stabilized and revegetated. The impacts from implementing any combination of the action alternatives are summarized in **Table 4–11**. The change in visual modification class and expected beneficial impact at the evaluated viewing points primarily result from removal of DOE-owned buildings under the Building Removal Alternative.

Table 4–11 Impacts on Aesthetics and Visual Quality Impacts under All Action Alternative Combinations

Viewing Point Identification [a]	*Public Sensitivity*	*Existing Visual Modification Class* [b]	*Combined Action Alternative Visual Modification Class* [b]	*Impact*
1	No Sensitivity	3	2	Beneficial
2	No Sensitivity	3	2	Beneficial
3	No Sensitivity	4	3	Beneficial

[a] See Chapter 3, Section 3.1.2, for descriptions of the three viewing points.

[b] See Appendix B, Section B.1.3.4, for detailed definitions aesthetics and visual quality and a description of the methodology used to assess them.

While site remediation activities take place, onsite views at Area IV and the NBZ would be degraded. In the long term, stabilization and revegetation of affected areas would introduce a new surface texture and color in areas that were previously barren and improve onsite aesthetics and visual quality.

4.1.5 Impact Threshold Analysis

Land resource impacts were assessed by comparing the projected changes in land use, recreation, infrastructure, and aesthetic and visual quality generated from the proposed activities to baseline conditions. Impact thresholds used to evaluate impacts depend on the degree of change or impact in conjunction with the context (e.g., the comparative size of the affected area) or the assigned or relative value of the altered resource. As analyzed for land resources, an impact threshold could be crossed for recreation and water use. Under the soil remediation action alternatives and all combinations of action alternatives, increased traffic volume could discourage weekday use of Sage Ranch Park. The projected annual water use is likely to be an important consideration under the Building Removal and soil remediation action alternatives, as well as any combination of action alternatives. Annual water use is an important consideration because of California's current drought conditions and the need, as expressed by California and CMWD officials, to significantly reduce water consumption.

4.2 Geology and Soil

Geologic resources at Area IV and the NBZ include bedrock and alluvial material, as well as paleontological resources. Geologic conditions include faults, topography, unstable soils, and other features that may represent hazards. Impacts on geology were evaluated with respect to the potential loss of bedrock geologic resources (for example, minable aggregate material), the potential loss of paleontological resources, and the potential for an alternative to present a risk to workers from a seismic event. Because none of the alternatives would remove bedrock outcrops, there would be no potential for permanent loss of an aesthetic geologic feature.

The California Division of Mines and Geology has produced maps and calculations of mineral resources (aggregate) in much of Ventura County, including Area IV. There is insufficient information to enable the California Division of Mines and Geology to determine the significance of mineral lands in Area IV (CDMG 1981). Areas classified this way are not considered in the Division's calculation of mineral reserves, although these areas are considered potential alternative resources to identified reserves. Area IV and the NBZ are located in the California Division of Mines and Geology Simi Production-Consumption Region. In the Simi Production-Consumption Region, aggregate is produced from the Simi Conglomerate member of the Santa Susana Formation and Saugus-San Pedro Formation (CDMG 1981).

Soil includes loose surface materials composed of mineral particles and organic material. Soil provides numerous functions, including habitat for soil organisms (including microorganisms), substrate for plants to grow, storage and cycling of nutrients, and filtration of pollutants. The uppermost soil layers contain organic matter; seed bank; regenerative structures such as bulbs, corms, and rootcrowns; and beneficial soil organisms, including mycorrhizae. Impacts on the ability of soil to regenerate native plant species and support native biota including wildlife are addressed in Section 4.5.1.2.1.

Impacts on soil resources were evaluated with respect to the potential for soil erosion during remediation activities,[2] the quantity of backfill obtained from sources outside of SSFL, and quality. Although erosion can be minimized by use of best management practices (BMPs), the potential for soil loss from erosion is increased when slopes are increased, soil is loosened, and stabilizing root structures are removed. Soil quality refers to how well soil performs all its functions as a medium for biological activity, filtration, and supporting vegetation. Endangered plant species inhabiting Area IV and the NBZ have specific soil nutrient requirements; unless the replacement soil meets these requirements, the species may no longer exist at the site. Loss of soil quality and functional capability is a potential impact under all alternatives where existing soil is removed. The quality of soil within Area IV varies from area to area because the existing soil includes fill or soil that was disturbed during the years of facility operation. To perform all of the functions of removed soil, the uppermost layers of backfill would need to contain the mineral, organic, and biological makeup of the native soil (where it is present), as well as chemical and radioactive constituents in concentrations below the values prescribed for Area IV remediation.

[2] The evaluation of possible soil loss due to erosion in Section 4.2 is different from the evaluation of potential impacts of erosion on surface water quality in Section 4.3. Soil could be eroded during rainstorms that would be filtered using BMPs to protect surface water, but loss of soil from the eroded areas could include loss of important mineral, organic, or biologic constituents, leading to a reduction of soil quality and functional capability in the eroded area.

4.2.1 Soil Remediation Alternatives

Impacts under the soil remediation alternatives are summarized and compared in **Table 4–12**.

Table 4–12 Soil and Geology Impacts under the Soil Remediation Alternatives

Resource	*Soil No Action Alternative*	*Soil Remediation Action Alternatives*		
		Cleanup to AOC LUT Values	*Cleanup to Revised LUT Values*	*Conservation of Natural Resources*
Bedrock geologic resources	Although there would be restrictions on access to potential sources of aggregate at Area IV and the NBZ, impacts on bedrock geologic resources are minimal because the potential for minable aggregate resources is low.	No adverse impacts are expected.	Same as the Cleanup to AOC LUT Values Alternative.	Same as the Cleanup to AOC LUT Values Alternative
Paleonto-logical resources	No impacts are expected.	Potential impacts on paleontological resources (i.e., loss of fossils) would be minimal because the Santa Susana Formation containing these resources is largely located within the proposed 2010 AOC exemption areas.[a] As required, remediation within the proposed exemption areas would occur using focused removal actions that would minimize soil disturbance. Outside of the proposed exemption areas, about 1 acre of land overlying the Santa Susana Formation contains chemical and radioactive constituents exceeding AOC LUT values.	Potential impacts on paleontological resources would be minimal because the Santa Susana Formation is largely located within the proposed exemption areas, where remediation would occur using focused removal actions. Outside of the proposed exemption areas, about 0.2 acre of land overlying the Santa Susana Formation contains chemical and radioactive constituents exceeding revised LUT values.	Potential impacts on paleontological resources would be minimal because the Santa Susana Formation is largely located within the proposed exemption areas, where remediation would occur using focused removal actions. Outside of the proposed exemption areas, less than 0.1 acre of land overlying the Santa Susana Formation contains chemical (but no radioactive) constituents exceeding risk assessment-based-values.
Seismic risk to workers	No activities would take place in zones where earthquake-induced landslides could occur.	Some activities in Area IV and the NBZ could take place in zones where earthquake-induced landslides could occur, leading to worker risks that DOE would minimize as needed using the 2010 AOC (DTSC 2010a) exemption process.	Similar to the Cleanup to AOC LUT Values Alternative, but with reduced risk to workers. Although remediation would take place in zones where earthquake-induced landslides could occur, the areas of the seismic hazard zones would be about 8 acres smaller than those under the Cleanup to AOC LUT Values Alternative.	Similar to the Cleanup to AOC LUT Values Alternative, but with reduced risk to workers. Although remediation would take place in zones where earthquake-induced landslides could occur, the areas of the seismic hazard zones would be about 0.3 acres smaller than those under the Cleanup to Revised LUT Values Alternative.
Soil erosion	No impacts are expected above baseline conditions.	Erosion is possible because of disturbance of about 130 acres of land outside the proposed exemption areas, but would be minimized using BMPs as summarized in Chapter 6. In the periods before completion of stabilization activities, precipitation runoff may erode soil leading to a reduction of soil quality and functional capability within the eroded areas.	Similar to the Cleanup to AOC LUT Values Alternative except the size of the area subject to disturbance is smaller (about 40 acres outside the proposed exemption areas).	Similar to the Cleanup to Revised LUT Values Alternative except the size of the area subject to disturbance is smaller (about 32 acres outside the proposed exemption areas).

Resource	Soil No Action Alternative	Soil Remediation Action Alternatives		
		Cleanup to AOC LUT Values	Cleanup to Revised LUT Values	Conservation of Natural Resources
Soil function	No impacts are expected.	Loss of soil function is possible if the backfill is not of equal soil quality, including regenerative structures, organic carbon, seed bank, and beneficial soil organisms, as that for current soil at Area IV and the NBZ.	Similar to the Cleanup to AOC LUT Values Alternative except that the sitewide potential for loss of soil function would be smaller because of the smaller need for backfill.	Similar to the Cleanup to Revised LUT Values Alternatives except that the sitewide potential for loss of soil function would be smaller because of the smaller need for backfill.
Backfill requirement	No backfill would be required	About 700,000 cubic yards of backfill would be required with chemicals and radionuclides in concentrations meeting AOC LUT values.	About 144,000 cubic yards of backfill would be required with concentrations of chemicals meeting revised LUT values and radionuclides meeting AOC LUT values.	About 111,000 cubic yards of backfill would be required with chemicals and radionuclides in concentrations meeting risk-assessment-based values.

AOC = *Administrative Order on Consent for Remedial Action*; BMP = best management practice; LUT = Look-Up Table; NBZ = Northern Buffer Zone.

[a] Proposed exemption areas are areas that are proposed for exemption in accordance with the 2010 AOC (DTSC 2010a). DOE would not take action in the proposed exemption areas unless it is demonstrated that levels of chemical or radioactive constituents in the soil would pose a risk to human health or the environment.

4.2.1.1 Soil No Action Alternative

There would be no appreciable impacts on geology and soil under the Soil No Action Alternative. The only impact would be to bedrock geologic resources because potential mineral resources (aggregate) would be inaccessible due to the presence of soil containing chemical or radioactive constituents. But based on the geologic units present at the site, the potential for minable aggregate resources in Area IV is low, so the potential for adverse impacts is low. In addition, there would be no impacts on paleontological resources (i.e., loss of fossils) under the Soil No Action Alternative, and no activities would take place in zones where earthquake-induced landslides could occur. The minimal activities that would take place under this alternative would not increase the potential for soil erosion at Area IV and the NBZ and would have no impact on soil function.

4.2.1.2 Soil Remediation Action Alternatives

No impacts on bedrock geological resources are expected under any of the soil remediation action alternatives. Although following soil remediation potential sources of aggregate material would be accessible, minimal additions to aggregate resources in Ventura County are expected considering the geologic units present at Area IV and the NBZ.

Impacts on paleontological resources under the soil remediation action alternatives would depend on the geological formation being remediated. Potential impacts on paleontological resources are directly related to the potential for the discovery of fossils in a bedrock unit. Soil at Area IV and the NBZ is derived largely from weathering of underlying bedrock units. Many fossils survive the weathering process and remain within the soil. Additional fossil resources may be discovered during excavations of soil from weathered rock units with known records of fossil discovery.

Impacts on paleontological resources from excavations in the upper portion of the Chatsworth Formation are not considered likely under any of the soil remediation action alternatives. The upper portion of the Chatsworth Formation, which underlies most of Area IV and all of the NBZ, has a low to moderate paleontological sensitivity rating, due to the limited amount, if any, of the fossiliferous siltstone beds that are more abundant in the lower portion of the Chatsworth Formation.

There is a greater potential for impacts on paleontological resources from excavations in the Santa Susana Formation, which underlies the southern, hilly portion of Area IV. This formation has a high paleontological sensitivity rating, as these sediments are known to regionally and locally contain significant fossils. The vast majority of the Santa Susana Formation in Area IV is located within areas that are proposed for exemption (hereafter called "proposed exemption areas") in accordance with the 2010 AOC (DTSC 2010a). As discussed in Chapter 2, Section 2.3.2, DOE would refrain from soil removal actions in the proposed exemption areas unless it is demonstrated that levels of chemical or radioactive constituents in the soil pose a risk to human health or the environment. In this event, remediation would occur via focused removal actions.[3] This would greatly reduce the potential for impacts on paleontological resources. The remaining Santa Susana Formation in Area IV that is outside of the proposed exemption areas is primarily located in the very southeastern-most corner of Area IV where there is a potential to impact paleontological resources if soil derived from the Santa Susana Formation is removed. Outside of the proposed exemption areas, the potential for impacts would be greater under the Cleanup to AOC LUT Values Alternative than that under the Cleanup to Revised LUT Values Alternative, which in turn would be greater than that under the Conservation of Natural Resources Alternative. This is because about 1 acre of land overlying the Santa Susana Formation and outside the proposed exemption areas contains chemical or radioactive constituents exceeding AOC LUT values, about 0.2 acres contain chemical constituents exceeding revised LUT values or radioactive constituents exceeding AOC LUT values, and less than 0.1 acre contains chemical (but no radioactive) constituents exceeding risk-assessment-based values. No land outside the proposed exemption areas and overlying the Santa Susana Formation contains radioactive constituents exceeding risk-assessment-based values.

Under the Cleanup to AOC LUT Values Alternative, there would be increased risk to workers in some locations in Area IV and the NBZ in the unlikely event that an earthquake occurs during soil remediation. These at-risk locations are zones where earthquake-induced landslides could occur, which are shown in blue on **Figure 4–4** and are generally on steep hillsides. The susceptible areas include several locations within the NBZ where there would be less need for remediation, and thus less need for the presence of workers, than that for Area IV. Some locations on the southern edge of Area IV are also within zones where earthquake-induced landslides could occur, but are also generally within the proposed exemption areas, where remediation activities would be reduced and worker presence restricted. Hence, worker risks from an earthquake-induced landslide are considered small. Under the Cleanup to Revised LUT Values and Conservation of Natural Resources Alternatives, the potential for work within these zones is less because most soil with concentrations of constituents potentially exceeding risk-based values is found in flatter areas within Area IV. Compared to the Cleanup to AOC LUT Values Alternative, risks would be smaller under the Cleanup to Revised LUT Values Alternative because the areas of the seismic hazard zones where remediation would occur would be about 8 acres smaller. Compared to the Cleanup to Revised LUT Values Alternative, risks would be slightly smaller under the Conservation of Natural Resources Alternative because the areas of the seismic hazard zones where remediation would occur would be about 0.3 acres smaller.

[3] Focused removal actions include measures intended to minimize disturbance of vegetation and soils. In some areas this may include the limited use of earth-moving equipment and in others, the use of all-terrain vehicles with large underinflated tires and removing contaminated soil using hand tools and portable mechanized equipment to remove only as much soil as necessary.

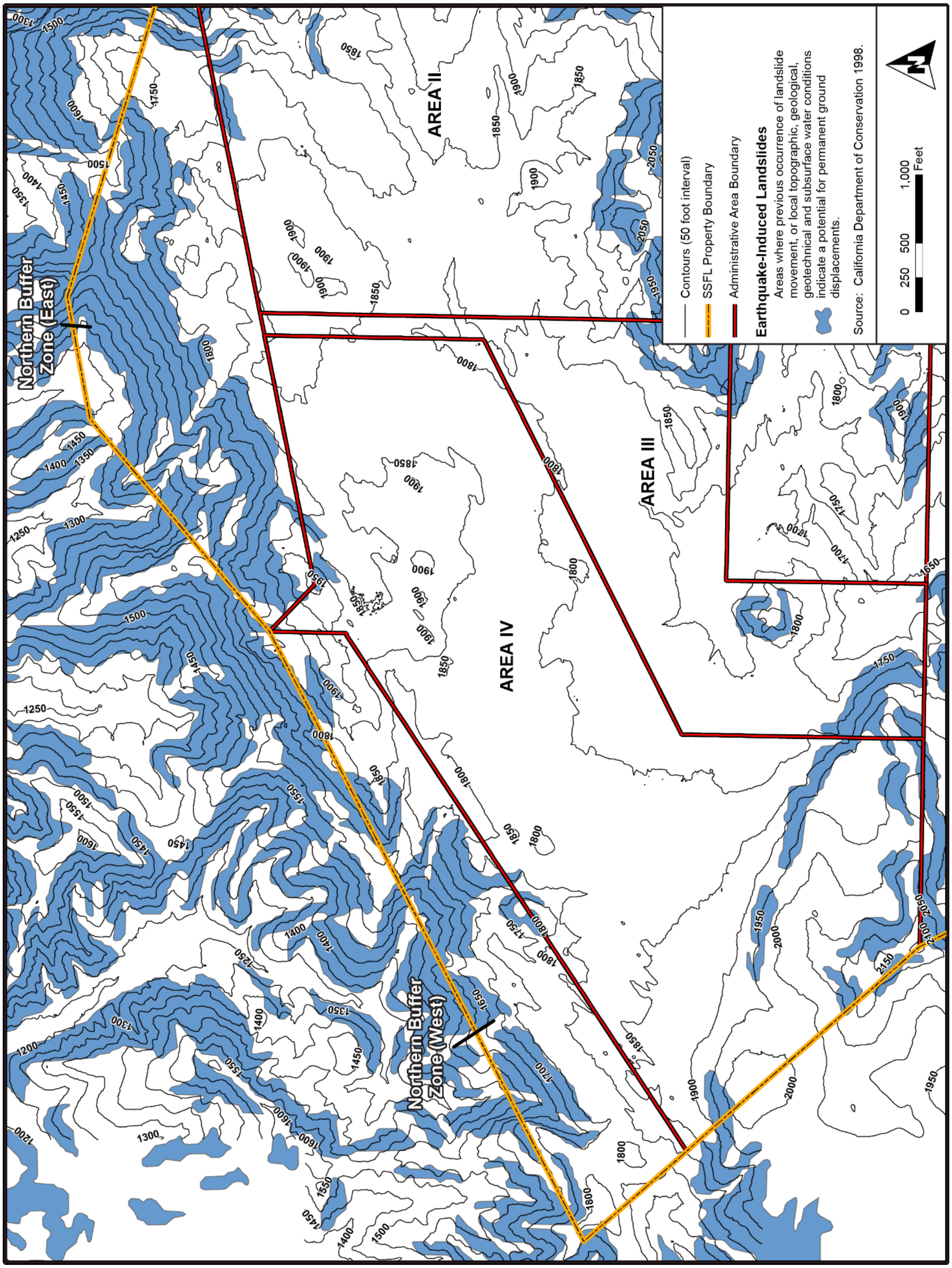

Figure 4–4 Calabasas Quadrangle Seismic Hazard Zones

Nonetheless, DOE fully considers the importance of worker health and safety during soil remediation. As addressed in Section 4.9.2.2, DOE would minimize risks to workers by proposing application of the 2010 AOC (DTSC 2010a) exemption process for certain areas if, during the planning and design of soil remediation activities, it was determined that excavating soil in these areas would present unacceptable risks to workers. Also, the measures identified in Chapter 6 include those to maintain slope stability in excavated areas during remediation activities to protect workers from the risk of localized subsidence.

All soil remediation action alternatives impact soil resources. Potential impacts from soil removal and backfilling would include loss of soil due to erosion and loss of soil function if the backfill is not compatible with the requirements of native plants within Area IV or the NBZ. See Section 4.5.1.2.1 for a discussion of the relationship of habitat to local species.

The extent of soil loss due to erosion, whether from precipitation, gravity, or wind, would depend on factors such as the slope of the land, soil composition (size and mineralogy of the soil particles), soil compaction, degree of vegetation, and moisture content. Permanent loss of soil can occur due to the scouring effects of water running across the soil. The rate of soil erosion would be accelerated in areas where soil is disturbed, both during excavation and after backfilling, because the soil structure would be loosened and the stabilizing root structures would be removed. Areas where the slope is relatively steep (greater than 10 percent) are expected to have more erosion due to gravity and runoff. However, the majority of the soil disturbance would occur in areas that are relatively flat; therefore, the amount of erosion would be approximately proportional to the area disturbed by the removal activities under each alternative (see **Table 4–13**).

Table 4–13 Volume of Soil Removed and Area of Soil Disturbed

Parameter	*Soil No Action Alternative*	*Soil Remediation Action Alternatives*		
		Cleanup to AOC LUT Values	*Cleanup to Revised LUT Values*	*Conservation of Natural Resources*
Volume of soil removed (cubic yards)[a]	NA	933,000	192,000	148,000
Area of disturbed soil (acres)[a]	NA	130	40	32

AOC = *Administrative Order on Consent for Remedial Action*; LUT = Look-Up Table; NA = not applicable.

[a] The indicated volumes and disturbed acreages are for removal activities outside of the exemption areas proposed under the 2010 AOC (DTSC 2010a).

The total acreage disturbed under each action alternative reflect areas outside the proposed exemption areas. Areas containing chemicals or radionuclides posing a risk to human health or the environment, which are assumed to constitute a small fraction of the proposed exemption areas, would be addressed via focused removal actions. Some disturbance is expected in the proposed exemption areas due to these removal actions, but this additional disturbance is yet to be determined (see Section 4.5.1.2.1).

BMPs would be implemented during soil remediation to minimize soil loss due to erosion (see Chapter 6, Table 6–1), as determined as part of a stormwater pollution prevention plan (SWPPP) to be developed for the proposed activity. These BMPs would provide stabilization or slow the flow of surface runoff, thereby reducing the scouring effect, and could include placement of nonwoven fiber mats on slopes, wattles, hydraulically applied products (particularly on steep slopes), and revegetation. Loss of soil during rainstorms would be controlled with silt fencing and wattles placed at the base of slopes and along runoff pathways and drainage ditches. However, in the periods before completion of stabilization activities, precipitation runoff could cause loss of soil and reduction of soil quality and functional capability within the eroded areas. The longer that excavations and backfilling operations are active and soil remains unstabilized by vegetation, the greater the potential for erosion during rainstorms.

All of the soil remediation action alternatives would include placement of backfill in excavated areas. The biological activity, filtration, and vegetation support quality of backfill received from offsite sources may be less than that of current soil at Area IV and the NBZ.[4] The sitewide potential for loss of soil function would be largest under the Cleanup to AOC LUT Values Alternative but smaller under the Cleanup to Revised LUT Values Alternative, because of the smaller need for backfill, and still smaller under the Conservation of Natural Resources Alternative. In addition, although sources of soil for construction or other industrial applications are readily available regionally, backfill to be used under the Cleanup to AOC LUT Values Alternative would need to contain concentrations of chemicals and radionuclides meeting AOC LUT values. If used at Area IV and the NBZ, backfill with these characteristics would represent a resource that would be less available to other users in Ventura or other counties.

A source of 700,000 cubic yards of backfill meeting AOC LUT values under the Cleanup to AOC LUT Values Alternative has not been identified, and it appears unlikely that backfill meeting these values can be found. As noted in Chapter 2, Section 2.3.3.1, DOE conducted initial evaluations of 3 potential borrow sites for backfill and soil from all 3 evaluated sites exceeded AOC LUT values for multiple chemicals of concern. Tested packages of soil products sold by home improvement stores also exceeded AOC LUT values for multiple chemicals of concern. As noted in Chapter 2, Section 2.3.2, if a source of backfill that meets all of the AOC LUT values cannot be reasonably found, then DTSC, DOE, and EPA would enter into a consultation process, and DTSC would determine the best available source of backfill (DTSC 2010a).

Under the Cleanup to Revised LUT Values Alternative, 144,000 cubic yards of backfill would be required that meets revised LUT values for chemicals and AOC LUT values for radionuclides. Under the Conservation of Natural Resources Alternative, 111,000 cubic yards of backfill would be required that contains concentrations of chemicals and radionuclides meeting risk-assessment-based values. DOE has not identified and evaluated potential sources of backfill to determine if the backfill would meet constituent concentration values consistent with these two alternatives. Because the allowable concentrations of chemical constituents in backfill under these two alternatives would generally be higher than AOC LUT values, DOE expects that finding acceptable sources of backfill would be more likely.

4.2.2 Building Demolition Alternatives

Impacts under the building demolition alternatives are summarized and compared in **Table 4–14**.

4.2.2.1 Building No Action Alternative

No activities would take place that would result in additional impacts on geology and soil within Area IV and the NBZ. Similar to the Soil No Action Alternative (Section 4.2.1.1), the only impacts would be to bedrock geologic resources because potential mineral resources (aggregate) would be inaccessible due to the presence of buildings containing chemical or radioactive constituents. But based on the geologic units present at the site, the potential for minable aggregate resources in Area IV is low, so the potential for adverse impacts is low. No impacts on paleontological resources are expected. No impacts due to soil erosion are expected and no backfill would be required. No activities would take place in zones where earthquake-induced landslides could occur.

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[4] For this EIS it is assumed that the areas disturbed by remediation would be restored to native plant communities including chaparral, oak woodland, and Venturan coastal scrub. For this reason, the backfill should have similar texture, pH, and nutrient status compared to native soils on site. Agricultural soil would not be preferred due to the propensity of such soil to support invasive weeds. Also see Section 4.5.1.

Table 4–14 Soil and Geology Impacts under the Building Demolition Alternatives

Resource	Building No Action Alternative	Building Removal Alternative
Bedrock geologic resources	Although there would be restrictions on access to potential sources of aggregate at Area IV, impacts on bedrock geologic resources are minimal because the potential for minable aggregate resources is low.	No adverse impacts are expected on bedrock geologic resources.
Paleontological resources	No impacts are expected.	Minimal impacts are expected during building removal.
Seismic risk to workers	No impacts are expected.	No risks to workers are expected from working in zones where earthquake-induced landslides could occur, because building removal would occur outside of these seismic hazard zones; however, in the event of an earthquake, there could be a risk to demolition workers resulting from building collapse.
Soil erosion	No impacts are expected.	Soil erosion would be minimized using BMPs as described in Chapter 6. However, in the period between building removal and completion of remediation activities, runoff from disturbed areas could cause a loss of soil and a reduction of soil quality and functional capability within the disturbed areas. Because most of the area to be disturbed is currently occupied by buildings or asphalt, soil quality and functional capability would likely be already reduced compared to that before development of Area IV.
Soil function	No impacts are expected.	Loss of soil function is possible if the backfill is not of equal soil quality, including the presence of regenerative structures, organic carbon, seed bank, and beneficial soil organisms, as that for current soil at Area IV. Because most of the area to be disturbed is currently occupied by buildings or asphalt, soil quality and functional capability would likely be already reduced compared to that before development of Area IV.
Backfill requirement	No backfill would be required.	Up to 13,500 cubic yards of backfill containing chemicals and radionuclides in low concentrations would be required.[a]

BMP = best management practice.

[a] It was assumed all backfill would be delivered to Area IV from offsite sources. Two estimates have been made of the required backfill volume for building removal: one of 8,140 cubic yards and one of 13,500 cubic yards (see Appendix D). The larger estimate (13,500 cubic yards) was assumed for purposes of analysis in this EIS.

4.2.2.2 Building Removal Alternative

Under the Building Removal Alternative, demolition of 18 DOE-owned buildings (7 metal sheds and 11 buildings) would include removal of slabs and sub-grade structures and backfilling holes left after removal of sub-grade structures. No adverse impacts are expected on bedrock geologic resources. Although following soil remediation potential sources of aggregate material would be accessible, minimal additions to aggregate resources in Ventura County are expected considering the geologic units present at Area IV. Minimal impacts are expected on paleontological resources during building removal because the buildings are located in the Upper Chatsworth Formation, which has a low potential for paleontological resources (see Section 4.2.1).

The equipment for building demolition would be staged wherever possible on existing concrete or asphalt areas or on previously disturbed soil. The total area of soil disturbed during demolition is expected to be about 8.4 acres (see Section 4.3.2.2). Nearly all of the 11 buildings other than sheds are adjacent to soil that could be removed under one or more of the soil remediation action alternatives (Section 4.2.1.2); therefore, the soil disturbed during building demolition is soil that could be disturbed even without building demolition. Building demolition would be conducted in a manner that would minimize soil loss from erosion, using BMPs as discussed in Sections 4.2.1.2 and Chapter 6 to slow the flow of surface runoff, thereby reducing the resulting scouring and permanent removal of soil from runoff pathways. (The design parameters of the BMPs will be determined as part of a SWPPP developed for the building removal project.) Nonetheless, in the periods before completion of stabilization activities, precipitation runoff could cause loss of soil and reduction of soil quality and functional capability within the eroded areas. It is recognized, however, that because most of the area disturbed under this alternative is overlain by concrete or asphalt or is otherwise changed from the state that existed before development of Area IV, some degradation of soil quality and functional capability within the area to be disturbed has probably already occurred. In any event, the longer that excavations and backfilling operations are active and soil remains unstabilized by vegetation, the greater the potential for erosion during rainstorms.

No risks to workers are expected from potential earthquake-induced landslides, because building removal would occur outside of zones where landslides could occur; however, in the event of an earthquake, there could be a risk to workers due to building collapse.

Building 4022 (Radioactive Materials Handling Facility [RMHF]), Building 4019 (Systems for Nuclear Auxiliary Power [SNAP] II), and Building 4024 (SNAP Environmental Test Facility) have extensive below-grade construction. Demolition of these three buildings would result in excavations that would be filled with backfill delivered from offsite sources. Up to about 13,500 cubic yards of backfill from offsite sources would be needed to fill these building excavations (see Appendix D). The biological activity, filtration, and vegetation support quality of the backfill received from offsite sources may be less than that of current soil at Area IV. As noted above, some degradation of soil quality and functional capability within the area to be disturbed has probably already occurred. In addition, although sources of soil for construction or other industrial applications are readily available regionally, backfill to be used at Area IV would need to contain very low concentrations of chemicals and radionuclides (e.g., meet AOC LUT, revised LUT, or risk-assessment-based values). As discussed in Section 4.2.1.2, a source of backfill with these characteristics has not been identified and it appears unlikely that a source of backfill meeting chemical AOC LUT values can be found.

4.2.3 Groundwater Remediation Alternatives

Impacts under the groundwater remediation alternatives are summarized and compared in **Table 4–15**.

Table 4–15 Soil and Geology Impacts under the Groundwater Remediation Alternatives

Resource	*Groundwater No Action Alternative*	*Groundwater Monitored Natural Attenuation Alternative*	*Groundwater Treatment Alternative*
Bedrock geologic resources	No impacts are expected.	Same as the Groundwater No Action Alternative.	Loss of 1,050 cubic yards of subsurface bedrock.
Paleontological resources	No impacts are expected.	Same as the Groundwater No Action Alternative.	Same as the Groundwater No Action Alternative.
Seismic risk to workers	No activities would take place in zones where earthquake-induced landslides could occur.	Same as the Groundwater No Action Alternative.	Same as the Groundwater No Action Alternative.
Soil erosion	No impacts are expected.	Minimal potential for loss of soil due to erosion.	Minimal potential for loss of soil due to erosion.
Soil function	No impacts are expected.	Minimal potential for loss of soil function due to erosion.	Loss of soil function may occur at some treatment system locations during the 6 months of treatment system installation followed by 5 years of treatment system operation.
Backfill requirement	No backfill would be required.	Same as the Groundwater No Action Alternative.	About 1,280 cubic yards of backfill would be required with chemicals and radionuclides in concentrations meeting prescribed values (e.g., AOC LUT, revised LUT, or risk-assessment-based values).

AOC = *Administrative Order on Consent for Remedial Action*; LUT = Look-Up Table.

4.2.3.1 Groundwater No Action Alternative

There would be no impacts on soil or geology, including bedrock geology, under the Groundwater No Action Alternative. There would be no impacts on paleontological resources, and no need for workers to be present in zones where earthquake-induced landslides could occur. There would be no additional soil disturbance and no additional soil erosion or loss of soil function. No backfill would be required.

4.2.3.2 Groundwater Monitored Natural Attenuation Alternative

There would be no appreciable impacts on soil or geology. Installation and sampling of five additional monitoring wells is not expected to impact paleontological resources because the Upper Chatsworth Formation, where wells likely would be sited, has a low potential for paleontological resources. Well installation is not expected to occur in zones where earthquake-induced landslides could occur. A total of about 10 cubic yards of soil and rock would be removed during installation of five wells (see Appendix D); however, because well installation would be a short-term activity that would be largely conducted from existing roads and solid waste and well installation water would be collected for offsite management, there would be minimal potential for soil erosion and loss of soil function.

4.2.3.3 Groundwater Treatment Alternative

Under the Groundwater Treatment Alternative, minor impacts on bedrock geology could occur from removal of 1,050 cubic yards of bedrock near the RMHF that is a source of strontium-90 contamination in groundwater. Because only a small volume of material would be removed under the Groundwater Treatment Alternative, the impact on availability of aggregate materials in Ventura County would be very small.[5]

The bedrock to be removed is beneath a cover of alluvial material, and after removal of the bedrock, the hole would be backfilled to the current grade. As addressed in Section 4.2.1.2, sources of soil for construction or other industrial applications are readily available regionally, although backfill to be used at Area IV would need to contain very low concentrations of chemicals and radionuclides (e.g., meeting AOC LUT values, revised LUT values, or risk-assessment-based values). If used at Area IV, backfill with these characteristics would represent a resource that would not be available to other users in Ventura or other counties. As discussed in Section 4.2.1.2, a source for 1,280 cubic yards of backfill with these characteristics has not been identified and it appears unlikely that a source of backfill meeting chemical AOC LUT values can be found.

The Upper Chatsworth Formation, where groundwater remediation would occur, has a low potential for paleontological resources; therefore, there would be no impacts on these resources under the Groundwater Treatment Alternative.

No risks to workers are expected from potential earthquake-induced landslides because no groundwater treatment activities would be performed in zones where earthquake-induced landslides could occur. Some potential groundwater treatment technologies, however, could require use of groundwater storage tanks delivered to the site. If used, the groundwater storage tanks would include secondary containment systems (e.g., berms) to prevent dispersion of the tank contents if they are damaged during seismic shaking.

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[5] As discussed in the opening paragraphs of this section, there is insufficient information to enable the California Division of Mines and Geology to determine the significance of mineral lands in Area IV (CDMG 1981). Areas classified this way are not considered in the Division's calculation of mineral reserves, although these areas are considered potential alternative resources to identified reserves.

Impacts on soil from implementing various potential groundwater treatment technologies would entail loss of soil function (for example, precipitation infiltration and supporting vegetation) in areas where groundwater treatment infrastructure is placed on soil or an infiltration system is installed. For example, pump and treat systems installed at the Former Sodium Disposal Facility (FSDF) or other plume locations would include overland piping and treatment units in the areas shown in Chapter 2, Figure 2–8. Although efforts would be made to install portions of the treatment systems on ground that had already been disturbed, the treatment systems could impact soil function in these areas for the 6 months that the systems would be installed followed by the 5 years that the systems are projected to operate. Similarly, there would be over-ground piping and a temporary treatment unit at the Hazardous Materials Storage Area (HMSA) or other plume locations (at the areas shown in Chapter 2, Figure 2–8) if soil vapor extraction or related systems were installed and operated for a period of approximately 5 years. If dewatering were performed at any plume location, there would be similar over-ground piping and a temporary treatment unit installed and operated during the time that dewatering would take place.

Source removal and installation and operation of groundwater treatment systems would be performed in a manner intended to control and minimize the potential for soil erosion using BMPs, including those discussed in Sections 4.2.1.2 and Chapter 6.

4.2.4 Geology and Soil Impacts under All Action Alternative Combinations

Excavation of 1,050 cubic yards of subsurface bedrock is assumed under action alternative combinations that include the Groundwater Treatment Alternative (such as the High Impact Combination). Excavation of this bedrock would have minimal potential adverse impacts on bedrock geologic resources.

There could be impacts on paleontological resources (i.e., loss of fossils) under soil removed from the Santa Susana Formation, but these impacts would be minimal because the formation is mostly located within the proposed exemption areas. Because building removal, installation of additional monitoring wells, and groundwater treatment would not be expected to occur within the Santa Susana Formation, impacts on paleontological resources would be similar under any combination of action alternatives. Nonetheless, potential impacts on paleontological resources would likely be largest under action alternative combinations that include the Cleanup to AOC LUT Values Alternative and smallest for action alternative combinations that include the Conservation of Natural Resources Alternative. Outside of the proposed exemption areas, about 1 acre of land containing chemical or radioactive constituents exceeding AOC LUT values overlies the Santa Susana Formation, but less than 0.1 acre of land containing chemical (but no radioactive) constituents exceeding risk-assessment-based values overlies the Santa Susana Formation.

There could be risks to workers remediating soil in some locations at Area IV and the NBZ that are within zones where earthquake-induced landslide zones could occur (see Figure 4–4). None of the buildings to be removed is in a landslide risk area, but the bedrock removed under the Groundwater Treatment Alternative is on the edge of a geologic hazard zone. Risks from landslides would be largest under the High Impact Combination and smallest under the Low Impact Combination (because of the lesser extent of soil remediation and no bedrock removal). DOE would minimize risk to workers by implementing the 2010 AOC (DTSC 2010a) exemption process for certain areas if, during the planning and design of soil remediation activities, it was determined that excavating soil in these areas would present unacceptable risks. Seismic shaking can also pose a risk to workers removing buildings. Risks to workers due to proximity to structures that could collapse due to seismic shaking would be the same under all action alternative combinations. These risks would not increase if DOE implemented both groundwater remediation action alternatives.

About 138 acres of land outside the proposed exemption areas could be disturbed under the High Impact Combination, while about 40 acres outside the proposed exemption areas could be disturbed under the Low Impact Combination. Disturbed land would primarily include areas where buildings and pavement are removed and soil is remediated. No appreciable potential for soil erosion is expected from installation of additional monitoring wells under the Groundwater Monitored Natural Attenuation Alternative, because of the minimal soil disturbance under this alternative, or from removal of bedrock under the Groundwater Treatment Alternative. Although impacts from soil erosion would be minimized using BMPs, rainstorms could result in soil loss due to erosion, leading to a reduction of soil quality and functional capability within the eroded areas.

About 715,000 cubic yards of backfill from offsite sources may be required under the High Impact Combination. The total quantity of backfill would not increase under this action alternative combination if DOE implemented both the Groundwater Monitored Natural Attenuation and Groundwater Treatment Alternatives. The quality of this backfill for biological activity, filtration, and vegetation support may be less than that of current soil at Area IV and the NBZ, in which case the backfill would be less able to support the growth of vegetation similar to that present before development of Area IV. Sources for this large quantity of backfill, containing chemical and radioactive constituents in concentrations meeting AOC LUT values, and of comparable quality, have not been located and it appears unlikely that a source of backfill meeting chemical AOC LUT values can be found. As noted in Chapter 2, Section 2.3.2, if a source of backfill that meets all of the AOC LUT values cannot be reasonably found, then DTSC, DOE, and EPA would enter into a consultation process, and DTSC would determine the best available source of backfill (DTSC 2010a).

About 125,000 cubic yards of backfill from offsite sources may be required under the Low Impact Combination. This backfill would need to be of comparable quality to that of current soil at Area IV and the NBZ and contain chemical and radioactive constituents in concentrations meeting prescribed risk-assessment-based values. DOE has not identified and evaluated potential sources of backfill to determine if the backfill would meet constituent concentration values consistent with this combination of action alternatives. But because the allowable concentrations of chemical constituents in backfill under this combination of action alternatives would generally be higher than AOC LUT values, DOE expects that finding acceptable sources of backfill would be more likely.

4.2.5 Impact Threshold Analysis

Impact thresholds for soil loss, as summarized in Table 4–2, could be exceeded. Implementation of any of the soil remediation action alternatives would require removal of soil from previously undisturbed areas representing a unique mineralogical and biological environment that is suitable for plant species currently found in Area IV. Therefore, implementing any of these action alternatives would have adverse and long-term impacts on this unique resource that could not be avoided unless a source of backfill is identified and used that meets prescribed values and has comparable mineralogical and biological characteristics to the soil at Area IV and the NBZ.

Particularly under the soil remediation action alternatives and the Building Removal Alternative, there is a potential for accelerated erosion that could not be completely eliminated by application of BMPs such as silt fencing, wattles, or revegetation. These BMPs will be designed as part of development of SWPPPs for the proposed actions. Soil erosion would be exacerbated if rainstorms overwhelm the implemented BMPs, leading to a reduction of soil quality and functional capability within the eroded areas. The likelihood of such events would be increased if there is a long time between soil disturbance and soil stabilization. The length of time between soil disturbance and stabilization is dependent on confirmation of successful completion of soil chemical remediation by

DTSC and confirmation of successful radiological remediation by the U.S. Environmental Protection Agency (EPA).

Although activities under some alternatives could require workers to spend time in zones where earthquake-induced landslides could occur, the risks of worker injury may be minimized by implementing the 2010 AOC (DTSC 2010a) exemption process, as discussed in Section 4.9.2.2.

4.3 Surface Water

This section analyzes impacts on surface water within and adjacent to Area IV. The analysis uses a methodology summarized in Appendix B, Section B.3. Chapter 3, Section 3.3, provides an overview of the affected environment, regulatory setting, and existing conditions for surface water resources in the ROI that includes Area IV, the larger SSFL site, and offsite drainages that connect with the Arroyo Simi/Calleguas Creek and Bell Creek/Los Angeles River waterways.

4.3.1 Soil Remediation Alternatives

Impacts under the soil remediation alternatives are summarized and compared in **Table 4–16**.

Table 4–16 Surface Water Impacts under the Soil Remediation Alternatives

Resource	*Soil No Action Alternative*	*Soil Remediation Action Alternatives*		
		Cleanup to AOC LUT Values	*Cleanup to Revised LUT Values*	*Conservation of Natural Resources*
Surface water quality	No changes would occur to the onsite NPDES stormwater control and outfall monitoring system. Chemical and radioactive constituents would remain in soil, representing a source of potential surface water contamination if an unusually large rainstorm occurs that exceeds the design of the NPDES system.	No adverse short-term impacts are normally expected during disturbance of 130 acres of land. However, if an unusually large rainstorm occurs, the design capacity of the existing onsite NPDES stormwater control and outfall monitoring system could be exceeded, resulting in offsite transport of soil. Mitigation measures would likely forestall this risk. There would be a long-term reduction of potential sources of surface water contamination.	Potential short-term impacts would be less than those for the Cleanup to AOC LUT Values Alternative because less acreage (40 acres) would be disturbed.	Same as the Cleanup to Revised LUT Values Alternative, except the potential for impacts would be less because less acreage (32 acres) would be disturbed.
Stormwater runoff quantity and velocity	No change in the existing NPDES stormwater control and monitoring system.	The design capacity of the existing NPDES stormwater control and monitoring system could be exceeded over the short term, with the possible overwhelming of regional stormwater control capacity. As needed, mitigation measures would be implemented to forestall this risk.	Same as the Cleanup to AOC LUT Values Alternative, except the potential for impacts would be less because less acreage would be disturbed.	Same as the Cleanup to Revised LUT Values Alternative, except the potential for impacts would be less because less acreage would be disturbed.

AOC = *Administrative Order on Consent for Remedial Action*; LUT = Look-Up Table; NPDES = National Pollutant Discharge Elimination System.

4.3.1.1 Soil No Action Alternative

Under the Soil No Action Alternative, DOE would leave in place the seven existing National Pollutant Discharge Elimination System (NPDES) stormwater control and outfall monitoring systems that intercept runoff from Area IV. Operation of existing multimedia filtration systems for treating this surface water runoff would continue in accordance with NPDES permit requirements. Nonetheless, DOE would perform no additional soil remediation or other actions that could change surface water runoff volumes or velocities over baseline conditions. The alternative would leave chemical and radioactive constituents in soil that would potentially impact the underlying groundwater over the long term. In addition, the alternative would leave the potential for runoff of these contaminants from the site into neighboring surface water drainages during large rainstorms that exceed the NPDES stormwater control and outfall monitoring systems 1-year return interval storm capacity. The 1-year return interval storm design for SSFL includes a storm with 2.5 inches of rain over 24 hours and a storm with 0.6 inches of rain over 1 hour, as measured at the Area IV rain gauge. The 1-year return interval storm design provides capture protection for full treatment of 95 percent of the storms that could occur on site and partial treatment for the remaining 5 percent (Boeing 2008b). If such a large rainfall event occurs, these contaminants could be discharged untreated into downstream drainages, resulting in water quality impacts.

4.3.1.2 Cleanup to AOC LUT Values Alternative

The Cleanup to AOC LUT Values Alternative would remove about 933,000 cubic yards of soil and disturb about 130 acres of land outside the proposed exemption areas. Soil would be excavated using typical construction equipment and hauled off site.

During and immediately following soil removal and remediation activities, soil disturbance and vegetation removal would create an increased opportunity during rainstorms for soil erosion and sediment loading in runoff. For purpose of analysis, an increase in sediment loads resulting from soil disturbance during and following soil removal and remediation activities was considered an exceedance of the water quality thresholds established in the *State General Permit for Storm Water Discharges Associated with Construction Activities* (SWRCB 2009). The SWPPP included with the Construction General Permit to be prepared for the overall project will include dust and runoff BMPs as described in Chapter 6. These BMPs include the use of straw bales and wattles around work sites and at regular intervals along disturbed slopes to intercept runoff and filter for sediment and other contaminants and prevent increases in runoff velocity and volume. After soil removal and remediation activities are complete and any remaining soil is characterized to determine whether it meets AOC LUT values for both chemicals and radionuclides, DTSC and EPA would determine whether additional soil excavation is needed. Once these areas have been shown to meet AOC LUT values, the remaining soil would be stabilized and revegetated.

In addition to BMPs and the stabilization and reseeding process, the SSFL stormwater control and NPDES monitoring system would remain in place during and following soil removal. As discussed in Section 4.3.1.1, this stormwater control and monitoring system is designed to provide for the full treatment of runoff from 95 percent of the storms that could occur on site and partial treatment for the remaining 5 percent of the storms (Boeing 2008b).

In some areas, soil would be excavated to the underlying bedrock to ensure removal of all contaminated soils. In these areas, the excavated soil would be replaced as soon as practical to support restoration of disturbed areas. In the event of a large rainstorm during excavation and restoration of disturbed areas, rainwater could runoff into neighboring drainages instead of being intercepted and percolating into the ground. Without sufficient BMPs, any soil left from excavation activities could be mobilized and transported off site in stormwater runoff. As noted above, the BMPs described in Chapter 6 would be implemented to filter sediments and other contaminants from surface water runoff from areas of exposed bedrock. Yet in the event of a large rainstorm, the increased runoff volume and velocity in exposed bedrock areas could potentially overwhelm the installed BMPs and existing NPDES control and monitoring system. To forestall this risk, Mitigation Measure SW-1 would be implemented in areas excavated to bedrock; this mitigation measure requires excavation and backfill activities to be completed prior to or following the typical rainfall season of December through May.

To ensure the performance of the BMPs and stormwater controls during soil remediation and removal, and during the restoration of impacted areas, DOE would conduct water quality and runoff velocity monitoring prior to commencement of activities to establish baseline sediment levels and runoff rates in stormwater runoff. Then, following rainstorms during soil remediation and removal, and during site restoration operations, surface water quality and runoff volumes and velocity would be monitored to identify increases in sediment levels or runoff rates. In the event of increased sediment levels in stream flow or increased runoff rates that exceed the design capacity of the NPDES monitoring locations, additional BMPs (e.g. increased numbers of straw bales and wattles to limit erosion) would be implemented as necessary to control sediment runoff and reduce runoff rates. Mitigation measures (e.g., Mitigation Measure SW-2) would be required if it is determined that, as a result of vegetation removal and soil disturbance, the additional runoff would likely exceed the design capacity of the existing NPDES stormwater control system during large rainstorms. Mitigation Measure SW-2 would include the addition of stormwater retention structures (such as catch basins or retention basins) and additional erosion control measures if the runoff studies indicate the NPDES stormwater control system design capacity would be exceeded. With use of BMPs, continued operation of the NPDES stormwater control and monitoring system, and implementing Mitigation Measures SW-1 and SW-2, this alternative is unlikely to impact surface water quality onsite and in regional waterways or overwhelm SSFL and regional stormwater control capacity. In the long term, this alternative would remove a potential source of surface water contamination and eventually reduce the necessity for monitoring surface water runoff from the site, a beneficial effect.

4.3.1.3 Cleanup to Revised LUT Values Alternative

Under the Cleanup to Revised LUT Values Alternative, although soil remediation and removal activities would be similar, the total disturbed area and removed soil volume would be much smaller than those under the Cleanup to AOC LUT Values Alternative (Section 4.3.1.2). Hence, a smaller area of land currently shielded from erosion by vegetation would be exposed to erosion through excavation and earth moving actions. As a result, the potential for impacts on surface water would be less under than this alternative than that under the Cleanup to AOC LUT Values Alternative.

4.3.1.4 Conservation of Natural Resources Alternative

Under the Conservation of Natural Resources Alternative, DOE would remediate soil with chemical and radioactive constituents until the constituent concentrations in remaining soil are less than risk-assessment-based values. Compared to the Cleanup to Revised LUT Values Alternative, a smaller area of land currently shielded from erosion by vegetation would be exposed to erosion through excavation and earth moving actions. Therefore, the potential for impacts on surface water would be less under this alternative than those under the Cleanup to Revised LUT Values Alternative.

4.3.2 Building Demolition Alternatives

Impacts under the building demolition alternatives are summarized and compared in **Table 4–17**.

Table 4–17 Surface Water Impacts under the Building Demolition Alternatives

Resource	*Building No Action Alternative*	*Building Removal Alternative*
Surface water quality	No change from baseline conditions; sources of potential surface water contamination would remain.	During building demolition, no adverse impacts on surface water quality are expected from stormwater runoff; sources of potential surface water contamination would be removed.
Stormwater runoff quantity and velocity	No change from baseline conditions.	No increases in runoff quantity and velocity are expected that could overwhelm SSFL or regional stormwater control capacities.

4.3.2.1 Building No Action Alternative

Under the Building No Action Alternative, remaining DOE buildings would be left in place. As with the Soil No Action Alternative (Section 4.3.1.1), the Building No Action Alternative would leave in place the seven existing NPDES stormwater control and outfall monitoring systems that intercept runoff from Area IV, and continue to operate the existing multimedia filtration systems for treating surface water runoff in accordance with NPDES permit requirements. There would be no new surface water quality impacts. Because the areas where the Area IV buildings are located are mostly covered with impermeable surfaces and runoff is controlled via existing drainage systems, no changes are expected in surface water volume and velocity that could impact stormwater control capacity on site or in the SSFL ROI. The Building No Action Alternative would, however, leave sources of potential surface water contamination in some of the remaining buildings.

4.3.2.2 Building Removal Alternative

Under the Building Removal Alternative, DOE would remove 18 DOE buildings at the locations in Area IV shown in **Figure 4–5**, including removal of at-grade concrete slabs and sub-grade vaults at Buildings 4022, 4019, and 4024. The excavated vaults would be backfilled. The area of disturbance from removal of DOE structures in Area IV is presented in **Table 4–18**. The structures owned by Boeing would be removed under a separate action as addressed in Chapter 5.

During and immediately following building removal, there would be increased opportunities for soil erosion and sediment loading in runoff during rainstorms. For purposes of analysis, an increase in sediment loads in runoff from Area IV during and following building removal was considered an exceedance of the water quality thresholds established in the *State General Permit for Storm Water Discharges Associated with Construction Activities* (SWRCB 2009). The Building Removal Alternative is not, however, expected to increase total stormwater runoff volumes because most of the disturbed area indicated in Table 4–18 is covered with impervious surfaces. Removal of these surfaces could reduce total runoff volumes because precipitation could increasingly saturate the disturbed area and potentially percolate to the underlying aquifer. Removal of these structures could, however, change existing flow directions and velocities as drainage controls and grades are altered. In addition, the removal and staging of demolition materials from these structures prior to transport off site could expose materials with chemical or radiological contamination to precipitation.

The SWPPP for the overall project described for the Cleanup to AOC LUT Values Alternative (Section 4.3.1.2) would be implemented. During demolition of structures with chemical or radiological contamination, demolition materials would be staged at locations where BMPs (as identified in the SWPPP) would be implemented to prevent contaminated runoff prior to offsite transport. After building foundations are removed and the soil beneath the foundations is characterized to determine whether it meets prescribed values for chemicals and radionuclides, DTSC and EPA would determine whether additional soil excavation was needed. Once these areas have been shown to meet the prescribed values, the remaining soil would be stabilized and revegetated. Following removal of subgrade vaults at Buildings 4019, 4022, and 4024, excavated soil would be replaced as soon as practical to support restoration of disturbed areas, but depending on the timing of demolition activities the excavated pits could remain empty until remediation had been confirmed by EPA and DTSC; the pits would be then backfilled and stabilized. The disturbed area immediately surrounding these pits would itself be surrounded by the erosion and runoff control measures described above and would be sloped toward the pits to prevent runoff from the disturbed area.

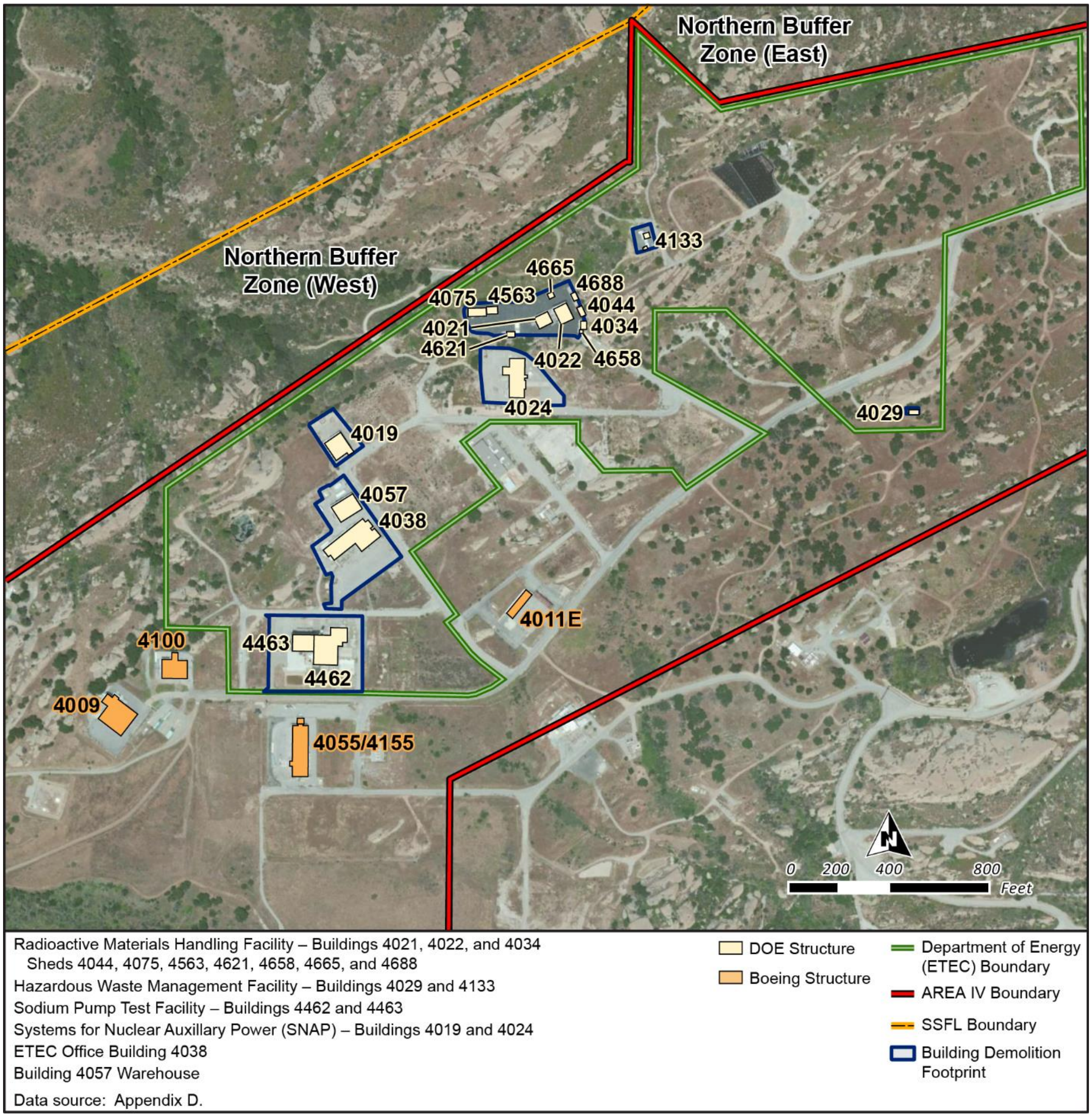

Figure 4–5 Locations of DOE Buildings in Area IV

Table 4–18 Building Removal Alternative Total Disturbed Area

Building	*Acres*
SNAP (Buildings 4019 and 4024)	1.9
HWMF (Buildings 4029 and 4133)	0.2
ETEC Office Building (Building 4038) and Building 4057 Warehouse	2.2
SPTF (Buildings 4462 and 4463)	2.6
RMHF (Buildings 4021, 4022, and 4034 and Sheds 4044, 4075, 4563, 4621, 4658, 4665, and 4688)	1.6
Total	**8.4**

ETEC = Energy Technology and Engineering Center; HWMF = Hazardous Waste Management Facility; RMHF = Radioactive Materials Handling Facility; SNAP = Systems for Nuclear Auxiliary Power; SPTF = Sodium Pump Test Facility.
Note: The estimated acreages have been rounded.

In addition to these BMPs and the stabilization and reseeding process, the SSFL stormwater control and NPDES monitoring system described in Sections 4.3.1.1 and 4.3.2.1 would remain in place during and following building removal. In addition to filtering sediments and other contaminants from surface water runoff, BMPs would be designed to limit increases in runoff velocity and, consequently, increase percolation of precipitation into the ground, reducing the potential for increases in runoff volume.

As described in Section 4.3.1.2, DOE would conduct water quality and runoff volume and velocity monitoring prior to commencement of building removal operations and then again, after building removal and site restoration, to identify increases in sediment levels or runoff rates. Considering the likely availability of impromptu catch basins created by building vault removal, the adaptive implementation of BMPs, and the continued operation of the NPDES stormwater control and monitoring system, this alternative would not impact surface water quality on site and in regional waterways and would not overwhelm SSFL and regional stormwater control capacities. This alternative would, however, remove a potential source of surface water contamination, a beneficial impact.

4.3.3 Groundwater Remediation Alternatives

Impacts under the groundwater remediation alternatives are summarized and compared in **Table 4–19**.

Table 4–19 Surface Water Impacts under the Groundwater Remediation Alternatives

Resource	*Groundwater No Action Alternative*	*Groundwater Monitored Natural Attenuation Alternative*	*Groundwater Treatment Alternative*
Surface water quality	No change from baseline conditions. Long-term reduction of potential sources of surface water contamination.	No adverse impacts on surface water quality during well installation and well monitoring. Long-term reduction of potential sources of surface water contamination.	No adverse impacts on surface water quality during treatment system installation and operation. The time required to eliminate potential sources of surface water contamination would be much shorter than that under the Groundwater Monitored Natural Attenuation Alternative.
Stormwater runoff quantity and velocity	No change from baseline conditions.	No adverse impacts are expected on SSFL or regional stormwater control capacities.	Same as the Groundwater Monitored Natural Attenuation Alternative.

4.3.3.1 Groundwater No Action Alternative

Under the Groundwater No Action Alternative, there would be no modifications to Area IV that would result in new surface water quality impacts or increase surface water runoff volumes or velocity that could impact SSFL or regional stormwater control capacity. This alternative would, however, allow continued introduction of trace amounts of groundwater contaminants into surface water drainages, although the concentrations of these contaminants would attenuate or decay over time. As noted in Chapter 3, Section 3.3.1, contaminants have been detected in groundwater seeps in the NBZ. Contaminants have not been detected in groundwater seeps downslope of the NBZ in the ROI, but the contamination plumes could potentially migrate to these downslope seeps (CDM Smith 2015a).

4.3.3.2 Groundwater Monitored Natural Attenuation Alternative

Under the Groundwater Monitored Natural Attenuation Alternative, DOE would monitor groundwater through sampling and analysis. As described in Chapter 2, Section 2.6.2, groundwater monitoring would largely occur using existing infrastructure, but the existing monitoring system would be augmented by five additional monitoring wells. Wastes generated as part of installing the additional wells would include cuttings and well installation water that would be collected and transported off site. Well installation and management of well installation wastes would be conducted in a manner that would minimize, if not eliminate, the potential for stormwater runoff of wastes or disturbed soil into site drainages. Groundwater monitoring would continue for each plume for time periods that would vary, depending on the plume. Groundwater monitoring would not cause new ground disturbances, would not introduce new impervious surfaces in Area IV, and would not alter drainage paths from the site.

Overall, monitoring well installation and monitoring would not cause new surface water quality impacts. Site modifications and operations would not cause changes to surface water volumes or velocities sufficient to impact SSFL or regional stormwater control capacity. Implementing this alternative would, however, result in a long-term reduction of contaminants in groundwater that currently seep into surface water drainages north of Area IV.

4.3.3.3 Groundwater Treatment Alternative

Under the Groundwater Treatment Alternative, DOE would treat contaminated groundwater within Area IV in accordance with the 2007 CO (DTSC 2007), which directs cleanup in accordance with RCRA requirements, including preparation of a Corrective Measures Study to evaluate remedial actions. As described in Chapter 2, Section 2.6.3, a variety of treatment technologies could be implemented, including removal of bedrock, pump and treat, enhanced groundwater treatment, or soil vapor extraction. Bedrock removal would excavate an area covering approximately 0.1 acre, with a total disturbed area of up to 0.25 acres (see Section 4.5.3.3.1). Installation of treatment systems and supporting structures for other treatment technologies could disturb additional soil to a minor extent. These activities could thus create an increased opportunity during rainfall events for soil erosion and sediment loads in runoff. For the purpose of analysis, an increase in sediment loads in runoff from Area IV resulting from soil disturbance was considered an exceedance of water quality thresholds established in the *State General Permit for Storm Water Discharges Associated with Construction Activities* (SWRCB 2009).

The SWPPP for the overall project (see Section 4.3.1.2) would be implemented. The BMPs described in Chapter 6 and Section 4.3.1.2 would be implemented to filter sediments and other contaminants from surface water runoff and to prevent increases in runoff velocity and volume. Following completion of the DTSC and EPA cleanup determination process described in Section 4.3.1.2, exposed soils would be stabilized and revegetated. In addition to these BMPs and the stabilization and reseeding process, the SSFL stormwater control and NPDES monitoring system would remain in place during and following construction.

As described in Section 4.3.1.2, DOE would conduct water quality and runoff volume and velocity monitoring prior to installation of treatment systems and supporting structures and during installation, operations, and equipment and structure removal to identify increases in sediment levels or runoff rates. In the event of increased sediment levels in stream flow or increases in runoff rates, additional BMPs would be implemented as necessary to eliminate sediment runoff. With implementation of BMPs and continued operation of the NPDES stormwater control and monitoring system, this alternative would not impact surface water quality on site and in regional waterways. Site modifications and operations under this alternative would not cause changes to surface water volumes or velocities sufficient to impact SSFL or regional stormwater control capacity. This alternative would, however, result in a beneficial long-term reduction in the contaminants in groundwater that currently seep into surface water drainages north of Area IV.

4.3.4 Surface Water Impacts under All Action Alternative Combinations

The High Impact Combination would have the greatest potential for impacts on surface water, primarily because of the area of soil disturbance outside the proposed exemption areas (about 138 acres). The Low Impact Combination would have the smallest potential for impacts on surface water because it would have the least soil disturbance outside the proposed exemption areas (about 40 acres) and would result in the least potential for soil erosion that could increase sediment levels in runoff. The Groundwater Monitored Natural Attenuation Alternative would have less potential for soil erosion than the Groundwater Treatment Alternative because it would disturb less soil currently shielded from erosion by vegetation when compared to the excavation and earth moving actions required under the Groundwater Treatment Alternative. If DOE implemented both groundwater remediation action alternatives, the potential for soil disturbance would be similar to that for implementing the Groundwater Treatment Alternative alone.

Under any combination of action alternatives, the BMPs and mitigation measures described in Chapter 6 and Sections 4.3.1 through 4.3.3 would be implemented to filter sediments and other contaminants from surface water runoff and to limit increases in runoff velocity and volume. Except possibly for scenarios where an unusually large rainstorm occurs in the interval between soil excavation and revegetation of disturbed areas, coupled with exceedance of the stormwater control system capacity, no impacts are expected on surface water quality on site and in regional waterways or on the capacities of the regional stormwater control systems downstream in regional waterways. To forestall the risks of impacts under these scenarios, Mitigation Measures SW-1 and SW-2 could be implemented. Mitigation Measure SW-1 would require that, in areas excavated to bedrock, excavation and backfill activities would be completed prior to or following the typical rainfall season of December through May. Mitigation Measure SW-2 would require the addition of stormwater retention structures (such as catch basins or retention basins), as well as additional erosion control measures, if runoff studies indicate the NPDES stormwater control system design capacity could be exceeded.

Implementing any combination of action alternatives would result in a long-term improvement in surface water resources at Area IV and its vicinity because a potential source of surface water contamination would be removed.

4.3.5 Impact Threshold Analysis

An impact threshold, as summarized in Table 4–2, could be exceeded for the surface water resource area with implementation of some of the alternative configurations analyzed in this section absent implementation of avoidance measures.

Under the soil remediation action alternatives, the mitigation measures described in Sections 4.3.1.2 and Chapter 6 would be implemented to control site runoff and to filter sediments and contaminants from this runoff to protect against exceedance of the water quality thresholds established in the *State General Permit for Storm Water Discharges Associated with Construction Activities* (SWRCB 2009). Under the building removal and the groundwater remediation alternatives, water discharge to surface water bodies in the ROI is not expected to contain constituents that would exceed these water quality thresholds. Under the Soil No Action Alternative, however, contaminants could be discharged from the site into downstream drainages and impact water quality if a rainfall event occurs that exceeds the current capacity of the site NPDES control and monitoring system, which is designed for a 1-year return interval storm. Under all soil remediation action alternatives, soil may be removed in some areas to the underlying bedrock. Until the areas are backfilled and stabilized (e.g., by revegetation), and in the event of a heavy rainstorm, there could be an increased potential for soil and sediment runoff from these hard-surface areas. The increased runoff volume and velocity under this scenario could overwhelm the NPDES control and monitoring system and exceed the water quality thresholds established in the *State General Permit for Storm Water Discharges Associated with Construction Activities* (SWRCB 2009). To forestall the likelihood and potential severity of this scenario, Mitigation Measure SW-1 would be implemented in areas excavated to bedrock; this mitigation measure requires completion of excavation and backfilling prior to or following the typical rainfall season of December through May. Also, under all soil remediation alternatives, a threshold for increased sediment runoff and exceedance of NPDES water quality standards could be exceeded without the addition of additional capacity. Mitigation Measure SW-2 would require the addition of stormwater retention structures (such as catch basins or retention basins), as well as additional erosion control measures, if runoff studies indicate their need (see Section 4.3.1.2).

4.4 Groundwater Resources

The primary use of groundwater in Area IV is to support vegetation and wildlife and as recharge to the adjacent downgradient groundwater basin, the Simi Valley Regional Basin. Secondarily, the near-surface groundwater contributes to the deeper aquifer beneath SSFL. Designated beneficial uses for adjacent groundwater basins include municipal and domestic water supply, agricultural supply, industrial process supply, and industrial service supply, as defined by the *Water Control Plan for Ventura and Los Angeles Counties* (CRWQCB 1994). The impacts (beneficial or adverse) from implementing the alternatives would primarily be to the quality and quantity of groundwater available to vegetation and wildlife.

Groundwater remedial actions would be conducted based on the 2007 CO (DTSC 2007), which directs cleanup to be completed in accordance with RCRA requirements, including preparation of a Corrective Measures Study to evaluate remedial actions. Because cleanup levels for groundwater have not been established, the quality of groundwater (e.g., the concentration of chemicals in the groundwater) is herein discussed with respect to Maximum Contaminant Levels (MCLs). MCLs are numerical standards established by EPA for the amounts of substances allowed in public drinking water supplies under the Federal Safe Drinking Water Act. As such, MCLs are useful benchmarks for measuring progress in attaining lower concentrations. Various actions under the groundwater remediation alternatives are designed to reduce the concentrations of substances in groundwater.[6]

The quantity of groundwater was evaluated with respect to net gains or losses of groundwater through the withdrawal or injection activities that are elements of the building demolition and groundwater remediation alternatives. There would be no withdrawal or injection of groundwater under the soil remediation alternatives.

Implementing the action alternatives could consume groundwater resources acquired outside of SSFL for purposes such as dust suppression. It was assumed that this water would come from CMWD. Water use under the alternatives on regional water resources is evaluated in Section 4.1.

4.4.1 Soil Remediation Alternatives

Impacts under the soil remediation alternatives are summarized and compared in **Table 4–20**.

[6] Remedial actions would be designed to reduce constituent concentrations to meet a risk-based standard that would be included in the corrective measures study for groundwater remediation. The corrective measures study would be subject to approval by DTSC.

Table 4–20 Groundwater Impacts under the Soil Remediation Alternatives

Resource	Soil No Action Alternative	Soil Remediation Action Alternatives: Cleanup to AOC LUT Values	Soil Remediation Action Alternatives: Cleanup to Revised LUT Values	Soil Remediation Action Alternatives: Conservation of Natural Resources
Groundwater quality	A source of potential additional groundwater contamination would remain.	No adverse impacts are expected; positive impacts would result from removal of a potential source of groundwater contamination.	Same as the Cleanup to AOC LUT Values Alternative.	Same as the Cleanup to AOC LUT Values Alternative.
Groundwater quantity	There would be no requirement to withdraw site groundwater.	Same as the Soil No Action Alternative.	Same as the Soil No Action Alternative.	Same as the Soil No Action Alternative.

AOC = *Administrative Order on Consent for Remedial Action*; LUT = Look-Up Table.

4.4.1.1 Soil No Action Alternative

Soil containing chemicals and site-related radionuclides is a potential source of these substances in groundwater. Under the Soil No Action Alternative, these substances would remain a source until they are depleted through a combination of attenuation, natural decay, and flushing from the soil into the groundwater. The length of time for these constituents to be depleted in soil to the point that they do not contribute to concentrations in groundwater above MCLs would depend on their present concentrations, mobility in soil, and ability to naturally degrade through a variety of mechanisms (e.g., natural radioactive decay or microbial attenuation of organic chemicals). Most of the highly impacted soils that were the sources of chemicals and radionuclides to groundwater were removed during prior Area IV removal actions. In addition, with the exception of tritium, the site-related radionuclides have a tendency to adhere to soil and are not easily flushed by precipitation through the soil and into groundwater. Nonetheless, some impacted soil remains and would represent a potential source of impacts on groundwater.

4.4.1.2 Soil Remediation Action Alternatives

As discussed in Section 4.4.1.1, soil containing chemicals and site-related radionuclides exists at Area IV and the NBZ that represents a potential source of groundwater impacts. Removal of this soil through any of the soil remediation action alternatives would have a positive impact on groundwater because a potential source of additional chemical and radionuclide contamination (the soil) would be removed. Removal of impacted soil would contribute to decreasing the concentrations of contaminants in groundwater to below MCLs. None of the soil remediation action alternatives would require withdrawal of groundwater above baseline conditions.

4.4.2 Building Removal Alternatives

Impacts under the building demolition alternatives are summarized and compared in **Table 4–21**.

Table 4–21 Groundwater Impacts under the Building Demolition Alternatives

Resource	Building No Action Alternative	Building Removal Alternative
Groundwater quality	No adverse impacts are expected.	Same as the Building No Action Alternative.
Groundwater quantity	No adverse impacts are expected.	This alternative may require dewatering of the basement of Building 4024 to enable safe demolition. If this occurs, up to 200,000 gallons of groundwater could be withdrawn from Area IV that would be managed by methods such as treatment (as needed) and onsite discharge.

4.4.2.1 Building No Action Alternative

Under the Building No Action Alternative, there would be no adverse impacts on groundwater quality because the remaining buildings are not sources of chemicals and radionuclides to groundwater. (Most site-related radionuclides are not soluble in water and would not migrate with precipitation from the buildings, through the overburden, and into the groundwater.) Site-related sources of radioactive contamination to groundwater consist of radiologically contaminated bedrock.

Because there would be no additional use of water at Area IV above baseline conditions (see Chapter 3, Section 3.4), there would be no impacts on groundwater quantity.

4.4.2.2 Building Removal Alternative

During dry years, the Building Removal Alternative would have no impacts on groundwater quality or quantity. During wet years, the basement of Building 4024 receives groundwater seepage. If demolition occurs when the basement has water in it, the basement would require dewatering in order to safely demolish the building. The groundwater level would need to be lowered to a depth below the bottom of the basement for a period of 3 months. Depending on groundwater elevation relative to the basement, groundwater pumping could remove up to 200,000 gallons of water that would be managed by methods such as treatment (as needed) and onsite discharge. Any groundwater contaminants removed during dewatering would result in a small water quality improvement in groundwater at the Building 4024 location.

4.4.3 Groundwater Remediation Alternatives

The three groundwater remediation alternatives—Groundwater No Action, Groundwater Monitored Natural Attenuation, and Groundwater Treatment—would all positively affect the quality of groundwater resources. All of the groundwater remediation alternatives include long-term monitoring to document the concentrations of chemical and radioactive constituents in the groundwater. Groundwater monitoring under the Groundwater Monitored Natural Attenuation Alternative could include analyzing the groundwater samples for more chemicals or water quality characteristics than those under the No Action Alternative. Groundwater sampling would have a minimal impact on the quantity of water available to recharge the underlying aquifer.

The treatment technologies and strategies that would be effective in reducing the concentrations of chemicals and radionuclides to below MCLs at each plume will depend on the substances present in the groundwater, their concentrations, their chemical properties, the groundwater chemistry, and the geology and hydrology. Therefore, different treatment technologies, or combinations of technologies, would be applied at different plumes. The technologies assumed for evaluation in this EIS are described in Chapter 2, Section 2.6.3. Plume- and source-specific treatment technologies are listed on **Table 4–22**. All listed technologies have been proven to work for the identified chemicals and radionuclides. However, because the groundwater chemistry, geology, and hydrogeology at each plume are different, some technologies will require a treatability study or other field testing to determine their efficiency or applicability for a given plume.

Table 4–22 Assumptions for Plumes and Strontium-90 Source under the Groundwater Remediation Action Alternatives

Plume	Groundwater Monitored Natural Attenuation Alternative	Groundwater Treatment Alternative (Technology Options)
Strontium-90 source (contaminated bedrock)	Monitor for about 150 years	– Source removal – Source isolation by injecting grout to seal contamination – Source isolation by lowering the groundwater table through active pumping to avoid further contamination of groundwater (about 150 years would be required for concentrations in the source to decrease below MCLs through radioactive decay) – MNA [a]
RMHF TCE plume	Monitor [b]	NA [c]
FSDF TCE plume	Monitor for 30 to 50 years	– Pump and treat, with re-injection of treated water – Enhanced groundwater treatment [d] – Soil vapor extraction – MNA [a]
HMSA TCE perched water plume	Monitor for more than 20 years	– Perched zone dewatering – Pump and treat, with re-injection of treated water – Enhanced groundwater treatment [d] – Soil vapor extraction – MNA [a]
Tritium plume	Monitor for about 10 years [b]	NA [c]
Building 4100/4056 landfill TCE plume	Monitor for about 20 years	– Pump and treat, with re-injection of treated water – Enhanced groundwater treatment [d] – Soil vapor extraction – MNA [a]
Building 4057 Warehouse PCE plume	Monitor for about 20 years	– Pump and treat, with re-injection of treated water – Enhanced groundwater treatment [d] – Soil vapor extraction – MNA [a]
Metals Clarifier TCE plume	Monitor for about 10 years [b]	NA [c]

FSDF = Former Sodium Disposal Facility; HMSA = Hazardous Materials Storage Area; MCL = Maximum Contaminant Level; MNA = monitored natural attenuation; NA = not applicable; PCE = perchloroethylene; RMHF = Radioactive Materials Handling Facility; TCE = trichloroethylene.

[a] All technologies require groundwater monitoring to assess progress. Under the Groundwater Treatment Alternative, MNA could be applied as a "polishing" step after implementing other, active remediation technologies. Impacts from groundwater monitoring, including MNA, are addressed under the Groundwater Monitored Natural Attenuation Alternative.

[b] Concentrations of TCE in the RMHF TCE plume have been about 6 parts per billion for about 15 years, so that the time that would be required for the TCE in this plume to be reduced to the TCE MCL is uncertain (see Chapter 2, Section 2.6.2). Radioactive decay can reduce concentrations in the tritium plume to the tritium MCL in about 10 years (CDM Smith 2015a). The concentration of TCE in the Metals Clarifier TCE plume is only about twice the TCE MCL of 5 parts per billion, and it is expected that MNA would require only about 10 years to complete *in situ* attenuation of TCE in this plume (CDM Smith 2015a).

[c] MNA is the only technology evaluated for the RMHF TCE plume, the tritium plume, and the Metals Clarifier TCE plume.

[d] Injection of a chemical or a nutrient into groundwater to enhance chemical or biological degradation of chemical constituents in groundwater.

Impacts under the groundwater remediation alternatives are summarized and compared in **Table 4–23**.

Table 4–23 Groundwater Impacts under the Groundwater Remediation Alternatives

Resource	Groundwater No Action Alternative	Groundwater Monitored Natural Attenuation Alternative	Groundwater Treatment Alternative
Groundwater quality	No additional adverse impacts are expected; groundwater quality would improve over time as chemical and radioactive constituents attenuate or decay.	Same as the Groundwater No Action Alternative.	No adverse impacts are expected. Positive long-term impacts would result from removal of contamination sources or treatment of groundwater.
Groundwater quantity	There would be no requirement to withdraw site groundwater above baseline conditions.	There could be slightly increased withdrawals of site groundwater to support groundwater monitoring operations.	No adverse impacts are expected.

4.4.3.1 Groundwater No Action Alternative

Under the Groundwater No Action Alternative, concentrations of chemical and radioactive constituents in groundwater would decrease over time, gradually improving the quality of groundwater at SSFL. Due to radioactive decay, concentrations of tritium in the tritium plume would be below the tritium MCL in about 10 years. Concentrations of strontium-90 in bedrock near the RMHF would take about 150 years to decay to below the strontium-90 MCL.

Concentrations of trichloroethylene (TCE) and other organic compounds in groundwater would decrease due to attenuation, diffusion into the rock matrix, or dilution. The length of time required for concentrations of organic chemicals to naturally decrease to concentrations below MCLs is not certain because both the concentrations of organic chemicals and the rate at which they are expected to decrease vary from plume to plume. Concentrations of TCE are highest at the FSDF area. Although there is some indication that these concentrations are decreasing naturally, it is expected that 30 to 50 years may be required before the TCE concentrations in the FSDF area decrease below the TCE MCL. Low levels of organic chemicals at the Metals Clarifier TCE plume have been decreasing since at least 2002 and are expected to continue so that, in 10 years, the concentration of TCE would be less than its MCL. The length of time for concentrations of TCE and perchloroethylene (PCE) in other plumes to decrease below their respective MCLs is expected to range from 10 to more than 20 years.

The current groundwater monitoring program would continue, with annual generation of about 250 gallons of purge water (see Appendix D), which would be transported to a permitted wastewater treatment plant in accordance with its waste acceptance criteria.

As part of the SSFL-wide groundwater interim measures, the currently planned FSDF Groundwater Interim Measure would be initiated.

4.4.3.2 Groundwater Monitored Natural Attenuation Alternative

As with the Groundwater No Action Alternative, under the Groundwater Monitored Natural Attenuation Alternative, there would be a steady decrease in tritium, strontium-90, and organic compounds in the groundwater plumes. Under the Groundwater Monitored Natural Attenuation Alternative, the current groundwater monitoring sample analysis program would be expanded to confirm that the chemical and biological conditions of the groundwater remain conducive to natural breakdown of organic chemicals.

This alternative would include the installation of five new monitoring wells. The installation of the five wells would generate about 10 cubic yards of nonhazardous drill cuttings (see Appendix D). Section 4.10 addresses the management of this waste.

In addition, water would be used for various activities and purposes during drilling and installation of monitoring wells, including cooling drill bits, removing drill cuttings, developing wells, mixing grout and cement for installation of drill casing, and decontaminating equipment before and after drilling a well. Each well installation would require about 1,000 gallons of water from CMWD (see Appendix D), with 5,000 gallons required for five wells. The annual generation of monitoring well purge water would be essentially the same (250 gallons) as that under the Groundwater No Action Alternative.

4.4.3.3 Groundwater Treatment Alternative

Under the Groundwater Treatment Alternative, a single technology or combination of technologies could be implemented for each groundwater plume. Implementing the Groundwater Treatment Alternative would result in a positive impact (improvement) to the quality of groundwater and minimal impacts on the quantity of groundwater available to recharge the aquifers in adjacent basins. At each plume, the treatment technologies would be designed to decrease the concentrations of chemicals or radionuclides to below standards that would be included in the Corrective Measures Study for groundwater remediation. The Corrective Measures Study would be subject to approval by DTSC.

Although the suite of treatment technologies to be implemented will be determined through the RCRA process (see Chapter 2, Section 2.6), several potential groundwater treatment technologies have been identified and are herein evaluated. The groundwater treatment technologies assessed by location within Area IV are summarized in Table 4–22. Contaminant concentrations in the Metals Clarifier TCE and tritium plumes are expected to decrease to below MCLs within 10 years without treatment other than monitored natural attenuation. Because the concentration of TCE in the RMHF TCE plume is only slightly above the TCE MCL, no treatment other than monitored natural attenuation is assumed for this plume as well. For the other plumes, the potential treatment technologies are summarized below:

- RMHF Strontium-90 Source – Technologies could include removal of the bedrock source of strontium-90 using mechanical equipment and water primarily obtained from CMWD to suppress dust generation; source isolation by injecting grout to seal contamination; or source isolation by lowering the water table through pumping. Lowering the water table through pumping would keep the strontium-90 from leaching into the groundwater, but would not decrease the time required to remediate strontium-90 when compared to monitored natural attenuation.
- FSDF Area TCE Plume – Pump and treat with re-injection of treated groundwater would allow treatment of the extracted groundwater to levels below MCLs before re-injecting it into the aquifer. This treatment strategy would improve groundwater quality without loss of available groundwater. Other treatment technologies (e.g., enhanced groundwater treatment to enhance chemical or biological degradation of groundwater constituents, soil vapor extraction) may be considered, but their efficacy would depend on the interconnection of the fractures in the bedrock. If the fractures are not well interconnected, it may be difficult to distribute the chemicals required for enhanced biological and chemical injections.
- HMSA TCE Perched Water Plume – Dewatering with treatment of groundwater would be a way to decrease TCE concentrations in the perched groundwater, although there is some uncertainty about the potential success of this strategy. Soil vapor extraction, pump and treat, enhanced *in situ* treatment through chemical injection, and treatment through biological enhancement may be viable technologies, but would require field testing to design.
- Building 4100/4056 Landfill TCE Plume – Pump and treat with local re-injection of treated groundwater or other technologies, as discussed for the FSDF TCE plume.
- Building 4057 Warehouse PCE Plume – Pump and treat with local re-injection of treated groundwater, as discussed for the FSDF TCE plume.

Implementing the bedrock removal, pump and treat, or soil vapor extraction technologies would generate waste. Waste streams are assumed to include bedrock removed at RMHF; filter media, spent resins, and granulated activated carbon[7] from treating groundwater; or granulated activated carbon from operation of soil vapor extraction systems. The generation and disposition of these wastes are addressed in Section 4.10.

4.4.4 Groundwater Impacts under All Action Alternative Combinations

The combination of action alternatives with the largest positive impact on groundwater quality, in the shortest time frame, would be the High Impact Combination. Nearly all of the positive impact would occur under the Groundwater Treatment Alternative. Although the Building Removal Alternative would be considered under all combinations of action alternatives, the Area IV buildings are not a source of chemicals or radionuclides to groundwater. Although the Cleanup to AOC LUT Values Alternative would remove more chemical contaminants in soil than the Cleanup to Revised LUT Values or Conservation of Natural Resources Alternative, and the Cleanup to AOC LUT Values and Cleanup to Revised LUT Values Alternatives would remove more radioactive constituents in soil than the Conservation of Natural Resources Alternative, there would be little difference among the soil remediation action alternatives in terms of positive impacts on groundwater. The added benefit to groundwater cleanup from soil removal is relatively low because the most highly impacted soil has already been removed. There would be no adverse impacts on groundwater from soil removal. The Low Impact Combination would have a comparable positive impact on groundwater quality, but this positive impact would be achieved over a much longer time frame.

If both groundwater remediation action alternatives were implemented, the advantageous features of monitored natural attenuation would be combined with other technologies employing active measures to remediate groundwater. The source of the water used for site remediation activities is expected to be CMWD (see Section 4.1).

4.4.5 Impact Threshold Analysis

Under all alternatives, there would be no decrease in the quality of groundwater at Area IV and the NBZ, with no exceedance of an impact threshold, as summarized in Table 4–2. Rather, implementing the soil remediation action alternatives and groundwater remediation alternatives would improve the quality of groundwater at Area IV and the NBZ. Because the source of water for Area IV remediation activities would be the CMWD rather than onsite wells, it is not expected that implementing any alternative would impact the quantity of groundwater available at Area IV, and there would be no exceedance of an impact threshold.

4.5 Biological Resources

Biological resources include vegetation; wildlife; wetlands and aquatic habitats; and rare, threatened, endangered, or sensitive species. The ROI encompasses areas that could be directly or indirectly impacted by remediation activities, including Area IV, the NBZ, and downslope areas that could be affected by runoff from Area IV or the NBZ, or by accelerated erosion or sedimentation.

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[7] Granular activated carbon is a highly porous adsorbent material produced by heating organic matter such as coal, wood, and coconut shell in the absence of air, and crushing the material into granules. Activated carbon is positively charged and therefore able to remove negatively charged ions from the water, such as ozone, chlorine, fluorides, and dissolved organic solutes, by absorption onto the activated carbon. The activated carbon must be replaced periodically, as it may become saturated and unable to absorb. Activated carbon is not effective in removing heavy metals (GreenFacts 2015).

Habitat-Based Analysis

A habitat-based analysis is used for most biological resources. This analysis quantifies the amount of different habitat types that would be removed or impacted by ground-disturbing activities. This is done by "overlaying" a map of plant communities within Area IV and the NBZ onto the areas that would be impacted under the alternatives. The quantity of each vegetation type removed is evaluated in the context of habitat importance in terms of species and function, sensitivity, the ability to restore it (considering effort and time), and the availability of regionally similar resources.

The analysis focused on the following:

- Undisturbed native habitat, including Venturan coastal sage scrub, dipslope grassland, northern mixed chaparral, sandstone outcrops, California walnut woodland, Coast live oak woodland and savanna, wetlands, vernal pools, and riparian habitat.

- Aquatic and wetland habitats and biota, including potential U.S. Army Corps of Engineers (USACE) jurisdictional wetlands (i.e., the Building 4056 excavation and the Sodium Reactor Experiment [SRE] wetland near outfall 4), other Waters of the U.S. (i.e., natural ephemeral streams), non-jurisdictional Waters of the U.S. (including man-made asphalt and concrete lined and unlined drainage ditches), and vernal pools. Aquatic biota is limited to wetland vegetation associated with the Building 4056 excavation and the SRE wetland near outfall 4, occasional common amphibian species observed in the SRE pond, and fairy shrimp and other invertebrates in vernal pools (see Chapter 3, Figure 3–21).

- Sensitive species, including species listed, proposed, or active candidates for protection under the Federal Endangered Species Act (ESA), California Native Plant Protection Act, and California Endangered Species Act (CESA); California Rare Plant Rank List 1B and List 4 species;[8] the Ventura County list of locally sensitive species; bald and golden eagles (Bald and Golden Eagle Protection Act); California Fully Protected Species; and California Species of Special Concern. For species not protected under ESA, CESA, or the California Native Plant Protection Act, the emphasis is on species known to occur at SSFL or in its immediate vicinity.

- Designated critical habitat for Braunton's milk-vetch and California red-legged frog, both of which are protected under the ESA.

- Nesting birds protected under the Migratory Bird Treaty Act (MBTA) during the breeding/nesting season.

Exemption Area Assumptions

Proposed exemption areas under the 2010 AOC (DTSC 2010a) include areas containing sensitive biological resources. The proposed exemption areas considered in this analysis are shown in Chapter 2, Figure 2–2, and include the sensitive biological resources listed in **Table 4–24**. Details on these biological resources are provided in Chapter 3, Section 3.5. It was assumed that the proposed exemption areas would be remediated via focused removal actions as discussed in Section 4.2.1.2.

[8] List 1B species are rare and endangered species and currently meet the CESA criteria for listing; List 4 species are on a "watch list" and may be determined in the future to meet the CESA criteria for listing.

Table 4–24 Sensitive Biological Resources in the Proposed Exemption Areas

Sensitive Biological Resource	*Status/Protection*
Braunton's milk-vetch (*Astragalus brauntonii)*	ESA – Endangered with designated critical habitat; CRPR 1B.1
Santa Susana tarplant (*Deinandra minthornii*)	CESA – Rare; CRPR 1B.2
Malibu baccharis (*Baccharis malibuensis*)	CRPR 1B.1
Mariposa lily (*Calochortus clavatus* var. undetermined: potentially var. *clavatus* or var. *gracilis*)	CRPR 4.3 (var. *clavatus*); 1B.2 (var. *gracilis*)
Plummer's mariposa lily (*Calochortus plummerae*) Potentially *C. weedii* var. *vestus* (*C. fimbriatus*) or *C. w.* var *intermedius*	CRPR 4.2 (*C. plummerae*); 1B.2 (*C. fimbriatus*); 1B.2 (*C. weedii* var. *intermedius*)
Catalina mariposa lily (*Calochortus catalinae*)	CRPR 4.2
California red-legged frog (*Rana draytonii*)	ESA - Threatened with designated critical habitat
Southern California black walnut (*Juglans californica*)	CRPR 4.2
Golden eagle (*Aquila chrysaetos*) nest sites	Bald and Golden Eagle Protection Act; California fully protected.
Vernal pools and vernal rock pools	Potential habitat for federally listed fairy shrimp

CESA = California Endangered Species Act; CRPR = California Rare Plant Rank; ESA = Endangered Species Act.

Impact Threshold Criteria

Under Council on Environmental Quality (CEQ) guidelines for NEPA, impact assessment is based on intensity (how severely the resource is affected) and context (what proportion of the resource is affected). Context includes the importance of the resource, which is related to factors including function, condition, and relative scarcity.

Regulatory-related thresholds include:

a. Adverse modification of critical habitat (ESA).

b. Impacts on a listed wildlife species reaching the level of "take" (ESA).

c. Substantial impacts on a listed (ESA) or otherwise sensitive plant species.

d. For federally listed wildlife and plant species, either "b" or "c" would equate to a "may affect and likely to adversely affect" determination for wildlife and plant species, respectively, in a biological assessment under the ESA.

e. Cut or fill impacts on jurisdictional wetlands and waters sufficient to trigger regulatory mitigation requirements under the Clean Water Act (e.g., habitat replacement ratios) in addition to *in situ* restoration. Indirect impacts may occur if discharges carrying sediments or potential pollutant result in degradation of these resources to the extent that regulatory mitigation requirements are triggered.

The evaluation identifies the potential for impacts on sensitive biological resources subject to direct or indirect impacts from the proposed activities. Potential direct impacts include disturbance or direct removal of individual plants or habitat; indirect impacts could result from human activity including dust deposition, noise, or movements of humans or vehicles. Biological impacts are generally categorized as short-term or long-term. Short-term impacts can range from nearly instantaneous effects (e.g., an animal's reaction to sudden movement) to effects of longer duration that may persist for a few years beyond completion of remediation and restoration activities. Long-term impacts typically last 5 years or longer after cessation of project activities. For this project, most impacts related to vegetation and soil removal would be long-term due to the length of time required to restore vegetation and wildlife habitat after remediation, except in rapidly establishing vegetation types such as annual grassland. Impacts related to human activity including noise, dust, and night-time lighting would generally be categorized as short-term. Potential adverse impacts on species federally listed as threatened or endangered would be considered substantial.

DOE is undertaking formal consultation with the U.S. Fish and Wildlife Service (USFWS) under Section 7 of the ESA. A biological assessment is being prepared to support formal consultation, and informal consultation has been ongoing over the past few years between DOE, USFWS, and the California Department of Fish and Wildlife (CDFW). Impact avoidance, species conservation, and other measures to reduce impacts on federally or state-listed and other special-status species would be implemented in addition to guidance and measures derived from the consultation process with USFWS.

4.5.1 Soil Remediation Alternatives

Impacts under the soil remediation alternatives are summarized and compared in **Table 4–25**.

4.5.1.1 Soil No Action Alternative

4.5.1.1.1 Vegetation and Wildlife Habitat and Biota

As vegetative cover gradually regenerates under the Soil No Action Alternative, a gradual reduction would be expected in the amount of sediment in runoff; in addition, runoff would be gradually reduced due to interception of rainfall by the increased presence of vegetation canopies.

Regeneration of vegetation through natural processes of succession would occur gradually in disturbed areas, and the vegetation would slowly (over decades) become more similar to nearby undisturbed vegetation. Constraints on natural regeneration would exist in areas where severe disturbance to preexisting vegetation and soils (such as stripping of topsoil, severe compaction, and mixing of soil layers following excavation) occurred during past development of Area IV. These constraints could result in long-term differences between vegetation in undisturbed areas and vegetation in previously developed areas. Due to the generally low concentrations of chemical constituents across most of Area IV and the NBZ, existing soil chemical concentrations in Area IV and the NBZ would have little, if any, impacts on regeneration of native vegetation. In formerly built-up areas the previous disturbance of soil (compaction, mixing of layers, removal of topsoil, etc.) associated with previous use of Area IV could limit the revegetation potential of affected areas.

4.5.1.1.2 Aquatic and Wetland Habitats and Biota

No impacts are expected on aquatic and wetland habitats or biota.

4.5.1.1.3 Threatened, Endangered, and Rare Species

There would be no changes to sensitive plant or wildlife habitat; thus, there would be no impacts on federally or state-listed or other special-status species or their habitat.

Table 4–25 Biological Resources Impacts under the Soil Remediation Alternatives

Resource	Soil No Action Alternative	Soil Remediation Action Alternatives: Cleanup to AOC LUT Values	Cleanup to Revised LUT Values	Conservation of Natural Resources
Vegetation and wildlife habitat and biota	No adverse impacts are expected.	Removal of existing vegetation and wildlife habitat from about 130 acres outside the proposed exemption areas would increase the difficulty of re-establishing native plant species and would reduce or eliminate the value of re-established habitat for most wildlife species. Remediation would require prolonged, focused efforts to restore native vegetation and wildlife habitat. If backfill is substantially different from soil originally present, it may not support vegetation similar to that present before development of Area IV. About 51 acres of relatively undisturbed native habitat (including coast live oak woodland, northern mixed chaparral, and Venturan coastal scrub) would be affected outside the proposed exemption areas. There would be fewer impacts within the proposed exemption areas because remediation would occur via focused removal actions that would minimize soil and habit disturbance.	Substantially reduced impacts on vegetation and wildlife habitat and biota because the removal of vegetation and wildlife habitat (about 40 acres outside the proposed exemption areas) would be less than that under the Cleanup to AOC LUT Values Alternative. The smaller area affected by remediation would increase the feasibility of restoration, and there would be more undisturbed habitat between remediated portions of the site, facilitating recolonization by native plant and wildlife species and beneficial soil organisms. About 17 acres of relatively undisturbed native habitat (including coast live oak woodland and northern mixed chaparral scrub) would be affected outside the proposed exemption areas. Impacts within the proposed exemption areas would be generally as described under the Cleanup to AOC LUT Values Alternative.	Substantially reduced impacts on vegetation and wildlife habitat and biota because the removal of vegetation and wildlife habitat (about 32 acres outside the proposed exemption areas) would be less than that under the Cleanup to AOC LUT Values Alternative and about 8 acres less than the Cleanup to Revised LUT Values Alternative. Because much less topsoil would be concurrently removed, this would increase the feasibility of restoration, and there would be more undisturbed habitat between remediated portions of the site, facilitating recolonization by native plant and wildlife species and beneficial soil organisms. About 13 acres of relatively undisturbed native habitat (including coast live oak woodland and northern mixed chaparral scrub) would be affected outside the proposed exemption areas. Impacts in the proposed exemption areas would be generally as described under the Cleanup to AOC LUT Values Alternative.
Aquatic and wetland habitats and biota	No adverse impacts are expected.	Less than one acre of wetlands, ephemeral drainages, and drainage ditches created in upland habitats would be directly affected. Potential indirect impacts on aquatic and wetland habitats and associated biota, including jurisdictional Waters of the U.S., from erosion and movement of sediment or soil would be minimized by use of BMPs and mitigation measures.	Generally similar impacts to those under the Cleanup to AOC LUT Values Alternative, but the area of ephemeral drainages directly affected would be would be about 0.4 acres. Use of BMPs and mitigation measures would minimize potential indirect impacts.	Generally similar impacts to those under the Cleanup to AOC LUT Values Alternative, but the area of ephemeral drainages directly affected would be about 0.4 acres. Use of BMPs and mitigation measures would minimize potential indirect impacts.
Threatened, endangered, and rare species	No adverse impacts are expected.	Remediation in Area IV and the NBZ would affect about 130 acres of wildlife habitat outside the proposed exemption areas. Within the proposed exemption areas where most threatened, endangered, and rare species in Area IV and the NBZ are located, as well as critical habitat for two federally listed species, focused removal actions would minimize the remediation footprint.	Generally similar to impacts under the Cleanup to AOC LUT Values Alternative, but much less habitat would be affected outside the proposed exemption areas (40 acres). Within the proposed exemption areas, including designated critical habitat, impacts of focused removal actions would be similar to those under the Cleanup to AOC LUT Values Alternative.	Generally similar to impacts under the Cleanup to AOC LUT Values Alternative, but much less habitat would be affected outside the proposed exemption areas (32 acres). Within the proposed exemption areas, including designated critical habitat, impacts of focused removal actions would be similar to those under the Cleanup to AOC LUT Values Alternative.

AOC = *Administrative Order on Consent for Remedial Action*; BMP = best management practice; LUT = Look-Up Table; NBZ = Northern Buffer Zone.

4.5.1.2 Cleanup to AOC LUT Values Alternative

4.5.1.2.1 Vegetation and Wildlife Habitat and Biota

Under the Cleanup to AOC LUT Values Alternative, chemical and radioactive constituents would be removed to AOC LUT values beginning on one side of Area IV and continuing across Area IV until all soil not meeting AOC LUT values was removed. Vegetation would be removed from most of Area IV outside of the proposed exemption areas; the depth of subsequent removal of topsoil and subsoil would depend on the depths of the soil exceeding AOC LUT values. Cleanup activities in the NBZ would primarily occur along drainages and in the vicinity of RMHF and north of the SRE area. **Table 4–26** summarizes the vegetation and wildlife habitat areas directly affected under each soil remediation action alternative.

Table 4–26 Vegetation and Wildlife Habitat Removed (acres and percent of total) by Soil Remediation Action Alternative[a]

Vegetation/ Wildlife Habitat	*Soil Remediation Action Alternatives* [a]						*Total Habitat in Area IV plus Northern Buffer Zone (acres)*
	Cleanup to AOC LUT Values	*% of Total*	*Cleanup to Revised LUT Values*	*% of Total*	*Conservation of Natural Resources*	*% of Total*	
Nonnative Annual Grassland	23.4	52	9.4	51	7.3	16	44.9
Northern Mixed Chaparral – Burned	24.6	13	10.0	12	7.5	4	192
Northern Mixed Chaparral – Sandstone Outcrops	2.1	4	0.8	3	0.6	1	61.1
Northern Mixed Chaparral – Unburned	0.9	10	0.0	10	0.0	0	8.8
Coast Live Oak Woodland/Savanna	21.7	34	5.2	34	4.7	7	63.3
California Walnut Woodland	0.0	0	0.0	0	0.0	0	9.4
Riparian	1.3	53	0.6	52	0.6	24	2.5
Mulefat-dominated Formerly Disturbed	0.6	68	0.7	71	0.7	79	0.9
Revegetated Formerly Disturbed	14.8	69	2.5	68	2.3	11	21.4
Steep Dipslope Grassland	0.0	0	0.0	0	0.0	0	7.7
Unvegetated Disturbed/Developed	28.9	68	7.4	67	5.2	12	42.4
Venturan Coastal Scrub	0.5	16	0.0	17	0.0	0	3.1
Weed-dominated Formerly Disturbed	11.1	79	3.3	78	3.0	22	14.0
Total [b]	**130**	**28%**	**40**	**8%**	**32**	**7%**	**472**

AOC = *Administrative Order on Consent for Remedial Action*; LUT = Look-Up Table.

[a] This analysis excludes the proposed exemption areas. Some disturbance would occur in the proposed exemption areas, but that additional disturbance is unknown and is not accounted for in this table (see text). Units are acres and percent of total in Area IV and the NBZ. The analysis is based on the habitat classification and vegetation map presented in Table 3–5 and Figure 3–20, respectively.

[b] Percentages in the "Total" row are based on the ratio of the total acreage affected by the treatment and the total acreage on site.

Note: Totals have been rounded.

Contamination within the proposed exemption areas, which total 220 acres, of which approximately 101 acres contain chemical or radioactive constituents exceeding AOC LUT values, would be addressed via focused removal actions that would minimize disturbance of soil and vegetation. The degree of disturbance caused by removal actions within the proposed exemption areas would vary from one exemption area to another, depending on the nature and extent of the removal actions required. The total area that may be disturbed within the proposed exemption areas, as well as the total volume of soil that may be removed, will be determined based on the results of consultations with USFWS, CDFW, DTSC, the California State Historic Preservation Officer (SHPO), and the Santa Susana Field Laboratory Sacred Sites Council (SSFL Sacred Sites Council) with respect to protection of biological and cultural resources (see Section 4.11) at Area IV and the NBZ.

Management measures, including conducting pre-construction surveys, identifying impact-minimizing access routes, deploying biological monitors during work activities, avoiding nesting season for migratory birds or incorporating adequate setbacks, and implementing soil stabilization and restoration techniques would help to further minimize impacts in the proposed exemption areas. DOE would not take action in these proposed exemption areas unless soil chemical or radionuclide levels pose a risk to human health and the environment. As needed, DOE may consider other exemptions allowable under the 2010 AOC (DTSC 2010a) for unforeseen circumstances, for example, to avoid removal of oak trees and to prevent environmental damage in remote locations.

About 130 acres of vegetation and wildlife habitat would be removed outside the proposed exemption areas, about 28 percent of the total habitat in Area IV and the NBZ. (The total acreage could be reduced because some areas may be treated by natural attenuation rather than soil removal.) Most of the remediation would take place in large contiguous blocks due to the extensive occurrence of one or more contaminants exceeding AOC LUT values in the previously developed portions of the site where most of the contamination is present. The degree of impact would vary depending on the nature of the vegetation present, which partially reflects the history of soil disturbance at SSFL. Many habitats outside the proposed exemption areas have more-heavily disturbed vegetation and soil than those in the proposed exemption areas. Previously developed areas in Area IV generally support common, invasive, or weedy species, and support fewer sensitive plant and wildlife species, than do previously undeveloped areas. Removal of soil from an area long supporting weedy vegetation would have less impact on vegetation and habitat because the value of the habitat is less. In contrast, removing soil from an area currently supporting native vegetation, such as chaparral or oak woodland, would have greater impact because of the greater habitat value provided by native vegetation, as well as the difficulty of restoring soil capable of supporting native vegetation. It also may not be possible to restore native vegetation if soil similar to native soil cannot be obtained for backfill.

Where soil removal outside the proposed exemption areas would occur in relatively undisturbed native habitats (including coast live oak woodland, northern mixed chaparral, and Venturan coastal scrub covering about 51 acres, or 39 percent of the area directly affected by soil removal), it is unlikely that restoration and revegetation would result in habitat functionally equivalent to preexisting native vegetation. The uppermost soil layers contain organic matter; seedbank; regenerative structures such as bulbs, corms, and root crowns; and beneficial soil organisms, including mycorrhizae. Where chemicals or radionuclides above AOC LUT values extend from the surface downward, there would be no opportunity to conserve the valuable uppermost soil layers or seedbank for later replacement as part of site restoration and revegetation. As discussed in Section 4.2.1.2, sources of backfill that meet AOC LUT values have not been identified. Additionally, the nature of the backfill (geologic parent material, texture, etc.) will partially determine the type of vegetation the site will support. Removal of existing vegetation and topsoil would increase the difficulty of re-establishing native plant species and reduce or eliminate the value of the habitat for most wildlife species during the process of re-establishing native vegetation and wildlife habitat. Extreme weather conditions during or following remediation could have substantial effects. For example, exceptionally heavy rainfall events could cause substantial loss of soil (or backfill) in areas where vegetation has been removed and soil has been loosened (or where backfill has been stockpiled or recently placed). The redistribution of these materials could affect revegetation and site restoration, both where it has been washed away and where it has been redeposited. Similarly, a severe drought following revegetation activities could cause loss of seed and transplant stock and necessitate replanting, which may require additional seed collection and propagation of transplant stock.

Loss of habitat due to remediation would reduce wildlife species populations in the affected area and the local vicinity depending on the home range of the species. In addition, there would be mortality among less mobile species, which would be reduced by relocating individuals of sensitive species (e.g., coast horned lizard, a California Species of Special Concern) encountered during pre-construction surveys. If vegetation clearing were to occur during nesting season (February through August), bird species protected by the MBTA would experience nest failures within and possibly nearby the remediation area. This could be avoided by clearing vegetation outside of the nesting season, surveying the remediation area and adjacent habitat prior to vegetation clearing by a qualified biologist to verify that no nests are present, or creating suitable buffers around active nests to avoid nest failure.

To summarize, this alternative would result in removal of vegetation and wildlife habitat over about 130 acres outside of the proposed exemption areas and an unquantified additional acreage within the proposed exemption areas, causing mortality and disturbance of wildlife within and adjacent to the affected area. The profound soil disturbance caused by remediation will require special measures to accomplish restoration of a self-sustaining native vegetation cover and sources of suitable clean soil for backfill where soil has been removed have not been identified. If backfill is substantially different than that originally present, it may not support vegetation similar to that present before development of Area IV. With implementation of habitat restoration and revegetation measures, as well as measures to reduce or avoid impacts on wildlife as described in Chapter 6, impacts would be reduced, but would remain substantial given the degree of habitat loss and the length of time required to restore vegetation, habitat function, and wildlife populations.

4.5.1.2.2 Aquatic and Wetland Habitats and Biota

Figure 4–6 illustrates areas projected for remediation under the Cleanup to AOC LUT Values Alternative, as well as the locations of aquatic features, including wetlands, potential jurisdictional Waters of the U.S., and other drainage features. Soil removal would directly impact less than one acre of wetland habitats and aquatic features outside of the proposed exemption areas:

- Jurisdictional Wetlands – 0.02 acres (the SRE [9] wetland near Outfall 4). The Building 4056 excavation and the adjacent vernal pools are within a proposed exemption area.
- Jurisdictional Waters of the U.S. – 0.4 acres, 8,336 linear feet (natural ephemeral streams in Area IV and parts of the NBZ adjacent to Area IV).
- Non-jurisdictional Waters of the U.S. – 0.26 acres, 6,272 linear feet (man-made asphalt and concrete lined and unlined drainage ditches in Area IV).

[9] Although the SRE wetland meets the definition of a USACE jurisdictional wetland, this feature was created by an earthen berm built to detain runoff and is known to be contaminated.

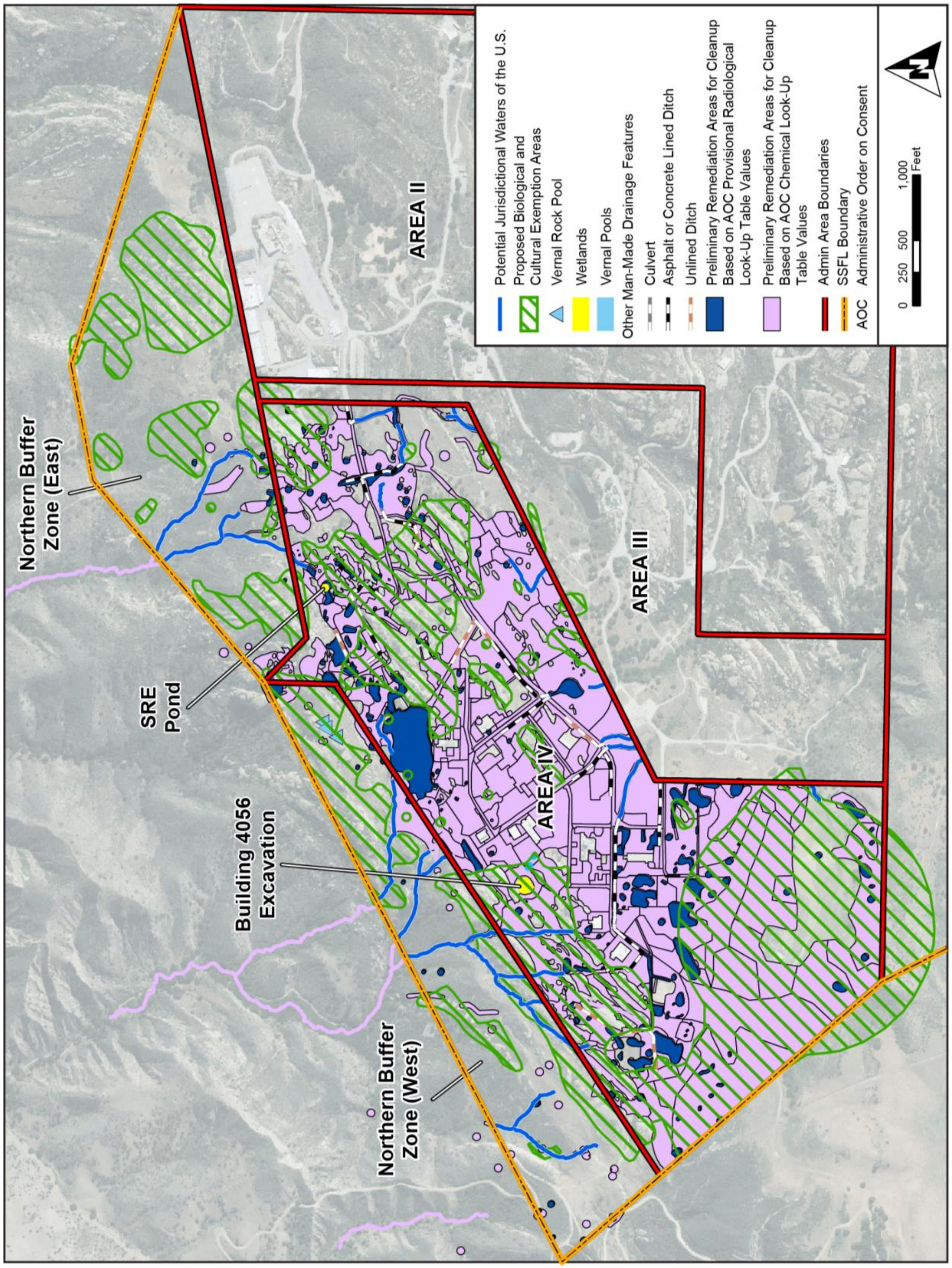

Figure 4–6 Wetlands and Waters of the U.S. under the Cleanup AOC LUT Values Alternative

The removal actions for the proposed exemption areas would avoid direct impacts on aquatic and wetland habitats and biota to the extent feasible, including the Building 4056 excavation and adjacent vernal pools. The rock vernal pools are on top of a large sandstone outcrop and are outside any proposed remediation area. Limited indirect impacts could occur from soil disturbance caused by personnel and equipment access and wind and water erosion. These localized impacts would be temporary and would be reduced by measures including pre-remediation surveys, identification of access routes, biological monitors, and soil stabilization and restoration techniques. Aquatic and wetland habitats that cannot be avoided would be directly impacted. Following cleanup, onsite drainages would be restored by revegetation of exposed soil surfaces to the extent feasible. At a minimum, a 1:1 replacement is expected for any ephemeral stream impacted from the proposed activities. USACE would have the final determination of compensation as part of the permitting process under Section 404 of the Clean Water Act.

Indirect impacts to aquatic and wetland habitats and associated biota, including jurisdictional Waters of the U.S., could occur from erosion and movement of sediment or soil. In addition, migration of sediment or pollutants during cleanup could impact wetlands and vernal pool habitats and biota. As described in Section 4.3, BMPs and mitigation measures implemented to protect surface water resources during soil removal and until restoration, or other means of stabilizing soils, would also protect aquatic and wetland habitats and biota from runoff and erosion. Therefore, no substantial indirect impacts to aquatic and wetland habitats and biota are expected.

4.5.1.2.3 Threatened, Endangered, and Rare Species

Soil would be removed from most of Area IV outside the proposed exemption areas and in some locations in the NBZ. Restricting the scope of removal activities within the proposed exemption areas, as described below, would reduce direct impacts on federally or state-listed and other special-status species, as well as critical habitat for Braunton's milk-vetch and California red-legged frog, though the disturbance caused by vegetation and soil removal surrounding the proposed exemption areas would be profound and could impact any sensitive species outside the proposed exemption areas.

Remediation within the proposed exemption areas would occur via focused removal actions. Depending on the characteristics of the material being remediated, such as its depth and extent, some removals may involve intense localized disturbance. Impacts within the proposed exemption areas would thus be less severe and extensive, and restoration would be more feasible than in areas remediated to AOC LUT values.

Access routes or work areas associated with soil removal actions could directly impact and damage individuals or habitat of listed plant species, although there would be flexibility in determining access routes to minimize damage. Critical habitat for Braunton's milk-vetch and California red-legged frog could also be impacted. The removal or damage to individual plants or habitat of a federally or state-listed species or rare species would be considered an adverse impact. These potential impacts could be minimized through implementation of pre-construction surveys, identification of access routes, protection or removal of individuals (as appropriate) prior to soil removal and restoration or transplanting of species, and the presence of biological monitors.

The alternative could cause indirect impacts to existing sensitive plant and wildlife habitats and critical habitat through the introduction of invasive non-native plant species where ground surfaces are disturbed, providing opportunities for invasive non-native plant species to establish and move into adjacent, undisturbed native habitats. Minimizing the spread of non-native species could reduce impacts to sensitive species and habitats. This would be done through development and implementation of an agency-approved invasive species/weed management plan, employing a combination of approaches to minimize entry of invasives onto the site, minimize their spread, and establish self-sustaining native vegetation communities resistant to weed invasion. Specific techniques would include power-washing earthmoving equipment prior to entry to Area IV, hand removal of invasives, mowing or trimming to reduce seed set, and control of invasives along roadsides and within imported backfill (see Chapter 6).

The designation of the proposed exemption areas minimizes direct and indirect impacts to special-status plants and wildlife species; however, there is the potential for temporary indirect impacts to special-status plant species resulting from dust and debris being scattered and becoming airborne, despite measures to minimize dust generation. The extent of dust disturbance would depend on factors including local soil characteristics, topography, presence of vegetation, and weather conditions. Dust deposits may affect essential plant processes, including photosynthesis, respiration, and transpiration; dust also may cause increased incidence of plant pests and diseases (Farmer 1993). Indirect impacts would likely be localized, and any sensitive plant species located adjacent to or downwind of soil removal areas would likely recover quickly. Overall, potential indirect impacts on federally or state-listed and special-status plant and animal species or their habitats would be temporary and short-term. Restricting nonessential equipment and personnel access to soil remediation areas; using existing disturbed areas where feasible for access roads and laydown areas; restoring disturbed areas; and using BMPs to reduce dust, erosion, and sedimentation would reduce potential indirect impacts to special-status species or their habitat.

Section 7 Consultation with USFWS under the ESA and consultation with CDFW under CESA is required and is underway. Informal consultation between DOE, USFWS, and CDFW has been ongoing since 2009 in face-to-face meetings and telephone conferences and a biological assessment is being prepared for submittal to both agencies (see Appendix E). Further analysis of potential impacts on sensitive species and habitats is required. A biological assessment addressing the requirements of Section 7 is in preparation for submission to USFWS in support of the consultation and a Biological Opinion from USFWS would be incorporated in the final EIS. Implementing the impact avoidance, minimization, and species conservation measures summarized in this EIS and identified through the consultations would further reduce impacts on sensitive species.

4.5.1.3 Cleanup to Revised LUT Values Alternative

4.5.1.3.1 Vegetation and Wildlife Habitat and Biota

Under the Cleanup to Revised LUT Values Alternative, much less vegetation removal and ground disturbance would occur because the areas where chemicals exceed revised LUT values are much more localized than the areas exceeding AOC LUT values. About 40 acres of vegetation and wildlife habitat would be removed outside the proposed exemption areas, or 8 percent of the habitat of Area IV and the NBZ. About 17 acres of relatively undisturbed native habitat including coast live oak woodland and northern mixed chaparral would be affected by remediation outside the proposed exemption areas.

The Cleanup to Revised LUT Values Alternative would have qualitatively similar impacts to those under the Cleanup to AOC LUT Values Alternative, but would impact much less vegetation and soil. In addition, restoration and revegetation would be facilitated because the areas to be remediated are individually relatively small and islands of unexcavated vegetation and soil would exist between excavated areas, providing more-ready dispersal of plants and soil micro-organisms, including beneficial species. Nesting birds protected under the MBTA could be impacted if nesting attempts are disrupted by project activities as described under the Cleanup to AOC LUT Values Alternative. Substantial direct and indirect impacts would occur on vegetation and wildlife habitat as described in Section 4.5.1.2.1 for the Cleanup to AOC LUT Values Alternative, but the impacts would be much less extensive. With implementation of habitat restoration and revegetation measures, as well as measures to reduce or avoid impacts on wildlife, including nesting birds, as described in Chapter 6, impacts would be reduced, but would remain substantial given the degree of habitat loss and the length of time required to restore vegetation, habitat function and wildlife populations.

4.5.1.3.2 Aquatic and Wetland Habitats and Biota

Figure 4–7 illustrates areas projected for remediation under the Cleanup to Revised LUT Values Alternative, as well as locations of aquatic features including wetlands, potential jurisdictional Waters of the U.S., and other drainage features. Soil removal would directly impact about 0.4 acres of wetland habitats and aquatic features outside of the proposed exemption areas:

- Jurisdictional Wetlands – 0.02 acres (the SRE wetland near Outfall 4);
- Jurisdictional Waters of the U.S. – 0.22 acres, 4,275 linear feet (natural ephemeral streams); and
- Non-jurisdictional Waters of the U.S. – 0.14 acres, 3,421 linear feet (man-made asphalt-lined, concrete-lined, and unlined drainage ditches).

There would be generally similar impacts to those described under the Cleanup to AOC LUT Values Alternative, but the area of drainages affected would be about 55 percent less than that under this alternative. Direct impacts to the Building 4056 excavation wetland and vernal pools within the proposed exemption areas would be avoided to the extent feasible. As under the previous action alternative, implementation of BMPs and mitigation measures, including those that would protect surface water resources, would avoid or reduce potential indirect impacts.

4.5.1.3.3 Threatened, Endangered, and Rare Species

Impacts on federally or state-listed species and other special-status species, as well as critical habitat for Braunton's milk-vetch, would be qualitatively similar to those under the Cleanup to AOC LUT Values Alternative, because most individuals of these species are contained within the proposed exemption areas, which are applicable under all three soil remediation action alternatives.

As described in Section 4.5.1.2.3, remediation within the proposed exemption areas would occur via focused removal actions, so that direct and indirect impacts within the proposed exemption areas would be less severe and extensive and restoration would be more feasible. Indirect impacts associated with personnel and equipment and the potential for invasive plant species to spread into areas supporting native vegetation would be qualitatively similar to those under the Cleanup to AOC LUT Values Alternative, but reduced in magnitude. Impacts may be further reduced by implementing the mitigation measures discussed in Section 4.5.1.2.3.

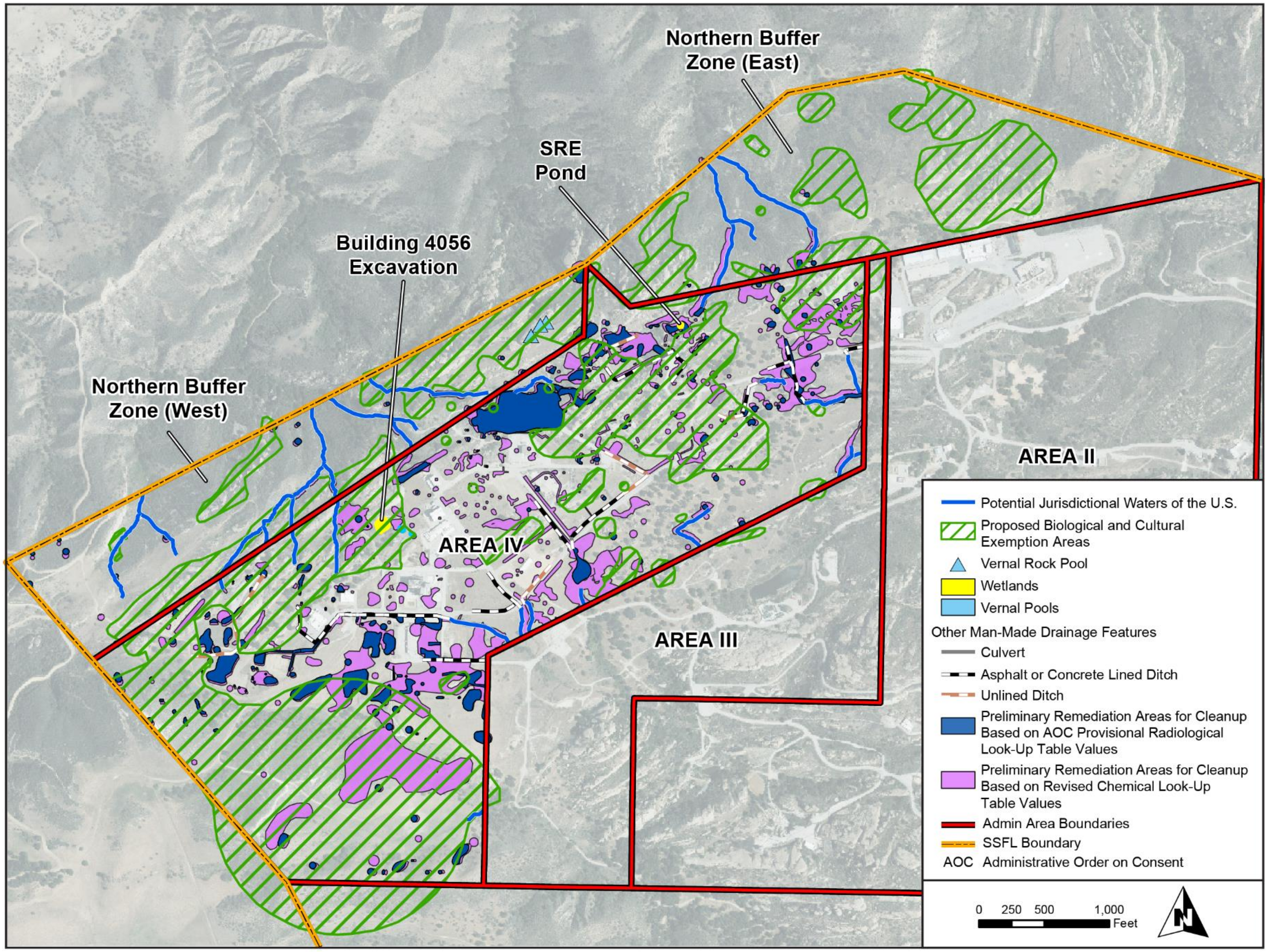

Figure 4–7 Impacts to Wetlands and Waters of the U.S. under the Cleanup to Revised LUT Values Alternative

4.5.1.4 Conservation of Natural Resources Alternative

4.5.1.4.1 Vegetation and Wildlife Habitat and Biota

Under the Conservation of Natural Resources Alternative, much less vegetation removal and ground disturbance would occur because the areas where chemicals and radionuclides would exceed risk-assessment-based values are much more localized than the areas exceeding AOC LUT values. About 32 acres of vegetation and wildlife habitat would be removed outside the proposed exemption areas, or 7 percent of the habitat of Area IV and the NBZ. About 13 acres of relatively undisturbed native habitat including coast live oak woodland and northern mixed chaparral would be affected outside the proposed exemption areas.

The Conservation of Natural Resources Alternative would have qualitatively similar impacts as those under the Cleanup to AOC LUT Values Alternative, but would impact much less vegetation and soil. In addition, restoration and revegetation would be facilitated because islands of unexcavated vegetation and soil would exist between excavated areas, providing more-ready dispersal of plants and soil micro-organisms, including beneficial species. Nesting birds protected under the MBTA could be impacted if nesting attempts are disrupted by project activities as described under the Cleanup to AOC LUT Values Alternative. Substantial direct and indirect impacts would occur on vegetation and wildlife habitat as described in Section 4.5.1.2.1 for the Cleanup to AOC LUT Values Alternative, but the impacts would be much less extensive. With implementation of habitat restoration and revegetation measures, as well as measures to reduce or avoid impacts on wildlife, including nesting birds, as described in Chapter 6, impacts would be reduced, but would remain substantial given the degree of habitat loss and the length of time required to restore vegetation, habitat function and wildlife populations.

4.5.1.4.2 Aquatic and Wetland Habitats and Biota

Areas projected for remediation under the Conservation of Natural Resources Alternative are similar to those under the Cleanup to Revised LUT Values Alternative, which are depicted in Figure 4–7 along with locations of aquatic features including wetlands, potential jurisdictional Waters of the U.S., and other drainage features. Soil removal would directly impact about 0.4 acres of wetland habitats and aquatic features outside the proposed exemption areas:

- Jurisdictional Wetlands – 0.02 acres (the SRE wetland near Outfall 4);
- Jurisdictional Waters of the U.S. – 0.19 acres, 3,544 linear feet (natural ephemeral streams); and
- Non-jurisdictional Waters of the U.S. – 0.14 acres, 3,421 linear feet (man-made asphalt-lined, concrete-lined, and unlined drainage ditches).

Impacts would be similar to those under the Cleanup to AOC LUT Values Alternative, but the area of natural ephemeral drainages affected would be about 48 percent of that under this alternative. Direct impacts to the Building 4056 excavation wetland and vernal pools within the proposed exemption areas would be avoided to the extent feasible. As under the previous two action alternatives, implementation of BMPs and mitigation measures, including those that would protect surface water resources, would avoid or reduce potential indirect impacts.

4.5.1.4.3 Threatened, Endangered, and Rare Species

Impacts on federally or state-listed species and other special-status species, as well as critical habitat for Braunton's milk-vetch, would be qualitatively similar to those under the Cleanup to AOC LUT Values Alternative because most individuals of these species are contained within the proposed exemption areas, which are applicable for all three soil remediation alternatives.

As described in Section 4.5.1.2.3, remediation within the proposed exemption areas would occur via focused removal actions, so that direct and indirect impacts within the proposed exemption areas would be less severe and extensive and restoration would be more feasible. Indirect impacts associated with personnel and equipment and the potential for invasive plant species to spread into areas supporting native vegetation would be qualitatively similar to those under the Conservation of Natural Resources Alternative but reduced in magnitude. To the extent feasible, impacts would be minimized through pre-soil-removal surveys, protection or removal of individuals before soil removal, and restoration or transplanting of species. Impacts may be further reduced by implementing the mitigation measures discussed in Section 4.5.1.2.3.

4.5.2 Building Demolition Alternatives

Impacts under the building demolition alternatives are summarized and compared in **Table 4–27**.

Table 4–27 Biological Resources Impacts under the Building Demolition Alternatives

Resource	*Building No Action Alternative*	*Building Removal Alternative*
Vegetation and wildlife habitat and biota	No adverse impacts are expected.	No measureable loss of native plant and wildlife communities would occur, although habitat could be lost for native wildlife species (e.g., birds and bats) using the buildings for roosting or nesting, and potential disturbance of MBTA-protected species if present in the buildings and nesting. There would be offsetting beneficial impacts on native wildlife from elimination of habitat for nuisance species and creation of restored habitat after buildings are removed. If backfill is substantially different from that before development of Area IV, it may not support restoration of vegetation similar to that previously present.
Aquatic and wetland habitats and biota	No adverse impacts are expected.	Wetlands or jurisdictional Waters of the U.S. would not be directly impacted. Existing drainage structures and impervious surfaces may be removed, but replaced by more natural drainage patterns. Indirect impacts from runoff would be minimized by use of BMPs and mitigation measures.
Threatened, endangered, and rare species	No adverse impacts are expected.	Impacts on special-status animal species or their habitats would be short-term, may be mitigated or avoided, and would be unlikely to result in take of listed wildlife species. Impacts on individuals of the Santa Susana tarplant could occur if they are established next to buildings at the time that demolition occurs. No other special status plant species are likely to be impacted because none have been observed or would be expected in the already disturbed areas adjacent to the buildings to be removed.

BMP = best management practice; MBTA = Migratory Bird Treaty Act.

4.5.2.1 Building No Action Alternative

4.5.2.1.1 Vegetation and Wildlife Habitat and Biota

DOE buildings would remain in place, and no additional impacts on vegetation and wildlife would occur. Native species (such as songbirds and bats) would continue to use the buildings, and weedy plants and nuisance wildlife species (such as starlings, pigeons, and non-native rodents) would continue to occur in or around the buildings.

4.5.2.1.2 Aquatic and Wetland Habitats and Biota

There would be no changes to existing Area IV drainage and no additional impacts on aquatic and wetland habitats and biota.

4.5.2.1.3 Threatened, Endangered, and Rare Species

There would be no changes to existing vegetation and wildlife habitat and no impacts on federally or state-listed and special-status plant and animal species or their habitats.

4.5.2.2 Building Removal Alternative

4.5.2.2.1 Vegetation and Wildlife Habitat and Biota

Ground-disturbing activities from building removal would cause direct impacts on plant and wildlife communities within the disturbed area for each building. However, these impacts would be minimal; following removal, the areas would be revegetated.

Because Area IV buildings have not been investigated for wildlife use, the extent to which the buildings are used by bat or bird species is not known. However, there have been incidental observations of nesting by native bird species such as American kestrel, house finches, and sparrows; use by owls and raptors is likely. Impacts on oak trees and sandstone outcrops that may provide habitat for listed species and occur nearby certain buildings would be avoided where feasible. Building removal would result in direct, temporary impacts on these species and habitats. Impacts may be reduced through measures such as pre-demolition surveys, timing of demolition phases to avoid impacts on bats and nesting bird species covered by the MBTA, or measures to humanely remove species from buildings[10] and prevent their reentry during demolition (see Chapter 6). Overall, removing buildings that provide habitat for nuisance species and replacing them with habitat for native species would be more beneficial to the long-term overall ecological health of Area IV than would loss of these structures for use by native bat and bird species.

Building removal would disturb about 8.4 acres, and removal of some buildings with subgrade vaults would leave holes requiring backfilling. A source is needed for soil for backfilling and resurfacing of the remediated areas for revegetation. The nature of the backfill (geologic parent material, texture, etc.) will partially determine the type of vegetation the site will support. If the soil is substantially different than that originally present, it may not support restoration of vegetation similar to that present before development of Area IV.

4.5.2.2.2 Aquatic and Wetland Habitats and Biota

There would be minimal impacts on aquatic and wetland habitat and biota. Demolition and re-grading would not directly impact potential USACE jurisdictional wetlands, other Waters of the U.S., or vernal pools. Impacts would be restricted to removal of man-made drainage ditches, culverts, and impervious areas such as paved lots. In most areas, the ditches surrounding the buildings were installed to direct runoff from buildings and pads. Because the ditches are in upland habitat, USACE may or may not assert jurisdiction over these features (concurrence from USACE is required). Removal of the ditches and subsequent re-grading and restoration to natural conditions would have minimal impacts on natural drainage in Area IV and NBZ. If re-graded contours were such that erosion was a concern, then drainage features would be configured to minimize runoff thereby minimizing the potential for erosion. Because there would be no direct impacts on jurisdictional wetlands or Waters of the U.S. or aquatic and wetland habitats or biota, no mitigation would be needed (confirmation from USACE and the Los Angeles Regional Water Quality Control Board is required).

The alternative could indirectly impact aquatic and wetland habitat and biota due to movement of sediment or potential contaminants into surface waters. In addition, the inadvertent release of sediment or pollutants into vernal pool habitats could affect these habitats and aquatic biota. For example, relatively small amounts of sediment could alter the natural topography of the vernal pool features and affect the hydrologic regime; additionally, sediment and pollutants could cause mortality

[10] For example, inducing perching birds to leave by human activity in proximity to the birds.

to fairy shrimp cysts and adults. However, as described in Section 4.3, implementing BMPs and mitigation measures to protect surface water would reduce the potential for indirect impacts from runoff, sedimentation, and erosion. In addition, use of existing disturbed areas to the extent feasible to support building removal, designated biologist-approved access routes, and other possible measures would further reduce impacts. Therefore, no substantial impacts are expected on aquatic and wetland habitats and biota.

4.5.2.2.3 Threatened, Endangered, and Rare Species

There could be direct and indirect impacts on federally or state-listed and other special-status species that occur in buildings or their vicinities. Direct impacts include the mortality of individuals or removal of sensitive plant or wildlife species habitat. Critical habitat for the Braunton's milk-vetch (Figure 3–22) or California red-legged frog (Figure 3–23) is not located in or near the building removal areas; thus, there would be no impacts on critical habitat for these species. The extent to which Area IV buildings are used by other federally or state-listed and other special-status species has not been investigated; however, the Santa Susana tarplant has been commonly observed by the EIS preparers in the cracks of paved areas near sandstone outcrops in the SRE area and other locations, and thus could occur adjacent to the buildings to be removed. No other sensitive plant species have been observed or would be expected in the already highly disturbed habitat adjacent to the buildings to be removed. The removal or damage to individuals or habitat of a federally or state-listed species or rare species would be considered a substantial adverse impact. In addition, sensitive wildlife species such as the Townsend's big eared bat (a candidate for state listing under the CESA) and birds protected under the MBTA may use the structures for shelter or nesting.

Where feasible, impacts to listed species (including the Santa Susana tarplant and Townsend's big eared bat) and habitat (including oak trees and sandstone outcrops) potentially supporting listed species, would be minimized or compensated through measures developed in consultation with CDFW and USFWS. These measures could include pre-demolition surveys; scheduling building demolition outside the nesting season; restricting nonessential equipment and personnel access to affected areas; use of existing disturbed areas for access roads and laydown areas; and restoration or transplantation of species such as the Santa Susana tarplant. Successful tarplant re-establishment has occurred in other areas of SSFL.

Indirect impacts could occur from noise, dust, and the presence of equipment and personnel associated with building demolition. However, these impacts would likely be localized and temporary, and species would generally avoid such activities. The most likely response from wildlife in the vicinity of a building would be temporary movement to another area. Indirect impacts to existing sensitive plant and wildlife habitats and critical habitat could result from disturbed ground surfaces that provide opportunities for invasive non-native plant species to establish and move into adjacent, undisturbed native habitats. Minimizing the spread of non-native species would reduce impacts.

Overall, potential impacts on special-status animal species or their habitats would be temporary and short-term, could be mitigated or avoided, and would be unlikely to result in take of listed wildlife species. In addition, the removal of the buildings followed by native habitat restoration would have long-term beneficial impacts by removing habitat for nuisance species and replacing it with habitat capable of supporting sensitive wildlife species. Adverse impacts on individuals of the Santa Susana tarplant could occur if they are established next to buildings at the time that demolition occurs.

4.5.3 Groundwater Remediation Alternatives

Impacts under the groundwater remediation alternatives are summarized and compared in **Table 4–28**.

Table 4–28 Biological Resources Impacts under the Groundwater Remediation Alternatives

Resource	*Groundwater No Action Alternative*	*Groundwater Monitored Natural Attenuation Alternative*	*Groundwater Treatment Alternative*
Vegetation and wildlife habitat and biota	Minor adverse impacts on vegetation and wildlife habitat and biota would occur from groundwater monitoring operations.	Five new monitoring wells would be installed. Because these wells would be installed generally in previously disturbed areas, impacts on vegetation and wildlife habitat and biota from periodic groundwater sampling would be minor and localized.	Impacts would be larger than those under the Groundwater Monitored Natural Attenuation Alternative, but nonetheless localized and minor. Installation of groundwater treatment units would generally be in previously disturbed habitats, with localized and minor impacts. Assuming sandstone bedrock containing strontium-90 source is removed, up to 0.25 acres of previously disturbed land near RMHF would be affected.
Aquatic and wetland habitats and biota	No adverse impacts are expected.	No adverse impacts are expected.	No adverse impacts are expected.
Threatened, endangered, and rare species	No adverse impacts are expected.	If a monitoring well is installed in a proposed exemption area, BMPs and mitigation measures would avoid or minimize adverse impacts of well installation and monitoring on threatened, endangered, and rare species. No adverse impacts on these species are expected from monitoring activities outside the proposed exemption areas.	Potential impacts on threatened, endangered and rare species would be minimal as described under the Groundwater Monitored Natural Attenuation Alternative.

BMP = best management practice; RMHF = Radioactive Materials Handling Facility.

4.5.3.1 Groundwater No Action Alternative

4.5.3.1.1 Vegetation and Wildlife Habitat and Biota

Under the Groundwater No Action Alternative, groundwater monitoring would continue in accordance with the 2007 CO (DTSC 2007). Over time, radiological and chemical constituents would be gradually reduced through natural attenuation.

This alternative would have minimal adverse impacts on vegetation and wildlife habitat. Groundwater monitoring wells already exist, and vegetation and wildlife habitat in their vicinity, including access routes, have previously been disturbed by well installation and periodic sampling activities. Personnel and equipment accessing the wells would temporarily disturb wildlife in the local area and have short-term, minor, and localized impacts on vegetation. The vegetation in the vicinity of the monitoring wells and access routes would be mowed, pruned, or trimmed for personnel safety and to reduce wildfire ignition hazard, a continuation of current practice. Impacts may be reduced by implementation of mitigation measures, as discussed in Chapter 6.

4.5.3.1.2 Aquatic and Wetland Habitats and Biota

No adverse impacts on aquatic and wetland habitats or biota are expected under the Groundwater No Action Alternative because periodic monitoring would be a low-intensity activity using existing wells and access routes and would lack physical effects on aquatic or wetland habitats.

4.5.3.1.3 Threatened, Endangered, and Rare Species

No adverse impacts on federally or state-listed and special-status plant and animal species or their habitats are expected under the Groundwater No Action Alternative because periodic monitoring would be a low-intensity activity using existing wells and access routes and would not disturb previously undisturbed habitat likely to support threatened, endangered, and rare species.

4.5.3.2 Groundwater Monitored Natural Attenuation Alternative

4.5.3.2.1 Vegetation and Wildlife Habitat and Biota

Under the Groundwater Monitored Natural Attenuation Alternative, five additional monitoring wells would be installed, generally in accessible, previously disturbed habitat, resulting in localized and short-term impacts on vegetation and wildlife. These impacts would be minimized by pre-installation surveys, avoidance of undisturbed native habitat and nesting birds, monitoring and treatment for invasive species, and revegetation. Impacts on vegetation and wildlife habitat would be localized and short-term and, with implementation of mitigation measures, these impacts would be reduced.

Plumes would be monitored for 10 to 150 years, depending on the plume, to verify that constituents are decaying or degrading as projected. Current monitoring activities may be augmented. Groundwater monitoring would have minimal, localized adverse impacts on vegetation and wildlife habitat.

4.5.3.2.2 Aquatic and Wetland Habitats and Biota

No adverse impacts to aquatic and wetland habitats or biota are expected under the Groundwater Monitored Natural Attenuation Alternative, including installation of new monitoring wells. This is due to the scarcity of wetland and aquatic habitat on site, the infrequent, low intensity nature of the activity, the use of existing wells and access routes, and the likely placement of new wells in accessible, previously disturbed habitat as well as the implementation of BMPs and mitigation measures that would allow work crews to avoid impacts on wetland and aquatic habitat.

4.5.3.2.3 Threatened, Endangered, and Rare Species

In the unlikely event that a monitoring well is installed in a proposed exemption area, adverse impacts on threatened, endangered, and rare species would be avoided or minimized through use of BMPs and mitigation measures. The biological assessment currently in preparation for Federal and state endangered species act consultation coupled with the Biological Opinion will address these actions and identify appropriate impact avoidance and species protection measures. As under the Groundwater No Action Alternative, no adverse impacts are expected on federally or state-listed and special-status plant and animal species or their habitats.

4.5.3.3 Groundwater Treatment Alternative

4.5.3.3.1 Vegetation and Wildlife Habitat and Biota

Under the Groundwater Treatment Alternative, groundwater may be treated through a variety of methods, as determined pursuant to the 2007 CO (DTSC 2007) and RCRA requirements. Treatment methods are assumed to generally involve installation and operation of localized pumps and treatment units near existing wellheads. Treatment options involving dewatering would include extraction and treatment of groundwater and disposition in an environmentally safe manner, in compliance with permit conditions.

Remedial measures for the RMHF strontium-90 source may require groundwater level manipulation by active pumping to lower the water table; re-injection to raise the water table is another potential groundwater remediation technology. These measures would involve somewhat more-intensive surface disturbance within a limited area and would have short-term impacts on vegetation and wildlife habitat. The RMHF strontium-90 source could also be treated by excavation of bedrock. This would require excavation and stockpiling of backfill placed from a prior removal action. Slightly less than 0.1 acres of area would be excavated, and an additional area would be required to stage equipment and stockpile the backfill. In total, up to 0.25 acres may be affected, although the previously disturbed condition of the affected area would reduce the overall impacts to wildlife habitat. Dust generation would be controlled. Impacts would be further reduced with implementation of mitigation measures, including pre-project surveys, seasonal avoidance of nesting birds or maintaining adequate setbacks from nests, revegetation and habitat restoration, and monitoring and treatment of invasive species.

Groundwater treatment would have minor, localized, and short- to medium-term (up to several years) impacts on vegetation and wildlife habitat. Groundwater treatment units, piping, and pumps would generally be located in previously disturbed areas that are not vegetated or are occupied by weed-dominated herbaceous vegetation and wildlife habitat. Implementing protective measures, including having a qualified biologist assist with siting of units, pumps, and piping, would enable impact avoidance or reduction. Some plumes may be subject to monitored natural attenuation with enhancements such as adding oxidants to encourage the chemical attenuation process. The addition of the enhancements would not adversely impact vegetation and wildlife habitat.

4.5.3.3.2 Aquatic and Wetland Habitats and Biota

Groundwater treatment for most plumes would include localized ground disturbance, mostly in previously disturbed areas, so that impacts to aquatic and wetland habitats and biota would be avoided or minimized.

Remediation technologies for the RMHF strontium-90 bedrock source may include groundwater level manipulation by active pumping to lower the water table or re-injection to raise the water table (see Section 4.4.3.3). Assuming this remediation technology is implemented, direct impacts on aquatic and wetland resources may be avoided by measures such as conducting pre-activity surveys, designating access routes and work areas to minimize impacts on intermittent drainages, and restricting equipment and personnel to designated work areas. Groundwater manipulation that lowers the water table at the contaminated bedrock site is not expected to affect the two wetlands whose hydrology depends partially on the groundwater table (SRE wetland near Outfall 4 or the Building 40565 excavation wetland) because of lack of proximity of the contaminated bedrock site to either wetland. Vernal pools depend on surface water and would be unaffected by groundwater manipulation. Therefore, no adverse impacts are expected on aquatic and wetland habitats or biota.

4.5.3.3.3 Threatened, Endangered, and Rare Species

Assuming bedrock is removed to address the strontium-90 source at RMHF, up to 0.25 acres of previously disturbed habitat would be affected during activities such as excavation, stockpiling of excavated material, and operation of equipment. Groundwater treatment for plumes would include localized ground disturbances, generally in previously disturbed areas and would likely avoid impacts on federally or state-listed and special-status plant and animal species or their habitats. Impacts on threatened, endangered, or rare species would be avoided by measures such as conducting pre-activity surveys, designating access routes and work areas to avoid impacts on sensitive species, and restricting equipment and personnel to designated work areas (see Section 4.5.1.2.3 and Chapter 6).

4.5.4 Biological Resources Impacts under All Action Alternative Combinations

The High Impact Combination would have the largest overall impacts. Although the soil remediation action alternatives would each have substantial impacts on biological resources, the largest impacts would occur under the Cleanup to AOC LUT Values Alternative. Vegetation and wildlife habitat would be removed from about 130 acres of land outside the proposed exemption areas, including about 51 acres of relatively undisturbed native habitat, including coast live oak woodland, northern mixed chaparral, and Venturan coastal scrub. This activity would cause profound disturbance to affected areas and would require a substantial, focused, and prolonged effort to achieve revegetation and restoration of habitat, including replacement of removed soil with soil similar in parent material, texture, and nutrient status; collection and propagation of native plants including oaks and shrubs; and several years of maintenance, weed control, and monitoring until the vegetation is self-sustaining.

Building removal would occur in previously disturbed habitats with low to moderate impacts on biological resources. Native species of birds and bats that roost or nest in the buildings would lose these sites when the buildings are removed. However, direct impacts on nesting or roosting species could be avoided or minimized through a combination of seasonal timing of demolition activities to avoid seasons when nesting is occurring, measures to humanely haze the individuals under the buildings prior to demolition (e.g., by human activity in proximity to perching birds, inducing them to leave), and measures to prevent their reentry until demolition is complete. If listed species such as Santa Susana tarplant have established in proximity to buildings, direct impacts could be minimized by surveys and avoidance where possible. (No other sensitive plant species are expected in the approximately 8.4 acres of highly disturbed habitat adjacent to the buildings to be removed.) Unavoidable impacts to individual tarplants could be mitigated by salvage of seed, propagation, and replanting as part of restoration activities following demolition.

Compared to the Groundwater Monitored Natural Attenuation Alternative, there would be greater surface disturbance under the Groundwater Treatment Alternative through the assumed emplacement and operation of treatment units and excavation of bedrock; however, impacts on threatened, endangered, or rare species would likely be avoidable due to the localized nature of the activities, the small areas affected, and the proximity of well sites to existing access roads and disturbed areas. If both groundwater remediation action alternatives were implemented, the amount of surface disturbance would be essentially the same as that for implementing the Groundwater Treatment Alternative alone.

The Low Impact Combination would have the smallest overall impacts. The Conservation of Natural Resources Alternative would remove vegetation and wildlife habitat from about 32 acres outside the proposed exemption areas, which is about 25 percent of the acreage that would be disturbed under the Cleanup to AOC LUT Values Alternative and 8 acres less than the area that would be disturbed under the Cleanup to Revised LUT Values Alternative. The Conservation of Natural Resources Alternative would have far fewer impacts on vegetation and wildlife habitat and biota, wetland and aquatic habitats and biota, and endangered, threatened, or rare species than the Cleanup to AOC LUT Values Alternative, and also fewer impacts than the Cleanup to Revised LUT Values Alternative. Impacts under the Building Removal Alternative have been summarized above. Impacts on these resources under the Groundwater Monitored Natural Attenuation Alternative would be smaller than those under the Groundwater Treatment Alternative, but either groundwater action alternative would have comparatively low impacts on biological resources, and the differences among the groundwater action alternatives in terms of biological impacts are modest.

4.5.5 Impact Threshold Analysis

For biological resources regulated under the ESA, the impact threshold would include adverse modification of critical habitat, impacts on wildlife species reaching the level of "take," or substantial impacts on listed plant species or their habitat. Each of these conditions would trigger the need for a biological assessment and consultation between DOE and USFWS. For jurisdictional wetlands and waters regulated under the Clean Water Act, the impact threshold would be impacts on jurisdictional wetlands or waters sufficient to trigger regulatory mitigation requirements in addition to *in situ* restoration through the Section 404 Clean Water Act permit process. For biological resources lacking specific regulatory thresholds, the impact threshold would center on the intensity of the impact and its context. Mitigation would be developed partially in consultation with USFWS, CDFW, and USACE, who oversee compliance with ESA, CESA, and the Clean Water Act, respectively.

Whether or not thresholds related to the ESA and Clean Water Act would be exceeded depends in part on the regulatory process and the final determination of activities that would be conducted in the proposed exemption areas. It is possible that thresholds related to those resources may not be exceeded due to the extent the resources (endangered, threatened, or rare species, wetlands, vernal pools) have been incorporated in the proposed exemption areas, where remediation impacts would be minimized.

For biological resources lacking specific regulatory thresholds (e.g., vegetation and wildlife habitat), thresholds would be exceeded as a result of soil remediation under the Cleanup to AOC LUT Values Alternative because of the large area affected and the profound habitat alteration that would occur. Mitigation could reduce these impacts, but not below threshold levels. The profound soil disturbance caused by remediation under these alternatives will require sustained effort and special measures to accomplish restoration of a self-sustaining native vegetation cover. The Cleanup to Revised LUT Values and Conservation of Natural Resources Alternatives would affect considerably less acreage, and considerably less soil would be replaced to achieve restoration, increasing the feasibility and likelihood of successful habitat restoration.

As discussed in Section 4.2.1.2, sources of suitable backfill have not been identified and it appears unlikely that a source of backfill meeting chemical AOC LUT values can be found. As noted in Chapter 2, Section 2.3.2, if a source of backfill that meets all of the AOC LUT values under the Cleanup to AOC LUT Values Alternative cannot be reasonably found, then DTSC, DOE, and EPA would enter into a consultation process, and DTSC would determine the best available source of backfill (DTSC 2010a). If backfill is substantially different than that originally present, it may not support vegetation similar to that present before development of Area IV. DOE has not identified and evaluated potential sources of backfill to determine if the backfill would meet chemical and radionuclide concentration values consistent with risk-based values under the Cleanup to Revised LUT Value or Conservation of Natural Resources Alternative. Because the allowable constituent concentrations in backfill under these two alternatives would generally be higher than chemical AOC LUT values, DOE expects that finding acceptable sources of backfill would be more likely.

With mitigation, the impacts under the Building Removal Alternative and groundwater remediation action alternatives would not exceed impact thresholds.

4.6 Air Quality and Climate Change

This section addresses the potential impacts on air quality and climate change that could result from implementing the alternatives.

Impact Assessment Methodology

Proposed activities include the use of fossil fuel-powered, off-road construction equipment, on-road heavy-duty trucks, and worker commuter vehicles generating combustive emissions. Equipment and vehicles that are performing earthmoving and demolition activities on unpaved and paved surfaces would also generate fugitive dust (particulate matter less than 2.5 microns in diameter [$PM_{2.5}$] and particulate matter less than 10 microns in diameter [PM_{10}]) emissions). Equipment and trucking usages and scheduling assumptions needed to estimate emissions are documented in the *Environmental Impact Statement for Remediation of Area IV and the Northern Buffer Zone of the Santa Susana Field Laboratory – Air Emissions Calculation Methods* (Leidos 2015).

Several offsite facilities were evaluated for the recycle or disposal of materials or waste from SSFL. To present a range of impacts that could occur from transporting materials and waste by truck to these facilities, emissions were determined for transport to both the nearest (nearby) and furthest (distant) facility evaluated for each type of material or waste. As an example, it was assumed that hazardous waste would be trucked to either the Buttonwillow Landfill in California or US Ecology in Idaho. Emissions also were determined due to the trucking of equipment, supplies, and backfill to or from SSFL.

Due to the extensive area affected by emissions from the proposed activities, the analysis focused on the potential for impacts within three main domains: (1) Ventura County and the area directly adjacent to SSFL, which are within the South Central Coast Air Basin; (2) the South Coast Air Basin, which includes most of Los Angeles County; and (3) regions beyond Ventura County and the South Coast Air Basin (see Chapter 3, Figure 3–24, for the locations of SSFL, Ventura County, and the South Coast Air Basin). The third domain spans several air basins and jurisdictional agencies, and its extent depends on the routes taken by trucks hauling waste between SSFL and offsite disposal facilities. The analysis considered the air quality conditions and jurisdictional agencies that are distinct to each domain.

The analysis used the following models and analytical procedures to estimate emissions:

- the California Air Resources Board EMFAC2014 emissions model for on-road trucks and worker commuter vehicles (ARB 2014c);
- the California Air Resources Board OFFROAD2011 emissions model for off-road equipment (ARB 2015b);
- the EPA AP-42 document for dust generated from movement of vehicles on unpaved surfaces and roads and handling of soil (EPA 2006a, 2006b, 2011); and
- the California Emission Estimator Model for dust generated from building demolition (Environ 2013).

Emissions from equipment and vehicle fleets were based on California average fleets for years 2017 and 2019. This approach accounted for the projected evolution of the average truck fleet to newer and lower-emitting models in compliance with EPA regulations, including the "2007 Highway Rule."[11] The analysis conservatively estimated emissions for proposed activities initially assumed 2017 fleet emission factors and then assuming 2019 fleet emission factors for activities lasting longer than 2 years.

[11] Information about the EPA's 2007 Highway Rule is provided in "Heavy-Duty Highway Diesel Program" at http://www.epa.gov/oms/highway-diesel/.

It was assumed that DOE would implement protective measures to minimize the generation of combustive emissions and fugitive dust. For example, it was assumed for analysis that DOE's implementation of these measures would reduce fugitive dust emissions (PM_{10} and $PM_{2.5}$) from active disturbed areas by 74 and 50 percent, respectively, from uncontrolled conditions (Countess Environmental 2006). Chapter 6 includes details of the air quality protection measures assessed in this EIS.

Although the projections of emissions from equipment and vehicle fleets in this section were based on the above assumptions, DOE would implement green cleanup methodologies to minimize air pollutants and greenhouses gases (GHGs). In particular, DOE would implement use of green fleets as part of Mitigation Measure AQ-1 (see Chapter 6, Section 6.2). Emissions from use of these green fleets were determined in accordance with the following (see Attachment 1.D of Leidos 2015):

- for off-road equipment, the lower of EPA Nonroad Tier 3 emission standards or California average fleet emission factors for a given pollutant and,
- for on-road trucks, a fleet with vehicles no more than 5 years old.

The projected reductions in emissions resulting from the green fleet analysis are presented as part of the analysis of impacts from combinations of action alternatives (see Section 4.6.4).

Impact Analysis

Projected emissions were evaluated relative to air quality conditions within several domains and their applicable Federal, state, and local air pollution standards and regulations. For criteria pollutants where a domain is in attainment of the National Ambient Air Quality Standards (NAAQS), annual emissions were compared to the EPA Prevention of Significant Deterioration (PSD) threshold for new major sources (250 tons per year of a pollutant) as an indicator of the magnitude of projected air quality impacts. The PSD program was chosen as the source to define emission indicator thresholds for proposed activities within clean air areas because the EPA uses this regulation to permit sources of pollutants in areas that attain a NAAQS (EPA 2015b). For criteria pollutants where a domain does not attain or is in maintenance of a NAAQS, annual emissions were compared to the applicable pollutant threshold that requires a conformity determination for that region (EPA 2015c). For example, because Ventura County attains the NAAQS for all pollutants except ozone, emissions from proposed activities within this domain were compared to the following annual emission thresholds: (1) 50 tons of volatile organic compounds and nitrogen oxides (as these are ozone precursor emissions), and (2) 250 tons of carbon monoxide, sulfur dioxide, PM_{10}, and $PM_{2.5}$. If emissions were determined to potentially exceed a PSD or conformity threshold, further analysis was conducted to determine whether they would: (1) contribute to an exceedance of an ambient air quality standard, or (2) conform to the approved State Implementation Plan.

To ensure identification of maximum long- and short-term impact scenarios, estimates were made of: (1) total emissions for each action alternative, and (2) peak annual and peak daily emissions for combinations of action alternatives. Peak annual emissions from combinations of action alternatives were compared to the indicator emission thresholds listed in **Table 4–29** for the three evaluated domains, whereas peak daily emissions were used to indicate the potential for an action alternative combination to contribute to an exceedance of an ambient air quality standard. The thresholds listed in Table 4–29 for the domain outside of Ventura County and the South Coast Air Basin include a range of values that encompass air quality conditions within all regions traversed by the proposed truck trips. Emissions from action alternative combinations are more suitable than individual alternatives for comparison to indicator emission thresholds and ambient air quality standards because the action alternative combinations represent total simultaneous activities and resulting air quality impacts associated with remediation of Area IV and the NBZ.

Table 4–29 Indicator Emission Thresholds Assumed for each Analysis Domain

Region of Influence	Pollutants (tons per year)					
	VOC	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$
Ventura County and the area directly adjacent to SSFL	50	250	50	250	250	250
South Coast Air Basin	10	100	10	250	100	100
Regions beyond Ventura County and the South Coast Air Basin [a]	10–250	250	10–250	100-250	100–250	100–250

CO = carbon monoxide; NOx = nitrogen oxides; $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter; PM_{10} = particulate matter less than 10 microns in diameter; SO_2 = sulfur dioxide; VOC = volatile organic compound.

[a] Some pollutant thresholds include a range of values that reflects air quality conditions within all regions of interest traversed by the vehicle traffic evaluated in this EIS.

The analysis calculated emissions for each action alternative and evaluated combinations of action alternatives. This section presents the ranges of annual and daily emissions determined for each evaluated action alternative combination.

This section also presents estimates of GHG emissions under the alternatives for informational and comparative purposes. The estimates of GHG emissions are presented as projected emissions of carbon dioxide, because carbon dioxide comprises about 99 percent of the carbon dioxide-equivalent emissions generated from all combustive sources (internal combustion engines) evaluated in this EIS. Section 4.6.5 addresses how proposed activities could affect climate change and how climate change could impact implementation of the proposed activities. Chapter 8, Section 8.1.5, summarizes California goals and requirements for reduction of GHG emissions, including California Executive Orders S-3-05 and B-30-15 which establish GHG reduction targets and the California Global Warming Solutions Act of 2006.

4.6.1 Soil Remediation Alternatives

Impacts under the soil remediation alternatives are summarized and compared in **Table 4–30**.

Table 4–30 Air Quality Impacts under the Soil Remediation Alternatives

Resource	Soil No Action Alternative	Soil Remediation Action Alternatives		
		Cleanup to AOC LUT Values	Cleanup to Revised LUT Values	Conservation of Natural Resources
Air quality	No additional emissions compared to existing conditions.	Emissions of pollutants such as VOCs, CO, NOx, SO_2, and particulates from onsite activities. Nearly all particulate emissions arise from fugitive dust. Additional emissions would occur from on-road vehicles, including those for transporting waste and backfill.	Emissions of the same types of pollutants as those under the Cleanup to AOC LUT Values Alternative, but in smaller total quantities.	Emissions of the same types of pollutants as those under the Cleanup to Revised LUT Values Alternative, but in smaller total quantities.
Greenhouse gases	No additional emissions compared to existing conditions.	A total of 28,000 to 84,000 metric tons of CO_2 would be emitted, primarily from vehicles.[a]	A total of 12,000 to 33,000 metric tons of CO_2 would be emitted, primarily from vehicles.[a]	A total of 7,700 to 24,000 metric tons of CO_2 would be emitted, primarily from vehicles.[a]

AOC = *Administrative Order on Consent for Remedial Action*; CO = carbon monoxide; CO_2 = carbon dioxide, LUT = Look-Up Table; NOx = nitrogen oxides; SO_2 = sulfur dioxide, VOC = volatile organic compound.

[a] The range in CO_2 emissions reflects differences in emissions under the nearby and distant disposal site scenarios.

4.6.1.1 Soil No Action Alternative

Under the Soil No Action Alternative, there would be no additional treatment or removal of soil for delivery to offsite facilities and no new emissions or air quality impacts.

4.6.1.2 Cleanup to AOC LUT Values Alternative

The Cleanup to AOC LUT Values Alternative would require the use of fossil fuel-powered off-road construction equipment to remove soil containing constituents above AOC LUT values and to backfill excavated areas with clean soil. On-road trucks would haul excavated soil to offsite disposal facilities and would deliver backfill from sources assumed to be an average of 50 miles away from SSFL (a distance that would encompass potential sources of local soil). Fugitive dust emissions would result from operation of equipment on exposed soil, truck travel on paved roads, loading soil into containers or dump trucks, and unloading backfill.

Table 4–31 presents estimates of total emissions from implementing the Cleanup to AOC LUT Values Alternative. Soil would be removed over 10 years. The largest contributors to combustive emissions would be heavy-duty trucks. Operation of equipment and trucks on unpaved and paved surfaces would cause the majority of the PM_{10} and $PM_{2.5}$ emissions in the form of fugitive dust. This would be the case for all soil remediation alternatives. Total emissions of all pollutants would be much larger under this alternative (more than an order of magnitude) than those under the Building Removal Alternative (see Section 4.6.2.2).

4.6.1.3 Cleanup to Revised LUT Values Alternative

Total emissions under the Cleanup to Revised LUT Values Alternative would be smaller than those under the Cleanup to AOC LUT Values Alternative. Substantially smaller quantities of nonhazardous soil would be removed compared to the Cleanup to AOC LUT Values Alternative – that is, only Soil Category 2 (chemicals above risk-based levels, radionuclides at or below AOC LUT values) would be removed. Soil would be removed from Area IV and the NBZ over slightly more than 2 years. Table 4–31 presents total emissions from implementing the Cleanup to Revised LUT Values Alternative.

4.6.1.4 Conservation of Natural Resources Alternative

The Conservation of Natural Resources Alternative would excavate smaller quantities of soil than the Cleanup to Revised LUT Values Alternative. The same amount of soil that exceeds hazardous waste standards (Soil Category 3) would be removed as that under the Cleanup to AOC LUT Values and Cleanup to Revised LUT Values Alternatives, and the same amount of nonhazardous soil would be removed as than under the Cleanup to Revised LUT Values Alternative (Soil Category 2). However, only soil containing radionuclides in concentrations that exceeds risk-assessment-based values would be removed (Soil Categories 5 and 6). Soil would be removed from Area IV and the NBZ in 2 years.

Table 4–31 presents total emissions from implementing the Conservation of Natural Resources Alternative. Table 4–31 shows that total emissions would be slightly less than those under the Cleanup to Revised LUT Values Alternative.

Table 4–31 Summary of Total Emissions under the Action Alternatives

Activity/Source	*Emissions (tons)*						
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2 (MT)*
Cleanup to AOC LUT Values Alternative							
Off-road Equipment	3.2	21	27	0.04	1.4	1.27	3,300
On-road Vehicles – Nearby Disposal Site	3.3	14	100	0.26	2.4	1.36	25,000
On-road Vehicles – Distant Disposal Site	9.3	36	330	0.85	8.0	4.6	81,000
Fugitive Dust					250	45	
Total – Nearby Disposal Site	**6.5**	**35**	**130**	**0.30**	**260**	**48**	**28,000**
Total – Distant Disposal Site	**12**	**56**	**360**	**0.89**	**260**	**51**	**84,000**
Cleanup to Revised LUT Values Alternative							
Off-road Equipment	0.72	4.7	6.1	0.01	0.31	0.28	770
On-road Vehicles – Nearby Disposal Site	1.3	5.2	45	0.12	1.1	0.63	11,000
On-road Vehicles – Distant Disposal Site	3.6	13	130	0.34	3.2	1.9	32,000
Fugitive Dust					38	8.6	
Total – Nearby Disposal Site	**2.0**	**9.8**	**51**	**0.12**	**39**	**9.5**	**12,000**
Total – Distant Disposal Site	**4.3**	**18**	**140**	**0.35**	**41**	**11**	**33,000**
Conservation of Natural Resources Alternative							
Off-road Equipment	0.54	3.5	4.5	0.01	0.23	0.21	560
On-road Vehicles – Nearby Disposal Site	0.86	3.5	29	0.08	0.69	0.40	7,100
On-road Vehicles – Distant Disposal Site	2.6	10	97	0.25	2.4	1.4	24,000
Fugitive Dust					31	7.2	
Total – Nearby Disposal Site	**1.4**	**7.0**	**34**	**0.08**	**32**	**7.8**	**7,700**
Total – Distant Disposal Site	**3.2**	**13**	**100**	**0.26**	**34**	**8.8**	**24,000**
Building Removal Alternative							
Off-road Equipment	0.17	1.00	1.7	a	0.08	0.08	200
On-road Vehicles – Nearby Disposal Site	0.30	1.2	8.1	0.02	0.22	0.15	1,600
On-road Vehicles – Distant Disposal Site	0.66	2.4	18	0.04	0.50	0.34	3,700
Fugitive Dust					4.2	1.0	
Total – Nearby Disposal Site	**0.47**	**2.2**	**9.8**	**0.02**	**4.5**	**1.3**	**1,800**
Total – Distant Disposal Site	**0.83**	**3.4**	**20**	**0.04**	**4.8**	**1.5**	**3,900**
Groundwater Treatment Alternative							
Off-road Equipment	0.01	0.07	0.10	a	a	a	15
On-road Vehicles – Nearby Disposal Site	0.03	0.09	0.62	a	0.02	0.01	160
On-road Vehicles – Distant Disposal Site	0.04	0.16	1.4	a	0.03	0.02	340
Fugitive Dust					0.37	0.09	
Total – Nearby Disposal Site	**0.03**	**0.15**	**0.72**	**a**	**0.39**	**0.11**	**180**
Total – Distant Disposal Site	**0.05**	**0.22**	**1.5**	**a**	**0.41**	**0.12**	**360**

AOC = *Administrative Order on Consent for Remedial Action*; CO = carbon monoxide; CO_2 = carbon dioxide; LUT = Look-Up Table; MT = metric tons; NOx = nitrogen oxides; $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter; PM_{10} = particulate matter less than 10 microns in diameter; SO_2 = sulfur dioxide; VOC = volatile organic compound.

[a] Emissions are smaller than 0.01 tons.

Notes:

– Emissions under each alternative include options to transport waste by truck to nearby and distant disposal sites.

– Calculated values and totals have been rounded.

4.6.2 Building Demolition Alternatives

Impacts under the building demolition alternatives are summarized and compared in **Table 4–32**.

Table 4–32 Air Quality Impacts under the Building Demolition Alternatives

Resource	*Building No Action Alternative*	*Building Removal Alternative*
Air quality	No additional emissions compared to existing conditions.	Emissions of pollutants such as VOCs, CO, NOx, SO_2, and particulates from onsite activities, with nearly all particulate emissions arising from fugitive dust. Additional emissions would occur from vehicles, including those for transporting waste and backfill.
Greenhouse gases	No additional emissions compared to existing conditions.	A total of 1,800 to 3,900 metric tons of CO_2 would be emitted, primarily from vehicles.[a]

CO = carbon monoxide; CO_2 = carbon dioxide, NOx = nitrogen oxides; SO_2 = sulfur dioxide, VOC = volatile organic compound.

[a] The range in CO_2 emissions reflects differences in emissions under the nearby and distant disposal site scenarios.

4.6.2.1 Building No Action Alternative

Under the Building No Action Alternative, DOE would not remove structures in Area IV, and there would be no new emissions or air quality impacts.

4.6.2.2 Building Removal Alternative

The Building Removal Alternative would require use of fossil fuel-powered, off-road construction equipment to remove building debris, concrete, and asphalt, as well as heavy-duty trucks to haul waste and materials to offsite facilities and deliver equipment and backfill. Building demolition also would generate fugitive dust emissions. Building removal would require 2 years to complete.

Table 4–31 presents total emissions that would result from implementing this alternative. The largest contributors to combustive emissions would be heavy-duty trucks hauling waste and materials to offsite facilities. Demolition activities and the operation of equipment and trucks on unpaved and paved surfaces would cause the majority of the PM_{10} and $PM_{2.5}$ emissions in the form of fugitive dust.

4.6.3 Groundwater Remediation Alternatives

Impacts under the groundwater remediation alternatives are summarized and compared in **Table 4–33**.

Table 4–33 Air Quality Impacts under the Groundwater Remediation Alternatives

Resource	*Groundwater No Action Alternative*	*Groundwater Monitored Natural Attenuation Alternative*	*Groundwater Treatment Alternative*
Air quality	No additional emissions compared to baseline conditions.	Minor quantities of pollutants, including particulates, would be emitted during monitoring well installation and groundwater monitoring, and from on-road vehicles	Emissions of small quantities of pollutants such as VOCs, CO, NOx, SO_2, and particulates, during bedrock removal and treatment system installation. Additional emissions would occur from on-road vehicles.
Greenhouse gases	No additional emissions compared to baseline conditions.	Minor quantities of CO_2 would result during monitoring well installation and groundwater monitoring, and from on-road vehicles.	A total of 180 to 360 metric tons of CO_2 would be emitted, primarily from vehicles.[a]

CO = carbon monoxide; CO_2 = carbon dioxide, NOx = nitrogen oxides; SO_2 = sulfur dioxide, VOC = volatile organic compound.

[a] The range in CO_2 emissions reflects differences in emissions under the nearby and distant disposal site scenarios.

4.6.3.1 Groundwater No Action Alternative

Under the Groundwater No Action Alternative, groundwater monitoring would continue in accordance with the 2007 CO (DTSC 2007). There would be no new emissions or air quality impacts.

4.6.3.2 Groundwater Monitored Natural Attenuation Alternative

The Groundwater Monitored Natural Attenuation Alternative would require minor uses of fossil fuel-powered off-road construction equipment to install new monitoring wells and on-road trucks to deliver supplies and conduct monitoring activities. Minor fugitive dust emissions would result from operation of equipment on exposed soils. Additional monitoring wells would be installed (assumed for analysis to occur during the first year of soil removal), and groundwater monitoring would continue for several years. Emissions were not estimated due to the minimal activities under this alternative. However, emissions would be substantially lower than those under the Groundwater Treatment Alternative, as addressed in Section 4.6.3.3.

4.6.3.3 Groundwater Treatment Alternative

The Groundwater Treatment Alternative would require the use of fossil fuel-powered off-road construction equipment to remove bedrock and backfill excavated areas with clean soil. The alternative would use heavy-duty trucks to haul excavated bedrock to offsite disposal facilities and to deliver backfill to SSFL. Groundwater treatment would generate fugitive dust emissions from operation of equipment on exposed soils, loading bedrock into containers, and unloading backfill. This alternative would begin during the first year of soil removal and is projected to continue for 5 years.

Table 4–31 presents total emissions from implementing the Groundwater Treatment Alternative. The overwhelming majority of these emissions would occur during the first year of activities. The largest contributors to combustive emissions would be from heavy-duty trucks. Operation of equipment and trucks on unpaved and paved surfaces would cause the majority of the PM_{10} and $PM_{2.5}$ emissions in the form of fugitive dust. Emissions of all pollutants listed in Table 4–31 under the Groundwater Treatment Alternative would be smaller by an order of magnitude than those estimated under the Building Removal Alternative, and smaller by more than an order of magnitude than those under any of the soil remediation action alternatives.

4.6.4 Air Quality and Climate Change Impacts under All Action Alternative Combinations

The air quality analysis evaluated three combinations of action alternatives that would result in the highest impacts: (1) Cleanup to AOC LUT Values, Building Removal, and Groundwater Treatment Alternatives; (2) Cleanup to Revised LUT Values, Building Removal, and Groundwater Treatment Alternatives; and (3) Conservation of Natural Resources, Building Removal, and Groundwater Treatment Alternatives. Emissions under the Groundwater Monitored Natural Attenuation Alternative were not quantitatively estimated because this alternative would generate very low emissions, and the Groundwater Treatment Alternative represents worse-case emissions for either groundwater remediation action alternative. Emissions presented in this section for the three combinations of action alternatives would be slightly smaller if the Groundwater Monitored Natural Attenuation Alternative were implemented under any action alternative combination, and slightly larger if both groundwater remediation action alternatives were implemented.[12]

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[12] The term, "High Impact Combination," is not used in this subsection because the largest impacts are not necessarily encompassed by the combination of the Cleanup to AOC LUT Values, Building Removal, and Groundwater Treatment Alternatives. This is primarily because the main focus of the analysis in this subsection is on comparison of emissions against annual emission thresholds and daily ambient air quality standards rather than total emissions. The term, "Low Impact Combination," is not used because the impacts from the Groundwater Monitored Natural Attenuation Alternative are negligibly small and are not addressed. Rather, the appropriate action alternative combinations are specified and evaluated. Three potential action alternative combinations are addressed to ensure comparison of the ranges in emissions from these combinations against the annual thresholds and daily standards.

The primary focus of this subsection is on comparison of emissions against annual emission thresholds and daily ambient air quality standards. As indicated in Table 4–31, total emissions under any action alternative combination would be dominated by emissions from the soil remediation action alternatives; the largest total emissions would result from action alternative combinations that include the Cleanup to AOC LUT Values Alternative and the smallest total emissions would result from action alternative combinations that include the Conservation of Natural Resources Alternative.

4.6.4.1 Ventura County Domain

Unmitigated Impacts

Table 4–34 presents the range in peak annual emissions that would occur within Ventura County from the groups of combined action alternatives summarized above. As noted, the range in emissions primarily reflects the implementation of the three soil remediation action alternatives: the Cleanup to AOC LUT Values, Cleanup to Revised LUT Values, and Conservation of Natural Resources Alternatives. Annual emissions would peak during the first year of soil removal due to maximum annual activity levels and because the average emission rates for the proposed off-road and on-road vehicle fleets would decrease each subsequent year due to replacement of older and higher-emitting vehicles in these fleets with newer vehicles that comply with more-stringent emission standards.

Table 4–34 shows that peak annual emissions of most pollutants for a nearby or distant disposal site scenario would not vary substantially under any of the combinations of action alternatives. The wider range of peak annual PM_{10} and $PM_{2.5}$ emissions is mainly due to levels of fugitive dust that would occur from the higher soil volumes excavated under the Cleanup to AOC LUT Values Alternative, compared to the Cleanup to Revised LUT Values or Conservation of Natural Resources Alternative. Table 4–34 also shows that peak annual emissions for either a nearby or distant disposal site scenario would be well below the indicator emission thresholds identified for Ventura County. Emissions for the nearby and distant disposal site scenarios would be the same because truck mileages would be the same within Ventura County under either scenario (no nearby site within the county was evaluated for disposal of waste). For most pollutants, the largest contributors to combustive emissions would be off-road construction equipment that would remove soils and bedrock and backfill excavated areas with clean soil. Operation of equipment and trucks on unpaved and paved surfaces would cause the majority of the PM_{10} and $PM_{2.5}$ emissions in the form of fugitive dust.

Table 4–35 presents the range in peak daily emissions that would occur within Ventura County from the same groups of combined action alternatives summarized above. As with peak annual emissions, peak daily emissions (other than PM_{10} and $PM_{2.5}$ emissions generated by fugitive dust) would not vary substantially under any of the evaluated combinations of action alternatives.

The evaluated combinations of action alternatives would generate relatively low levels of daily combustive emissions such as carbon monoxide (up to 24 pounds per day) and nitrogen oxides (up to 46 pounds per day). These emissions would occur intermittently from mobile equipment and trucks over a large portion of Area IV, throughout approximately 3.1 miles of roads internal to SSFL, and within Woolsey Canyon Road between the site gate and the Los Angeles County boundary. As a result, these emissions would be diluted in the atmosphere to the point that they would cause minimal ambient impacts in a localized area outside of SSFL and would not contribute to an exceedance of an ambient air quality standard within Ventura County or any other area. Following this same reasoning, the evaluated combinations of action alternatives also would cause minimal ambient impacts of hazardous air pollutants and toxic air contaminants within Ventura County.

Table 4–34 Peak Annual Emissions under the Combined Action Alternatives – Ventura County

Activity/Source	*Emissions (tons per year)*						
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2 (MT)*
Soil Remediation Alternatives							
Off-road Equipment	0.33–0.36	2.1–2.3	2.7–3.0	a	0.14–0.15	0.13–0.14	340–380
On-road Vehicles – Nearby Disposal Site	0.12	0.53	2.6	0.01	0.04	0.03	550
On-road Vehicles – Distant Disposal Site	0.12	0.53	2.6	0.01	0.04	0.03	550
Fugitive Dust					19–26	4.4–4.7	
Subtotal – Nearby Disposal Site	**0.45–0.48**	**2.6–2.9**	**5.3–5.6**	**0.01**	**19–26**	**4.5–4.9**	**890–930**
Subtotal – Distant Disposal Site	**0.45–0.48**	**2.6–2.9**	**5.3–5.6**	**0.01**	**19–26**	**4.5–4.9**	**890–930**
Building Removal Alternative							
Off-road Equipment	0.09	0.55	0.93	a	0.04	0.04	110
On-road Vehicles – Nearby Disposal Site	0.01	0.08	0.12	a	a	a	37
On-road Vehicles – Distant Disposal Site	0.01	0.08	0.11	a	a	a	36
Fugitive Dust					3.1	0.77	
Subtotal – Nearby Disposal Site	**0.10**	**0.63**	**1.1**	**0.00**	**3.1**	**0.82**	**140**
Subtotal – Distant Disposal Site	**0.10**	**0.63**	**1.1**	**0.00**	**3.1**	**0.82**	**140**
Groundwater Treatment Alternative							
Off-road Equipment	0.01	0.07	0.10	a	a	a	15
On-road Vehicles – Nearby Disposal Site	a	0.02	0.05	a	a	a	13
On-road Vehicles – Distant Disposal Site	a	0.02	0.05	a	a	a	13
Fugitive Dust					0.37	0.09	
Subtotal – Nearby Disposal Site	**0.01**	**0.09**	**0.14**	**a**	**0.37**	**0.10**	**28**
Subtotal – Distant Disposal Site	**0.01**	**0.09**	**0.14**	**a**	**0.37**	**0.10**	**28**
Total – Nearby Disposal Site	**0.47–0.49**	**2.7–2.9**	**5.5–5.8**	**0.01**	**20–27**	**4.6–5.0**	**920–960**
Total – Distant Disposal Site	**0.47–0.49**	**2.7–2.9**	**5.5–5.8**	**0.01**	**20–27**	**4.6–5.0**	**920–960**
Emission Thresholds	**50**	**250**	**50**	**250**	**250**	**250**	**NA**

CO = carbon monoxide; CO_2 = carbon dioxide; MT = metric tons; NOx = nitrogen oxides; $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter; PM_{10} = particulate matter less than 10 microns in diameter; SO_2 = sulfur dioxide; VOC = volatile organic compound.

[a] Peak annual emissions are smaller than 0.01 tons per year.

Notes:

– The highest total annual emissions would occur during the first year of soil removal after completion of the Building Removal Alternative.

– Emissions under each alternative include options to transport materials by truck to representative nearby and distant disposal sites.

– Calculated values and totals have been rounded.

Table 4–35 also shows that the combined action alternatives would result in elevated levels of daily PM_{10} emissions (up to 210 pounds per day). The largest contributor to PM_{10} emissions would be generation of fugitive dust from operation of equipment and trucks on unpaved surfaces and trucks on paved roads internal to SSFL. It was assumed as part of the analysis that DOE would implement measures that would reduce fugitive dust emissions (PM_{10} and $PM_{2.5}$) from these sources by 74 and 50 percent, respectively, from uncontrolled levels. In addition, DOE would comply with Ventura County Air Pollution Control District (VCAPCD) Rule 55 (Fugitive Dust), which restricts emissions of fugitive dust from being visible beyond the property line of a source. Therefore, these controls and restrictions would ensure that emissions of fugitive dust under the combined alternatives would not contribute to an exceedance of a PM_{10} ambient air quality standard at any offsite location.

Table 4–35 Peak Daily Emissions under the Combined Action Alternatives – Ventura County

Activity/Source	*Emissions (pounds per day)*					
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*
Soil Remediation Alternatives						
Off-road Equipment	2.6–2.8	17–19	22–24	a	1.1–4.2	1.0–1.1
On-road Vehicles – Nearby Disposal Site	1.0	4.2–4.3	21	a	0.4	0.2
On-road Vehicles – Distant Disposal Site	1.0	4.2–4.3	21	a	0.4	0.2
Fugitive Dust					150–210	35–38
Subtotal – Nearby Disposal Site	**3.6–3.8**	**21–23**	**43–45**	**0.1**	**150–210**	**36–39**
Subtotal – Distant Disposal Site	**3.6–3.8**	**21–23**	**43–45**	**0.1**	**150–210**	**36–39**
Building Removal Alternative						
Off-road Equipment	0.7	4.4	7.5	a	0.4	0.3
On-road Vehicles – Nearby Disposal Site	0.1	0.6	1.0	a	a	a
On-road Vehicles – Distant Disposal Site	0.1	0.6	0.9	a	a	a
Fugitive Dust					25	6.2
Subtotal – Nearby Disposal Site	**0.8**	**5.0**	**8.4**	**a**	**25**	**6.5**
Subtotal – Distant Disposal Site	**0.8**	**5.0**	**8.4**	**a**	**25**	**6.5**
Groundwater Treatment Alternative						
Off-road Equipment	0.1	0.5	0.8	a	a	a
On-road Vehicles – Nearby Disposal Site	a	0.1	0.4	a	a	a
On-road Vehicles – Distant Disposal Site	a	0.1	0.4	a	a	a
Fugitive Dust					3.0	0.7
Subtotal – Nearby Disposal Site	**0.1**	**0.7**	**1.2**	**a**	**3.0**	**0.8**
Subtotal – Distant Disposal Site	**0.1**	**0.7**	**1.2**	**a**	**3.0**	**0.8**
Total – Nearby Disposal Site	**3.7–3.9**	**22–24**	**44–46**	**0.1**	**160–210**	**37–40**
Total – Distant Disposal Site	**3.7–3.9**	**22–24**	**44–46**	**0.1**	**160–210**	**37–40**

CO = carbon monoxide; NOx = nitrogen oxides; $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter; PM_{10} = particulate matter less than 10 microns in diameter; SO_2 = sulfur dioxide; VOC = volatile organic compound.

[a] Peak daily emissions are smaller than 0.1 pounds per day.

Notes:

- The highest total peak day emissions would occur during the first year of soil removal after completion of the Building Removal Alternative.
- Emissions for each alternative include options to transport materials by truck to nearby and distant disposal sites.
- Based on 250 workdays per year.
- Peak daily carbon dioxide emissions are not listed because the effects of GHGs on climate change are long-term and, therefore, annual and total emissions are more relevant metrics to evaluate these effects.
- Calculated values and totals have been rounded.

Green Cleanup Impacts

The total peak annual and daily emissions presented in Tables 4–34 and 4–35 are based on California average off-road and on-road vehicle fleets for the year 2019. These impacts may be reduced by measures discussed in Chapter 6, such as use of off-road equipment and on-road trucks that meet EPA Nonroad Tier 3 and 4 standards, respectively. Implementing the green cleanup fleets proposed by DOE as Mitigation Measure AQ-1 would reduce emissions from the average calendar year 2019 fleets by the following amounts, as averaged over emissions of volatile organic compounds, carbon monoxide, nitrogen oxides, and PM_{10}: (1) 21 percent for off-road equipment that meet EPA Nonroad Tier 3 emission standards; and (2) 58 percent for a fleet of on-road heavy-duty trucks that are no more than 5 years old. Therefore, implementing the proposed green cleanup fleets would cause substantial emission reductions within Ventura County compared to use of California average fleets.

4.6.4.2 South Coast Air Basin Domain

Unmitigated Impacts

Table 4–36 presents the range in peak annual emissions that would occur within the South Coast Air Basin from the groups of combined action alternatives summarized above. Annual emissions for most of the combined action alternative scenarios would peak during the first year of soil removal due to maximum annual activity levels and resulting miles traveled by proposed haul trucks within this domain.

Table 4–36 Peak Annual Emissions under the Combined Action Alternatives – South Coast Air Basin

Activity/Source	*Emissions (tons per year)*						
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2 (MT)*
Soil Remediation Alternatives							
On-road Vehicles – Nearby Disposal Site	0.15–0.22	0.68–0.94	5.7–8.5	0.02	0.14–0.21	0.08–0.12	1,500–2,100
On-road Vehicles – Distant Disposal Site	0.35–0.47	1.4–1.8	13–18	0.03–0.05	0.33–0.44	0.19–0.26	3,300–4,400
Building Removal Alternative							
On-road Vehicles – Nearby Disposal Site	0.04	0.20	1.1	a	0.03	0.02	240
On-road Vehicles – Distant Disposal Site	0.04	0.21	1.2	a	0.03	0.02	260
Groundwater Treatment Alternative							
On-road Vehicles – Nearby Disposal Site	0.01	0.03	0.20	a	a	a	5
On-road Vehicles – Distant Disposal Site	0.01	0.03	0.20	a	a	a	53
Total – Nearby Disposal Site	**0.15–0.33**	**0.68–0.97**	**5.7–8.7**	**0.02**	**0.14–0.22**	**0.08–0.12**	**1,500–2,200**
Total – Distant Disposal Site	**0.35–0.47**	**1.4–1.9**	**13–18**	**0.03-0.05**	**0.33–0.45**	**0.19–0.26**	**3,300–4,500**
Emission Thresholds	**10**	**100**	**10**	**250**	**100**	**100**	**NA**

CO = carbon monoxide; CO_2 = carbon dioxide; MT = metric tons; NOx = nitrogen oxides; $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter; PM_{10} = particulate matter less than 10 microns in diameter; SO_2 = sulfur dioxide; VOC = volatile organic compound.

[a] Peak annual emissions would be smaller than 0.01 tons per year.

Notes:

– Emissions under each alternative include options to transport materials by truck to nearby and distant disposal sites.

– Calculated values and totals have been rounded.

Table 4–36 shows that, except for nitrogen oxides, none of the evaluated pollutants would exceed the South Coast Air Basin indicator emission thresholds under either the nearby or distant disposal site scenario. Peak annual nitrogen oxides emissions under the nearby disposal site scenario would be lower than the nitrogen oxides emission threshold identified for the South Coast Air Basin (10 tons per year), and they would range from a low of 5.7 tons under the combination of the Cleanup to AOC LUT Values, Building Removal, and Groundwater Treatment Alternatives to a high of 8.7 tons for the Cleanup to Revised LUT Values, Building Removal, and Groundwater Treatment Alternatives or the Conservation of Natural Resources, Building Removal, and Groundwater Treatment Alternatives. Peak annual nitrogen oxides emissions under the distant disposal site scenario would exceed the nitrogen oxides emission threshold identified for the South Coast Air Basin, and they would range from a low of 13 tons under the combination of the Cleanup to Revised LUT Values, Building Removal, and Groundwater Treatment Alternatives or the Conservation of Natural Resources, Building Removal, and Groundwater Treatment Alternatives to a high of 18 tons for the Cleanup to AOC LUT Values, Building Removal, and Groundwater

Treatment Alternatives. The variation in emissions between the near and distant disposal site scenarios reflects, for each combination of action alternatives, the transport of different quantities of different types of waste to different disposal sites, and the lengths of the truck routes within or through the South Coast Air Basin may differ depending on the disposal site scenario. All emissions within the South Coast Air Basin would occur from worker commuter vehicles and trucks hauling waste to offsite disposal facilities and backfill from nearby sources to SSFL.

Table 4–37 presents the range in peak daily emissions that would occur within the South Coast Air Basin from the same groups of combined action alternatives summarized above. As with peak annual emissions, except for nitrogen oxides, both the nearby or distant disposal site scenarios would result in relatively low levels of daily emissions of any evaluated pollutant (less than or equal to 15 pounds per day).

Table 4–37 Peak Daily Emissions under the Combined Action Alternatives – South Coast Air Basin

Activity/Source	*Emissions (pounds per day)*					
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*
Soil Remediation Action Alternatives						
On-road Vehicles – Nearby Disposal Site	1.2–1.8	5.2–7.5	44–68	0.1–0.2	1.1–1.7	0.6–1.0
On-road Vehicles – Distant Disposal Site	2.3–3.8	11–15	11–140	0.2–0.4	2.6–3.6	1.5–2.0
Building Removal Alternative						
On-road Vehicles – Nearby Disposal Site	0.3	1.6	9.1	a	0.2	0.2
On-road Vehicles – Distant Disposal Site	0.3	1.6	9.7	a	0.3	0.2
Groundwater Treatment Alternative						
On-road Vehicles – Nearby Disposal Site	a	0.2	1.6	a	a	a
On-road Vehicles – Distant Disposal Site	a	0.2	1.6	a	a	a
Total – Nearby Disposal Site	**1.2–1.8**	**5.4–7.7**	**46–70**	**0.1–0.2**	**1.1–1.7**	**0.7–1.0**
Total – Distant Disposal Site	**2.8–3.8**	**11–15**	**110–140**	**0.3–0.4**	**2.6–3.6**	**1.5–2.1**

CO = carbon monoxide; NOx = nitrogen oxides; $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter; PM_{10} = particulate matter less than 10 microns in diameter; SO_2 = sulfur dioxide; VOC = volatile organic compound.

[a] Peak daily emissions would be smaller than 0.1 pounds per day.

Notes:

- The higher total peak day emissions would occur during the first year of soil removal after completion of the Building Removal Alternative.
- Emissions under each alternative include options to transport materials by truck to nearby and distant disposal sites.
- Based on 250 workdays per year.
- Peak daily carbon dioxide emissions are not listed because the effects of GHGs on climate change are long-term and, therefore, annual and total emissions are more relevant metrics to evaluate these effects.
- Calculated values and totals have been rounded.

Under the nearby disposal site scenario, relatively low levels of daily nitrogen oxides emissions (46 pounds per day) would be generated under the combination of the Cleanup to AOC LUT Values, Building Removal, and Groundwater Treatment Alternatives. The largest daily emissions for the nearby disposal site scenario would be generated under the Cleanup to Revised LUT Values, Building Removal, and Groundwater Treatment Alternatives and the Conservation of Natural Resources, Building Removal, and Groundwater Treatment Alternatives (70 pounds per day). Elevated emissions of nitrogen oxides (110 to 140 pounds per day) would be generated under the distant disposal site scenario under all evaluated action alternative combinations. However, these emissions would occur intermittently from up to 48 daily haul truck round trips and would extend over several miles of roads across the South Coast Air Basin. As a result, these emissions would be diluted in the atmosphere to the point that they would cause minimal ambient impacts in a localized area and would not contribute to an exceedance of an ambient air quality standard. Following this same reasoning, these combined alternatives also would cause minimal ambient impacts of hazardous air pollutants and toxic air contaminants within the South Coast Air Basin.

Green Cleanup Impacts

Implementing the green cleanup truck fleet proposed by DOE as Mitigation Measure AQ-1 would reduce emissions from the average calendar year 2019 truck fleet by 61 percent in the South Coast Air Basin domain, as averaged over the same air pollutants as those in Section 4.6.4.1. Use of this measure would reduce nitrogen oxides emissions from proposed truck travel within the South Coast Air Basin by 85 percent compared to those from an average calendar year 2019 truck fleet. As a result, implementing the green cleanup truck fleet proposed by DOE would result in peak annual truck emissions within the South Coast Air Basin that would remain below indicator the emission thresholds identified for this domain.

4.6.4.3 Outside Ventura County/South Coast Air Basin Domain

Unmitigated Impacts

Table 4–38 presents the range in peak annual emissions that would occur outside Ventura County and the South Coast Air Basin from the groups of combined action alternatives discussed above. Annual emissions for the combined action alternative scenarios would peak during the first year of soil removal due to maximum annual activity levels and resulting miles traveled by proposed haul trucks within this domain.

Table 4–38 Peak Annual Emissions under the Combined Action Alternatives – Outside Ventura County/South Coast Air Basin

Activity/Source	*Emissions (tons per year)*						
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2 (metric tons)*
Soil Remediation Action Alternatives							
On-road Vehicles – Nearby Disposal Site	0.06–0.30	0.22–1.0	2.3–11	0.01–0.03	0.06–0.28	0.03–0.16	580–2,800
On-road Vehicles – Distant Disposal Site	0.35–1.3	1.4–4.8	13–50	0.03–0.13	0.33–1.2	0.19–0.71	3,300–12,000
Building Removal Alternative							
On-road Vehicles – Nearby Disposal Site	0.08	0.29	2.4	a	0.07	0.05	476
On-road Vehicles – Distant Disposal Site	0.26	0.88	7.5	0.02	0.21	0.14	1,500
Groundwater Treatment Alternative							
On-road Vehicles – Nearby Disposal Site	0.01	0.04	0.38	a	0.01	0.01	94
On-road Vehicles – Distant Disposal Site	0.03	0.11	1.1	a	0.03	0.02	280
Total – Nearby Disposal Site	**0.07–0.31**	**0.26–1.1**	**2.7–12**	**0.01–0.03**	**0.07–0.29**	**0.04–0.17**	**670–2,900**
Total – Distant Disposal Site	**0.38–1.3**	**1.4–4.9**	**14–51**	**0.04–0.13**	**0.36–1.3**	**0.21–0.73**	**3,600–13,000**
Emission Thresholds – Nearby Disposal Site	**10-250**	**250**	**10-250**	**250**	**100-250**	**100-250**	**NA**
Emission Thresholds – Distant Disposal Site	**25-250**	**250**	**25-250**	**100-250**	**100-250**	**250**	**NA**

CO = carbon monoxide; CO_2 = carbon dioxide; NOx = nitrogen oxides; $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter; PM_{10} = particulate matter less than 10 microns in diameter; SO_2 = sulfur dioxide; VOC = volatile organic compound.

[a] Peak annual emissions would be smaller than 0.01 tons per year.

Notes:

- The highest total peak annual emissions would occur during the first year of soil removal after completion of the Building Removal Alternative.
- Emissions under each alternative include options to transport materials by truck to nearby and distant disposal sites.
- Calculated values and totals have been rounded.

Except for nitrogen oxides, none of the evaluated pollutants would exceed the indicator emission thresholds in any of the evaluated domains outside Ventura County and the South Coast Air Basin under either the nearby or distant disposal site scenario. As shown in Table 4–38, the indicator emission thresholds assumed for these domains range from 10 to 250 tons per year. Under the nearby disposal site scenario, nitrogen oxides emissions would be smaller than the most restrictive indicator emission threshold (10 tons per year) under the combination of the Cleanup to AOC LUT Values, Building Removal, and Groundwater Treatment Alternatives (2.7 tons per year), but larger than this threshold under the combination of the Cleanup to Revised LUT Values, Building Removal, and Groundwater Treatment Alternatives or the Conservation of Natural Resources, Building Removal, and Groundwater Treatment Alternatives (12 tons per year). Under the distant disposal site scenario, nitrogen oxides emissions would be smaller than the most restrictive indicator emission threshold (25 tons per year) under the combination of the Cleanup to AOC LUT Values, Building Removal, and Groundwater Treatment Alternatives (14 tons per year), but larger than this threshold under the combination of the Cleanup to Revised LUT Values, Building Removal, and Groundwater Treatment Alternatives or the Conservation of Natural Resources, Building Removal, and Groundwater Treatment Alternatives (51 tons per year).

To define the worst-case indicator emission thresholds for the regions outside of Ventura County and the South Coast Air Basin, the most degraded air quality conditions were assumed for any area where trucks would travel between SSFL and offsite disposal facilities. Hence, the worst-case air quality conditions for the domains traversed by trucks to nearby (Buttonwillow Landfill) and distant (Energy*Solutions* in Utah or US Ecology in Idaho) disposal sites occur within the San Joaquin Valley Air Basin and the Mojave Desert Air Basin. The worst-case indicator emission thresholds for nitrogen oxides in these two air basins are 10 and 25 tons per year, respectively. As identified above, under two of the three combinations of action alternatives, peak annual emissions generated by all truck travel between SSFL and either the nearby or distant disposal site location would exceed these worst-case nitrogen oxides emission thresholds. However, haul truck mileages driven solely within the San Joaquin Valley Air Basin and Mojave Desert Air Basin would cause emissions that would remain below their applicable nitrogen oxides emission thresholds. Haul truck mileages driven within all other air basins also would cause emissions that would remain below their applicable nitrogen oxides emission thresholds (100 or 250 tons per year).

Table 4–39 presents the range in peak daily emissions that would occur outside of Ventura County and the South Coast Air Basin under the combined action alternatives. As with peak annual emissions, emissions of the listed pollutants are relatively low, except for nitrogen oxides. Under the nearby disposal site scenario, relatively low levels of daily nitrogen oxides emissions (about 22 pounds per day) would be generated under the combination of the Cleanup to AOC LUT Values, Building Removal, and Groundwater Treatment Alternatives. In contrast, relatively high levels of daily nitrogen oxides emissions would be generated under the Cleanup to Revised LUT Values, Building Removal, and Groundwater Treatment Alternatives or the Conservation of Natural Resources, Building Removal, and Groundwater Treatment Alternatives (about 95 pounds per day). Under the distant disposal site scenario, relatively high levels of daily nitrogen oxides emissions would occur under all evaluated combinations of action alternatives (120 to 410 pounds per day).

These emissions would occur intermittently from up to 48 daily haul truck round trips and would extend over hundreds of miles of roads. As a result, these emissions would be diluted in the atmosphere to the point that they would cause minimal ambient impacts in a localized area and would not contribute to an exceedance of an ambient air quality standard. Following this same reasoning, minimal ambient impacts of hazardous air pollutants and toxic air contaminants are expected outside of Ventura County and the South Coast Air Basin.

Table 4–39 Peak Daily Emissions under the Combined Action Alternatives – Outside Ventura County/South Coast Air Basin

Activity/Source	*Emissions (pounds per day)*					
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*
Soil Remediation Action Alternatives						
On-road Vehicles – Nearby Disposal Site	0.5–2.4	1.8–8.8	19–92	a–0.2	0.5–2.3	0.3–1.3
On-road Vehicles – Distant Disposal Site	2.8–11	10–38	110–400	0.3–1.0	2.6–11	1.5–5.7
Building Removal Alternative						
On-road Vehicles – Nearby Disposal Site	0.7	2.3	19	a	0.5	0.4
On-road Vehicles – Distant Disposal Site	2.1	7.1	60	0.1	1.6	1.1
Groundwater Treatment Alternative						
On-road Vehicles – Nearby Disposal Site	0.1	0.3	3.0	a	0.1	a
On-road Vehicles – Distant Disposal Site	0.2	0.9	9.0	a	0.2	0.1
Total – Nearby Disposal Site	**0.6–2.5**	**2.1–9.1**	**22–95**	**0.01–0.3**	**0.5–2.4**	**0.3–1.4**
Total – Distant Disposal Site	**3.0–11**	**11–39**	**120–410**	**0.3–1.1**	**2.9–10**	**1.6–5.8**

CO = carbon monoxide; NOx = nitrogen oxides; $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter; PM_{10} = particulate matter less than 10 microns in diameter; SO_2 = sulfur dioxide; VOC = volatile organic compound.

[a] Peak daily emissions would be smaller than 0.1 pounds per day.

Notes:

- The highest total peak day emissions would occur during the first year of soil removal after completion of the Building Removal Alternative.
- Emissions under each alternative include options to transport materials by truck to representative nearby and distant disposal sites.
- Based on 250 workdays per year.
- Peak daily carbon dioxide emissions are not listed because the effects of GHGs on climate change are long-term and, therefore, annual and total emissions are more relevant metrics to evaluate these effects.
- Calculated values and totals have been rounded.

Green Cleanup Impacts

Implementing the green cleanup truck fleet proposed by DOE as Mitigation Measure AQ-1 would reduce emissions from the average calendar year 2019 truck fleet by 61 percent, as averaged over the same air pollutants as those in Section 4.6.4.1. Use of this measure would reduce nitrogen oxides emissions from proposed truck travel outside of Ventura County and the South Coast Air Basin by 85 percent, compared to those from an average calendar year 2019 truck fleet. As a result, implementing the proposed green cleanup truck fleet would result in peak annual truck emissions outside of Ventura County and the South Coast Air Basin that would remain below the applicable indicator emission thresholds identified for this domain.

4.6.5 Climate Change

Climate change in this subsection is addressed in terms of emissions of GHG in the form of carbon dioxide. Table 4–31 presents total carbon dioxide emissions that would occur under each action alternative, while **Table 4–40** presents peak annual and total carbon dioxide emissions under each evaluated combination of action alternatives. Emissions under each combination of action alternatives would be slightly smaller if the Groundwater Monitored Natural Attenuation Alternative were implemented and slightly larger if both groundwater action alternatives were implemented. The maximum total carbon dioxide emissions under any evaluated action alternative combination (86,000 metric tons) would occur under the Cleanup to AOC LUT Values, Building Removal, and Groundwater Treatment Alternatives. Lesser amounts of indirect GHG emissions would occur from subsequent handling of demolished and excavated materials at the disposal sites. These emissions would represent a negligible contribution to future climate change, the effects of which are presented in Chapter 3, Section 3.6.2. In addition, these emissions would be consistent with local and state GHG plans and policies (see Chapter 8, Section 8.1.5), as they would occur from mobile sources that would comply with the most recent vehicle clean fuels, mileage efficiencies, and emissions regulations (such as the Low Carbon Fuel Standard and Heavy-Duty Truck GHG Regulations). Implementation of potential mitigation AQ-1 (see Chapter 6, Table 6–2) also would maximize the use of clean off-road equipment and the newest fleet of haul trucks, which would minimize GHG emissions from these sources.

Table 4–40 Peak Annual and Total Emissions of Greenhouse Gases per Action Alternative Combination

Action Alternative Combination	*Peak Annual CO_2 Emissions (metric tons)*	*Total CO_2 Emissions (metric tons)*
Cleanup to AOC LUT Values + Building Removal + Groundwater Treatment Alternatives	3,000 to 8,900	30,000 to 89,000
Cleanup to Revised LUT Values + Building Removal + Groundwater Treatment Alternatives	6,000 to 17,000	14,000 to 37,000
Conservation of Natural Resources + Building Removal + Groundwater Treatment Alternatives	6,100 to 17,000	9,700 to 29,000

AOC = *Administrative Order on Consent for Remedial Action*; CO_2 = carbon dioxide; LUT = Look-Up Table.
Note: Calculated values and totals have been rounded.

Climate change could impact implementation of the alternatives and the adaptation strategies needed to respond to future conditions. For the region within Ventura County, the main effect of climate change is increased temperature and aridity, as documented by climate analyses presented in Chapter 3, Section 3.6.2. These analyses predict that, in the future, the region will experience: (1) an increase in temperatures, droughts, and wildfires; and (2) scarcities of water supplies (California Energy Commission 2012; IPCC 2013; USGCRP 2014). Current operations at SSFL have adapted to droughts, high temperatures, wildfires, and scarce water supplies. However, exacerbation of these conditions in the near future could impede proposed activities during extreme events. For example, SSFL remediation could be impeded if the occurrence of wildfires increased over the duration of the remediation activities.

4.6.6 Impact Threshold Analysis

Impact thresholds developed to evaluate projected air emissions are as follows:

1. for domains that attain a NAAQS, emissions exceeding the EPA PSD threshold of 250 tons per year of an attainment pollutant;
2. for domains that do not attain or are in maintenance of a NAAQS, emissions exceeding the applicable annual threshold for a pollutant that requires a conformity determination;
3. emissions contributing to an exceedance of an ambient air quality standard or nonconformance of an approved State Implementation Plan; or
4. generation of fugitive dust that would exceed offsite ambient concentration limitations of VCAPCD Rule 55.

Because the periods for implementation of the alternatives evaluated in this EIS could overlap, the best comparison to these thresholds was determined to be with emissions associated with combinations of action alternatives rather than individual action alternatives.

Under any evaluated combination of action alternatives, no pollutant would be emitted in quantities that would exceed a PSD or conformity threshold within any domain, with the exception that peak annual nitrogen oxides emissions under the distant disposal site scenario would exceed the nitrogen oxides emission threshold identified for the South Coast Air Basin for each evaluated combination of action alternatives. However, under all evaluated combinations of action alternatives, proposed emissions would not contribute to exceedance of an ambient air quality standard within any domain.

Although activities at SSFL would generate fugitive dust, it is expected that implementation of DOE's protective measures and compliance with VCAPCD Rule 55 (Fugitive Dust) would ensure that emissions of fugitive dust under the combined alternatives would not contribute to an exceedance of a PM_{10} or $PM_{2.5}$ ambient air quality standard at any offsite location. As a result, the proposed alternatives and combination of action alternatives would not result in substantial air quality impacts at any location.

4.7 Noise

This section analyzes noise and vibration impacts under each of the alternatives. Primary noise sources include heavy equipment used at Area IV and the NBZ for demolition and excavation, and vehicles used for transportation of waste and materials (equipment, backfill, and supplies) to or from SSFL. Noise impacts are assessed by comparing projected noise levels for proposed activities to noise levels under baseline conditions within the context of local noise sensitivity. Baseline conditions in the SSFL ROI (the SSFL vicinity and haul routes) are presented in Chapter 3, Section 3.7. Terms used to describe noise are defined in Section 3.7 and summarized in the following text box.

Sound is quantified in units of A-weighted decibels (dBAs [decibels A-weighted]), where a decibel (dB) is a logarithmic unit expressing the intensity of a sound wave, and a dBA is a unit weighted in accordance with sound frequencies heard best by the *human ear.*

Different noise measurements (or metrics) quantify noise. The noise metrics used in this environmental impact statement are as follows:

- Maximum noise level (L_{max}) represents the noise level during the loudest 1-second time period. Many noise sources vary over time due to engine power settings, variable distances from the listener, and other factors.
- Equivalent sound level (L_{eq}) represents the average noise level over a specified time period. Equivalent sound level during the workday ($L_{eq\text{-}workday}$) is used to quantify overall noise from construction equipment during working hours. Note that L_{eq} does not represent the sound level at any given moment, but rather the average of variable noise levels experienced across the stated time period.
- Community noise equivalent level (CNEL) is the average noise level over a 24-hour period with decibel "penalties" applied to noise events during the "evening" and "night." Five decibels are added to the sound levels of noise events occurring between 7 PM and 10 PM, and 10 decibels are added to sound levels between 10 PM and 7 AM. These additions are made to account for noise-sensitive time periods (evening and nighttime [sleeping] hours) when sounds appear louder. The CNEL metric is a useful predictor of the percentage of the affected population that would be highly annoyed by noise and is the primary noise metric used in California.
- Day-night average sound level (DNL) is the same as CNEL, except no decibel "penalty" is applied for noise events between 7 PM and 10 PM. DNL is the primary noise metric used by states other than California.

Different metrics predict different impacts. Annoyance represents the most common noise impact. There is a high correlation between the percentage of people in a community that are highly annoyed and the average noise level measured using the CNEL noise metric.

The overall noise level from Area IV activities and waste and material transportation was quantified using the community noise equivalent level (CNEL) as an analytical metric, considering time-averaged noise levels (total noise energy received over time) and including the added annoyance caused by evening and night noise events. The *L.A. CEQA Thresholds Guide, Your Resource for Preparing CEQA Analyses in Los Angeles* (*L.A. CEQA Thresholds Guide*) (City of Los Angeles 2006) indicates that significant noise impacts can occur when noise level is increased by 3 decibels A-weighted (dBA) CNEL, and the resulting noise level is above the "normally acceptable" 65 dBA

CNEL threshold established for residential areas. According to the *L.A. CEQA Thresholds Guide*, noise impacts are also expected to be widely considered unacceptable if any noise increases of 5 dBA CNEL or greater were to occur in a noise-sensitive area. The areas paralleling the haul routes are primarily residential and would be generally categorized as noise-sensitive. Therefore, for purposes of analysis, an impact was assumed to occur if the time-averaged noise levels at the nearest residence to Area IV or in the vicinity of a truck route were to increase by 5 dBA CNEL and the resulting noise is less than 65 dBA CNEL, or if noise levels were to increase by 3 dBA CNEL and the resulting noise exceeds 65 dBA CNEL.

4.7.1 Soil Remediation Alternatives

Impacts under the soil remediation alternatives are summarized and compared in **Table 4–41**.

Table 4–41 Noise Impacts under the Soil Remediation Alternatives

Resource	Soil No Action Alternative	*Soil Remediation Action Alternatives*		
		Cleanup to AOC LUT Values	***Cleanup to Revised LUT Values***	***Conservation of Natural Resources***
Noise from onsite activities	No impacts are expected above baseline conditions.	Noise levels at the closest residence are expected to increase during the 10 years of soil removal but be well below 65 dBA CNEL and a 5 dBA CNEL increase, a threshold for potential adverse noise impacts established for this EIS per the *L.A. CEQA Thresholds Guide* (LA 2006).	Similar to the Cleanup to AOC LUT Values Alternative except the duration of increased noise would be slightly more than 2 years.	Similar to the Cleanup to AOC LUT Values Alternative, except the duration of increased noise would be 2 years.
Noise from heavy-duty truck traffic to and from SSFL	No impacts are expected above baseline conditions.	Average daily noise levels at a distance of 100 feet from the evaluated roads could increase by up to 2.1 dBA CNEL, where the final noise level would be below 65 dBA CNEL. Along one road, the noise level would increase by 0.3 dBA, from 65.9 to 66.2 dBA CNEL. Assuming the maximum number of daily round trips from Area IV (96 round trips), time-averaged noise levels in residential areas would increase by no more than 3.5 dBA CNEL along all roads where noise levels would remain below 65 dBA CNEL (the threshold for an adverse impact is an increase of 5 dBA CNEL). Along one section of Valley Circle Boulevard where the noise level already exceeds 65 dBA CNEL, the increase would be no more than 0.6 dBA CNEL (the threshold for an adverse impact where the final noise level exceeds 65 dBA is an increase of 3 dBA CNEL). Although no adverse noise impacts are expected during the 10 years of soil removal, traffic along roads other than Woolsey Canyon Road may be reduced by use of different routes between SSFL and major highways.	Similar to the Cleanup to AOC LUT Values Alternative except the duration of increased noise would be slightly more than 2 years.	Similar to the Cleanup to AOC LUT Values Alternative, except the duration of increased noise would be 2 years.

AOC = *Administrative Order on Consent for Remedial Action*; CNEL = Community Noise Equivalent Level; dBA = decibels A-weighted; LUT = Look-Up Table.

4.7.1.1 Soil No Action Alternative

Under the Soil No Action Alternative, there would be no additional soil remediation at Area IV and the NBZ, with no noise impacts above baseline conditions (see Chapter 3, Section 3.7).

4.7.1.2 Cleanup to AOC LUT Values Alternative

Noise from Soil Remediation

Table 4–42 lists noise levels associated with equipment commonly used in construction and demolition projects; much of the listed equipment would be used during soil removal operations. Noise levels were calculated using the Federal Highway Administration's Roadway Construction Noise Model (FHWA 2006). A scenario was modeled for which all listed equipment was assumed to operate at a single location. Under this highly conservative scenario, the equivalent sound level (L_{eq}) during workday hours ($L_{eq\text{-}workday}$) would be below 65 dBA at a distance of 1,000 feet. At the closest residences located roughly 5,000 feet to the South from the nearest edge of the assumed working location, or to potential residences 5,000 feet to the Northwest, noise levels would be roughly 50 dBA $L_{eq\text{-}workday}$. Noise levels determined using CNEL, which averages noise across a 24-hour period rather than the workday, would be approximately 3 decibels (dB) less than $L_{eq\text{-}workday}$. The hilly terrain surrounding SSFL would provide additional sound reduction, which was not considered when determining the noise levels shown in Table 4–42. Noise generated by equipment may be audible at nearby residences at certain times and under certain atmospheric conditions, but is not expected to be disruptive. Ground vibrations generated by equipment are not expected to be noticeable at these residences. Therefore, no adverse noise impacts from soil remediation are expected.

Table 4–42 Noise Levels of Construction and Demolition Equipment

	Noise Level (in dBA) at Distance	
Equipment Type	***L_{max} at 1,000 Feet***	***L_{max} at 5,000 Feet***
Crane	55	41
Dozer	56	42
Dump Truck (low speeds)	50	37
Excavator	55	41
Fork Lift	49	35
Front End Loader	53	39
Concrete Saw	64	50
Impact Chisel	63	49
Street Sweeper	56	42
Water Truck	49	35
	$L_{eq\text{-}workday}$ at 1,000 feet	$L_{eq\text{-}workday}$ at 5,000 feet
Total	64	50

dBA = decibels A-weighted; $L_{eq\text{-}workday}$ = equivalent sound level during workday hours; *L_{max}*. = maximum noise level.
Source: FHWA 2006.

Noise from Traffic

As described in Chapter 2, DOE, NASA, and Boeing have entered into a Transportation Agreement whereby the three parties would dispatch no more than 96 daily heavy-duty truckloads offsite (Boeing 2015a). During soil removal operations, DOE would conduct up to 48 round trips per day. On days when NASA and Boeing use less than their allotted share of truck round trips, DOE could conduct up to 96 daily round trips. No truck trips would occur during hours for which a noise penalty would be applied during the calculation of CNEL.

Under the Cleanup to AOC LUT Values Alternative, trucks would be similar in noise level to those used currently by Boeing to transport materials to or from SSFL. Trucks would be heavy-duty, with gross vehicle weight ratings equal to or greater than 26,001 pounds. Expected time-averaged noise levels along the haul routes were calculated using algorithms replicating the Federal Highway Administration's Highway Noise Prediction Model FHWA-RD-77-108. In accordance with California Department of Transportation standard practice, reference noise levels from the California Vehicle Noise data set were used. To avoid underestimating noise impacts, the modeled scenarios reflect all heavy-duty truck round trips on each of the optional haul routes.

Table 4–43 lists existing and projected noise levels along five roads on haul routes in the SSFL vicinity: Roscoe Boulevard, Plummer Street, Woolsey Canyon Road, Valley Circle Boulevard (Roscoe Boulevard to Victory Boulevard), and Valley Circle Boulevard (Victory Boulevard to U.S. Highway 101). Both the projected noise levels and existing noise levels were evaluated at a distance of 100 feet from each road. (These values differ from the noise levels listed in Chapter 3, Table 3–13, which were measured at variable distances from the road centerline.) Because, on some days, DOE heavy-duty truck round trips could exceed 48 (provided the daily total by DOE, NASA, and Boeing did not exceed 96) and are projected to be no more than 32 during the last year of soil removal, Table 4–43 also lists projected noise levels along the five roads assuming 32 and 96 daily heavy-duty truck round trips. Assuming DOE activities were responsible for 96 heavy-duty truck round trips during a limited number of days, the largest increase in noise would be along Woolsey Canyon Road, where noise levels could experience a 3.5 dBA increase from 55.7 dBA to 59.2 dBA. The highest projected noise levels would be along Valley Circle Boulevard between Victory Boulevard and U.S. Highway 101 (66.5 dBA).

Table 4–43 Traffic Noise Levels under Three Heavy-Duty Truck Scenarios

Road	Existing CNEL (dBA)	*Heavy-Duty Truck Scenarios (dBA)*					
		32 Round Trips		*48 Round Trips*		*96 Round Trips*	
		CNEL	*Increase*	*CNEL*	*Increase*	*CNEL*	*Increase*
Roscoe Blvd	60.5	61.2	0.7	61.6	1.0	62.4	1.9
Plummer Street	57.5	58.4	1.0	58.8	1.4	59.9	2.4
Woolsey Canyon Road	55.7	57.2	1.5	57.8	2.1	59.2	3.5
Valley Circle Blvd (Roscoe Blvd to Victory Blvd)	63.4	63.7	0.3	63.9	0.5	64.3	0.9
Valley Circle Blvd (Victory Blvd to U.S. Highway 101)	65.9	66.1	0.2	66.2	0.3	66.5	0.6

Blvd = Boulevard; CNEL = Community Noise Equivalent Level; dBA = decibels A-weighted.
Source: Urban Crossroads 2011; Barry and Reagan 1978.

Under the Cleanup to AOC LUT Values Alternative, soil would be removed and backfill delivered over a 10-year period, with a daily average of approximately 48 heavy-duty daily truck round trips during the first 9 years of soil removal and a daily average of 31 round trips during the final year (see Appendix H, Table H–16). As shown in Table 4–43, the largest increase in noise during the first 9 years would result from a daily average of 48 heavy-duty truck round trips along Woolsey Canyon Road, where noise levels could increase by 2.1 dBA from 55.7 dBA to 57.8 dBA CNEL. The highest projected noise levels would be along Valley Circle Boulevard between Victory Boulevard and U.S. Highway 101 (66.2 dBA CNEL). During the final year of soil removal, the largest increase in noise would be along Woolsey Canyon Road, where, assuming a daily average of 32 heavy-duty truck round trips, noise levels could increase by 1.5 dBA from 55.7 dBA to 57.2 dBA. The highest projected noise levels would be along Valley Circle Boulevard between Victory Boulevard and U.S. Highway 101 (66.1 dBA).

The frequency of heavy-duty truck traffic would be higher under the Cleanup to AOC LUT Values Alternative than under baseline conditions. As noted in Chapter 3, Section 3.7.3, individual SSFL truck by-pass events generate maximum roadside noise levels between 80 and 95 dBA, with the loudest noise levels associated with engine braking. Heavy-duty trucks transporting waste or materials to or from Area IV would generate noise at levels similar to those currently operating along the haul routes. However, time-averaged noise levels in residential areas would increase by no more than 3.5 dBA CNEL along all roads where noise levels would remain below 65 dBA CNEL, and would increase by less than 0.6 dBA CNEL along roads where baseline noise levels exceed 65 dBA CNEL. This would occur both during "average" days, assuming 48 daily heavy-duty truck round trips, and days when shipments from DOE activities could spike to 96 daily heavy-duty truck round trips. On highways such as Topanga Canyon Boulevard or any of the interstate highways, the baseline traffic volume is such that the additional truck traffic and noise would not be noticeable.

DOE would make efforts to reduce noise levels from heavy-duty truck traffic by implementing measures to minimize impacts, as discussed in Chapter 6. These practices would include maintaining the efficiency of heavy-duty truck mufflers and maintaining the pavement of Woolsey Canyon Road free of bumps and potholes to the extent practicable. In addition, noise impacts along roads other than Woolsey Canyon Road may be reduced by use of different routes connecting SSFL with nearby highway systems.

4.7.1.3 Cleanup to Revised LUT Values Alternative

Noise levels from onsite equipment would be similar in terms of intensity as those under the Cleanup to AOC LUT Values Alternative (see Section 4.7.1.2), but with a much shorter duration (slightly over 2 years rather than 10 years). No adverse noise impacts are expected.

There would be up to 48 average daily heavy-duty truck round trips during the first two years of soil removal and much less than 1 average daily round trip during the final partial year (see Appendix H, Table H–16). In addition, shipments could spike during some days to as many as 96 heavy-duty truck round trips. During these isolated days, noise increases would be the same as those under the Cleanup to AOC LUT Values Alternative (see Section 4.7.1.2).

Compared to baseline conditions, the frequency of truck traffic would be higher under the Cleanup to Revised LUT Values Alternative. Nonetheless, time-averaged traffic noise levels along the haul routes at the reference distance of 100 feet would increase by no more than 3.5 dBA CNEL along all roads where noise levels would remain below 65 dBA CNEL, and would increase by no more than 0.6 dBA CNEL along roads where baseline noise levels exceed 65 dBA CNEL. This is expected to be the case during average days, assuming up to 48 daily heavy-duty truck round trips, as well as days when shipments from DOE activities could spike to 96 daily heavy-duty truck round trips. On larger highways such as Interstate 5, the baseline traffic volume is such that the additional truck traffic and noise would not be noticeable. Irrespective of this determination, DOE would make efforts to reduce noise levels from heavy-duty truck traffic by implementing measures to minimize impacts, as discussed in Section 4.7.1.2 and Chapter 6.

4.7.1.4 Conservation of Natural Resources Alternative

Noise levels from onsite equipment would be similar in terms of intensity to those under the Cleanup to AOC LUT Values Alternative (see Section 4.7.1.2), with no expected adverse noise impacts on nearby residents. The duration of noise would be much shorter—that is, approximately 2 years.

There would be 48 average daily heavy-duty truck round trips during 2019 and 26 during 2020 (see Appendix H, Table H–16). In addition, shipments could spike during some days to as many as 96 heavy-duty truck round trips. During these isolated days, noise increases would be the same as those under the Cleanup to AOC LUT Values Alternative (see Section 4.7.1.2).

Traffic noise levels would be similar in terms of intensity as those under the Cleanup to AOC LUT Values Alternative (see Section 4.7.1.2), but with a much shorter duration similar to that for the Cleanup to Revised LUT Values Alternative. No adverse noise impacts are expected.

4.7.2 Building Demolition Alternatives

Impacts under the building demolition alternatives are summarized and compared in **Table 4–44**.

Table 4–44 Noise Impacts under the Building Demolition Alternatives

Resource	*Building No Action Alternative*	*Building Removal Alternative*
Noise from onsite activities	No impacts are expected above baseline conditions.	Noise levels at the closest residence to Area IV are expected to be well below 65 dBA CNEL with no expected adverse noise impacts.
Noise from heavy-duty truck traffic to and from SSFL	No impacts are expected above baseline conditions.	Average daily noise levels at a distance of 100 feet from the evaluated roads could increase by up to 1.5 dBA CNEL on roads where the highest noise levels would remain below 65 dBA CNEL. Increases along roads where noise levels are above 65 dBA CNEL would be much lower (0.2 dBA). Assuming the maximum number of daily round trips from Area IV (96 round trips), time-averaged noise levels in residential areas would increase by no more than 3.5 dBA CNEL along all roads where noise levels would remain below 65 dBA CNEL (the threshold for an adverse impact is an increase of 5 dBA CNEL). Time-averaged noise levels would increase by no more than 0.6 dBA CNEL along roads where baseline noise levels exceed 65 dBA CNEL (the threshold for an adverse impact where the final noise level exceeds 65 dBA CNEL is an increase of 3 dBA CNEL). No adverse noise impacts are expected.

CNEL = Community Noise Equivalent Level; dBA = decibels A-weighted.

4.7.2.1 Building No Action Alternative

Under the Building No Action Alternative, existing DOE-owned buildings would remain in place. There would be no building demolition or transportation noise above baseline levels (see Chapter 3, Section 3.7), with no additional noise impacts.

4.7.2.2 Building Removal Alternative

Under the Building Removal Alternative, DOE would demolish 18 structures over 2 years. While demolition is under way, noise would be generated at the demolition site and along the routes used to transport waste, backfill, equipment, and supplies to or from Area IV.

Noise from Building Demolition

Equipment used for building demolition would be similar in noise level to that used for soil remediation, as listed in Table 4–42. As with noise levels from soil remediation, noise generated during building remediation could be audible at nearby residences at certain times and under certain atmospheric conditions, but is not expected to be disruptive. Ground vibrations generated by equipment are not expected to be noticeable at these residences. Therefore, no adverse noise impacts from building demolition are expected.

Noise from Traffic

During the 2 years of building demolition, DOE would typically conduct less than 32 round trips per day consisting of shipments of waste and backfill associated with building demolition as well as shipments of equipment. [13] This number of round trips is roughly a third of the total maximum number of offsite shipments under the Transportation Agreement (Boeing 2015a). On days when Boeing uses less than its allotted share of truck round trips, DOE could conduct up to 96 daily round trips. As shown in Table 4–43, noise levels associated with 32 or 96 round trips per day would result in time-averaged noise level increases of no more than 3.5 dBA CNEL along the evaluated roads at a distance of 100 feet from the roads. Traffic noise levels at residences along the haul routes would remain below 65 dBA CNEL, or, if baseline noise levels exceed 65 dBA CNEL, would increase by no more than 0.6 dBA CNEL. No adverse impacts are expected because the traffic noise is not expected to rise to unacceptable levels in accordance with the *L.A. CEQA Thresholds Guide* (City of Los Angeles 2006). Irrespective of this determination, DOE would make efforts to reduce noise levels from heavy-duty truck traffic by implementing measures to minimize impacts, as discussed in Section 4.7.1.2 and Chapter 6.

4.7.3 Groundwater Remediation Alternatives

Impacts under the groundwater remediation alternatives are summarized and compared in **Table 4–45**.

Table 4–45 Noise Impacts under the Groundwater Remediation Alternatives

Resource	*Groundwater No Action Alternative*	*Groundwater Monitored Natural Attenuation Alternative*	*Groundwater Treatment Alternative*
Noise from onsite activities	No impacts are expected above baseline conditions.	Noise levels at the closest residence could increase slightly compared to those under the Groundwater No Action Alternative, but are still expected to be well below 65 dBA CNEL, with no adverse noise impacts.	Noise levels at the closest residence could increase compared to those under the Groundwater Monitored Natural Attenuation Alternative, but are still expected to be well below 65 dBA CNEL, with no adverse noise impacts.
Noise from heavy-duty truck traffic to and from SSFL	No impacts are expected above baseline conditions.	There could be 11 heavy-duty truck round trips distributed over a working year, with no expected adverse noise impacts.	Along roads where noise levels would not exceed 65 dBA CNEL, time-averaged noise levels would increase by no more than 3.5 dBA CNEL at a distance of 100 feet from these roads. At residences along roads where baseline noise levels exceed 65 dBA CNEL, traffic noise levels would increase by less than 0.6 dBA CNEL. No adverse traffic-related noise impacts are expected.

CNEL = Community Noise Equivalent Level; dBA = decibels A-weighted.

[13] Shipments were assumed to occur over 2 to 5 months during each of 2 years and, during these months, average daily truck shipments could range from about 8 to 27 (see Appendix H, Table H–16) Daily shipments may be reduced by distributing shipments over longer time periods in each year.

4.7.3.1 Groundwater No Action Alternative

Under the Groundwater No Action Alternative, environmental monitoring programs would continue, and noise impacts would not increase compared to baseline conditions.

4.7.3.2 Groundwater Monitored Natural Attenuation Alternative

Under the Groundwater Monitored Natural Attenuation Alternative, five additional monitoring wells could be constructed. Equipment used to install the wells would be similar in noise level to equipment used for demolition and soil remediation. Noise levels at the closest residence would be larger than those under the Groundwater No Action Alternative, but are still expected to be well below 65 dBA CNEL with no adverse noise impacts experienced by nearby residents.

Traffic noise would be very low, with no adverse noise impacts. Even if all five wells were installed in a single year, there would be only five round trips of truck-mounted drill rigs, and five shipments of well installation water in tanker trucks. Shipments would occur at different times during the year. In addition, deliveries of well equipment for each well are not expected to require use of heavy-duty trucks. Well monitoring activities would result in about the same annual number (one) of tanker trucks transporting monitoring well purge water to publicly owned treatment works as that under the Groundwater No Action Alternative. Implementing measures to minimize impacts, as discussed in Section 4.7.1.2 and Chapter 6, would further reduce these low noise levels.

4.7.3.3 Groundwater Treatment Alternative

The primary use of heavy equipment under this alternative would be to remove bedrock containing strontium-90, an activity projected to require about 20 working days. Heavy equipment used for this purpose would be similar in noise level to equipment used in building demolition and soil remediation. Other equipment installed to treat groundwater (e.g., pumps) would emit considerably less noise. Noise levels at the closest residence could be larger than those under the Groundwater Monitored Natural Attenuation Alternative, but are still expected to be well below 65 dBA CNEL with no adverse noise impacts.

There would be 15 deliveries of equipment in heavy-duty trucks, and then 211 shipments of excavated bedrock and backfill. If all shipments of waste and bedrock were made during 20 working days, during these days there would be 11 average daily truck round trips between SSFL and major highways. Noise impacts from this scenario would be smaller in terms of intensity and duration than those for the Building Removal Alternative (Section 4.7.2.2). This scenario is not likely, however, because shipments would be constrained in accordance with the Transportation Agreement among DOE, NASA, and Boeing (Boeing 2015a), and in consideration of shipments associated with other DOE operations. If spread over a working year, the projected shipments of waste and bedrock would average less than one round trip per day. Along roads where noise levels would not exceed 65 dBA CNEL, time-averaged noise levels would increase by no more than 3.5 dBA CNEL at a distance of 100 feet from these roads. At residences along roads where baseline levels exceed 65 dBA CNEL, traffic noise levels would increase by no more than 0.6 dBA CNEL. No adverse traffic-related noise impacts are expected.

4.7.4 Noise Impacts under All Action Alternative Combinations

There would be little difference in the intensity of noise emanating from Area IV for any combination of action alternatives. All combinations would require use of heavy equipment, and similar noise intensities would be experienced at the nearest residence, with no expected noise impacts. In addition, all combinations would entail up to 48 average daily heavy-duty truck round trips, with possible occasional spikes to 96 round trips. Over the entire range of daily truck round trips, time-averaged noise levels in residential areas would increase by no more than 3.5 dBA CNEL along all roads where noise levels would remain below 65 dBA CNEL, and would increase by no more than 0.6 dBA CNEL along the road where noise levels exceed 65 dBA CNEL (one section of Valley Circle Boulevard already exceeds 65 dBA CNEL). These noise increases would not exceed the thresholds defined in the *L.A. CEQA Thresholds Guide* (LA 2006). Therefore, although the increased traffic would be audible to persons in the vicinity of the evaluated roads, the increased noise would not be expected to exceed "normally acceptable" levels as established for this EIS per the *L.A. CEQA Thresholds Guide* (LA 2006).

The combination of action alternatives having the longest noise duration (12 years) would be the High Impact Combination, primarily because of the volume of soil removed. There would be no change in noise duration if both groundwater remediation action alternatives were implemented. The combination of action alternatives having the shortest noise duration would be the Low Impact Combination. Because much less soil would be removed, almost all remediation activities under this combination of action alternatives would be completed in 4 years. After that, there would be very minor traffic noise, primarily emitted from transport of monitoring well purge water for offsite disposition and monitoring samples to offsite laboratories.

4.7.5 Impact Threshold Analysis

Under all alternatives, noise levels from activities in Area IV and the NBZ either would not exceed 65 dBA CNEL at the nearest residence or, at those locations where noise already exceeds 65 dBA CNEL, would increase by less than 3 dBA CNEL. Therefore, an impact threshold, as summarized in Table 4–2, would not be exceeded.

4.8 Transportation and Traffic

This section consists of two primary subsections that respectively: (1) describe the routing and handling of waste, equipment, and materials to or from SSFL and assess the associated radiological and nonradiological risks to workers and the public; and (2) evaluate the impacts of the alternatives on traffic and pavement conditions in the SSFL vicinity.

4.8.1 Transportation

For incident-free transportation, the potential human health impacts from the radiation field surrounding the radioactive packages were estimated for transportation workers and populations along the route (off-traffic or off-link), people sharing the route (in-traffic or on-link), and people at rest areas and stops along the route. The System for Analyzing the Radiological Impact of the Transportation of Radioactive Materials (RADTRAN) 6.02 computer program (SNL 2013) was used to estimate impacts on transportation workers and populations, as well as the impact to a maximally exposed individual (MEI), who may be a worker or a member of the public (for example, a resident along the route, a person struck in traffic, a gasoline station attendee, or an inspector).

In addition to evaluating the radiological risks that would result from all reasonably conceivable accidents during transportation of radioactive waste, DOE evaluated the radiological consequences of maximum reasonably foreseeable accidents with probabilities greater than 1×10^{-7} (1 chance in 10 million) per year. These latter consequences were determined for the atmospheric conditions that would likely prevail during accidents. This analysis used the Risks and Consequences of Radioactive Material Transport (RISKIND) computer program to estimate doses to individuals and populations (Yuan et al. 1995).

Two options, all truck transport (truck option) and combined truck and rail transport (truck/rail option), were evaluated for delivery of waste to offsite facilities. The following waste facilities were evaluated under the truck option:

- The Nevada National Security Site (NNSS) in Nevada and Energy*Solutions* in Utah for low-level radioactive waste (LLW) and mixed low-level radioactive waste (MLLW);
- Buttonwillow and Westmorland in California and US Ecology in Idaho for hazardous waste;
- Chiquita Canyon, Antelope Valley, and McKittrick in California for nonhazardous waste from building removal; these facilities, as well as Buttonwillow and Westmorland in California, were evaluated for nonhazardous waste from soil remediation; and
- Kramer Metals, Standard Industries, and P.W. Gillibrand in California for building recycle materials. [a]

Under the combined truck and rail (truck/rail) option, some types of waste may be sent by truck to an intermodal facility (assumed to be the Puente Hills Intermodal Facility, which is under construction in City of Industry, California [about 60 miles from SSFL]), where the waste would be placed on railcars to be delivered to appropriate disposal facilities. The following facilities were evaluated under the truck/rail option:

- NNSS in Nevada for LLW and MLLW;
- Energy*Solutions* in Utah for LLW and MLLW
- US Ecology in Idaho for hazardous waste; and
- Mesquite Regional Landfill in California for nonhazardous waste. [b]

For truck/rail shipment to NNSS, waste would be transferred to trucks from the railcars at a second intermodal facility (in addition to the Puente Hills facility) that was assumed (for analysis) to be located at Barstow, California, and then delivered to NNSS.

See Appendix D, Section D.4, for information on how the disposal, recycle, and intermodal facilities for the truck and truck/rail options were selected.

[a] Building recycle materials would only be generated under the Building Removal Alternative and would only be transported via truck because the recycle facilities are near SSFL and do not have rail connections.

[b] Because the operational date for the Mesquite Regional Landfill is uncertain, transportation impacts were estimated by assuming a shipment distance corresponding to that for US Ecology in Idaho; this assumption envelopes impacts that could result from shipment of nonhazardous waste by rail to the Mesquite Regional Landfill.

Transportation packaging for radioactive materials must be designed, constructed, and maintained to contain the package contents and provide radiation shielding. The type of packaging used is determined by the total radioactive hazard presented by the material within the packaging. For transport of waste analyzed in this EIS, three basic types of packaging were assumed: Excepted, Industrial, and Type A. Specific requirements for these packages are detailed in 49 CFR Part 173, Subpart I. See Appendix H, Section H.3, for additional information about radioactive material packaging and transportation regulations.

Potential human health impacts from transportation accidents were evaluated. The impact of a specific radiological accident is expressed in terms of probabilistic risk, which is defined as the accident probability (accident frequency) multiplied by the accident consequence. The overall risk was obtained by summing individual risks from all reasonably conceivable accidents. The analysis of accident risks accounts for a spectrum of accidents ranging from high-probability accidents of low severity (a fender-bender) to hypothetical high-severity accidents that have a corresponding low probability of occurrence.

The expected very low concentrations of radioactive material in the contaminated soil, building debris, and other waste addressed in this EIS pose very little risk, in general, to human health and the environment, even under accident conditions, as discussed here and detailed in Appendix H, Tables H–4 through H–8. Nevertheless, Appendix H, Section H.4, discusses the applicable procedures and programs for emergency response, assuming an accident occurs that results in a radiological release. To summarize, in the event of a radiological release from a shipment along a route, local emergency response personnel would be the first to arrive at the accident scene. It is expected that response actions would be taken in the context of the *Nuclear/Radiological Incident Annex* (DHS 2008). Based on their initial assessment at the scene, training, and available equipment, first responders would involve Federal and state resources as necessary. First responders and/or Federal and state responders would initiate actions in accordance with the U.S. Department of Transportation (DOT) *Emergency Response Guidebook* (DOT 2012) to isolate the incident and perform the actions necessary to protect human health and the environment (such as evacuations or other means to reduce or prevent impacts to the public). Cleanup actions are the responsibility of the carrier. DOE would partner with the carrier, shipper, and applicable state and local jurisdictions to ensure cleanup actions met regulatory requirements.

Incident-free radiological health impacts are expressed as additional latent cancer fatalities (LCFs). Radiological accident health impacts are also expressed as additional LCFs, and nonradiological accident risks are expressed in terms of additional immediate (traffic) fatalities. LCFs associated with radiological exposure were estimated by multiplying the occupational (transport crew) and public dose by a risk factor of 0.0006 (6.0×10^{-4}) LCFs per rem or person-rem of exposure (DOE 2003b). Impacts from transporting various wastes were calculated assuming that the wastes are shipped by truck or a combination of truck and rail.[14] All shipments must meet applicable DOT and U.S. Nuclear Regulatory Commission packaging and other transportation regulations, as discussed in Appendix H, Sections H.3.1 and H.3.2.

> *Maximally exposed individual (MEI)* – a hypothetical individual worker or member of the public whose location and habits result in the highest total radiological exposure (and thus dose) from a particular source for all exposure pathways. For transport of radioactive material the exposure pathway is direct radiation.
>
> *Rem* – a unit of radiation dose equivalent used to measure the biological effects of different types of radiation on humans. The dose in rem is estimated by a formula that accounts for the type of radiation, the total absorbed dose, and the tissues involved. One thousandth of a rem is a millirem.
>
> *Person-rem* – a unit of collective radiation dose applied to a population or group of individuals. It is calculated as the sum of the estimated doses, in rem, received by each individual of the specified population. For example, if 1,000 people each received a dose of 1 millirem, the collective dose would be 1 person-rem (1,000 persons × 0.001 rem).
>
> *Latent cancer fatalities (LCFs)* – deaths from cancer resulting from and occurring sometime after exposure to ionizing radiation or other carcinogens. For transport of radioactive material, this EIS focuses on LCFs as the primary means of evaluating health risk from radiation exposure. A risk factor of 0.0006 LCFs per person-rem or rem is used, consistent with DOE guidance (DOE 2003b). The values reported for an LCF are: (1) the increased risk of an MEI or other individual developing a fatal cancer, or (2) the number of LCFs projected to occur in an identified population. For a population, if the calculated LCF value is less than 0.5, the number of LCFs is reported as zero.

[14] Because SSFL does not have rail connections, waste shipments would have to be transported via truck to an intermodal location (a rail yard). For purposes of analysis, it was assumed that, for every rail shipment of 8 railcars, 16 truck shipments would be required to transfer the waste from SSFL to the Puente Hills Intermodal Facility, which is under construction (including road and rail modifications) in City of Industry, California. Because NNSS lacks a direct rail connection for waste delivery, additional truck transports were evaluated to account for shipments from a second intermodal facility to NNSS. For purposes of analysis and consistent with the *Final Environmental Impact Statement for Continued Operation of the Department of Energy/National Nuclear Security Administration Nevada National Security Site and Off-Site Locations in the State of Nevada* (DOE/EIS-0426) (DOE 2013a); the second intermodal facility was assumed to be the rail yard at Barstow, California.

In determining transportation risks, per-shipment risk factors were calculated for incident-free and accident conditions using the RADTRAN 6.02 computer program (SNL 2013) in conjunction with the Transportation Routing Analysis Geographic Information System (TRAGIS) computer program (Johnson and Michelhaugh 2003) to choose transportation routes in accordance with DOT regulations. The TRAGIS program provides population density estimates for rural, suburban, and urban areas along the routes based on the 2010 U.S. census. The population density estimates were escalated to 2020 population density estimates using state-level 2000 and 2010 census data and assuming population growth between 2000 and 2010 would continue through 2020. The ROI of this analysis is the affected population, including individuals living within 0.5 miles of each side of the road or rail line for incident-free operations and, for accident conditions, individuals living within 50 miles of the accident. The MEI was assumed to be a receptor located 330 feet directly downwind from the accident. Additional details on the analytical approach and the modeling and parameter selections are provided in Appendix H.

Route-specific accident and fatality rates for commercial truck transports and rail shipments were used to determine the risk of traffic accident fatalities (Saricks and Tompkins 1999) after being adjusted for possible under-reporting (UMTRI 2003). The methodology for obtaining and using accident and fatality rates is provided in Appendix H, Section H.7.2.

Table 4–46 shows the route characteristics for offsite transport of low-level radioactive waste (LLW), mixed low-level radioactive waste (MLLW), and hazardous waste.

Table 4–46 Route Characteristics for Offsite Transport of Low-Level Radioactive Waste, Mixed Low-Level Radioactive Waste, and Hazardous Waste

Transport Method	*Destination* [a]	*Nominal Distance (miles)*
Truck	Energy*Solutions*, Utah	780
Truck	US Ecology, Idaho	1,020
Truck	NNSS, Nevada	330
Truck/Rail	Energy*Solutions*, Utah	840 [b]
Truck/Rail	US Ecology, Idaho	1,190 [b]
Truck/Rail	NNSS, Nevada	470 [b]

NNSS = Nevada National Security Site.

[a] The Energy*Solutions* facility and NNSS were evaluated for receipt of LLW and MLLW; US Ecology in Idaho was evaluated for receipt of hazardous waste.

[b] Total distance (truck and truck/rail).

Table 4–47 summarizes the potential transportation impacts under each action alternative for shipment of radioactive waste to each disposal location. To ensure a conservative analysis, the impacts of sending *all* radioactive waste to each facility were evaluated rather than distributing the waste shipments among the identified radioactive waste management facilities. The Groundwater Monitored Natural Attenuation Alternative is not included in the table because activities evaluated under this alternative are not expected to generate radioactive waste.[15] The accident impacts presented in the table are those that could result from all reasonably conceivable accidents during transport of radioactive waste. Details are presented in Appendix H.

[15] Very small quantities of well installation cuttings and water and purge water from environmental sampling would be generated under the Groundwater Monitored Natural Attenuation Alternative that would not be expected to be classified as LLW or MLLW. If determined otherwise when generated, the wastes would be safely transported to appropriate facilities for disposition.

Table 4–47 Risks to Crew Members and Populations from Transporting Radioactive Waste under each Action Alternative

			Incident-Free				Accident	
			Crew		Population			
Destination	*Number of Shipments* [a]	*One-way Miles Traveled*	*Dose (person-rem)*	*LCFs* [b]	*Dose (person -rem)*	*LCFs* [b]	*Radiological Risk (LCFs)* [b, c]	*Non-radiological Risk (traffic fatalities)* [b]
Cleanup to AOC LUT Values and Cleanup to Revised LUT Values Alternatives [e]								
Truck								
Energy*Solutions*	6,830	5,290,000	1.3	8×10^{-4}	0.33	2×10^{-4}	4×10^{-9}	0.3
NNSS	6,830	2,080,000	0.50	3×10^{-4}	0.13	8×10^{-5}	4×10^{-10}	0.04
Truck/Rail [d]								
Energy*Solutions*	430	665,000	0.20	1×10^{-4}	0.22	1×10^{-4}	3×10^{-10}	0.2
NNSS	430	1,570,000	0.39	2×10^{-4}	0.17	1×10^{-4}	3×10^{-10}	0.2
Conservation of Natural Resources Alternative								
Truck								
Energy*Solutions*	3,530	2,730,000	0.66	4×10^{-4}	0.17	1×10^{-4}	2×10^{-9}	0.1
NNSS	3,530	1,070,000	0.26	2×10^{-4}	0.069	4×10^{-5}	2×10^{-10}	0.02
Rail/Truck [d]								
Energy*Solutions*	220	344,000	0.10	6×10^{-5}	0.12	7×10^{-5}	1×10^{-10}	0.1
NNSS	220	810,000	0.20	1×10^{-4}	0.089	5×10^{-5}	1×10^{-10}	0.1
Building Removal Alternative								
Truck								
Energy*Solutions*	1,030	808,000	0.19	1×10^{-4}	0.050	3×10^{-5}	6×10^{-10}	0.04
NNSS	1,030	311,000	0.075	5×10^{-5}	0.020	1×10^{-5}	5×10^{-11}	0.006
Truck/Rail [d]								
Energy*Solutions*	65	101,000	0.030	2×10^{-5}	0.034	2×10^{-5}	4×10^{-11}	0.03
NNSS	65	239,000	0.060	4×10^{-5}	0.026	2×10^{-5}	4×10^{-11}	0.03
Groundwater Treatment Alternative [f]								
Truck								
Energy*Solutions*	130	99,200	0.024	1×10^{-5}	0.0062	4×10^{-6}	8×10^{-11}	0.005
NNSS	130	38,900	0.0093	6×10^{-6}	0.0025	2×10^{-6}	7×10^{-12}	0.0008
Truck/Rail [d]								
Energy*Solutions*	10	12,500	0.0037	2×10^{-6}	0.0042	3×10^{-6}	5×10^{-12}	0.004
NNSS	10	29,400	0.0053	3×10^{-6}	0.0032	2×10^{-6}	5×10^{-12}	0.004

AOC = *Administrative Order on Consent for Remedial Action*; LCF = latent cancer fatality; LUT = Look-Up Table; NNSS = Nevada National Security Site, rem = roentgen equivalent man.

[a] The number of shipments was rounded to the nearest ten when greater than 100 and to the nearest 5 when less than 100. Under the truck option, the number of shipments would be those directly transported to the disposal facilities. Under the truck/rail option, the same number of truck shipments would leave SSFL, but the trucks would transport the waste to a nearby intermodal facility, and the listed truck/rail shipments would be the number of rail shipments that would result. (Essentially every 16 truck shipments equal 1 rail shipment.) Also see table note "d".

[b] Risk is expressed in terms of LCFs, except for nonradiological risk, where risk refers to the number of traffic accident fatalities. Radiological risk is calculated for one-way travel, while nonradiological risk is calculated for two-way travel. Accident dose can be calculated by dividing the risk values by 0.0006 (DOE 2003b). The values were rounded to one non-zero digit.

[c] Because the radioactive content in soil, building materials, and groundwater bedrock debris is very small, the accident risk is dominated by doses from external radiation from packages during the 12-hour recovery time after an accident with no release (see Appendix H, Section H.7.5).

[d] For purposes of analysis, it was assumed that, for every rail shipment of 8 railcars, there would be 16 truck shipments to transfer the waste from SSFL to the Puente Hills Intermodal Facility, which is under construction (including rail and road modifications) in City of Industry, California. Since NNSS does not have a rail connection, rail shipments would be shipped by rail from Puente Hills to a second intermodal facility (which was assumed for analysis purposes to be at Barstow, California) and then transported by truck to NNSS; impacts from these additional shipments are included in the tabulated results in this table.

[e] Impacts from transport of radioactive waste would be the same under the Cleanup to AOC LUT Values Alternative and the Cleanup to Revised LUT Values Alternative.

[f] Very small quantities of well installation cuttings and water and purge water from environmental sampling would be generated under the Groundwater Monitored Natural Attenuation Alternative that are not expected to be classified as LLW or MLLW. If determined otherwise when generated, the wastes would be safely transported to appropriate facilities for disposition.

As indicated in Table 4–47, all transportation risks are less than one. This means that no LCFs or traffic fatalities are expected to occur during the transport of radioactive waste. Under the Building Removal Alternative, for example, the potential impacts to truck crews and populations from 1,030 shipments by truck of LLW/MLLW from SSFL to Energy*Solutions* in Utah are given as 1×10^{-4} and 3×10^{-5} LCFs (risk of a single LCF in the exposed population), respectively, meaning there would be a very low risk of developing additional LCFs among the truck crews and populations. This risk can also be interpreted to mean there is a chance of approximately 1 in 10,000 that an additional latent fatal cancer could be experienced among the workers from exposure to radiation during 1,030 shipments of this waste over the entire transportation campaign. The chance of a single latent fatal cancer among the exposed population residing along the transport route due to these shipments is 1 in 33,000. It should be noted also that crew and population doses and risks were determined assuming that essentially the same individuals would be exposed to radiation from transporting all radioactive waste over the duration of any alternative. The largest statistical risk of fatality due to a traffic accident is about 0.3 among the in-route population, which would occur under the Cleanup to AOC LUT Values or the Cleanup to Revised LUT Values Alternative, assuming delivery to Energy*Solutions* in Utah. This risk is less than 0.5, even with about 5,290,000 miles traveled, which statistically means no (less than 1) fatality.

Table 4–48 summarizes the potential impacts from transporting nonradioactive (hazardous and nonhazardous) wastes, recycle materials, and miscellaneous materials (backfill, equipment, and supplies) under all action alternatives. It was conservatively assumed that all hazardous waste would be transported to US Ecology in Idaho because this facility is the farthest distance from SSFL. Nonhazardous waste was assumed to be shipped to permitted facilities for disposal; for conservative analysis it was assumed that all nonhazardous waste would be transported to the Westmorland Landfill in California under the truck option and to US Ecology in Idaho under the truck/rail option as these two sites are located at the farthest distance from SSFL amongst all sites considered. It was also assumed that recycle materials (concrete, asphalt, metals) would be shipped to permitted California recycle facilities in trucks and that trucks would be used to deliver miscellaneous materials to SSFL.

Table 4–48 Risks from Transporting Nonradioactive Waste and Miscellaneous Materials under each Action Alternative

Alternative	*Number of Truck Shipments* [a]	*Number of Rail Shipments* [a]	*Two-way Miles Traveled*	*Number of Accidents*	*Number of Traffic Fatalities*
Truck					
Cleanup to AOC LUT Values	**110,000**	**NA**	**39,000,000**	**12**	**0.52**
Hazardous	3,680	NA	7,500,000	5.2	0.23
Nonhazardous	59,500	NA	27,350,0000	6.0	0.25 [b]
Backfill/Equipment/Supplies	45,700	NA	4,540,000	1.0	0.041
Cleanup to Revised LUT Values	**17,000**	**NA**	**10,200,000**	**5.8**	**0.25**
Hazardous	3,680	NA	7,500,000	5.2	0.23
Nonhazardous	3,900	NA	1,793,000	0.39	0.016 [b]
Backfill/Equipment/Supplies	9,440	NA	936,300	0.21	8.5×10^{-3}
Conservation of Natural Resources	**14,900**	**NA**	**10,000,000**	**5.7**	**0.25**
Hazardous	3,680	NA	7,500,000	5.2	0.23
Nonhazardous	3,900	NA	1,793,000	0.39	0.016 [b]
Backfill/Equipment/Supplies	7,290	NA	722,000	0.16	6.6×10^{-3}
Building Removal	**1,400**	**NA**	**201,000**	$\mathbf{5.5 \times 10^{-2}}$	$\mathbf{2.3 \times 10^{-3}}$
Hazardous	10	NA	23,000	1.6×10^{-2}	7.1×10^{-4}
Nonhazardous	120	NA	54,000	1.2×10^{-2}	4.9×10^{-4}

Alternative	*Number of Truck Shipments* [a]	*Number of Rail Shipments* [a]	*Two-way Miles Traveled*	*Number of Accidents*	*Number of Traffic Fatalities*
Building Recycle Material	340	NA	34,000	7.5×10^{-3}	3.1×10^{-4}
Backfill/Equipment/Supplies	920	NA	89,000	2.0×10^{-2}	8.1×10^{-4}
Groundwater Monitored Natural Attenuation [c]	**280**	**NA**	**17,000**	$\mathbf{3.7 \times 10^{-3}}$	$\mathbf{1.5 \times 10^{-4}}$
Hazardous	0	NA	0	0	0
Nonhazardous	20	NA	4,000	8.7×10^{-4}	3.6×10^{-5}
Equipment/Supplies	260 [d]	NA	13,000	2.8×10^{-3}	1.2×10^{-4}
Groundwater Treatment	**420**	**NA**	**503,000**	**0.34**	$\mathbf{1.5 \times 10^{-2}}$
Hazardous [e]	240	NA	490,000	0.34	1.5×10^{-2}
Nonhazardous	0	NA	0	0	0
Backfill/Equipment/Supplies	180	NA	13,000	2.9×10^{-3}	1.2×10^{-4}
Truck/Rail					
Cleanup to AOC LUT Values	**110,000**	**3,900**	**19,590,000**	**7.9**	**2.6**
Hazardous	3,680	230	880,000	0.40	0.15
Nonhazardous	59,500	3,700	14,180,000	6.5	2.4 [b]
Backfill/Equipment/Supplies [f]	45,700	NA	4,540,000	1.0	0.041
Cleanup to Revised LUT Values	**17,000**	**470**	**2,743,000**	**1.0**	**0.32**
Hazardous	3,680	230	880,000	0.40	0.15
Nonhazardous	3,900	240	930,000	0.43	0.16 [b]
Backfill/Equipment/Supplies [f]	9,440	NA	936,300	0.21	8.5×10^{-3}
Conservation of Natural Resources	**14,900**	**470**	**2,529,000**	**1.0**	**0.31**
Hazardous	3,680	230	880,000	0.40	0.15
Nonhazardous	3,900	240	930,000	0.43	0.16 [b]
Backfill/Equipment/Supplies [f]	7,290	NA	722,000	0.16	6.6×10^{-3}
Building Removal	**1,400**	**10**	**156,000**	$\mathbf{4.2 \times 10^{-2}}$	$\mathbf{7.0 \times 10^{-3}}$
Hazardous	10	1	3,400	1.7×10^{-3}	6.5×10^{-4}
Nonhazardous	120	10	29,600	1.4×10^{-2}	5.2×10^{-3}
Building Recycle Material [f]	340	NA	34,000	7.5×10^{-3}	3.1×10^{-4}
Backfill/Equipment/Supplies [f]	920	NA	89,000	2.0×10^{-2}	8.1×10^{-4}
Groundwater Monitored Natural Attenuation	**c**	**c**	**c**	**c**	**c**
Groundwater Treatment	**e**	**e**	**e**	**e**	**e**

AOC = *Administrative Order on Consent for Remedial Action*; LUT = Look-Up Table; NA = not applicable.

a The number of truck and rail shipments was rounded to the nearest ten.

b The difference in traffic fatalities for transport of nonhazardous waste is largely due to the difference in distance traveled between the truck (Westmorland in California) and truck/rail (US Ecology in Idaho) options.

c Wastes generated under the Groundwater Monitored Natural Attenuation Alternative were assumed to consist of very small quantities of nonhazardous cuttings from monitoring well installation and water from well installation and sampling that are shipped by truck only. These wastes are not expected to be classified as low-level or mixed low-level radioactive waste, but if determined otherwise when generated, would be safely transported to appropriate facilities for disposition.

d Includes 240 shipments of well water samples that are delivered to offsite laboratories in light-duty trucks or cars.

e Groundwater treatment systems were assumed to include pump and treat or other systems requiring periodic exchange of treatment media by a vendor. The media was assumed to contain hazardous constituents and be disposed of either directly as hazardous waste or as hazardous waste generated as part of processing the treatment media. Only truck shipment was assumed for this material.

f These shipments would be transported by truck only.

Note: Values have been rounded.

4.8.1.1 Transportation Impacts under the Soil Remediation Alternatives

Impacts under the soil remediation alternatives are summarized and compared in **Table 4–49**.

Table 4–49 Transportation Impacts under the Soil Remediation Alternatives

Resource	*Soil No Action Alternative*	*Soil Remediation Action Alternatives*		
		Cleanup to AOC LUT Values	*Cleanup to Revised LUT Values*	*Conservation of Natural Resources*
Incident-free shipment of radioactive waste	No impacts are expected above baseline conditions.	Under the truck option, there would be about 6,830 truck shipments of soil with radionuclides exceeding AOC LUT values to offsite facilities. Under the truck/rail option, the same number of truck shipments to a nearby intermodal facility would occur, and then about 430 rail shipments to the facilities. No LCFs are expected among the transport crews or the public. Calculated crew LCF risks range from 3×10^{-4} to 8×10^{-4} under the truck option or from 1×10^{-4} to 2×10^{-4} under the truck/rail option. Calculated population LCF risks range from 8×10^{-5} to 2×10^{-4} under the truck option or 1×10^{-4} under the truck/rail option.	Same as the Cleanup to AOC LUT Values Alternative, however shipments occur over slightly more than 2 years rather than 10 years.	Under the truck option, there would be about 3,530 truck shipments of soil with radionuclides above risk-assessment-based values to offsite facilities. Under the truck/rail option, the same number of truck shipments to a nearby intermodal facility would occur, and then about 220 rail shipments to the facilities. No LCFs are expected among the transport crews or the public. Calculated crew LCF risks range from 2×10^{-4} to 4×10^{-4} under the truck option or from 6×10^{-5} to 1×10^{-4} under the truck/rail option. Calculated population LCF risks range from 4×10^{-5} to 1×10^{-4} under the truck option or from 5×10^{-5} to 7×10^{-5} under the truck/rail option.
Shipment of radioactive waste under accident conditions	No impacts are expected above baseline conditions.	No LCFs are expected among the exposed population. Considering all reasonably conceivable accidents, calculated radiological risks range from 4×10^{-10} to 4×10^{-9} under the truck option or 3×10^{-10} under the truck/rail option.	Calculated radiological risks from all reasonably conceivable accidents are the same as those under the Cleanup to AOC LUT Values Alternative.	No LCFs are expected among the exposed population. Considering all reasonably conceivable accidents, calculated radiological risks range from 2×10^{-10} to 2×10^{-9} under the truck option or 1×10^{-10} under the truck/rail option.
		The consequences of a maximum reasonably foreseeable truck accident would be about 2.6×10^{-4} person-rem, resulting in no (2×10^{-7}) additional LCFs among the exposed population. The consequences from a truck/rail accident would be 6.4×10^{-3} person-rem, resulting in no (4×10^{-6}) LCFs among the exposed population. The likelihoods of such accidents for truck and rail/truck transports are about 4.2×10^{-7} and 1.0×10^{-7} per year, respectively. Taking the annual frequency of the accidents occurring into account, the maximum increased risk of a single LCF in the exposed population would be 4×10^{-13}.	The consequences of maximum reasonably foreseeable truck and truck/rail accidents are similar to those under the Cleanup to Revised LUT Values Alternative, because the waste would have similar characteristics. However, the likelihoods of the truck and truck/rail accidents are about 2.0×10^{-6} and 4.7×10^{-7} per year, respectively. Taking the annual frequency of the accidents occurring into account, the maximum increased risk of a single LCF in the exposed population would be about 2×10^{-12}.	The likelihood and consequences of a maximum reasonably foreseeable truck accident would be the same those under as the Cleanup to Revised LUT Values Alternative.
		Calculated nonradiological (traffic accident) fatality risks while transporting radioactive waste range from 0.04 to 0.3 under the truck option or 0.2 under the truck/rail option.	Calculated nonradiological (traffic accident) fatality risks while transporting radioactive waste are similar to those under the Cleanup to Revised LUT Values Alternative.	Calculated nonradiological (traffic accident) fatality risks while transporting radioactive waste range from 0.02 to 0.1 to under the truck option or 0.1 under the truck/rail option.

Resource	Soil No Action Alternative	Soil Remediation Action Alternatives		
		Cleanup to AOC LUT Values	Cleanup to Revised LUT Values	Conservation of Natural Resources
Traffic fatalities from accidents when transporting backfill, hazardous and nonhazardous wastes, equipment, and supplies	No impacts are expected above baseline conditions.	About 110,000 shipments under the truck option. About 12 traffic accidents are expected leading to about 1 (0.52) traffic fatality. Under the truck/rail option, about 63,000 shipments of waste from SSFL to an intermodal facility, and then 3,900 rail shipments; plus 45,700 truck shipments of backfill, equipment, and supplies to SSFL, leading to about 3 (2.6) traffic fatalities.	About 17,000 shipments under the truck option. About 5.8 traffic accidents are expected leading to no traffic fatalities (0.25). Under the truck/rail option, about 7,580 shipments of waste from SSFL to an intermodal facility, and then 470 rail shipments; plus 9,440 truck shipments of backfill, equipment, and supplies to SSFL, leading to no (0.32) traffic fatalities.	About 14,900 shipments under the truck option. About 5.7 traffic accidents are expected leading to no traffic fatalities (0.25). Under the truck/rail option, about 7,580 shipments of waste from SSFL to an intermodal facility, and then 470 rail shipments; plus 7,290 truck shipments of backfill, equipment, and supplies to SSFL, leading to no (0.31) traffic fatalities.

AOC = *Administrative Order on Consent for Remedial Action*; LCF = latent cancer fatality; LUT = Look-Up Table.
Note: Sums presented in the table may differ from those calculated from table entries due to rounding.

4.8.1.1.1 Soil No Action Alternative

Under the Soil No Action Alternative, there would be no remediation of contaminated soil in Area IV and the NBZ, and no radiological or nonradiological impacts from waste and material transport above baseline conditions (see Chapter 3, Section 3.10.2).

4.8.1.1.2 Soil Remediation Alternatives

4.8.1.1.2.1 Cleanup to AOC LUT Values Alternative

For the Cleanup to AOC LUT Values Alternative, under the truck option, there would be about 6,830 truck shipments of soil with radionuclides exceeding LUT values to offsite radioactive waste disposal facilities. These shipments would occur over 10 years. Under the truck/rail option, there would be the same number of truck shipments to an intermodal facility, and then then about 430 rail shipments to the radioactive waste disposal facilities. Two facilities were evaluated in this EIS for treatment or disposal of LLW or MLLW, both of which have been used for managing waste from SSFL (Energy*Solutions* in Utah and the Nevada National Security Site [NNSS]). For shipments to NNSS, there would be an additional 6,830 truck shipments from a second intermodal facility.

Additionally, under the truck option, there would be about 110,000 truck shipments of hazardous and nonhazardous wastes, backfill, equipment, and supplies. Under the truck rail/option, there would be about 63,000 truck shipments of hazardous and nonhazardous waste to an intermodal facility, and then about 3,900 truck/rail shipments of hazardous and nonhazardous wastes to disposal facilities. There would also be about 45,700 truck deliveries of backfill, equipment, and supplies to SSFL.[16]

Impacts of Incident-Free Transportation of Radioactive Waste

Under the Cleanup to AOC LUT Values Alternative, the impacts of transporting radioactive waste would be the same as those under the Cleanup to Revised LUT Values Alternative and greater than those under the Building Removal Alternative and either of the groundwater remediation action alternatives. The potential radiological impacts on the crews and population are shown in Table 4–47. The table includes the results of shipping all radioactive waste to each of the two

[16] Backfill, heavy equipment, and supplies would only be delivered to SSFL by truck. Hazardous and nonhazardous waste may be shipped from SSFL to some disposal facilities by truck or truck/rail.

evaluated facilities; the discussion below presents the results for shipments to the disposal facilities that would yield the largest impacts.

Crews. Transport of radioactive waste would likely not result in any LCFs to crew members. For truck transport, the maximum calculated LCF risk over the duration of the project (assuming all radioactive waste is disposed of at Energy*Solutions* in Utah) would be 8×10^{-4}, or 1 chance in 1,300 of a single LCF among the transportation crews. For truck/rail transport, the maximum calculated LCF risk over the duration of the project (assuming all radioactive waste is disposed of at NNSS), would be 2×10^{-4}, or 1 chance in 5,000 of a single LCF among the transportation crews.

Public. The cumulative dose to the general population likely would not result in LCFs from transport of radioactive waste. For truck transport, the maximum calculated LCF risk over the duration of the project (assuming all radioactive waste was disposed of at Energy*Solutions* in Utah) would be 2×10^{-4}, or 1 chance in 5,000 of a single LCF in the exposed population. For truck/rail transport, the maximum calculated LCF risk over the duration of the project (assuming all radioactive waste was disposed of at Energy*Solutions* in Utah) [17] would be 1×10^{-4}, or 1 chance in 10,000 of a single LCF in the exposed population.

The total radioactive dose received by an MEI (a resident along the route near SSFL), hypothetically assumed to be exposed to all 6,830 radioactive waste truck shipments over the duration of the project, would be about 3.3×10^{-3} millirem, resulting in an increased risk of developing a fatal cancer of 2×10^{-9}, or 1 chance in 500 million (see Appendix H, Table H–7). Assuming that shipments would occur over 10 years, the average annual dose would be 3.3×10^{-4} millirem, representing 3.3×10^{-4} percent of DOE's limit in DOE Order 458.1 of 100 millirem in a year for exposure to members of the public.

Impacts of Transportation Accidents involving Radioactive Waste

Two sets of analyses, all conceivable accidents (total transportation accidents) and maximum reasonably foreseeable accidents (accidents with a likelihood of occurrence equal to or greater than 1×10^{-7} [1 chance in 10 million] per year), were performed to evaluate potential radiological transportation accident impacts.

Under the Cleanup to AOC LUT Values Alternative, estimates of total transportation accident dose risks for all potential accidents involving all radioactive waste are shown in Table 4–47. Transport activities would not be expected to result in any LCFs or nonradiological fatalities due to traffic accidents.

For truck transport, the maximum reasonably foreseeable offsite accident would involve truck transport of waste to Energy*Solutions* in Utah. The likelihood of occurrence of a maximum reasonably foreseeable accident involving truck transport of this waste would be about 4.2×10^{-7} per year in an urban area, or approximately 1 chance in 2.4 million per year. The consequences of the truck transport accident, if it occurred, in terms of population and MEI dose would be about 2.6×10^{-4} person-rem and 2.6×10^{-7} rem, respectively (see Appendix H, Table H–8). These doses are expected to result in no (2×10^{-7} [1 chance in 5 million]) additional LCFs among the exposed population and a negligible (2×10^{-10} [1 chance in 5 billion]) risk that the MEI would develop an LCF. When the annual frequency of the accident occurring is taken into account, the increased risk

[17] Although Table 4–47 shows similar population LCF (rounded) values for transport to NNSS and Energy*Solutions* in Utah, the population dose for transport to Energy*Solutions* in Utah is about 30 percent higher than that for NNSS (see Appendix H, Table H–5).

of a single LCF in the exposed population would be 8×10^{-14}, or approximately 1 chance in 12 trillion.

For truck/rail transport, the likelihood of occurrence of a maximum reasonably foreseeable accident involving rail transport of this waste to Energy*Solutions* in Utah would be about 1.0×10^{-7} per year in an urban area, or approximately 1 chance in 10 million each year. The consequences of the truck/rail transport accident, if it occurred, in terms of population and MEI dose would be about 6.4×10^{-3} person-rem and 4.2×10^{-6} rem, respectively (see Appendix H, Table H–8). These doses are expected to result in no (4×10^{-6} [1 chance in 250,000]) additional LCFs among the exposed population and a negligible (2×10^{-9} [1 chance in 500 million]) risk that the MEI would develop an LCF. When the annual frequency of the accident occurring is taken into account, the increased risk of a single LCF in the exposed population would be 4×10^{-13}, or approximately 1 chance in 2.5 trillion.

Therefore, no LCFs are expected as a result of truck or truck/rail transport accidents involving these shipments.

In addition, because all rail transports include truck transport to an intermodal location (assumed for analysis to be the Puente Hills Intermodal Facility), an analysis of the maximum foreseeable accident for truck transport to this facility was performed. The consequences of the truck transport accident, if it occurred, in terms of population dose would be about 4.1×10^{-4} person-rem, resulting in no (2×10^{-7} [1 chance in 5 million]) additional LCFs among the exposed population. The frequency of this accident would be about 1.0×10^{-7} per year in an urban area, or approximately 1 chance in 10 million each year.

Impacts of Nonradioactive Waste and Materials Transport

Impacts from transporting nonradioactive wastes to an offsite disposal facility and transporting backfill, equipment, and supplies to SSFL were also evaluated. The difference in traffic fatalities for transport of nonhazardous waste is largely due to the difference in distance traveled between the truck (Westmorland in California) and truck/rail (US Ecology in Idaho) options. As shown in Table 4–48, under the truck option, 1 traffic fatality is expected (0.52 [0.23 for hazardous waste, 0.25 for nonhazardous waste, and 0.041 for backfill, equipment, and supplies]). Under the truck/rail option, 3 traffic fatalities are expected (2.6 [0.15 for hazardous waste, 2.4 for nonhazardous waste, and 0.041 for backfill, equipment, and supplies]).

4.8.1.1.2.2 Cleanup to Revised LUT Values Alternative

Under the Cleanup to Revised LUT Values Alternative there would be the same number of radioactive waste shipments as the Cleanup to AOC LUT Values Alternative for both the truck and truck/rail option (see Section 4.8.1.1.2.1). However, the shipments would occur over slightly more than 2 years.

Additionally, under the truck option, there would be about 17,000 truck shipments of hazardous/nonhazardous wastes, backfill, equipment, and supplies. Under the truck/rail option, there would be about 7,580 truck shipments of hazardous and nonhazardous waste to an intermodal facility, and then about 470 rail shipments of hazardous and nonhazardous wastes to disposal facilities. There would also be about 9,440 truck deliveries of backfill, equipment, and supplies to SSFL.

Impacts of Incident-Free Transportation of Radioactive Waste

Under the Cleanup to Revised LUT Values Alternative, the impacts of transporting radioactive waste would be the same as those under the Cleanup to AOC LUT Values Alternative (Section 4.8.1.1.2.1).

Impacts of Transportation Accidents involving Radioactive Waste

Estimates of total transportation accident dose risks for all potential accidents involving all radioactive waste are shown in Table 4–47. Transport activities under the Cleanup to Revised LUT Values Alternative would not be expected to result in any LCFs or nonradiological fatalities due to traffic accidents.

For truck transport, the maximum reasonably foreseeable offsite accident would involve truck transport of waste to Energy*Solutions* in Utah. The consequences of the truck transport accident, if it occurred, are similar to those in Section 4.8.1.1.2.1, because the waste would have similar characteristics. However, because the same amount of waste would be transported within a shorter period of time (2 years versus 10 years), the likelihood of occurrence of a maximum reasonably foreseeable accident would be larger than that under the Cleanup to AOC LUT Values Alternative—that is, about 2.0×10^{-6} per year in an urban area, or approximately 1 chance in 500,000 each year. When the annual frequency of the accident occurring is taken into account, the increased risk of a single LCF in the exposed population would be 4×10^{-13}, or approximately 1 chance in 2.5 trillion.

For truck/rail transport, the likelihood of occurrence of a maximum reasonably foreseeable accident involving truck/rail transport of this waste would again be larger than that under the Cleanup to AOC LUT Values Alternative—that is, about 4.7×10^{-7} per year in an urban area, or approximately 1 chance in 2.1 million each year. The consequences of the truck transport accident, if it occurred, are similar to those listed in Section 4.8.1.1.2.1 because the waste would have similar characteristics. When the annual frequency of the accident occurring is taken into account, the increased risk of a single LCF in the exposed population would be 2×10^{-12}, or approximately 1 chance in 500 billion.

Therefore, no LCFs are expected as a result of truck or truck/rail transport accidents involving these shipments.

In addition, because all rail transports include truck transport to an intermodal location (assumed for analysis to be the Puente Hills Intermodal Facility), an analysis of the maximum foreseeable accident for truck transport to this facility was performed. The consequences of the truck transport accident, if it occurred, are similar to those listed in Section 4.8.1.1.2.1. However, the frequency of this accident would be 4.0×10^{-7} per year in an urban area, or approximately 1 chance in 2.5 million each year.

Impacts of Nonradioactive Waste and Materials Transport

Impacts from transporting nonradioactive wastes to an offsite disposal facility and transporting backfill, equipment, and supplies to SSFL were also evaluated. As shown in Table 4–48, under both the truck and truck/rail options, no traffic fatalities are expected (0.25 and 0.32, respectively).

4.8.1.1.2.3 Conservation of Natural Resources Alternative

For the Conservation of Natural Resources Alternative, under the truck option, there would be a total of about 3,530 truck shipments of soil with radionuclides above risk-assessment-based values sent to offsite radioactive waste disposal facilities. These operations would occur over 2 years, with nearly all shipments occurring in the first year. Under the truck/rail option, there would be the same number of truck shipments to an intermodal facility, and then about 220 rail shipments to the radioactive waste disposal facilities. For shipments to NNSS, there would be an additional 3,530 truck shipments from a second intermodal facility.

Additionally under the truck option, there would be about 14,900 truck shipments of hazardous/nonhazardous wastes, backfill, equipment, and supplies. Under the truck/rail option, there would be about 7,580 truck shipments of hazardous and nonhazardous waste to a nearby intermodal facility, and then about 470 rail shipments of hazardous and nonhazardous wastes to disposal facilities. There would also be about 7,290 truck deliveries of backfill, equipment, and supplies to SSFL.

Impacts of Incident-Free Transportation of Radioactive Waste

Under the Conservation of Natural Resources Alternative, the impacts of transporting radioactive waste would be greater than those under the Building Removal Alternative and either of the groundwater remediation action alternatives but less than those under the Cleanup to AOC LUT Values or Cleanup to Revised LUT Values Alternative. The potential radiological impacts on the crews and population are shown in Table 4–47. The discussion below presents the results for shipments to the disposal facilities that would yield the largest impacts.

Crews. Transport of radioactive waste likely would likely not result in any LCFs to crew members. For truck transport, the maximum calculated LCF risk over the duration of the project (assuming all radioactive waste is disposed of at Energy*Solutions* in Utah) would be 4×10^{-4}, or 1 chance in 2,500 of a single LCF among the transportation crews. For truck/rail transport, the maximum calculated LCF risk over the duration of the project (assuming all radioactive waste is disposed of at NNSS), would be 1×10^{-4}, or 1 chance in 10,000 of a single LCF among the transportation crews.

Public. The cumulative dose to the general population likely would not result in LCFs from transport of radioactive waste. For truck transport, the maximum calculated LCF risk over the duration of the project (assuming all radioactive waste was disposed of at Energy*Solutions* in Utah) would be 1×10^{-4}, or 1 chance in 10,000 of a single LCF in the exposed population. For truck/rail transport, the maximum calculated LCF risk over the duration of the project (assuming all radioactive waste was disposed of at Energy*Solutions* in Utah) would be 7×10^{-5}, or 1 chance in 14,000 of a single LCF in the exposed population.

The total radioactive dose received by an MEI (a resident along the route near SSFL), hypothetically assumed to be exposed to all 3,530 radioactive waste truck shipments over the duration of the project, would be about 1.7×10^{-3}millirem, resulting in an increased risk of developing a fatal cancer of 1×10^{-9}, or 1 chance in 1 billion (see Appendix H, Table H–7). Assuming that shipments would occur over 2 years (with almost all in the first year), the annual dose would be about 1.7×10^{-3} millirem, representing 1.7×10^{-3} percent of DOE's limit in DOE Order 458.1 of 100 millirem in a year for exposure to members of the public.

Impacts of Transportation Accidents involving Radioactive Waste

Estimates of total transportation accident dose risks for all potential accidents involving all radioactive waste are shown in Table 4–47. Transport activities under the Conservation of Natural Resources Alternative would not be expected to result in any LCFs or nonradiological fatalities due to traffic accidents.

The maximum reasonably foreseeable offsite truck transportation accident with the highest consequence would involve truck/rail transport of waste to Energy*Solutions* in Utah. The calculated likelihood and consequences are similar to those presented in Section 4.8.1.1.2.2 under the Cleanup to Revised LUT Alternative.

Impacts of Nonradioactive Waste and Materials Transport

Impacts from transporting nonradioactive wastes to an offsite disposal facility and delivering backfill, equipment, and supplies to SSFL were also evaluated. As shown in Table 4–48, no traffic fatalities are expected under both the truck and truck/rail options (0.25 and 0.31, respectively).

4.8.1.2 Transportation Impacts under the Building Demolition Alternatives

Impacts under the building demolition alternatives are summarized and compared in **Table 4–50**. Under either the truck or truck/rail option, the same number of waste trucks would leave SSFL.

Table 4–50 Transportation Impacts under the Building Demolition Alternatives

Resource	*Building No Action Alternative*	*Building Removal Alternative*
Incident-free shipment of radioactive waste	No impacts are expected above baseline conditions.	Under the truck option, there would be about 1,030 truck shipments of radioactive waste to offsite facilities. Under the truck/rail option, the same number of truck shipments to a nearby intermodal facility would occur, and then about 65 rail shipments to the facilities. No LCFs are expected among the transport crews or the public. Calculated crew LCF risks range from 5×10^{-5} to 1×10^{-4} under the truck option or from 2×10^{-5} to 4×10^{-5} under the truck/rail option. Calculated population LCF risks range from 1×10^{-5} to 3×10^{-5} under the truck option or 2×10^{-5} under the truck/rail option.
Shipment of radioactive waste under accident conditions	No impacts are expected above baseline conditions.	No LCFs are expected among the public. Considering all reasonably conceivable accidents, calculated LCF risks range from 5×10^{-11} to 6×10^{-10} under the truck option and 4×10^{-11} under the truck/rail option. As shown in Table H–8, the consequences of a maximum reasonably foreseeable truck accident would be about 4.1×10^{-4} person-rem, resulting in no (2×10^{-7}) additional LCFs among the exposed population. Taking the annual frequency of the accident occurring into account, the increased risk of a single LCF in the exposed population would be 6×10^{-14}. Calculated nonradiological fatality risks (traffic accident fatalities) range from 6×10^{-3} to 4×10^{-2} under the truck option or 3×10^{-2} under the truck/rail option, indicating that no traffic accident fatalities are expected.
Traffic fatalities from accidents when transporting hazardous and nonhazardous wastes, backfill, equipment, and supplies	No impacts are expected above baseline conditions.	Under the truck option, there would be about 1,400 shipments by truck. No traffic fatalities are expected among the public (calculated risk: 2.3×10^{-3}). Under the truck/rail option, there would be 130 truck shipments of waste from SSFL to an intermodal facility and then 10 rail shipments; plus 1,260 shipments of recycle materials, backfill, equipment, and supplies. No traffic fatalities are expected among the public (calculated risk: 7.0×10^{-3}).

LCF = latent cancer fatality.

4.8.1.2.1 Building No Action Alternative

Under the Building No Action Alternative, there would be no removal of DOE-owned buildings in Area IV and no shipment of waste from building removal to offsite disposal facilities. There would be no radiological or nonradiological impacts from waste and material transport above baseline conditions (see Chapter 3, Section 3.10).

4.8.1.2.2 Building Removal Alternative

Under the Building Removal Alternative and the truck option, there would be about 1,030 truck shipments of radioactive waste to offsite facilities. Under the truck/rail option, there would be the same number of truck shipments to a nearby intermodal facility, and then about 65 rail shipments of radioactive waste to the offsite facilities. For shipments to NNSS, there would be an additional 1,030 truck shipments from a second intermodal facility (assumed to be at Barstow, California) to NNSS.

Under the truck option, there would be about 1,400 truck shipments of hazardous and nonhazardous waste, backfill, equipment, and supplies. Under the truck/rail option, there would be approximately 130 truck shipments of hazardous waste (10 shipments) and nonhazardous waste

(120 shipments) to a nearby intermodal facility, and then about 10 rail shipments of hazardous and nonhazardous waste to disposal facilities. In addition, under the truck/rail option, there would be about 920 truck shipments of backfill, equipment, or supplies to SSFL and about 340 truck shipments of recycle material to recycle facilities (see Table 4–48).

Impacts from Incident-Free Transportation of Radioactive Waste

Under the Building Removal Alternative, impacts from transporting radioactive waste would be smaller than those under any of the soil remediation action alternatives, but greater than those under either of the groundwater remediation action alternatives. The potential radiological impacts among transport crews and populations along the routes are shown in Table 4–47. The table includes the results of shipping all radiological waste to each of the two evaluated facilities; the discussion below presents the impacts for shipment to the disposal facilities that would yield the largest impacts.

Crews. Under the Building Removal Alternative, transport of radioactive waste likely would not result in any LCFs to crew members. For truck transport, the maximum calculated LCF risk over the duration of the project (assuming all radioactive waste is disposed of at Energy*Solutions* in Utah) would be 1×10^{-4}, or 1 chance in 10,000 of a single LCF among the transportation crew. For truck/rail transport, the maximum calculated LCF risk over the duration of the project (assuming all radioactive waste is disposed of at NNSS) would be 4×10^{-5}, or 1 chance in 25,000 of a single LCF among the transportation crews.

Public. Under the Building Removal Alternative, the cumulative dose to the general population likely would not result in LCFs from transport of radioactive waste. For truck transport, the maximum calculated LCF risk over the duration of the project (assuming all radioactive waste is disposed of at Energy*Solutions* in Utah) would be 3×10^{-5}, or 1 chance in 33,000 of a single LCF in the exposed population. For truck/rail transport, the maximum calculated LCF risk over the duration of the project (assuming all radioactive waste is disposed of at Energy*Solutions* in Utah)[18] would be 2×10^{-5}, or 1 chance in 50,000 of a single LCF in the exposed population.

The total radioactive dose received by an MEI (a resident along the route near SSFL), hypothetically assumed to be exposed to all 1,030 radioactive waste truck shipments over the duration of the project, would be about 5×10^{-4} millirem, resulting in an increased risk of developing a fatal cancer of 3×10^{-10}, or 1 chance in 3.3 billion (see Appendix H, Table H–7). Assuming these shipments would occur over 2 years, the average annual dose would be 2.5×10^{-4} millirem, representing 2.5×10^{-4} percent of DOE's limit in DOE Order 458.1, Radiation Protection of the Public and the Environment, of 100 millirem in a year for exposure to members of the public.

Impacts of Transportation Accidents Involving Radioactive Waste

Similar to the soil remediation action alternatives, two sets of analyses, all conceivable accidents (total transportation accidents) and maximum reasonably foreseeable accidents (accidents with radioactive release probabilities greater than 1×10^{-7} [1 chance in 10 million] per year), were performed to evaluate potential radiological transportation accident impacts.

As indicated in Table 4–47, considering all conceivable accidents, transport of radioactive waste would likely not result in any LCFs or nonradiological fatalities due to traffic accidents.

[18] Although Table 4–47 shows similar population LCF (rounded) values for the transport to NNSS and Energy*Solutions* in Utah, the population dose for Energy*Solutions* is about 30 percent higher than that for NNSS (see Appendix H, Table H–5).

For radioactive waste shipped under any of the alternatives, the maximum reasonably foreseeable transportation accident with the highest consequence/risk would involve rail transport of LLW and MLLW (building debris) from SSFL to NNSS. (See Appendix H, Table H–8, for doses and LCFs from all reasonably foreseeable accidents.)

The maximum reasonably foreseeable probability of an accident involving truck/rail transport of waste to NNSS in Nevada would be up to 1.5×10^{-7} per year in a suburban area, or approximately 1 chance in 6.7 million per year. The consequences of the truck/rail transport accident, if it occurred, in terms of population and MEI dose would be about 8.2×10^{-4} person-rem and 2.7×10^{-6} rem, respectively. These doses would likely result in no (5×10^{-7} [1 chance in 2 million]) additional LCFs among the exposed population and negligible (2×10^{-9} [1 chance in 500 million]) risk that the MEI would develop an LCF. When the annual frequency of the accident occurring is taken into account, the increased risk of a single LCF in the exposed population would be negligible (8×10^{-14} [1 chance in 13 trillion]).

Impacts of Nonradioactive Waste and Materials Transport

Impacts from transporting nonradioactive waste or material to an offsite disposal or recycle facility and transporting backfill, equipment, and supplies to SSFL were also evaluated. As shown in Table 4–48, no traffic fatalities are expected due to these activities. The calculated traffic fatality risks are 2.3×10^{-3} under the truck option and 7.0×10^{-3} under the truck/rail option. The latter risk includes the traffic fatalities from transporting backfill, equipment, and supplies using trucks.

4.8.1.3 Transportation Impacts under the Groundwater Remediation Alternatives

Impacts under the groundwater remediation alternatives are summarized and compared in **Table 4–51**.

4.8.1.3.1 No Action Alternative

Under the Groundwater No Action Alternative, current groundwater monitoring would continue. There would be no radiological or nonradiological impacts from waste or material transport above baseline conditions (see Chapter 3, Section 3.10.2).

4.8.1.3.2 Groundwater Remediation Alternatives

Under the Groundwater Monitored Natural Attenuation Alternative, there would be about 280 truck shipments of nonhazardous wastes, equipment, and supplies, including shipments of environmental monitoring samples to offsite laboratories. Nonhazardous wastes consist of well cuttings from monitoring well installation and water from well installation and environmental sampling; these wastes would be shipped by truck to authorized facilities. No rail shipments would occur under this alternative.

Under the Groundwater Treatment Alternative and the truck option, there would be about 130 truck shipments of radioactive waste (composed of bedrock removed from Area IV) to disposal facilities. Under the truck/rail option, there would be the same number of truck shipments to a nearby intermodal facility, and then about 10 rail shipments to disposal facilities. Under the truck/rail option, for shipments to NNSS, there would be an additional 130 truck shipments from a second intermodal facility to NNSS.

Table 4–51 Transportation Impacts under the Groundwater Remediation Alternatives

Resource	*Groundwater No Action Alternative*	*Groundwater Monitored Natural Attenuation Alternative*	*Groundwater Treatment Alternative*
Incident-free shipment of radioactive waste	No impacts are expected above baseline conditions.	NA[a]	Under the truck option, there would be about 130 truck shipments of radioactive waste to offsite facilities. Under the truck/rail option, the same number of truck shipments would occur to a nearby intermodal facility, and then about 10 rail shipments to the facilities. No LCFs are expected among the transport crews or the public. Calculated crew LCF risks range from 6×10^{-6} to 1×10^{-5} under the truck option or from 2×10^{-6} to 3×10^{-6} under the truck/rail option. No LCFs are expected among the public. Calculated population LCF risks range from 2×10^{-6} to 4×10^{-6} under the truck option or from 2×10^{-6} to 3×10^{-6} under the truck/rail option.
Shipment of radioactive waste under accident conditions	No impacts are expected above baseline conditions.	NA[a]	No LCFs are expected among the public. Considering all reasonably conceivable accidents, calculated population radiological risks range from 7×10^{-12} to 8×10^{-11} under the truck option or 5×10^{-12} under the truck/rail option. The consequences and risks of a maximum reasonably foreseeable truck accident would be more than 100 times smaller than those for shipment of soil. No traffic accident fatalities among the public are expected. Calculated nonradiological (traffic) fatality risks range from 8×10^{-4} to 5×10^{-3} under the truck option or 4×10^{-3} under the truck/rail option.
Traffic fatalities from accidents when transporting backfill, hazardous and nonhazardous wastes, equipment, and supplies	No impacts are expected above baseline conditions.	About 280 shipments by truck. No traffic fatalities (1.5×10^{-4}) are expected among the public.	About 420 shipments by truck. No traffic fatalities (0.015) are expected among the public.

LCF = latent cancer fatality; NA = not applicable.

[a] Wastes generated under the Groundwater Monitored Natural Attenuation Alternative would consist of very small quantities of cuttings from monitoring well installation and water from well installation and sampling that are shipped by truck only. These wastes are not expected to be classified as low-level or mixed low-level radioactive waste, but if determined otherwise when generated, would be safely transported to appropriate facilities for disposition.

Under the truck option, there would be about 420 truck shipments of hazardous waste, backfill, equipment, and supplies.

Impacts from Incident-Free Transportation of Radioactive Waste

Under the Groundwater Treatment Alternative, the impacts of transporting radioactive waste would be less than those under the Building Removal Alternative or any of the soil remediation action alternatives. The potential radiological impacts on the crew and population are shown in Table 4–47. The discussion below presents the results for shipments to the disposal facilities that would yield the largest impacts.

Crews. Transport of radioactive waste likely would not result in any LCFs to crew members. For truck transport, the maximum calculated LCF risk over the duration of the project (assuming all radioactive waste is disposed of at Energy*Solutions* in Utah) would be 1×10^{-5}, or 1 chance in 100,000 of a single LCF among the transportation crews. For truck/rail transport, the maximum calculated LCF risk over the duration of the project (assuming all radioactive waste is disposed of at NNSS), would be 3×10^{-6}, or 1 chance in 330,000 of a single LCF among the transportation crews.

Public. The cumulative dose to the general population likely would not result in LCFs from transport of radioactive waste. For truck transport, the maximum calculated LCF risk over the duration of the project (assuming all radioactive waste is disposed of at Energy*Solutions* in Utah) would be 4×10^{-6}, or 1 chance in 250,000 of a single LCF in the exposed population. For truck/rail transport, the maximum calculated LCF risk over the duration of the project (assuming all radioactive waste is disposed of at Energy*Solutions* in Utah) would be 3×10^{-6}, or 1 chance in 330,000 of a single LCF in the exposed population.

The total radioactive dose received by an MEI (e.g., a resident along the route near SSFL), hypothetically assumed to be exposed to all radioactive waste truck shipments over the duration of the project, would be about 6.3×10^{-5} millirem, resulting in an increased risk of developing a fatal cancer of 4×10^{-11}, or 1 chance in 25 billion (see Appendix H, Table H–7). Assuming all shipments occurred within a single year, the average annual dose would be 6.3×10^{-5} millirem, representing 6.3×10^{-5} percent of DOE's limit in DOE Order 458.1 of 100 millirem in a year for exposure to members of the public.

Impacts of Transportation Accidents Involving Radioactive Waste

For radioactive waste shipped under the Groundwater Treatment Alternative, estimates of total transportation accident dose risks for all projected accidents involving all radioactive waste shipments are shown in Table 4–47. Waste transport under this alternative is not expected to result in any LCFs or nonradiological fatalities due to traffic accidents.

The maximum reasonably foreseeable offsite truck transportation accident with the highest consequence would be expected to occur in rural areas with a frequency of about 1×10^{-7} per year. For these accidents, the release fractions (fractions of material that could be released to the environment in the event of an accident) for the contaminated bedrock are 100 times lower than those for soil because the contamination is entrapped within solid rocks. Therefore, the consequences would be much smaller than those under any of the soil remediation action alternatives. No LCFs are expected as a result of truck transport accidents involving these shipments.

Impacts of Nonradioactive Waste and Materials Transport

Impacts from transporting nonradioactive wastes to an offsite disposal facility and transporting backfill to SSFL were also evaluated. As shown in Table 4–48, no traffic fatalities are expected from these activities.

4.8.1.4 Transportation Impacts under All Action Alternative Combinations

Table 4–52 shows the risks of transporting radioactive waste to each evaluated disposal facility using truck and truck/rail transport methods, assuming a combination of alternatives. The highest risks would occur under the High Impact Combination or the combination of the Cleanup to Revised LUT Values, Building Removal, and Groundwater Treatment Alternatives. The lowest risks would occur under the Low Impact Combination. The calculated risks differ principally due to shipment of soil under the soil remediation action alternatives. No radioactive waste would be shipped under the Groundwater Monitored Natural Attenuation Alternative, and the Groundwater Treatment Alternative would contribute less than 2 percent of all shipped radioactive waste.

Under the High Impact Combination or the combination of the Cleanup to Revised LUT Values, Building Removal, and Groundwater Treatment Alternatives, for incident-free transport and assuming all waste shipments were by truck, the maximum risks to truck crews and populations would occur for shipment to Energy*Solutions* in Utah, with potential LCF risks of 9×10^{-4} (1 chance in 1,100) and 2×10^{-4} (1 chance in 5,000), respectively. Assuming the truck/rail option, the maximum risks to truck/rail crews would occur for shipment to NNSS, with an LCF risk of 3×10^{-4} (1 chance in 3,300); and the maximum risks to populations would occur for shipment to

Energy*Solutions* in Utah, with an LCF risk of 2×10^{-4} (1 chance in 5,000). The maximum radiological risk of a single LCF from an accident considering all possible accidents from minor to severe, would be 5×10^{-9} (1 chance in 200 million), assuming all shipments were sent by truck to Energy*Solutions* in Utah or 3×10^{-10} (1 chance in 3.3 billion) by the truck/rail option to either evaluated facility. These risks are essentially equivalent to zero risk. Note that the risk of a traffic accident fatality, which is entirely due to the mechanical forces of the accident, independent of the cargo, would be much larger than the radiological risks from a traffic accident.

Table 4–52 Total Doses and Risks from Transporting Radioactive Waste under the Combined Action Alternatives

			Incident-Free				***Accident***	
			Crew		***Population***			
Destination	***Number of Shipments*** [a]	***One-way Miles Traveled***	***Dose (person-rem)***	***LCFs*** [b]	***Dose (person-rem)***	***LCFs*** [b]	***Radiological Risk (LCFs)*** [b, c]	***Nonradiological Risk (traffic fatalities)*** [b]
Highest Impact Combination [d]								
Truck								
Energy*Solutions*	7,980	6,197,000	1.5	9×10^{-4}	0.39	2×10^{-4}	5×10^{-9}	0.3
NNSS	7,980	2,430,000	0.58	3×10^{-4}	0.16	9×10^{-5}	4×10^{-10}	0.05
Truck/Rail [e]								
Energy*Solutions*	500	779,000	0.23	1×10^{-4}	0.26	2×10^{-4}	3×10^{-10}	0.3
NNSS	500	1,840,000	0.46	3×10^{-4}	0.20	1×10^{-4}	3×10^{-10}	0.2
Low Impact Combination [f]								
Truck								
Energy*Solutions*	4,680	3,637,000	0.88	5×10^{-4}	0.23	1×10^{-4}	3×10^{-9}	0.2
NNSS	4,680	1,420,000	0.34	2×10^{-4}	0.092	6×10^{-5}	2×10^{-10}	0.03
Rail/Truck [e]								
Energy*Solutions*	290	458,000	0.14	8×10^{-5}	0.15	9×10^{-5}	2×10^{-10}	0.1
NNSS	290	1,078,000	0.27	2×10^{-4}	0.12	7×10^{-5}	2×10^{-10}	0.1

LCF = latent cancer fatality; NNSS = Nevada National Security Site.

[a] The number of shipments was rounded to the nearest ten. The cited values for truck/rail transport reflect the numbers of rail shipments (see footnote c for additional details).

[b] Risk is expressed in terms of LCFs, except for nonradiological risk, where risk refers to the number of traffic accident fatalities. Radiological risk was calculated for one-way travel, while nonradiological risk was calculated for two-way travel. Accident dose can be calculated by dividing the risk values by 0.0006 (DOE 2003b). The values were rounded to one non-zero digit.

[c] Because the radiological accident risks for soil, building demolition debris, and bedrock presented in Appendix H, Table H–4, are dominated by the doses associated with the 12-hour recovery after an accident, only one value is shown.

[d] Impacts if DOE implemented the High Impact Combination or the combination of the Cleanup to Revised LUT Values, Building Removal, and Groundwater Treatment Alternatives.

[c] For purposes of analysis, it was assumed that, for every rail shipment of 8 railcars, there would be 16 truck shipments to transfer the waste from SSFL to the Puente Hills Intermodal Facility, which is under construction (including rail and road modifications) in City of Industry, California. Shipments to NNSS also include truck transports from Barstow, California, to NNSS.

[f] Impacts if DOE implemented the Conservation of Natural Resources, Building Removal, and Groundwater Monitored Natural Attenuation Alternatives.

Under the Low Impact Combination, for incident-free transport conditions and assuming all waste shipments were by truck, the maximum LCF risks to truck crew and the population would occur for shipment to Energy*Solutions* in Utah, with LCF risks of 5×10^{-4} (1 chance in 2,000) and 1×10^{-4} (1 chance in 10,000), respectively. Assuming the truck/rail option, the maximum LCF risks to truck/rail crews would occur for shipment to NNSS (2×10^{-4} LCF, or 1 chance in 5,000); and the maximum LCF risks to populations would occur for shipment to Energy*Solutions* in Utah (9×10^{-5}

LCF, or 1 chance in 11,000). The maximum radiological risk from an accident, considering all possible accidents from the minor to the severe, would be 3×10^{-9} LCF (1 chance in 330 million), assuming all shipments were sent by truck to NNSS or 2×10^{-10} (1 chance in 5 billion) under the truck/rail option to either evaluated facility. The maximum risk of a traffic accident fatality resulting from the mechanical forces of the assumed accidents would be 0.2, assuming all shipments were sent by truck to Energy*Solutions* in Utah.

Table 4–53 shows the range of risks from transporting nonradioactive waste under the truck and truck/rail options. The largest risks would occur under the High Impact Combination. Under the truck option, there would be about 13 accidents and 1 (0.54) traffic fatality. If both groundwater remediation action alternatives were implemented, a single traffic facility would again be projected (the calculated risk would increase from 0.54 by 1.6×10^{-4} [an additional risk of 1 chance in 6,250]). Under the truck/rail option, there would be about 8 accidents and 3 (2.6 fatalities). The smallest risks would occur under the Low Impact Combination. The number of accidents and fatalities that would result from transporting nonradioactive waste and material by truck would be 5.8 and 0 (0.25), respectively, under the truck option and 1.0 and 0 (0.32), respectively, under the truck/rail option.

Table 4–53 Total Risks from Transporting Nonradioactive Waste and Material

Transport Method	*Number of Truck Shipments*	*Number of Rail Shipments*	*Total Distance Traveled (miles; two-way)*	*Number of Accidents*	*Number of Traffic Fatalities*
High Impact Combination [a]					
Truck	111,000	Not applicable	40,000,000	13	0.54 [b]
Truck/Rail [c]	111,000	3,960	19,800,000	8.0	2.6 [b]
Low Impact Combination [d]					
Truck	16,600	Not applicable	10,200,000	5.8	0.25
Truck/Rail [c]	16,600	490	2,700,000	1.0	0.32

[a] Impacts if DOE implemented the Cleanup to AOC LUT Values, Building Removal, and Groundwater Treatment Alternatives.

[b] The difference in traffic fatalities between the two options is primarily due to transport of nonhazardous soil over longer distances under the truck/rail option (US Ecology in Idaho) than under the truck option (Westmorland in California).

[b] Hazardous and nonhazardous wastes would be shipped by truck from SSFL to an intermodal rail yard and thence by rail to facilities having rail access capabilities. Trucks would be used to shipment backfill, equipment, and supplies to SSFL.

[c] Impacts if DOE implemented the Conservation of Natural Resources, Building Removal, and Groundwater Monitored Natural Attenuation Alternatives.

4.8.1.5 Impact Threshold Analysis

An impact threshold for transportation was assumed to occur if shipments of radioactive waste could exceed regulatory requirements for radiation protection of the public. The applicable regulation for transporting radioactive material on public roads is 49 CFR 173, Subpart I. Section 173.441 of this regulation limits the radiation levels to 10 millirem per hour at 6.6 feet from the outer lateral surfaces of the vehicle (excluding the top and underside of the vehicle). Because of low quantities and concentrations of the radioactive materials in the various wastes, the radiation levels of the radioactive waste shipments under all alternatives would be very small, on the order of 0.01 millirem per hour or less at 3.3 feet from each package, which is far less than the regulatory limit. In addition, no individual member of the public would receive a radiation dose equal to even a fraction of DOE's limit in DOE Order 458.1 of 100 millirem in a year for exposure to members of the public. Therefore, no threshold for potential impacts from radioactive waste transportation would be exceeded.

4.8.2 Traffic

This subsection evaluates the impacts of the alternatives on traffic conditions and potential pavement deterioration for roads in the SSFL vicinity that are used to transport waste and recycle material to offsite facilities; and delivery of equipment, backfill, and supplies to SSFL. As discussed in Appendix H, Section H.13.2, it was assumed that three types of trucks would be used to transport waste and materials:

- light-duty trucks with gross vehicle weight ratings up to 14,000 pounds;
- medium-duty trucks with gross vehicle weight ratings from 14,001 pounds to 26,000 pounds; or
- heavy-duty trucks with gross vehicle weight ratings equal to or exceeding 26,001 pounds.[19]

Waste from building removal and soil remediation would be transported using heavy-duty trucks carrying an average of 20 tons of waste per truck,[20] while backfill would be delivered to SSFL using heavy-duty trucks carrying 23 tons of backfill per truck. As discussed in Section 4.8.1, two options were evaluated for transport of waste to an offsite disposal facility. Under the truck option, waste would be transported directly to the disposal facilities. Under the truck/rail option, waste would be transported to an intermodal facility, which was assumed for analysis to be the Puente Hills Intermodal Facility under construction (including road and rail modifications) in City of Industry, California (see Appendix D, Section D.4). There, the cargo would be loaded onto railcars for transport to a facility that can receive waste by rail. The disposal facilities evaluated for receipt of waste by a combination of truck and rail transport were NNSS,[21] Energy*Solutions* in Utah, US Ecology in Idaho, and the Mesquite Regional Landfill in California (see Section 4.8.1). Waste from groundwater remediation activities (including well installation and monitoring and groundwater treatment) would be shipped to offsite facilities using heavy- or medium-duty trucks.

Equipment for building removal, soil remediation, or groundwater remediation would be delivered to SSFL primarily using heavy-duty vehicles, while supplies would be delivered using medium-duty trucks. Light-duty trucks or cars would be used for minor activities such as delivery of well monitoring samples to offsite laboratories for analysis. Cars or light-duty trucks also would be used by site workers commuting to SSFL. One worker per vehicle was assumed; however, less worker traffic would occur if workers shared rides during the commute.

Impacts were evaluated by examining changes to average daily traffic on roads in the SSFL vicinity, changes to the level of service (LOS) ratings for these roads, and potential pavement deterioration. LOS is a qualitative measurement of operating conditions that ranges from A to F, as summarized in **Table 4–54**.

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[19] Gross vehicle weight ratings of heavy-duty trucks can exceed 80,000 pounds in some states and situations. A limit of 80,000 pounds was assumed for this EIS.

[20] Soil waste (particularly soil that exceeds chemical LUT values, but not radiological LUT values, and is classified as nonhazardous waste) may be shipped to offsite facilities in trucks such as semi-trailer dump trucks that can transport larger quantities of waste (e.g., 23 tons per truck). In this case, the number of trucks required for offsite shipment would be reduced, with less traffic volume.

[21] NNSS does not have onsite rail access, so waste would be transported by rail to an intermodal facility in the region, and then by truck to NNSS.

Table 4–54 Level of Service Definitions

Level of Service	Operating Conditions	Delay
A	Highest quality of service; free traffic flow, low volumes and densities; little or no restriction on maneuverability or speed.	None
B	Stable traffic flow; speed becoming slightly restricted; low restriction on maneuverability.	None
C	Stable traffic flow, but less freedom to select speed, change lanes, or pass; density increasing. LOS ratings A though C meet the Ventura County LOS threshold of acceptability.	Minimal
D	Approaching unstable flow; speeds tolerable, but subject to sudden and considerable variation; less maneuverability and driver comfort. LOS ratings A through D meet the Caltrans LOS threshold of acceptability.	Minimal
E	Unstable traffic flow with rapidly fluctuating speeds and flow rates; short headways, low maneuverability, and lower driver comfort. LOS ratings A through E meet the Los Angeles City and County thresholds of acceptability.	Significant
F	Forced traffic flow; speed and flow may drop to zero with high densities.	Considerable

Caltrans = California Department of Transportation; LOS = level of service.
Source: TRB 2010.

Movement of large numbers of heavy-duty trucks can damage the structure of pavement, reducing its life span and requiring repair or replacement. The pavement can rut or crumble if the pavement structure is not sufficiently strong, and the edges of pavement are vulnerable to crumbling if sufficient lateral support is not provided. For purpose of analysis, the potential for pavement deterioration was evaluated qualitatively, but was quantitatively informed through calculations of the number of equivalent single-axle loads (ESALs) traveling over the pavement structure on evaluated roads. That is, the rate of deterioration of a section of pavement was assumed for analysis to be directly linked to the number of ESALs impacting that pavement. Higher than anticipated ESALs could reduce pavement service life, requiring pavement repairs sooner than anticipated.[22]

One ESAL is defined as the damage to pavement caused by the passage of a single 18,000-pound vehicle axle. Therefore, an ESAL can be considered a unit of pavement damage. (The higher the number of ESALs over a road, the higher the pavement damage associated with traffic flow.) For each action alternative, the number of ESALs for a road was determined by multiplying the ESALs for a particular type of vehicle by the annual number of vehicles of that type traversing the road, and then summing the results over all vehicle types and the total number of years of truck traffic required to implement the alternative. See Appendix H, Section H.13.3.2, for additional information.

Although beyond the scope of this EIS, the impacts of increased axle loadings can be used in engineering studies of the remaining service life of analyzed roads. Most flexible pavements are designed for a 20-year service life, after which the pavement structure is projected to require reconstruction to repair accumulated damage. In designing pavement structures, engineers consider an estimate of axle loadings based on the anticipated traffic. If traffic exceeds the forecasted loading, the pavement structure will experience heavier than planned loadings, resulting in acceleration in the use of the remaining pavement service life and a requirement for renewal of the pavement structure sooner than anticipated.

[22] Pavements are designed to accommodate a design number of ESALs over a projected service length, and when design ESALs are exceeded, the result is a decrease in pavement service life. For example, if a pavement that is designed to carry 100 million ESALs over a 20-year service life carries 100 million ESALs over 18 years, pavement deterioration would occur sooner than planned.

Appendix H, Table H–15, summarizes the number of annual vehicle trips for each action alternative. These trips include shipments of waste; deliveries of backfill, equipment, and supplies; and commutes of workers to and from SSFL. Impacts from vehicle movements to and from SSFL were analyzed for four routes as summarized in **Table 4–55** and illustrated in Chapter 3, Figure 3–28. For purposes of analysis, it was assumed that all traffic would traverse each evaluated route. Note that Routes 2, 3, and 4 would all require heavy-duty trucks leaving SSFL to make a sharp right turn from Woolsey Canyon Road onto Valley Circle Boulevard. In making this turn, trucks may need to pull out partially into the adjacent lane, where there could be a risk of incidents with oncoming traffic. This risk would be applicable to all action alternatives (particularly the soil remediation action alternatives and the Building Removal Alternative) and may be mitigated by measures such as installation of a traffic signal at the intersection or posting of a flag person when shipments are made from Area IV.

Table 4–55 Routes Analyzed

Route 1					
Road	Woolsey Canyon Road	Valley Circle Blvd [a]	Plummer Street	Topanga Canyon Blvd	SR 118 (Ronald Reagan Freeway)
Segment	SSFL entrance to Valley Circle Blvd	Woolsey Canyon Road to Plummer Street	Valley Circle Blvd to Topanga Canyon Blvd	Plummer St to SR 118 (Ronald Reagan Freeway)	Junction with Topanga Canyon Blvd
Route 2					
Road	Woolsey Canyon Road	Valley Circle Blvd [a]	Roscoe Blvd	Topanga Canyon Blvd	SR 118 (Ronald Reagan Freeway)
Segment	SSFL entrance to Valley Circle Blvd	Woolsey Canyon Road to Roscoe Blvd	Valley Circle Blvd to Topanga Canyon Blvd	Roscoe Blvd to SR 118 (Ronald Reagan Freeway)	Junction with Topanga Canyon Blvd
Route 3					
Road	Woolsey Canyon Road	Valley Circle Blvd [a]	Valley Circle Blvd	Valley Circle Blvd	U.S. Highway 101 (Ventura Freeway)
Segment	SSFL entrance to Valley Circle Blvd	Woolsey Canyon Road to Roscoe Blvd	Roscoe Blvd to Victory Blvd	Victory Blvd to U.S. Highway 101 (Ventura Freeway)	Junction with Topanga Canyon Blvd
Route 4					
Road	Woolsey Canyon Road	Valley Circle Blvd [a]	Roscoe Boulevard	Topanga Canyon Blvd	U.S. Highway 101 (Ventura Freeway)
Segment	SSFL entrance to Valley Circle Blvd	Woolsey Canyon Road to Roscoe Blvd	Valley Circle Blvd to Topanga Canyon Blvd	Roscoe Blvd to U.S. Highway 101 (Ventura Freeway)	Junction with Topanga Canyon Blvd

Blvd = Boulevard; SR = State Route.

[a] A portion of Valley Circle Boulevard is called Lake Manor Drive.

Under all action alternatives, it was assumed that shipments of waste to offsite facilities could occur under either the truck or truck/rail option. Under the latter option, impacts were assessed assuming shipment to the Puente Hills Intermodal Facility, which is under construction in City of Industry, California. Impacts from operation of the Puente Hills Intermodal Facility were evaluated in the *Puente Hills Intermodal Facility Environmental Impact Report* (*PHIF EIR*) (City of Industry 2008) and the *Addendum to the Puente Hills Intermodal Facility Environmental Impact Report* (*PHIF EIR Addendum*) (City of Industry 2009). Traffic impacts were evaluated in the *PHIF EIR* assuming that the facility would have the capacity to address two trains per day, each composed of 50 railcars, or approximately 8,000 tons per day of municipal solid waste received in trucks from various materials recovery facilities and transfer stations in the Los Angeles area. The *PHIF EIR* and *PHIF EIR Addendum* determined that the construction or operation of the Puente Hills Intermodal Facility would not result in any significant impacts to local traffic, assuming that mitigation measures were implemented. Shipments from SSFL to the Puente Hills Intermodal Facility (up to 29 per working day for some action alternative combinations) would be within the total daily or annual number of trucks evaluated and authorized for the facility. Therefore, there would be no additional traffic impacts from shipment of waste from SSFL to the Puente Hills Intermodal Facility in addition to those evaluated in the *PHIF EIR* and the *PHIF EIR Addendum*.

4.8.2.1 Traffic Impacts under the Soil Remediation Alternatives

Impacts under the soil remediation alternatives are summarized and compared in **Table 4–56**.

Table 4–56 Traffic Impacts under the Soil Remediation Alternatives

Resource	Soil No Action Alternative	*Soil Remediation Action Alternatives* Cleanup to AOC LUT Values	Cleanup to Revised LUT Values	Conservation of Natural Resources
Percent increase in average daily traffic	No changes above baseline conditions are expected for average daily traffic in the SSFL vicinity.	The weekday average daily traffic on Woolsey Canyon Road would increase by 7.2 to 7.3 percent during 9 years of soil removal and 5.6 percent during the final year. Traffic increases on other evaluated roads would be much smaller. Weekday motorist delays could occur on Woolsey Canyon Road and at its intersection with Valley Circle Boulevard. Other than Woolsey Canyon Road, traffic volumes on the evaluated roads may be reduced by use of multiple routes between SSFL and major highways.	The weekday average daily traffic on Woolsey Canyon Road would increase by 7.2 to 7.3 percent during the first 2 years of soil removal and 0.23 percent during the final partial year of soil removal. Traffic increases on other evaluated roads would be much smaller. Weekday motorist delays could occur on Woolsey Canyon Road and at its intersection with Valley Circle Boulevard, but these impacts would last for a fifth as many years as those under the Cleanup to AOC LUT Values Alternative. Other than Woolsey Canyon Road, traffic volumes on roads near SSFL may be reduced by use of multiple routes between SSFL and major highways.	The weekday average daily traffic on Woolsey Canyon Road would increase by 7.2 percent during the first year of soil removal and 5.1 percent during the final year. Increases on other evaluated roads would be much smaller. Although weekday motorist delays could occur on Woolsey Canyon Road and at its intersection with Valley Circle Boulevard, the duration of these impacts would be shorter time than that under the Cleanup to Revised LUT Values Alternative. Other than Woolsey Canyon Road, traffic volumes on roads near SSFL may be reduced by use of multiple routes between SSFL and major highways.
ESALs	No ESALs on roads in the SSFL vicinity are expected above baseline conditions, with damage to road pavement.	Traffic would impose about 200,000 ESALs on the evaluated roads. This increase in vehicle traffic would likely have adverse impacts on road pavement and result in it needing repair sooner than currently anticipated.	Traffic would impose about 51,000 ESALs on the evaluated roads, which would likely cause less road pavement damage than that under the Cleanup to AOC LUT Values Alternative, but would still result in roads needing repairs sooner than currently anticipated.	Traffic would impose about 40,000 ESALs on the evaluated roads, which would likely cause less road pavement damage than that under the Cleanup to AOC LUT Values Alternative, but would still result in roads needing repairs sooner than currently anticipated.
LOS	No changes to the LOS ratings of roads in the SSFL vicinity are expected above baseline conditions.	The LOS on Woolsey Canyon Road could change from a B rating to a C rating. LOS ratings on other roads would be unchanged.	Same as the Cleanup to AOC LUT Values Alternative, except the change in LOS rating on Woolsey Canyon Road would last for about a fifth as many years.	Same as the Cleanup to AOC LUT Values Alternative, except the change in LOS rating on Woolsey Canyon Road would last for slightly smaller time than that under the Cleanup to Revised LUT Values Alternative.

AOC = *Administrative Order on Consent for Remedial Action*; ESAL = equivalent single-axle load; LOS = level of service; LUT = Look-Up Table.

4.8.2.1.1 Soil No Action Alternative

Under the Soil No Action Alternative, there would be no removal of soil from Area IV for shipment to offsite facilities. There would be no increases in traffic or impacts on roads above baseline conditions (see Chapter 3, Table 3–16).

4.8.2.1.2 Cleanup to AOC LUT Values Alternative

Under the Cleanup to AOC LUT Values Alternative, about 116,000 heavy-duty truck round trips would be required to transport waste, backfill, equipment, and supplies (see Appendix H, Table H–15). In addition, there would be about 62,500 round trips of cars or light-duty trucks, primarily due to worker commutes. The largest increase in weekday traffic, considering all vehicles, would occur on Woolsey Canyon Road, where the average daily traffic would increase by 7.2 to 7.3 percent during the first 9 years of soil removal and 5.6 percent during the final year. During the projected 10 total years of soil removal, the LOS for this road could change from its current rating of B to a rating of C. Other evaluated roads would likely not experience a change in LOS rating. If all traffic traversed Plummer Street between Valley Circle Boulevard and Topanga Canyon Boulevard, the average daily traffic would increase on this road by 2.7 percent. Similarly, if all traffic traversed Valley Circle Boulevard between the Woolsey Canyon Road intersection and Plummer Street, the average daily traffic would increase on this road by 2.3 percent. The largest increase in average daily traffic on the remaining evaluated roads would be less than 2 percent (see Appendix H, Table H–20).

Woolsey Canyon Road is winding, in hilly terrain, and consists of two lanes for its entire length. Because of the added traffic, an increase in vehicle platooning (i.e., vehicles traveling in groups behind slower moving vehicles) is expected due to limited opportunities to safely pass for the entire length of the road. Therefore, motorists on Woolsey Canyon Road during weekdays when heavy-duty trucks would be traveling to and from SSFL could experience a reduction in travel speed and an increase in the time spent following slower vehicles. The increase in the time spent following slower vehicles would result in a desire to make more passing maneuvers. When unable to pass, motorists may experience an increased level of frustration and perceive a decline in LOS compared to actual conditions. In addition to a possible increase in the time spent following slower vehicles, the average traffic speed on the road could be reduced due to the increased daily number of heavy-duty trucks, which would be expected to be slow-moving when shipping soil from Area IV and even slower when delivering backfill to Area IV. Platooning and speed restrictions would be more pronounced on some days if DOE shipments during those days exceed average levels.

In addition, motorists could experience traffic delays to some extent at the intersection of Woolsey Canyon Road with Valley Circle Boulevard. Valley Circle Boulevard consists of two lanes with stop signs in both directions at its intersection with Woolsey Canyon Road. Stopped, loaded trucks turning left or right onto Woolsey Canyon Road would be slow to accelerate, as would loaded trucks stopped on Woolsey Canyon Road and turning left or right onto Valley Circle Boulevard. Thus, there could be traffic delays during weekdays at this intersection.

As noted above, the increased traffic under this alternative would last for 10 years. This increased traffic may be reduced on roads other than Woolsey Canyon Road by distributing traffic among multiple routes between SSFL and major highways.

As discussed in Section 4.8.2, movement of large numbers of heavy-duty trucks can damage the structure of pavement, reducing its life span and requiring repair or replacement. Over the duration of this alternative, the additional traffic would impose about 200,000 ESALs on the evaluated routes between SSFL and major highways (see Table H–23). These increases were determined assuming each evaluated route received all traffic. Because some roads surrounding SSFL are already in need of repair, increased vehicle traffic could accelerate damage to affected roads necessitating repairs sooner than currently anticipated. The Cleanup to AOC LUT Values Alternative would have the greatest chance of causing structural damage to roads (compared to all other action alternatives) because of the greater total weight of materials that would be transported on the roads.

4.8.2.1.3 Cleanup to Revised LUT Values Alternative

Under the Cleanup to Revised LUT Values Alternative, about 23,800 heavy-duty truck round trips would be required to transport waste, backfill, equipment, and supplies (see Appendix H, Table H–15). In addition, there would be about 13,000 round trips of cars or light-duty trucks, primarily due to worker commutes. The largest increase in weekday traffic, considering all vehicles, would occur on Woolsey Canyon Road, where the average daily traffic would increase by 7.2 to 7.3 percent during the first 2 years of soil removal, and by about 0.23 percent during the final year. If all traffic traversed Plummer Street between Valley Circle Boulevard and Topanga Canyon Boulevard, the average daily traffic would increase on this road by 2.7 percent during 2 years. Similarly, if all traffic traversed Valley Circle Boulevard between the Woolsey Canyon Road intersection and Plummer Street, the average daily traffic would increase on this road by 2.3 percent during 2 years. The largest increase in average daily traffic on the remaining evaluated roads would be less than 2 percent (see Appendix H, Table H–20).

During the first 2 years of soil removal, the LOS for Woolsey Canyon Road would likely be reduced from a B to a C rating. During these years, motorists on Woolsey Canyon Road during week days when heavy-duty trucks would be traveling to and from SSFL could experience delays compared to baseline conditions; there could also be delays at the intersection of Woolsey Canyon Road with Valley Circle Boulevard. These delays would be similar to those addressed under the Cleanup to AOC LUT Values Alternative, but would last for 2 years rather than 10. The increased traffic may be reduced on roads other than Woolsey Canyon Road by distributing traffic among multiple routes between SSFL and major highways.

Traffic associated with the alternative would impose about 51,000 ESALs on the evaluated routes between SSFL and major highways (see Table H–23). These increases were determined assuming each route received all traffic. This increase in vehicle traffic would be smaller than that for the Cleanup to AOC LUT Values Alternative, but would still likely have adverse impacts on some roads and result in their needing repairs sooner than currently anticipated.

4.8.2.1.4 Conservation of Natural Resources Alternative

Under the Conservation of Natural Resources Alternative, about 18,400 heavy-duty truck round trips would be required to transport waste, backfill, equipment, and supplies. In addition, there would be about 12,500 round trips by cars or light-duty trucks, primarily for worker commutes (see Appendix H, Table H–15). The largest increase in weekday traffic would occur on Woolsey Canyon Road, where the average daily traffic would increase by 7.2 percent during the first year of soil removal and 5.1 percent during the last year. If all traffic traversed Plummer Street between Valley Circle Boulevard and Topanga Canyon Boulevard, the average daily traffic during the first year of soil removal would increase on this road by 2.7 percent; and if all traffic traversed Valley Circle Boulevard between the Woolsey Canyon Road intersection and Plummer Street, the average daily traffic would increase on this road by 2.3 percent. The largest increase in average daily traffic on the remaining evaluated roads during the first year of soil removal would be less than 2 percent (see Appendix H, Table H–20). There would be reduced traffic on all these roads during the second year of soil removal.

During the 2 years of soil removal (particularly for the first year), the LOS for Woolsey Canyon Road could be reduced from a B to a C rating. Motorists on Woolsey Canyon Road during week days when heavy-duty trucks would be traveling to and from SSFL could experience delays compared to baseline conditions; there could also be delays at the intersection of Woolsey Canyon Road with Valley Circle Boulevard. These delays would be similar to those addressed under the Cleanup to AOC LUT Values Alternative but would last for 2 years (with reduced impacts during the second year) rather than 10. The increased traffic may be reduced on roads other than Woolsey Canyon Road by distributing traffic among multiple routes between SSFL and major highways.

Traffic associated with the alternative would impose about 40,000 ESALs on the evaluated routes between SSFL and major highways (see Table H–23). These increases were determined assuming each route received all traffic. This increase in vehicle traffic would be smaller than those for either the Cleanup to AOC LUT Values or the Cleanup to Revised LUT Values Alternative, but would still likely have adverse impacts on some roads and result in their needing repairs sooner than currently anticipated.

4.8.2.2 Traffic Impacts under the Building Demolition Alternatives

Impacts under the building demolition alternatives are summarized and compared in **Table 4–57**.

Table 4–57 Traffic Impacts under the Building Demolition Alternatives

Resource	*Building No Action Alternative*	*Building Removal Alternative*
Percent increase in average daily traffic	No changes above baseline conditions are expected for average daily traffic in the SSFL vicinity.	The weekday average daily traffic on Woolsey Canyon Road would increase by about 3.4 percent in the first year of building removal and 5.3 percent in the second year, leading to potential weekday motorist delays on this road, assuming the waste and backfill shipments occur during a 2- to 5- month period in each working year. Traffic increases on other evaluated roads would be smaller. The increase in average daily traffic on Woolsey Canyon Road would be less than 1 percent, with corresponding reductions in traffic on other roads, assuming waste and backfill were instead shipped throughout each working year. Except for Woolsey Canyon Road, traffic on the evaluated roads may be further reduced by distributing traffic among multiple routes between SSFL and major highways.
ESALs	No ESALs on roads in the SSFL vicinity are expected above baseline conditions, with no damage to road pavement.	Traffic would impose about 5,200 ESALs on the evaluated roads. This increase in vehicle traffic would likely have some adverse impacts on road pavement and result in roads needing repair sooner than currently anticipated.
LOS	No changes to the LOS ratings of roads in the SSFL vicinity are expected above baseline conditions.	Assuming waste and backfill shipments are made over a 2- to 5-month period in each year, the LOS for Woolsey Canyon Road could change from a B rating to a C rating. No change in LOS rating would be expected if waste and backfill were instead shipped throughout each working year. LOS ratings for other roads are not expected to change.

ESAL = equivalent single-axle load; LOS = level of service.

4.8.2.2.1 Building No Action Alternative

Under the Building No Action Alternative, there would be no removal of DOE-owned buildings in Area IV and no impacts on traffic or roads above baseline conditions (see Chapter 3, Table 3–16).

4.8.2.2.2 Building Removal Alternative

There would be a total of about 2,420 heavy-duty truck round trips during the 2 years of building removal to transport waste, backfill, and equipment (see Appendix H, Table H–15). In addition, there would be about 5,420 round trips of worker commuter vehicles. The largest impacts on weekday traffic would occur on Woolsey Canyon Road. Assuming shipments of waste and backfill occurred over a 2- to 5-month period during each of 2 years, the average daily traffic on this road would increase by 3.4 percent in the first year of building removal and 5.3 percent in the second year. The average daily traffic on all other evaluated routes between SSFL and major highways would increase by less than 2 percent (see Appendix H, Table H–20).

Given these assumptions for shipment scheduling, the LOS for Woolsey Canyon Road would change during at least 1 year from a B to a C rating. Motorists on Woolsey Canyon Road during weekdays when heavy-duty trucks would be traveling to and from SSFL could experience delays compared to baseline conditions; there could also be delays at the intersection of Woolsey Canyon Road with Valley Circle Boulevard. These delays would be similar to those addressed under the Cleanup to AOC LUT Values Alternative, but reduced because the peak increases in traffic would be less. Traffic could be significantly reduced by making shipments each year over longer periods than 2 to 5 months. If shipments were instead made throughout each working year, the average daily traffic on Woolsey Canyon Road would increase during both years by less than 1 percent, with no change in its LOS rating. Except for Woolsey Canyon Road, traffic on all evaluated roads may be reduced by distributing traffic among multiple routes between SSFL and major highways.

Traffic associated with the alternative would impose about 5,200 ESALs on the evaluated routes between SSFL and major highways (see Table H–23). These increases were determined assuming each route received all traffic. The alternative would have a smaller chance of causing structural damage on roads than any of the soil remediation action alternatives, but a larger chance than either of the groundwater remediation action alternatives.

4.8.2.3 Groundwater Remediation Alternatives

Impacts under the groundwater remediation alternatives are summarized and compared in **Table 4–58**.

Table 4–58 Traffic Impacts under the Groundwater Remediation Alternatives

Resource	*Groundwater No Action Alternative*	*Groundwater Monitored Natural Attenuation Alternative*	*Groundwater Treatment Alternative*
Percent increase in average daily traffic	No changes above baseline conditions are expected for average daily traffic in the SSFL vicinity.	The weekday average daily traffic on Woolsey Canyon Road would increase by 0.16 percent during 1 year. Traffic increases on other roads or during other years when shipments would occur would be smaller. No traffic-related impacts are expected.	The weekday average daily traffic on Woolsey Canyon Road would increase by 0.36 percent during 1 year. Traffic increases on other roads or during other years when shipments would occur would be smaller. No traffic-related impacts are expected.
ESALs	No ESALs on roads in the SSFL vicinity are expected above baseline conditions, with no damage to road pavement.	No routes would experience noticeable increases in ESALs, with no damage to road pavement.	Traffic under this alternative would impose about 990 ESALs on the evaluated roads, with minimal potential for damage to road pavement.
LOS	No changes to the LOS ratings of roads in the SSFL vicinity are expected above baseline conditions.	LOS ratings are not expected to change for any evaluated road.	Same as the Groundwater Monitored Natural Attenuation Alternative.

ESAL = equivalent single-axle load; LOS = level of service.

4.8.2.3.1 Groundwater No Action Alternative

Under the Groundwater No Action Alternative, current groundwater monitoring would continue. There would be approximately 1 annual round trip of heavy-duty tanker trucks transporting well monitoring purge water off site and approximately 20 annual shipments (in cars or light-duty trucks) of well monitoring samples to offsite laboratories, as well as arrivals and departures of workers performing monitoring activities. There would be no impacts on traffic or on roads above baseline conditions (see Chapter 3, Table 3–16).

4.8.2.3.2 Groundwater Monitored Natural Attenuation Alternative

Under this alternative, the maximum increase in traffic would occur in 1 year. During this year, there would be about 31 heavy- and medium-duty truck shipments to transport equipment, waste, and supplies, as well as about 378 round trips of light-duty vehicles (primarily worker commuter vehicles). In other years, there would be 1 heavy-duty truck shipment and 228 round trips of light-duty vehicles (see Appendix H, Table H–15). The largest increase in weekday traffic would occur on Woolsey Canyon Road. The average daily traffic in the peak year would increase by about 0.16 percent (see Table H–20), which would not represent a noticeable change to traffic volumes or the current LOS rating for any of the evaluated roads (see Chapter 3, Table 3–16).

Because the number of additional vehicle trips under this alternative is so small (see Appendix H, Table H–23) compared to baseline conditions, there would be only minimal additional ESALs imposed on the evaluated roads. No damage on these roads is expected.

4.8.2.3.3 Groundwater Treatment Alternative

Under this alternative, DOE would remove approximately 1,050 cubic yards of bedrock from Area IV, place the bedrock into containers for offsite disposal, and install and operate groundwater treatment equipment. About 470 heavy- and medium-duty truck round trips would be required to transport waste, backfill, equipment, and supplies. In addition, there would be about 705 round trips of light-duty vehicles (primarily worker commuter vehicles). The largest increase in weekday traffic would occur on Woolsey Canyon Road. Assuming shipments for bedrock disposal and treatment system installation were made over the course of a year, the average daily traffic would increase during this year by 0.36 percent (see Table H–20), which would not represent a noticeable change to traffic volumes or the current LOS ratings for any of the evaluated roads (see Chapter 3, Table 3–16).

Because the number of additional vehicle trips under this alternative is small, there would be a minimal increase to ESALs (about 990 ESALs) on all evaluated routes between SSFL and major highways (see Appendix H, Table H–23), with minimal potential for damage to roads.

4.8.2.4 Traffic Impacts under All Action Alternative Combinations

Impacts from implementing combinations of action alternatives are summarized and compared in **Table 4–59**.

Under the High Impact Combination, there would be about 119,000 heavy- and medium-duty truck round trips. In addition, there would be about 68,600 round trips of cars or light-duty trucks, primarily for worker commutes. The largest increase in weekday traffic volume would occur on Woolsey Canyon Road, where over 12 years, the average daily traffic would increase by 3.4 to 7.6 percent (see Appendix H, Table H–21). During most of these years, the LOS for Woolsey Canyon Road could change from a B rating to a C rating. Motorists on Woolsey Canyon Road during weekdays when heavy-duty trucks would be traveling to and from SSFL could experience delays compared to baseline conditions; there could also be delays at the intersection of Woolsey Canyon Road with Valley Circle Boulevard. These delays would be similar to those under the Cleanup to AOC LUT Values Alternative (Section 4.8.2.1.2), but would last for 12 years rather than 10. The increased traffic may be reduced on roads other than Woolsey Canyon Road by distributing traffic among multiple routes between SSFL and major highways.

Table 4–59 Traffic Impacts under the Combined Action Alternatives

Resource	High Impact Combination [a]	Low Impact Combination [b]
Percent increase in average daily traffic	Woolsey Canyon Road would experience the largest weekday increase in average daily traffic, with a peak increase of 7.6 percent. This increase or comparable increases would last for 9 years over the 12 years required for this action alternative combination. These increases could lead to motorist delays on Woolsey Canyon Road and at its intersection with Valley Circle Boulevard. Other than Woolsey Canyon Road, traffic volumes on roads near SSFL may be reduced by use of multiple routes between SSFL and major highways.	Woolsey Canyon Road would experience the largest weekday increase in average daily traffic, by 3.5 to 7.4 percent over the first 4 years of this action alternative combination. Increases for subsequent years would be about 0.092 percent, primarily due to shipments of well monitoring purge water and environmental samples and worker commutes. These increases could lead to motorist delays on Woolsey Canyon Road and at its intersection with Valley Circle Boulevard. Other than Woolsey Canyon Road, traffic volumes on roads near SSFL may be reduced by use of multiple routes between SSFL and major highways.
ESALs	Traffic would impose about 210,000 ESALs on the evaluated roads. This increase in vehicle traffic would likely have adverse impacts on road pavement and result in their needing rehabilitation or repair sooner than currently anticipated.	Traffic would impose about 45,000 ESALs on the evaluated roads. This increase in vehicle traffic would likely have adverse impacts on road pavement and result in their needing rehabilitation or repair sooner than currently anticipated.
LOS	LOS ratings could be reduced on Woolsey Canyon Road for approximately 12 years.	LOS ratings could be reduced on Woolsey Canyon Road for approximately 4 years.

AOC = *Administrative Order on Consent for Remedial Action*; ESAL = equivalent single-axle load; LOS = level or service.

[a] Evaluated for the combination of the Cleanup to AOC LUT Values, Building Removal, and Groundwater Treatment Alternatives.

[b] Evaluated for the combination of the Conservation of Natural Resources, Building Removal, and Groundwater Monitored Natural Attenuation Alternatives.

Traffic associated with the High Impact Combination would impose about 210,000 ESALs on the evaluated routes between SSFL and major highways. These increases were determined assuming each route received all traffic. Because some of the evaluated roads already need repair, increased vehicle traffic could further damage the surrounding roads, causing them to need repairs sooner than currently anticipated.

If both groundwater remediation action alternatives were implemented, the number of heavy- and medium-duty truck round trips would increase during a 12-year period by about 42 round trips compared to the High Impact Combination estimate of 119,000. Thus, there would thus be no noticeable increase in traffic volumes or ESALs from those analyzed under the High Impact Combination.

Under the Low Impact Combination, there would be about 20,800 heavy- and medium-duty truck round trips. In addition, there would be about 20,800 round trips of cars or light-duty truck, primarily from worker commutes. The largest increase in weekday traffic would occur on Woolsey Canyon Road, where the average daily traffic would increase by 3.5 to 7.4 percent during the first 4 years of this action alternative combination, with a change in LOS from a B rating to a C rating, similar to that for the High Impact Combination. Increases for subsequent years would be about 0.092 percent, primarily due to shipments of well monitoring purge water and environmental samples and worker commutes (see Appendix H, Table H–21). Traffic delays similar to those for the High Impact Combination could occur, except that the delays would last for 4 years rather than 12. The increased traffic may be reduced on roads other than Woolsey Canyon Road by distributing traffic among multiple routes between SSFL and major highways.

Traffic associated with the Low Impact Combination would impose about 45,000 ESALs on the evaluated routes between SSFL and major highways. These increases were determined assuming each route received all traffic. Because some of the evaluated roads already need repair, this increase in vehicle traffic could further damage the surrounding roads, causing them to need repairs sooner than currently anticipated.

4.8.2.5 Impact Threshold Analysis

An impact threshold for traffic was assumed to occur if increased traffic resulting from implementing the alternatives could: (1) change the LOS rating on an evaluated traffic route; (2) result in an increased potential for pavement deterioration of roads in the SSFL vicinity; or (3) create a safety hazard. All of the soil remediation action alternatives would result in increased traffic, particularly on Woolsey Canyon Road where the LOS could decrease during days when shipments could occur from a B to a C rating. Compared to baseline conditions, motorist delays are possible on this road and at its intersection with Valley Circle Boulevard. The longest duration of this increased traffic could occur under the Cleanup to AOC LUT Values Alternative with the smallest under the Conservation of Natural Resources Alternative. A decrease in LOS rating for Woolsey Canyon Road could also occur under the Building Removal Alternative assuming shipments occurred during a 2- to 5-month period in each working year, but not if shipments were spread throughout each working year. Regarding combinations of action alternatives, the longest duration of increased traffic would occur under the High Impact Combination with the smallest under the Low Impact Combination.

Implementing any of the soil remediation action alternatives, the Building Removal Alternative, or any combination of action alternatives could result in additional pavement damage. Therefore, an impact threshold was assumed to be crossed based on this potential for additional pavement damage.

A safety concern is noted, and thus an impact threshold could be crossed, in that heavy-duty trucks making a sharp right turn from Woolsey Canyon Road onto Valley Circle Boulevard may need to pull partially into an adjacent lane, resulting in a risk of incidents with oncoming traffic. This risk would be applicable to all action alternatives, but particularly the soil remediation action alternatives and the Building Removal Alternative, and may be mitigated by measures such as installation of a traffic signal at the intersection or posting of a flag person when shipments are made from Area IV.

4.9 Human Health

This section presents the potential impacts on humans under the alternatives evaluated for the three components of SSFL Area IV and NBZ remediation: soil, buildings, and groundwater. Human health impacts addressing each of these components are discussed for a no action alternative and for one or more action alternatives in the following subsections. These subsections address the potential impacts that could result from leaving radiological and chemical constituents in place or from activities undertaken to remove the constituents and their residual concentrations after remediation; the potential risks to workers from industrial accidents and seismic activity; and the potential risks to members of the public due to valley fever, site accidents, and intentional destructive acts.

4.9.1 Risk Assessment Overview

4.9.1.1 Evaluated Receptors

Impacts are considered possible for hypothetical receptors representing members of the public and workers involved in the monitoring and maintenance or removal and remediation activities. The receptors include:

- Onsite suburban resident – a hypothetical future resident who establishes a residence in Area IV or the NBZ in an area with soil containing chemical or radioactive constituents. The onsite suburban resident was assumed to be exposed 24 hours a day, 350 days per year, for 30 years as defined in the *Final Standardized Risk Assessment Methodology Revision 2 Addendum, Santa Susana Field Laboratory, Ventura County, California* (SRAM) (MWH 2014). The direct exposure pathways addressed in this section include dermal absorption of chemicals; direct radiation exposure; and inhalation and incidental ingestion of chemical and radioactive constituents (MWH 2014). The direct exposure pathways are discussed in this section.

  The SRAM also includes an indirect exposure pathway for the onsite suburban resident. It is assumed for the indirect exposure pathway that the hypothetical future resident ingests fruits and vegetables raised in an onsite garden in an area with soil containing chemical or radioactive constituents. The impacts of the indirect exposure pathway on the onsite suburban resident are not addressed in this EIS because the models for making exposure point calculations in plants are associated with significant uncertainty as discussed in the SRAM (MWH 2014) and because it is expected that future use of the property as residential development will be restricted by the landowner (Boeing 2016b).

  The onsite suburban resident was considered under both the No Action Alternative (after an assumed future loss of institutional control) and the action alternatives after remediation. Loss of institutional control was assumed to occur 100 years in the future. However, because the precise time when access controls may be lost is uncertain, a near-term onsite suburban resident scenario (a hypothetical onsite suburban resident currently living on the site) representing exposure to current conditions was included as a baseline.

- Recreational user – a hypothetical member of the public who engages in outdoor recreational activities, such as hiking, in Area IV and the NBZ. This scenario also provides a conservatively high estimate of potential impacts to a site visitor because a site visitor's exposure time would likely be much less than that assumed for the recreational user. The recreational user was assumed to be exposed 8 hours a day, 75 days per year, for 30 years. Exposure pathways include dermal absorption of chemicals; direct radiation exposure; and inhalation and

Human Health Impact Assessment Terms

Cancer incidence – also referred to as cancer morbidity, is the occurrence of a cancer.

Cancer fatality – also referred to as cancer mortality, is a death resulting from cancer.

Dose (radiation) – as used in this EIS it means total effective dose, a term referring to the amount of energy absorbed by a tissue or organ adjusted by a radiation weighting factor, a tissue weighting factor, and other factors that allows radiation of different types received through different modes of exposure to be compared on a common basis.

Exposure – being exposed to a radioactive or chemical material.

Hazard quotient – a unitless value determined by (1) dividing the exposure concentration by the reference concentration reported in the EPA Integrated Risk Information System for direct inhalation exposures, or (2) dividing the average daily dose by the reference dose for oral exposures. The reference concentration is an estimate of a continuous inhalation exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime.

Hazard index – the sum of hazard quotients of noncarcinogenic chemicals that affect the same target organ or organ system. A cumulative hazard index below 1.0 will likely not result in adverse noncancer health effects over a lifetime of exposure.

Latent cancer fatality – death from cancer resulting from, and occurring sometime after, exposure to ionizing radiation or other carcinogens.

Excess lifetime risk – the additional or extra risk of developing a cancer due to exposure to a toxic substance incurred over the lifetime of an individual.

incidental ingestion of chemical and radioactive constituents. (The air pathway is the dominant pathway.) The recreational user was considered under both the Soil No Action Alternative and the soil remediation action alternatives. Under the Soil No Action Alternative, site access was assumed in spite of institutional controls that would make the recreational user a trespasser.

- Monitoring and maintenance worker – a worker who performs routine work in Area IV and the NBZ that does not involve demolishing buildings or removing soil. Activities could include checking security of site fences and buildings, collecting groundwater or other samples, and changing filter media. Exposure pathways include dermal absorption of chemicals; direct radiation exposure; and inhalation and incidental ingestion of chemical and radioactive constituents. Exposures were assumed to be similar to current exposures associated with managing the site.
- Decontamination and decommissioning (D&D) worker – a worker involved in the removal of Area IV buildings. D&D worker exposure pathways include direct radiation exposure and inhalation and incidental ingestion of radioactive materials on building surfaces.
- Remediation worker – a worker involved in the removal of Area IV and NBZ soils or strontium-contaminated bedrock. Exposure pathways include direct radiation exposure; dermal absorption of chemicals; and inhalation and incidental ingestion of chemical and radioactive constituents in the soil.

The following subsections address the receptors that were identified as potentially exposed under each alternative and action alternative combination. Potential health impacts on representative members of the public and workers were assessed for exposure to chemical and radioactive constituents. For radioactive constituents, dose impacts on members of the public were compared to the DOE dose constraint of 25 millirem per year that applies to each specific clearance of real property[23] for any actual or likely future use (DOE Order 458.1). Cancer risk impacts on members of the public from carcinogenic chemical and radioactive constituents were evaluated with respect to an evaluation range for excess lifetime cancer risk of 1×10^{-6} to 1×10^{-4}. Impacts on members of the public and workers from noncarcinogenic chemical constituents were evaluated with respect to a hazard index of 1.

4.9.1.2 Risk Assessment Assumptions

Estimates of risk and dose are conditional, based on a number of assumptions concerning exposure. Generation of a point estimate of risk (using single values for parameters as input to the exposure models yielding a single deterministic risk estimate), as has been done in this assessment, has the potential to underestimate or overestimate actual values and can lead to improper decisions. Therefore, it is necessary to specify the assumptions and uncertainties inherent in the screening-level evaluation process to place the risk and dose estimates in perspective and ensure that anyone making risk-management decisions is well informed.

Uncertainty about environmental risk estimates is known to be an order of magnitude or greater (EPA 1989). The evaluation of uncertainties for the assessment is qualitative because the resource

[23] Clearance of property means the removal of property that contains residual radioactive material from DOE radiological control under 10 CFR Part 835 and DOE Order 458.1. Each specific clearance refers to each parcel being submitted to DOE headquarters for approval of clearance. In practice, the partial size used for averaging of results will be limited by the survey unit area limits recommended in the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), a multi-agency consensus document that describes a consistent approach for planning, performing, and assessing building surface and surface soil final status surveys to meet established dose- or risk-based release criteria (NRC/EPA/DOE/DOD 2000).

requirements necessary to provide a quantitative statistical uncertainty analysis for this study area would generally outweigh the benefits. The following subsections focus on the important variables and assumptions that contribute the most to the overall uncertainty. Uncertainties are discussed in detail in Appendix G.

4.9.1.2.1 Source Term

Several assumptions are associated with the data set and the data evaluation process. These assumptions include the selection of Contaminants of Potential Concern and the determination of the Exposure Point Concentration.

Although the selection of Contaminants of Potential Concern was based on an historical site assessment, it required making decisions and developing assumptions on the basis of historical information, process knowledge, and best professional judgment about the data. Uncertainties are associated with all such assumptions. The background concentrations are also subject to uncertainty.

Representative concentrations and other statistics were calculated in this risk evaluation based on the assumption that the samples collected are truly random samples. Some of the data may not have been taken randomly, but instead may have come from biased sampling aimed at identifying high contaminant concentration locations.

Radionuclides that are short-lived were eliminated from the data set (as they will have decayed away) along with daughter products of radionuclides that include the contributions of the daughter products in the Preliminary Remediation Goal (PRG) calculation. Daughter products of radionuclides were assumed to be in equilibrium with and included in the risk factors of their parents. This approach avoids double counting the contribution of daughter products to the overall risks.

4.9.1.2.2 Exposure Assessment

For each exposure pathway, assumptions were made concerning the parameters, routes of exposure, amounts of contaminated media an individual can be exposed to, and intake rates for different routes of exposure. In the absence of site-specific data provided in the SRAM (MWH 2014), the assumptions used to calculate the EPA default Regional Screening Levels (chemicals) and PRGs (radionuclides) were used. When several of these upper-bound values are combined in estimating exposure for any one pathway, the resulting risks can be in excess of the 99th percentile and, therefore, outside the range that may be reasonably expected.

The guidance values for intake rates and exposure parameters were assumed to represent the hypothetical populations evaluated. All contaminant exposures and intakes were assumed to be from site-related exposure media (i.e., no other sources contribute to the receptor's risk). Even if these assumptions were true, other areas of uncertainty may apply. Selected intake rates and population characteristics (i.e., weight, life span, and activities) were assumed to be representative of the exposed population. The SRAM (MWH 2014) exposure parameters are based on conservative assumptions for intake routes, exposure fractions, and exposure intake rates (MWH 2014).

The consistent conservatism used in the estimation of these parameters generally leads to overestimation of the potential risk to the postulated receptors.

4.9.1.2.3 Toxicity Values and Risk Predictions

The values used to represent the dose-response relationship will highly impact the risk estimates. These assumptions are contaminant-specific and are embedded in the toxicity value. The factors that are assumed include the sources of the data, duration of the study, extrapolations from short- to long-term exposures, intra-human or interspecies variability, and other special considerations. In addition, toxicity varies with the chemical form.

The Risk-Based Screening Levels (RBSLs)/PRGs used to develop risk and dose slope factors are subject to uncertainty in the toxicity values. The toxicity values used in the derivation of RBSLs/PRGs are subject to change; as additional information from scientific research becomes available, these periodic changes in toxicity values may cause the RBSL/PRG values to change as well, causing increased uncertainty in the risk evaluation process. The exposure parameters specified in the SRAM (MWH 2014) were used when available. However, other exposure parameters were based on the default values used in the EPA RBSLs and PRGs. The use of these default parameters, rather than site-specific data, adds uncertainty to the evaluation of risk and dose.

Assumptions related to the summation of carcinogenic risk and noncarcinogenic hazard estimates across contaminants and pathways are a primary uncertainty in the risk characterization process. In the absence of information on the toxicity of specific chemical mixtures, additive (cumulative) risks were assumed (EPA 1989).

Limitations of the additive risk approach for exposure to multiple chemicals include the following:

- The slope factors may represent the mean, but often represent the upper 95th percentile estimate of potency (the central estimate of the mean for radionuclides), so the summation can result in an excessively conservative estimate of lifetime risk.
- The reference doses do not have equal accuracy or precision and are not based on the same severity of effects.
- The effects of a mixture of carcinogens are unknown, and possible interactions could be synergistic or antagonistic.

Despite these limitations and the general unavailability of data on these interactions, summations were performed for the carcinogenic risks and chemical hazards presented in the risk screen. This approach is consistent with the EPA *Risk Assessment Guidance for Superfund* (EPA 1989).

4.9.2 Soil Remediation Alternatives

Table 4–60 summarizes the human health impacts associated with the soil remediation alternatives.

As described in Chapter 2, Sections 2.3 and 2.4, a no action and three action alternatives were defined with respect to remediating soil containing chemicals and radionuclides in Area IV and the NBZ. The Soil No Action Alternative could result in exposure of people who work on the site or intrude onto the site, whether the intrusion is temporary and occasional or more permanent. Under the Soil No Action Alternative, members of the public would be restricted from accessing the site through fencing, signage, and routine visits by site security personnel. Although DOE's intent would be to prevent public access to the site, two scenarios involving hypothetical public receptors were analyzed: an onsite suburban resident and an onsite recreational user. The onsite suburban resident was considered under the Soil No Action Alternative, after an assumed loss of institutional control 100 years in the future, as well as for the soil remediation action alternatives after remediation. A near-term onsite suburban resident scenario representing exposure to current conditions was also evaluated as a baseline. The onsite recreational user was considered under the Soil No Action Alternative and the soil remediation action alternatives after remediation. Under the No Action Alternative, site access was assumed to occur in spite of institutional control.

Table 4–60 Human Health Impacts under the Soil Remediation Alternatives

Receptors	Soil No Action Alternative	Soil Remediation Action Alternatives		
		Cleanup to AOC LUT Values	Cleanup to Revised LUT Values	Conservation of Natural Resources
Onsite Suburban Resident (direct pathways)	Cancer risk and toxicity impacts from chemical and/or radionuclides [a] in Area IV and the NBZ are comparable to or less than the risk determined for background soil.[b]	Chemically and radioactively impacted soil exceeding AOC LUT values would be removed. Thereafter, risks would be less than those under the No Action Alternative.	Chemically impacted soil exceeding revised LUT values would be removed, as would radioactively impacted soil exceeding AOC LUT values. Thereafter, risks would be less than those under the No Action Alternative, but more than those under the Cleanup to AOC LUT Values Alternative.	Chemically and radioactively impacted soil exceeding risk assessment-based levels would be removed. Thereafter, risks would be less than those under the No Action Alternative, but more than those under the Cleanup to AOC LUT Values or Cleanup to Revised LUT Values Alternative.
Onsite recreational User	Cancer risk and toxicity impacts from chemical and/or radionuclides [a] in Area IV and the NBZ are comparable to or less than the risk determined for background soil.[b]	Chemically and radioactively impacted soil exceeding AOC LUT values would be removed. Thereafter, risks would be less than those under the No Action Alternative.	Chemically impacted soil exceeding revised LUT values would be removed, as would radioactively impacted soil exceeding AOC LUT values. Thereafter, risks would be less than those under the No Action Alternative, but more than those under the Cleanup to AOC LUT Values Alternative.	Chemically and radioactively impacted soil exceeding risk assessment-based levels would be removed. Thereafter, risks would be less than those under the No Action Alternative, but more than those under the Cleanup to AOC LUT Values or Cleanup to Revised LUT Values Alternative.
Worker	Minimal exposures from monitoring and maintenance activities; maintenance workers would be protected from chemical and radiation exposure and industrial hazards through compliance with DOE requirements for worker safety and radiation protection.	Exposures would be higher than those for the Soil No Action Alternative during 10 years of soil remediation. Remediation workers would be protected from chemical and radiation exposure through compliance with DOE requirements for worker safety and radiation protection. Radiation protection practices would be employed so that doses are as low as reasonably achievable.	The duration of higher exposures would be slightly more than 2 years and workers would have less exposure to chemical constituents; exposure to radioactive constituents would be the same. Remediation worker protection would be the same as that under the Cleanup to AOC LUT Values Alternative.	The duration of higher exposures would be about 2 years and workers would have less exposure to chemical and radioactive constituents. Remediation worker protection would be the same as that under the Cleanup to AOC LUT Values Alternative.

AOC = *Administrative Order on Consent for Remedial Action*; LUT = Look-Up Table; NBZ = Northern Buffer Zone.

[a] All impacts for soil constituents are based on the mean (for chemicals) or median (for radionuclides) concentrations for all constituents that had one or more exceedances of the LUT values.

[b] Because members of the public would be restricted from accessing the site through fencing, signage, and routine visits by site security personnel, and DOE's intent would be to prevent public access to the site, impacts calculated for the onsite suburban resident and onsite recreational user under the Soil No Action Alternative are hypothetical.

Under the action alternatives, the activities of excavating soil and loading it into containers and trucks for shipment off site could cause soil with chemical or radioactive constituents to become airborne. Workers involved in remediation activities could be exposed to chemical and radioactive constituents in the soil, through direct radiation exposure, dermal absorption of chemicals, inhalation, and incidental ingestion pathways. Depending on the concentrations of chemical and radioactive constituents, the remediation contractor would employ various administrative and physical techniques to control potential releases and exposure of workers. Water sprays could reduce the particulate concentration in air by a factor of approximately 2 (50 percent efficiency) (EPA 1996).

Potential impacts under the Soil No Action Alternative and the soil remediation action alternatives are discussed in the following subsections. Potential impacts of the Soil No Action Alternative are summarized in **Table 4–61**. To compare impacts among the alternatives and to background, the impacts on a hypothetical onsite suburban resident were calculated based on 95 percent upper confidence levels on the mean concentration (upper side of the confidence range for the average) in background soil, as shown in Table 4–61. Those impacts were subtracted from the impacts under the Soil No Action Alternative to obtain an incremental difference.

Table 4–61 Human Health Impacts under the Soil No Action Alternative[a]

Receptors [c]	Annual Radiological Impact (millirem)	Excess Lifetime Cancer Risk [b]			Hazard Index
		Radiological		Chemical	
		Incidence	Fatality	Incidence	
Impacts from Average Background Soil (with U and Th decay chain radionuclides) [d]					
Onsite suburban resident – current [e]	6.3	1.5×10^{-4}	1.1×10^{-4}	1.6×10^{-4}	3.5
Onsite suburban resident – future [f]	5.7	1.3×10^{-4}	9.4×10^{-5}		
Recreational user	1.2	2.9×10^{-5}	2.1×10^{-5}	4.4×10^{-5}	0.78
Total Impacts from SSFL Soil (with U and Th decay chain radionuclides)					
Onsite suburban resident – current [e]	5.3	1.3×10^{-4}	1.0×10^{-4}	1.3×10^{-4}	3.6
Onsite suburban resident – future [f]	4.0	9.1×10^{-5}	6.6×10^{-5}		
Recreational user	1.2	2.9×10^{-5}	2.1×10^{-5}	4.1×10^{-5}	1.2
Incremental Impacts from No Action Alternative (total minus background, with U and Th decay chain radionuclides) [g]					
Onsite suburban resident – current [e]	-1.0	-2.0×10^{-5}	-1.0×10^{-5}	-3.0×10^{-5}	0.1
Onsite suburban resident – future [f]	-1.7	-3.9×10^{-5}	-2.8×10^{-5}		
Recreational user	0.0	0.0	0.0	-3.0×10^{-6}	0.42
Incremental Impacts from No Action Alternative (total minus background, without U and Th decay chain radionuclides) [g]					
Onsite suburban resident – current [e]	0.67	2.3×10^{-5}	1.7×10^{-5}	-3.0×10^{-5}	0.1
Onsite suburban resident – future [f]	0.08	2.0×10^{-6}	1.4×10^{-6}		
Recreational user	0.31	7.0×10^{-6}	5.0×10^{-6}	-3.0×10^{-6}	0.42

Th = thorium; U = uranium.

[a] All impacts for soil constituents are based on the mean (for chemicals) or median (for radionuclides) concentration for all constituents that had one or more exceedances of the LUT values. For the onsite suburban resident, the mean or median concentrations were only from the sub-area that gave the highest impacts. For the recreational user, the average (mean or median) concentration of each constitutent was determined for each sub-area and the highest average of each constituent was used in the analysis. The direct pathways addressed for this table include external radiation exposure, dermal contact, inhalation, and ingestion. Indirect exposure pathways from a suburban resident garden are not addressed in this EIS because the models for making exposure point concentration calculations are associated with significant uncertainties as discussed in the SRAM (MWH 2014) and because it is expected that future use of the property as residential development will be restricted by the landowner (Boeing 2016b).

[b] Total cancer risk per receptor can be estimated by combining the chemical and radiological risks. However, combining the risks should be done with the recognition that the underlying risk slope factors (risk per concentration ratios) were developed differently. The slope factors used to determine chemical risks generally represent an upper bound, or 95th percent confidence limit value, developed from studies on laboratory animals. Radionuclide slope factors are best estimates or average values developed from epidemiology studies.

[c] Impacts for all receptors address direct exposure pathways.

[d] The background includes the natural uranium and thorium decay chain radionuclides, which contribute a major portion of the radiological impacts (see radionuclide specific impacts in Appendix G). EPA determined in its site survey that except for 18 locations, all results greater than the LUT values were from natural background sources (HGL 2012b). However, the variability in the natural background from location to location is significant and may mask the incremental impacts from site-related radionuclides when viewing the total radiological impacts. Therefore, incremental radiological impacts are shown with and without considering impacts from the uranium and thorium decay chain radionuclides.

[e] Current conditions for baseline exposures without radioactive decay.

[f] Future conditions assuming a hypothetical loss of institutional control following 100 years of radioactive decay.

[g] The negative incremental risks indicate that there will be less of a chance of cancer incidence and death from onsite soil contamination than from average background soil.

The onsite suburban resident and recreational user pathways of exposure to residual contaminants include dermal absorption of chemicals, direct radiation exposure, inhalation, and incidental ingestion of soil. For a suburban resident, as defined in the SRAM (MWH 2014), an indirect exposure pathway could also include ingestion of fruits and vegetables raised on site in a garden. The onsite suburban resident impacts shown in Table 4–61 and discussed below include the direct pathways of dermal absorption of chemicals (through contact with soil), direct radiation exposure, inhalation, and incidental ingestion. The onsite suburban resident indirect pathway of ingestion of fruits and vegetables from a garden is not addressed in this EIS because the models for making exposure point concentration calculations in plants are associated with significant uncertainty as discussed in the SRAM and because it is expected that future use of the property as residential development will be restricted by the landowner (Boeing 2016b).

As shown in Table 4–61, the excess lifetime risk of cancer incidence for a hypothetical onsite suburban resident who was exposed to chemicals in background soil through direct pathways would be 1.7×10^{-4} (1 chance in 5,900). The cumulative hazard index for onsite suburban resident from exposure to background soil was calculated to be 3.5, implying the threshold for toxic effects from chemical concentrations in background soil (a hazardous index of 1) could be exceeded. An onsite suburban resident who hypothetically establishes a residence 100 years in the future in background soil would potentially receive an annual radiation dose of 5.7 millirem through direct pathways; the excess lifetime risk of cancer incidence from radionuclides in background soil for a hypothetical future onsite suburban resident would be 1.3×10^{-4} (1 chance in 7,700); and the excess lifetime fatal cancer risk would be 9.4×10^{-5} (1 chance in 11,000).

As shown in Table 4–61, the excess lifetime risk of cancer incidence for a hypothetical recreational user who was exposed to chemicals in background soil through direct pathways would be 4.4×10^{-5} (1 chance in 23,000). The cumulative hazard index for the recreational user from background was calculated to be 0.78, implying the threshold for toxic effects from all toxic chemicals combined was not exceeded and no toxic effects would be expected. The hypothetical onsite recreational user would potentially receive an annual radiation dose of 1.2 millirem from background soil through direct pathways; the excess lifetime risk of cancer incidence from background soil for a hypothetical recreational user from radionuclides would be 2.9×10^{-5} (1 chance in 34,000); and the excess lifetime fatal cancer risk would be 2.1×10^{-5} (1 chance in 48,000).

4.9.2.1 Soil No Action Alternative

Under the Soil No Action Alternative, members of the public would be restricted from accessing the site through fencing, signage, and routine patrols by site security personnel. Although DOE's intent would be to prevent public access to the site, two scenarios involving site access were analyzed: a hypothetical future onsite suburban resident and a hypothetical recreational user. For the hypothetical onsite suburban resident, it was assumed that, over time, there is a lapse in active management control of the site. Due to the lapse, a person was assumed to build a house on site in an area where the soil contains chemical and radioactive constituents. It is not possible to predict when such a lapse would occur, but for purposes of analysis, it was assumed to be 100 years in the future. Evaluation of impacts on the hypothetical future onsite suburban resident did not account for natural processes, such as wind erosion or soil accretion, that might change the availability of the chemical and radioactive constituents or for chemical degradation, but did include 100 years of decay of the radioactive constituents. The exposure pathways include dermal absorption of chemicals, direct radiation exposure, and inhalation and incidental ingestion of soil.

Background radioactive constituents include natural uranium and thorium decay chain radionuclides, which contribute a major portion of the radiological impacts (see radionuclide specific impacts in Appendix G). EPA determined in its site survey that except for 18 locations, all results greater than the LUT values were from natural background sources (HGL 2012b). However, the variability in the natural background from location to location is significant and may mask the incremental impacts from site-related radionuclides when viewing the total radiological impacts. Therefore, incremental radiological impacts were calculated with and without including the uranium and thorium decay chain radionuclides.

As shown in Table 4–61, the excess lifetime risk of cancer incidence for a hypothetical future onsite suburban resident from exposure to site-related chemicals relative to average background levels would be -4.0×10^{-5}. This negative incremental risk implies that the concentrations of chemicals and radionuclides in soil from site-related activities are less than the variability of background concentrations of those chemicals and radionuclides. Therefore, the risk of cancer incidence or death from chemicals and/or radionuclides in Area IV and the NBZ are comparable to or less than the risk determined for background soil. The cumulative hazard index for the hypothetical future onsite suburban resident from exposure to chemical constituents that are above average background levels in soil was calculated to be 0.1, implying the threshold for toxic effects from all toxic chemicals combined was not exceeded and no toxic effects would be expected. As also shown in Table 4–61, the hypothetical future onsite suburban resident (after 100 years of radioactive decay) would potentially receive an incremental radiation dose (without considering uranium and thorium decay chain radionuclides) of 0.08 millirem in a year from radionuclides in soil at concentrations above average background levels; the excess lifetime risk of cancer incidence for a hypothetical future onsite suburban resident for exposure to radionuclides would be 2.0×10^{-6} (1 chance in 500,000); and the excess lifetime fatal cancer risk would be 1.4×10^{-6} (1 chance in 710,000).

A hypothetical recreational user (or site visitor) was evaluated for the Soil No Action Alternative. Impacts were evaluated for a recreational user accessing the site in the near term, that is, under current site conditions. As shown in Table 4–61, the excess lifetime risk of cancer incidence for a hypothetical recreational user (or site visitor) from exposure to chemical constituents that are above average background levels in soil would be -3.0×10^{-6}. This negative incremental risk implies that the concentrations of chemicals and radionuclides in soil from site-related activities are less than the variability of background concentrations of those chemicals and radionuclides. Therefore, the risk of cancer incidence or death from chemicals and/or radionuclides in Area IV and the NBZ are comparable to or less than the risk determined for background soil. The cumulative hazard index for the hypothetical recreational user (or site visitor) from background concentrations of chemicals in soil was calculated to be 0.2, implying the threshold for toxic effects from all toxic chemicals combined was not exceeded and no toxic effects would be expected. As also shown in Table 4–61, a hypothetical recreational user would potentially receive an incremental radiation dose (without considering uranium and thorium decay chain radionuclides) of 0.31 millirem in a year from radionuclides in soil at concentrations above average background levels; the excess lifetime risk of cancer incidence would be 7.0×10^{-6} (1 chance in 140,000); and the excess lifetime fatal cancer risk would be 5.0×10^{-6} (1 chance in 200,000).

Workers would monitor and maintain Area IV and the NBZ as part of the Soil No Action Alternative. Radiation exposures that may be received by an average worker performing ongoing monitoring and maintenance of Area IV and the NBZ were judged to be less than the exposures that may be received by an average Area IV worker under the Building No Action Alternative (see Section 4.9.3.1) because less activity would be required for maintenance of soil areas than that for maintenance of structures. Workers would be protected from chemical and radiation exposure through the implementation of DOE regulations (e.g., 10 CFR Parts 835 and 851) and DOE Orders developed to ensure protection of worker health and safety.

4.9.2.2 Soil Remediation Action Alternatives

Impacts from Exposure to Chemical and Radioactive Constituents in Soil

Under the soil remediation action alternatives, different quantities of soil containing chemical and radioactive constituents would be excavated and removed from the site. Once cleanup is complete, impacts from exposure to chemical or radioactive constituents in the soil would be reduced. Chemical concentrations remaining on site would be below AOC LUT values under the Cleanup to AOC LUT Values Alternative, below revised LUT values under the Cleanup to Revised LUT Values Alternative, or below agreed-to risk-assessment values under for the Conservation of Natural Resources Alternative. Concentrations of radionuclides remaining on site would be below AOC LUT values for the Cleanup to AOC LUT Values or Cleanup to Revised LUT Values Alternative, or below an agreed-to dose level for the Conservation of Natural Resources Alternative. Following remediation, the intent would be to terminate access restrictions due to risks from chemical and radioactive constituents.

Under the Cleanup to AOC LUT Values Alternative, soil containing chemicals and radionuclides above AOC LUT values would be excavated and removed from the site. Concentrations in soil remaining on the site and any backfill brought to the site would meet AOC LUT values; therefore, post remediation, the residual chemical and radionuclide average concentrations would meet AOC LUT values due to the spotty nature of contamination and averaging the remediated area concentrations, presumed to be at or less than the AOC LUT values, with concentrations in the area that are less than the AOC LUT values. Concentrations would also be less than the current average concentrations when they are lower than the LUT values. Therefore, the impacts to the onsite suburban resident and the onsite recreational user would be between the impacts for the No Action Alternative and those for the average background shown in Table 4–61. The incremental difference from background levels would also be smaller.

Under the Cleanup to Revised LUT Values Alternative, soil containing chemicals above risk-based levels (that is, soil with chemicals exceeding risk-based LUT values or with chemicals having a hazard quotient of 1, whichever is less)[24] and radionuclides above AOC LUT values would be excavated and removed from the site. Concentrations in soil remaining on the site and any backfill soil brought to the site would meet LUT values for chemicals and radionuclides; therefore, post remediation, the residual chemical and radionuclide average concentrations would be less than LUT values due to the spotty nature of contamination and averaging the remediated area concentration, presumed to be at the LUT values, with concentrations less than LUT values. Concentrations would also be less than the current average concentrations when they are lower than LUT values. Therefore, the impacts to an onsite suburban resident and onsite recreational user would be between the impacts for the No Action Alternative and those for average background as shown in Table 4–61, but somewhat higher than the impacts under the Cleanup to AOC LUT Values Alternative. The incremental difference from background levels would also be somewhat higher. In addition, the use of risk- or hazard-based LUT values for chemicals allows for the use of a sum of fractions approach for all detected contaminants that the use of LUT values based on background/detection-confidence does not allow, which would further minimize the impact difference.

[24] Or above AOC LUT values, if greater.

Under the Conservation of Natural Resources Alternative, soil containing average chemical concentrations that are above a concentration equal to a 1.0×10^{-6} risk of cancer incidence or a cumulative hazard index of 1 (whichever is less)[18] and soil containing average radionuclide concentrations above a concentration equal to a dose of 25 millirem or other as low as reasonably achievable (ALARA)-based (see Chapter 2) value agreed-to by regulators would be excavated and removed from the site. (Twenty-five millirem is the upper limit for ALARA-based values and was used for evaluation of this alternative in this EIS.) Soil with average chemical concentrations below a risk- or toxicity-based concentration or with average radionuclide concentrations below the prescribed dose level would be left in place. Post remediation, the average residual chemical and radionuclide concentrations would be less than the prescribed risk- or toxicity-based concentrations (whichever is greater) and dose-based concentrations, and less than the current average concentrations, but greater than the average background concentrations. Therefore, the impacts to an onsite suburban resident and onsite recreational user would be less than the impacts shown in Table 4–61 under the No Action Alternative, but somewhat higher than the impacts under the Cleanup to AOC LUT Values Alternative or Cleanup to Revised LUT Values Alternative. In addition, the use of risk- or hazard-based values for chemicals and dose-based values for radionuclides allows for the use of a sum of fractions approach for all detected contaminants that the use of LUT values based on background or detection-confidence does not allow, which will further minimize the impact difference.

Workers involved in soil remediation would be exposed in varying degrees to inhalation of chemicals and radionuclides in soil that become airborne from remediation activities, incidental ingestion of chemicals and radionuclides in the soil, dermal absorption of chemicals in the soil, and direct radiation from radioactive materials in the soil. Exposures would occur during 10 years of soil removal under the Cleanup to AOC LUT Values Alternative, slightly over 2 years under the Cleanup to Revised LUT Values Alternative, or 2 years under the Conservation of Natural Resources Alternative. Considering the risks from exposure to chemicals and radionuclides in soil that are projected for an onsite suburban resident, it is expected that the risks to workers involved in soil remediation would be very small and were not estimated.[25] As discussed above, the risks that may be received by an onsite suburban resident are only slightly different from those that may be received from exposure to background soil. Although disturbance of soil that could result in suspension of chemical or radioactive constituents may be larger for soil removal than that from the activities of an onsite suburban resident, it is expected that soil disturbance and suspension would be the same for soil at Area IV and the NBZ as that for background soil. This indicates that remediation worker risks would be nearly the same for removal of soil at Area IV and the NBZ as those for removal of soil having the characteristics of the evaluated background soil.

Under all action alternatives, workers would be protected in accordance with DOE regulations (e.g., 10 CFR Parts 835 and 851) and DOE Orders. Worker radiation protection practices would be employed so that doses are as low as reasonably achievable. Personal protective equipment, such as coveralls and respirators, would be used as dictated by the level of chemical and radiological impacts associated with each area. Breathing protection equipment may be used by workers when necessary to reduce the impacts from exposure to toxic chemicals to below DOE occupational exposure limits and the thresholds for toxic effects.

[25] This is consistent with DOE's sliding-scale guidance for preparation of environmental assessments and EISs whereby the length and breadth of analysis of environmental impacts would be commensurate with their significance (DOE 2004).

Physical controls, including use of tools that allow workers to perform their jobs at some distance from contaminated or activated materials and use of surfactants or water sprays to control the generation of dust, would be applied as appropriate. Additionally, administrative controls, such as limiting time of exposure, would be employed to ensure workers do not exceed DOE annual dose limits.

Soil excavation and packaging would pose an industrial safety risk to workers. Injuries could be minor, requiring no or basic first aid treatment. In this EIS, potential impacts are reported as total recordable cases (TRCs) and cases that result in days away from work, restricted duty, or transfer to another job (DART cases). The rates used to project incidences for DOE activities are 1.5 TRCs and 0.7 DART cases per 200,000 hours worked (DOE 2010b). Based on these rates, 3.8 TRCs and 1.8 DART cases are expected under the Cleanup to AOC LUT Values Alternative. Because of the fewer worker hours associated with the shorter soil cleanup period under the Cleanup to Revised LUT Values Alternative and the Conservation of Natural Resources Alternative, approximately 1.5 TRC and 0.7 DART cases are expected to occur for these alternatives.

Impacts from Exposure to Fungus Spores that Cause Valley Fever

Valley fever is the initial form of coccidioidomycosis infection, a fungal infection caused by inhalation of airborne *Coccidioides spp*. spores that are present in certain arid soils. In California, valley fever is caused by the fungus *Coccidioides immitis* that lives in the top 2 to 12 inches of soil in many parts of the state. When soil containing this fungus is disturbed by activities such as digging or by the wind, the fungal spores can get into the air (CDC 2014; HESIS 2013). Valley fever incidence in Ventura and Los Angeles Counties has been in the range of 0.1 to 19.9 cases per 100,000 people, lower than in nearby counties to the north, where incidence has exceeded 75 cases per 100,000 (HESIS 2013). Nonetheless, soil-disturbing activities under the action alternatives would increase the potential for exposure to the fungus spores that cause valley fever.

Under the Soil No Action Alternative, there would be no change in the potential for exposure of workers or the offsite public. Because of the large volume of soil to be removed under the Cleanup to AOC LUT Values Alternative, this alternative would have the largest potential of causing exposure to the fungus spores. Because the volume of soil to be removed under the Conservation of Natural Resources Alternative is about one-fifth of that under the Cleanup to AOC LUT Values Alternative, the potential for exposure to the fungus that causes valley fever under the Conservation of Natural Resources Alternative would be about one-fifth of that for the Cleanup to AOC LUT Values Alternative. The potential for exposure under the Cleanup to Revised LUT Values Alternative would be somewhat greater than that under the Conservation of Natural Resources Alternative.

There are no commercially available tests to reliably test the soil for *Coccidioides* spores before working in a particular location (CDC 2014; HESIS 2013). Soil testing is currently only done for scientific research, and the available methods to detect *Coccidioides* in the soil do not always detect the spores, even when they are present (CDC 2014). Because the spores may be present in the soil, reasonable precautions would be taken to reduce potential for exposure. Project design features to control fugitive dust in accordance with VCAPCD Rule 55 would also reduce potential exposures to the valley fever fungus spores. Features include treating surfaces with soil binders or dust control agents, limiting speed on unpaved roads, placing solid barriers around stockpiled soils and covering or wetting them, and loading materials carefully and not loading during high winds or storms. In addition to wetting soils during loading, wetting or binding agents would be applied at the points of excavation to minimize the amount of dust raised.

The largest risk of exposure would be to the workers involved in soil excavation and loading for offsite disposal because they would be exposed to the highest concentrations of airborne dust. If necessary, additional precautions to protect workers could include workers' use of filter masks and heavy equipment with enclosed cabs supplied with filtered air. Members of the public would be at much lower risk than workers, but some of the same precautions taken to protect workers that minimize the amount of dust raised would lessen the potential for exposure of site visitors.

To reduce the risk of exposure during offsite transportation of removed soil, the remediation contractor would employ measures to preclude emissions of dust from transport trucks to the extent practical. Bulk materials would be contained by loading them into container-like enclosures (a solid container or a soft-sided liner with a top that folds over to enclose the material) or potentially transported in lined and covered dump trucks. To minimize the amount of soil that would be tracked off site on truck exteriors, trucks would pass through a decontamination and inspection station, where they would be cleaned of visible soil before they leave the staging and loading areas.

Additional Worker Safety Considerations

Much of the soil remediation work would occur in previously developed areas that are safely accessible to workers and the heavy equipment that would be used for soil removal. There are, however, portions of the site where the topography presents challenges to working safely. In particular, steep hillsides present hazards in that heavy machinery could be susceptible to rollover. Additionally, portions of the site in the NBZ and along the southern edge of Area IV are within earthquake-induced landslide zones (see Section 4.2.1.2).

As noted in Chapter 2, the 2010 AOC (DTSC 2010a) allows exemptions from soil remediation for unforeseen circumstances. DOE would use this exemption if, during the planning and design of the soil removal project, it were determined that excavating soil in certain areas presented an unacceptable risk to workers.

4.9.3 Building Demolition Alternatives

Impacts under the building demolition alternatives are summarized in **Table 4–62**.

Table 4–62 Human Health Impacts under the Building Demolition Alternatives

Receptor	*Building No Action Alternative*	*Building Removal Alternative*
Onsite Suburban Resident	No impacts are expected because access to the buildings is restricted.	No impacts are expected. Following building removal, there would be no impacts attributable to the buildings to an onsite suburban resident. Any residual impacts would be associated with chemicals or radionuclides in the soil
Onsite Recreational User	No impacts are expected because access to the buildings is restricted.	No impacts are expected. Following building removal, there would be no impacts attributable to the buildings to an onsite recreational user. Any residual impacts would be associated with chemicals or radionuclides in the soil.
Worker	Minimal exposures from monitoring and maintenance activities; workers would be protected from radiation exposure and industrial hazards through compliance with DOE requirements for worker safety and radiation protection.	Potential radiation exposures would be substantially higher than those under the No Action Alternative; building demolition workers would be protected through compliance with DOE requirements for worker protection from industrial and radiological hazards and administrative controls.

Under the Building No Action and Building Removal Alternatives, members of the public would be protected from radiation exposure through containment of the radioactive material (within buildings or under pavement), administrative controls that limit access, and engineering controls that prevent access (locked doors) and control the movement of materials (water sprays during demolition).

Workers would be protected though compliance with site procedures that implement DOE requirements for worker protection from industrial and radiological hazards.

Eighteen structures (buildings and sheds) in Area IV are addressed under the building demolition alternatives. Seven structures were not impacted by site radiological operations or are not believed to be contaminated based on available survey data and were assumed to not present a radiological risk to workers or the public under either the Building No Action or Building Removal Alternative. The remaining 11 structures have residual radioactive material at varying levels. Eight structures have residual contamination that may be below free release limits,[26] while the remaining 3 structures are known to be contaminated with radioactive material above free release limits. The radioactive material is primarily inside the buildings or below pavement on surfaces just outside the buildings, where it does not present a relevant hazard to the public. These buildings represent varying radiation risks; Buildings 4021, 4022, and 4024 represent the majority of the risks. No buildings have been identified as a potential source of exposure with respect to chemical contaminants.

While the buildings remain standing, only individuals who enter the buildings or stand on a contaminated paved surface are expected to receive a radiation dose. Doses could come from direct external exposure to radioactive material within the buildings or from the outside paved surfaces. Individuals who enter the buildings could also receive an internal exposure to radioactive materials that become airborne and are inhaled or inadvertently ingested. Any activity in the building could mobilize loose radioactive material and make it become airborne; activities that disturb buildings surfaces could mobilize fixed radioactive material in building components.

Exposure of site workers could occur as a result of building demolition. Demolition could mobilize loose or fixed radioactive materials, potentially making them available for exposure. Potential pathways of exposure from airborne radioactive materials include direct external radiation, inhalation, and incidental ingestion. As discussed below, the demolition contractor would use a variety of techniques, commensurate with the quantity of radioactive materials and the potential radiation risk, to control releases.

4.9.3.1 Building No Action Alternative

Under the Building No Action Alternative, the buildings would remain standing and be subject to routine monitoring and maintenance. Members of the public would be prevented from entering the buildings by fencing, locks on building doors, or both, as well as inspections by site personnel. Area IV buildings would be routinely inspected as part of DOE's monitoring and maintenance activities, and corrective actions would be taken to address gates or building doors found to be open or in disrepair. Workers would be protected from chemical and radiation exposure through the implementation of DOE regulations (e.g., 10 CFR Parts 835 and 851) and DOE Orders developed to ensure protection of worker health and safety.

Under the Building No Action Alternative, workers could be injured as a result of industrial accidents while performing their monitoring and maintenance duties. Injuries could be minor, requiring no or basic first aid. A management and maintenance presence of two full-time equivalent staff is expected under the Building No Action Alternative. Given this staffing level and assuming

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[26] For a building to be free released, it must meet the conditions of DOE Order 458.1, *Radiation Protection of the Public and the Environment*, which are either dose-based (less than 25 millirem in a year and as low as reasonably achievable [ALARA]) or the surface contamination levels must meet the default limits expressed in DOE Order 5400.5 (same title as DOE Order 458.1 and superseded by that Order) and U.S. Nuclear Regulatory Commission Regulatory Guide 1.86, *Termination of Operating Licenses for Nuclear Reactors*. Note that free-released does not mean not contaminated; debris from free-released buildings may require disposal as low-level radioactive waste.

the same rate used to project incidences for DOE activities as that assumed in Section 4.9.2.1, the annual likelihood of a TRC would be 0.03, and the annual likelihood of a DART case would be 0.01.

4.9.3.2 Building Removal Alternative

Under the Building Removal Alternative, buildings in Area IV would be demolished and the resulting building materials and rubble removed from the site for recycle or disposal. Following removal of the buildings, there would be no impact attributable to the buildings to an onsite suburban resident or onsite recreational user. Any residual impacts would be associated with chemicals or radionuclides in the soil, which are addressed in Section 4.9.2.

Demolition and removal of the buildings was estimated to require about 43,300 worker-hours, assuming 26 workers engaged in demolition activities for 8 hours per working day during 5 months in each of 2 years. Workers involved in building demolition and removal would be exposed in varying degrees to direct radiation from radioactive materials on and in building components, and inhalation and incidental ingestion of radioactive materials that may become airborne. Under the Building Removal Alternative, workers would be protected in accordance with DOE regulations (e.g., 10 CFR Parts 835 and 851) and DOE Orders. Worker radiation protection practices would be employed so that doses would be ALARA. Personal protective equipment, such as coveralls and respirators, would be used as dictated by the level of radioactive risk associated with each building. Breathing protection equipment (e.g., respirators) would be used by workers when necessary to reduce the impacts from exposure to radionuclides to below DOE occupational exposure limits. For subgrade vaults in Buildings 4021 and 4022, it was assumed that workers involved in demolition activities would wear respiratory protection that provides 99 percent particulate removal efficiency.

Physical controls, including decontaminating surfaces prior to demolition, use of tools that allow workers to perform their jobs at a distance from contaminated or activated materials, and use of water sprays to control dust generation would be applied as appropriate. Water sprays could reduce the particulate concentrations in air by a factor of approximately 2 (50 percent efficiency) (EPA 1996). This factor has been applied to the air concentrations evaluated during building removal. Additionally, administrative controls, such as limiting time of exposure, would be employed as necessary to ensure workers do not exceed their annual dose limits.

Impacts on involved workers were assessed assuming that each worker would be involved in removal of all 11 structures containing radioactive material and that during the removal of each building, there would be a constant ambient dose rate and air concentration of radioactive materials. The actual dose that a worker would receive is expected to be less than that calculated because the quantity of radioactive material would decrease as building demolition and removal progresses. The average annual dose to a worker over the 2 years during which building removal would occur was estimated to be 240 millirem. The excess lifetime risk of cancer incidence for the worker from 2 years of building removal would be 1.1×10^{-4}. The excess lifetime fatal cancer risk from 2 years of building removal would be 1.0×10^{-4}. In other words, an involved worker who was exposed during the 2 years of building demolition would have a 1 in 9,100 chance of developing a cancer and a 1 in 10,000 chance of developing a fatal cancer. Assuming 26 involved workers during each of two working years, the total dose received by all workers would be about 12.5 person-rem, which is not expected to cause an LCF among the involved worker population (calculated value: 0.003 LCF).

Building demolition and removal would also pose an industrial safety risk to workers. Based on the average DOE incidence rates for accidents discussed in Section 4.9.2.2, no TRCs or DART cases are expected (calculated values of 0.32 and 0.15, respectively) for this activity.

4.9.4 Groundwater Remediation Alternatives

Impacts under the groundwater remediation alternatives are summarized and compared in **Table 4–63**.

Table 4–63 Human Health Impacts under the Groundwater Remediation Alternatives

Receptor	*Groundwater No Action Alternative*	*Groundwater Monitored Natural Attenuation Alternative*	*Groundwater Treatment Alternative*
Onsite Suburban Resident	No impacts are expected; groundwater wells do not produce sufficient water for residential use. [a]	Same as the Groundwater No Action Alternative.	Same as the Groundwater No Action Alternative.
Onsite recreational user	No impacts are expected for an onsite recreational user because no use of, or exposure to, onsite well water is expected.	Same as the Groundwater No Action Alternative.	Same as the Groundwater No Action Alternative.
Worker	No impacts are expected on workers solely attributed to the groundwater monitoring program; workers could receive a radiation dose if the building or soil were not remediated.	Same as the Groundwater No Action Alternative.	Workers could receive a radiation dose from excavation of contaminated bedrock; workers would be protected through compliance with DOE requirements for worker safety and radiation protection.

[a] The expected pumping rate for Area IV groundwater wells is about 0.5 to 1 gallons per hour (CDM Smith 2015a). Considering the slow movement of the groundwater and the concentrations of chemicals and radionuclides, impacts on offsite members of the public are not expected because groundwater migration is not expected to reach offsite receptors prior to decay below screening levels.

Feasibility studies and technology evaluations are under way for remediation of groundwater at Area IV, and the groundwater treatment remedies to be implemented will be selected through a groundwater remedial investigation plan. The remedies eventually selected and implemented will be in accordance with the 2007 CO (DTSC 2007) and RCRA closure requirements. Except during bedrock excavation under the Groundwater Treatment Alternative, remediation workers will have negligible risk from all groundwater monitoring remediation activities due to limited potential exposure levels over limited periods of time. During bedrock remediation, remediation workers could be exposed to strontium-90 through inhalation, ingestion, and external exposure pathways.

4.9.4.1 Groundwater No Action Alternative

Under the Groundwater No Action Alternative, the current groundwater monitoring program for Area IV would continue. Considering the slow movement of the groundwater and the concentrations of radionuclides and chemicals, impacts on offsite members of the public are not expected because groundwater migration is not expected to reach offsite receptors prior to decay below screening levels. No impacts are expected on a hypothetical future onsite suburban resident because groundwater wells at Area IV have pumping rates of about 0.5 to 1 gallon per hour (CDM Smith 2015a), which would be insufficient for residential use. No impacts are expected for a hypothetical onsite recreational user because no use of, or exposure to, onsite well water is expected. There would be no impacts on workers solely attributable to groundwater monitoring; workers could receive a radiation dose if the buildings or soil were not remediated.

Maintaining and monitoring the groundwater wells would require 10 workers about 20 days per year. Industrial accidents, represented by TRCs and DART cases, for this level of effort would be 0.01 TRCs and 0.006 DART cases per year.

4.9.4.2 Groundwater Action Alternatives

Under the Groundwater Monitored Natural Attenuation Alternative, impacts would be similar to those under the Groundwater No Action Alternative. Five additional monitoring wells would be installed, but no impacts on the offsite public or workers are expected. The number of TRCs and DART cases would be higher in the first year as a result of the additional labor associated with well installation: 0.02 TRCs and 0.01 DART cases.

Under the Groundwater Treatment Alternative, impacts would be similar to those under the Groundwater No Action Alternative. A variety of groundwater remedies may be implemented, depending on the outcome of the groundwater remedial investigation plan. The installation and operation of equipment to treat groundwater would not result in chemical or radiation exposures to offsite members of the public. Workers would perform installation, monitoring, maintenance, and repair of systems in accordance with procedures designed to ensure their exposures are minimal.

The most intrusive groundwater treatment remedy would be removal of a source of strontium-90 in groundwater near the RMHF. This source consists of strontium-90 contamination within bedrock that was left in place during a prior remediation activity. Under this alternative, the cover soil would be removed, and a small area would be excavated to remove the contaminated bedrock. Excavation of the bedrock is estimated to require 20 days.

Impacts on workers could occur from excavation of the contaminated bedrock and from industrial accidents associated with field work. Under all action alternatives, workers would be protected in accordance with DOE regulations (e.g., 10 CFR Parts 835 and 851) and DOE Orders. Worker radiation protection practices would be employed so that doses are ALARA. Personal protective equipment, such as coveralls and respirators, would be used as dictated by the level of radiological and chemical impacts associated with each area. Breathing protection equipment may be used by workers when necessary to reduce the impacts from exposure to toxic chemicals to below DOE occupational exposure limits and the thresholds for toxic effects.

During excavation and packaging, workers are assumed to wear respirators what would be 99 percent efficient in filtering respirable particles. An involved worker would receive a dose of 130 millirem during the removal activity; the excess lifetime risk of cancer incidence is 1.0×10^{-5}; and the risk of a latent cancer fatality associated with this dose is 9.8×10^{-6}. In other words, an involved worker would have a 1 in 100,000 chance of developing a cancer and an equivalent chance of developing a fatal cancer. Assuming a work crew of 5, the total dose received by all workers would be about 0.7 person-rem, which is not expected to cause an LCF among the involved worker population (calculated value: 5×10^{-5} LCF).

The likelihood of TRCs and DART cases was based on projected numbers of workers and durations for performing groundwater treatment activities. It would take six workers a total of 25 days to install five additional monitoring wells. Installation of pump and treat equipment would take five workers 5 days. Monitoring and maintaining groundwater treatment equipment was assumed to require two workers, 1 day every 2 weeks, over a 5-year period. Excavation of the strontium-contaminated bedrock was assumed to be completed by a crew of five in 20 days. These activities would take about 4,300 worker hours. No TRC or DART cases are expected for this level of activity; the calculated values are 0.03 TRCs and 0.02 DART cases.

4.9.5 Human Health Impacts under All Action Alternative Combinations

4.9.5.1 Combined Chemical and Radionuclide Impacts

Following remediation of Area IV and the NBZ, the principal risk would be residual chemical and radioactive constituents in soil. Following removal of DOE buildings under the Building Removal

Alternative, there would be no remaining impact attributable to the buildings. Under the groundwater remediation action alternatives, neither near-term activities such as installing wells and removing the strontium-90 subsurface bedrock source, nor remaining activities such as monitoring or operating treatment equipment, would result in chemical or radiation exposures to offsite members of the public. Consequently, the combined impacts would be dominated by the impacts associated with soil. The impacts on an onsite suburban resident following any of the soil action alternatives would be smaller than those under the No Action Alternative, which are very close to impacts from background soil. The High Impact Combination, under which the most soil would be removed from the site, would be expected to have the lowest residual risk. The Low Impact Combination, under which soil with concentrations meeting risk-assessment-based values would remain on site, would have a slightly higher residual risk.

Individual receptors listed in Table 4–61 would be exposed to chemicals and radionuclides through similar transport processes and routes of exposure, so a combined risk can be estimated by combining the chemical and radiological risks. However, combining the risks should be done with the recognition that the underlying risk slope factors were not developed in the same manner. The slope factors used to determine chemical risks generally represent an upper bound, or 95th percent confidence limit value, developed from studies on laboratory animals. Radionuclide slope factors are best estimates or average values developed from epidemiology studies. Combined impacts from chemicals and radionuclides for each soil exposure receptor and the Soil No Action Alternative are summarized in **Table 4–64**. Combined impacts from chemicals and radionuclides for the soil remediation action alternatives would be smaller than those listed in Table 4–64.

Table 4–64 Combined Chemical and Radionuclide Impacts for Direct Pathways under the Soil No Action Alternative[a]

Receptors [b]	*Excess Lifetime Cancer Risk from Chemicals and Radionuclides* [c]	
	Incidence	*Fatality*
Average Background		
Onsite suburban resident – current [d]	3.2×10^{-4}	1.5×10^{-4}
Recreational user	7.3×10^{-5}	3.3×10^{-5}
No Action Alternative [e]		
Onsite suburban resident – future [f] (increment above background)	-3.9×10^{-5}	-9.9×10^{-6}
Recreational user (increment above background)	-1.0×10^{-5}	-8.0×10^{-7}

[a] All impacts for soil constituents are based on the mean or median concentration for all constituents that had one or more exceedances of the LUT values. For the onsite suburban resident, the mean concentrations were only from the sub-area that gave the highest impacts. For the recreational user, the mean concentrations were averaged for all sub-areas.
[b] Impacts for all receptors address direct pathways.
[c] Total cancer risk per receptor can be estimated by combining the chemical and radiological risks. However, combining the risks should be done with the recognition that the underlying risk slope factors were developed differently. The slope factors used to determine chemical risks generally represent an upper bound, or 95th percent confidence limit value, developed from studies on laboratory animals. Radionuclide slope factors are best estimates or average values developed from epidemiology studies.
[d] Current conditions for baseline exposures without radioactive decay.
[e] The negative incremental risks indicate that there will be less chance of cancer incidence and death from onsite soil contamination than from average background soil.
[f] Future conditions for assumed loss of institutional controls after 100 years of radioactive decay.

4.9.5.2 Combined Alternative Group Impacts

If action alternatives were implemented for each of the three action alternative groups evaluated in this EIS (building remediation, soil remediation, and groundwater remediation), potential risks to members of the public would be primarily associated with residual chemical and radioactive constituents in the site soil, as discussed in Section 4.9.5.1.

Implementing different combinations of action alternatives would have little effect on the maximum number of workers on site in a year, but would have a large effect on the number of years that workers could be exposed to chemical, radiological, and industrial hazards. Under the High Impact Combination, workers would be subject to hazards over about a 12-year period, while under the Low Impact Combination, workers would be subject to hazards for about a 4-year period. In addition, there could be a combined impact on workers involved in both building demolition (D&D workers) and soil or groundwater remediation (remediation workers). However, because the impacts on remediation workers are estimated to be significantly less than those for D&D workers, the combined impacts would not be significantly larger than those for D&D workers alone.

Regardless of the combination of action alternatives, workers would be protected in accordance with DOE regulations (e.g., 10 CFR Parts 835 and 851) and DOE Orders. Worker protection practices would be employed so that doses are as low as reasonably achievable below DOE occupational exposure limits.

4.9.6 Site Accidents and Intentional Destructive Acts

The potential risks of an accident at or near Area IV and the NBZ, or of an intentional destructive act at the site, were considered during the development of this EIS. The concern is that an accident or intentional destructive act could cause the release of a large quantity of chemical or radioactive constituents that could pose a threat to human health. It was concluded that there is minimal risk of such a release because there are no large inventories of chemical or radioactive constituents on site and only limited energy sources capable of spreading these constituents. The focus of the following analysis is on the potential for impacts on offsite receptors because it is recognized that impacts of an accident or intentional destructive act on workers could vary dramatically, depending on their proximity to the initiating event. Those close to the event could be greatly impacted, and those more distant from the event could be minimally impacted. Potential impacts on workers from industrial-type accidents that are typical of any construction, demolition, or remediation activity were addressed in the previous sections.

Materials of concern in Area IV and the NBZ are the radioactive materials contaminating a number of the structures on site and chemicals and radioactive constituents in soil or bedrock. Three site structures (Buildings 4021, 4022, and 4024) have radioactive surface contamination or contamination incorporated into the materials of construction (see Chapter 3, Table 3–21). Removal of the structures may involve direct demolition of the structure or decontamination of the surfaces, followed by demolition. In either case, radioactive waste would be generated and prepared for offsite transport. Although the decontamination and demolition processes may concentrate the radioactive materials somewhat, they would still be distributed in the waste. Additional structures that have previously been decontaminated but have a history of radiological operations would be managed in a manner similar to the radiological facilities, but could result in generation of nonradioactive waste.

Chemical and radioactive constituents are not uniformly distributed in the soil; some areas of the site have only background concentrations, and other areas have comparatively high concentrations. Even in the areas with comparatively high concentrations, the chemicals and radionuclides are dispersed and do not represent a large, concentrated inventory (see Tables 3–22 and 3–23). Remediation activities would not increase the concentrations of the chemical and radioactive constituents to any relevant degree; therefore, accidents involving these constituents are not expected to present risks much beyond those associated with operational exposures to workers or members of the public.

There are no operational facilities in Area IV or the NBZ; therefore, no facility accidents could result in an energetic release of material. The only source of an energetic release would be from fuel for trucks and earth-moving equipment. The quantities of fuel would be limited to those required for efficient operations (for example, a fueling truck). In the unlikely event that common safety practices did not prevent an accident involving fuel, there could be a small energetic release (that is, a fire or small explosion). Immediate impacts of such an accident would be localized and limited in size.

The accidents presenting the largest potential consequences would be more likely associated with a wildfire with its cause unrelated to the presence of radioactive and chemical materials. Operating procedures would incorporate safety measures to prevent the ignition of a fire from demolition and remediation activities. However, an accident or natural causes (for example, a lightning strike) could result in a fire starting on or off the site. The threat of such a fire to the offsite public or to workers would be essentially the same as that for any other wildfire. If such a fire were to occur, potentially affected members of the public, as well as workers, would be evacuated to safe areas.

Based on experience, the chemical and radioactive constituents in the soil are not expected to present an undue risk in the event of a wildfire. In September 2005, the Topanga Fire burned over 2,000 acres of SSFL, including portions of Area IV. Contaminants released were typical of those resulting from burning brush, wood, and building materials, as well as petroleum products (for example, kerosene and oil). Brush burned in Area IV; however, sampling showed that the existing vegetation contained no radiological contamination. Air sampling conducted on 2 days during the fire and for several days following the fire did not show any detectable radiological contamination (Boeing 2005, DOE 2005). Radiation exposure measurements taken around Area IV in the days following the fire revealed safe, normal levels (DOE 2005). The most relevant impact of a wildfire in Area IV would be similar to the potential impacts from disturbing the soil through excavation, that is, the potential for stormwater to carry soil into drainages leaving the site.

4.9.7 Impact Threshold Analysis

Impact thresholds developed to evaluate human health impacts include the following:

- radiological dose to members of the public from all-pathways of 100 millirem in a year;
- radiological dose to members of the public from release of real property for any actual or likely future use of 25 millirem in a year;
- excess lifetime cancer risk on members of the public and workers from exposure to carcinogenic chemical and radioactive constituents of 1×10^{-4} (1×10^{-6} is the threshold for comparison of alternative impacts); and
- a toxicity hazard index of 1 for members of the public and workers from exposure to noncarcinogenic chemical constituents.

Because the periods for implementation of the alternatives evaluated in this EIS could overlap, the best comparison to these thresholds was determined to be with exposures associated with combinations of action alternatives rather than individual action alternatives.

The cancer risk threshold and the hazard index threshold are marginally exceeded by background values for the direct pathways by both chemicals and radionuclides in soil for the onsite suburban resident. Under the Soil No Action Alternative, the incremental above-background cancer risk and dose impacts from radionuclides are 2 orders of magnitude less than those from background. No thresholds are exceeded under the Soil No Action Alternative for the recreational user (see Table 4–61).

4.10 Waste Management

This section presents potential impacts on facilities evaluated for receipt of waste from Area IV and the NBZ. Impacts were determined by comparing the projected waste quantities with the total capacities of the facilities and their permitted annual or daily acceptance limits. In addition, the impacts of receipt of nonhazardous materials at the evaluated recycle facilities were assessed. The facilities are representative of those that would be reasonably considered for Area IV waste and recycle material. Waste and recycle material could also be dispositioned at other facilities, including those identified in Chapter 3, Section 3.10.3.

The representative facilities evaluated for receipt of waste from Area IV are listed in **Table 4–65**, along with facility capacities and permitted acceptance limits, if any, in terms of daily allowable tonnages or similar restrictions. There are no daily or annual limits on waste disposal at US Ecology in Idaho, Energy*Solutions* in Utah, or NNSS in Nevada. Daily and annual acceptance of waste at these facilities would depend on logistical concerns – in this case, matching the quantities of waste to be received with the scope of facility operations, so that there would be sufficient equipment, personnel, and space in active disposal units to efficiently cycle all daily waste delivery trucks into and out of a disposal facility. As shown in Table 4–65, different facilities were evaluated for receipt of different classifications of waste, including nonhazardous waste, hazardous waste, LLW, or MLLW. Definitions for these waste classifications are provided in Chapter 3, Section 3.10. Each of these waste classifications may include materials from remediation of Area IV and the NBZ.

In addition, two options for waste shipment were considered, as described in Section 4.8.1: (1) a truck option where waste or recycle material would be shipped from SSFL to offsite facilities solely by truck; and (2) a truck/rail option where waste would be shipped by truck from SSFL to a truck-to-rail intermodal transfer site, with subsequent rail shipment to disposal facilities able to receive deliveries of waste by rail. The truck option was evaluated for all facilities listed in Table 4–65 except for the Mesquite Regional Landfill; because of the distance of the Mesquite Regional Landfill from SSFL and its operational concept (see Appendix D, Section D.4), shipment of nonhazardous waste to the Mesquite Regional Landfill was evaluated only for the truck/rail option. The truck/rail option was also evaluated for hazardous waste sent to US Ecology in Idaho, and for LLW and MLLW sent to NNSS or Energy*Solutions* in Utah. Because NNSS lacks direct-rail capability, rail shipments from an intermodal transfer site near SSFL would be transferred to trucks at a second intermodal transfer site (assumed for analysis to be at Barstow, California) before subsequent waste delivery to NNSS. The truck/rail option was not evaluated for shipment of material to any recycle facility or to any California facility, except for the Mesquite Regional Landfill (see Section D.4).

In addition, three standalone facilities near SSFL – P.W. Gillibrand, Kramer Metals, and Standard Industries – were evaluated for receipt of recycle materials from building removal. No limits have been identified on the daily quantities of authorized materials that may be received at these facilities. Additional standalone recycle facilities are located in the SSFL vicinity, and recycle facilities are frequently collocated with nonhazardous waste landfills.

Table 4–65 Summary of Waste Disposal Capacities

Disposal Facility	Location	Waste Accepted	Available or Projected Waste Capacity	Permitted Waste Acceptance Limit
Antelope Valley	Palmdale, CA	Nonhazardous	20.05 million cubic yards as of February 2013.	3,564 tons per day
Chiquita Canyon	Castaic, CA	Nonhazardous	96 million cubic yards as of May 2014.	6,500 tons per day
Mesquite [a]	El Centro, CA	Nonhazardous	600 million tons of projected capacity.	20,000 tons per day [b]
McKittrick	McKittrick, CA	Nonhazardous	About 5.5 million cubic yards of disposal capacity.	4,000 tons per day
Buttonwillow	Buttonwillow, CA	Hazardous [c]	Permitted capacity is greater than 10 million cubic yard.	10,500 tons per day
Westmorland	Westmorland, CA	Hazardous [c]	Design capacity is 5 million cubic yards.[d]	440,000 cubic yards per year
US Ecology in Idaho [e, f]	Grand View, ID	Hazardous	1.5 million cubic yards as of May 2014, with 10 million cubic yards permitted; 28 million cubic yards are cited for future expansion.	No daily or annual limit [g]
Energy*Solutions* [e] in Utah	Clive, UT	LLW/MLLW	Current capacity is greater than 8 million cubic yards; additional capacity would be available subject to licensing or permitting.	No daily or annual limit [g]
NNSS [e]	Nye County, NV	LLW/MLLW	237,000 cubic yards as of April 2014; up to 1,950,000 cubic yards of projected capacity. [h]	No daily or annual limit [g]

CA = California; ID = Idaho; LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; NNSS = Nevada National Security Site; NV = Nevada; UT = Utah.

[a] Waste delivery under the truck/rail option only (see Section 4.8.1).

[b] The indicated limit is for combined truck and rail waste delivery. The truck-only delivery limit is 1,000 tons per day from Imperial County generators and 4,000 tons per day from Los Angeles County generators. The Mesquite Regional Landfill is not currently accepting waste for disposal.

[c] The Buttonwillow and Westmorland Landfills are also evaluated for disposal of nonhazardous soil generated under the soil remediation alternatives.

[d] The Westmorland facility is currently not accepting waste due to low demand in the California market, but could accept waste in the future if market conditions improve.

[e] Waste delivery under both the truck option and truck/rail option (see Section 4.8.1).

[f] Only waste determined to be only hazardous would be sent to US Ecology in Idaho.

[g] There are no permitted daily or annual limits on waste acceptance; limitations on waste acceptance would depend on logistical concerns – that is, the availability of sufficient personnel, equipment, and space in active disposal units to address the quantity of waste to be received.

[h] The smaller volume (237,000 cubic yards) is the capacity in currently constructed disposal units. In DOE's December 30, 2014, Record of Decision (79 *Federal Register* [FR] 78421) for the *Final Site-Wide Environmental Impact Statement for the Continued Operation of the Department of Energy/National Nuclear Security Administration Nevada National Security Site and Off-Site Locations in the State of Nevada* (DOE 2013a), DOE decided to dispose of up to 48 million cubic feet (1.8 million cubic yards) of DOE LLW and 4 million cubic feet (150,000 cubic yards) of DOE MLLW at NNSS. Additional disposal units will be developed at NNSS consistent with this Record of Decision.

Note: Data derived from Chapter 3, Section 3.10.

4.10.1 Soil Remediation Alternatives

Impacts under the soil remediation alternatives are summarized and compared in **Table 4–66**.

4.10.1.1 Soil No Action Alternative

Under the Soil No Action Alternative, there would be no remediation of soil in Area IV and the NBZ. Site maintenance activities would generate very small quantities of waste as described in Chapter 3, Section 3.10.2. All waste would be shipped off site for disposition at appropriate facilities, with no impacts on the capacities of these facilities.

Table 4–66 Waste Management Impacts under the Soil Remediation Action Alternatives

Waste	*Soil No Action Alternative*	*Soil Remediation Action Alternatives*		
		Cleanup to AOC LUT Values	*Cleanup to Revised LUT Values*	*Conservation of Natural Resources*
LLW and MLLW soil	No impacts are expected on offsite waste capacity.	Generation of about 91,000 cubic yards of waste. No impacts on total waste capacity are expected at any facility. Under either the truck or truck/rail option, no logistical concerns are expected.	Generation of about 91,000 cubic yards of waste. No impacts on total waste capacity are expected at any facility. Under the truck option, there could be logistical concerns that could require additional coordination with facility operators. Under the truck/rail option, there would be no logistical concerns at Energy*Solutions* in Utah because it has direct rail access.	Generation of about 47,000 cubic yards of waste. No impacts on total waste capacity are expected at any facility. Under the truck option, there could be logistical concerns that could require additional coordination with facility operators. Under the truck/rail option, there would be no logistical concerns at Energy*Solutions* in Utah because it has direct rail access.
Hazardous soil	No impacts are expected on offsite waste capacity.	Generation of about 49,000 cubic yards of waste. No impacts on total waste capacity are expected at any facility. Under the truck option, no exceedance of daily or annual receipt limits is expected. Under the truck/rail option, no logistical concerns are expected at US Ecology in Idaho.	Same as the Cleanup to AOC LUT Values Alternative.	Same as the Cleanup to AOC LUT Values Alternative.
Non-hazardous soil	No impacts are expected on offsite waste capacity.	Generation of about 793,000 cubic yards of waste. No impacts on total waste capacity are expected at any facility. Under the truck option, no exceedance of daily or annual receipt limits is expected at any facility. Under the truck/rail option, no exceedance of daily receipt limits is expected.	Generation of about 52,000 cubic yards of waste. No impacts on total waste capacity are expected at any facility. Under the truck option, no exceedance of daily or annual receipt limits is expected at any facility. Under the truck/rail option, no exceedance of daily receipt limits is expected.	Same as the Cleanup to Revised LUT Values Alternative.

AOC = *Administrative Order on Consent for Remedial Action*; LLW = low-level radioactive waste; LUT = Look-Up Table; MLLW = mixed low-level radioactive waste.

4.10.1.2 Soil Remediation Action Alternatives

Waste Generation

Shipment of soil removed from Area IV and the NBZ to offsite facilities would occur under all action alternatives. The most frequently observed radionuclide constituents are cesium-137 and strontium-90 (see Appendix H, Table H–3). The most frequently observed chemical constituents are polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons, dioxins, total petroleum hydrocarbons, and metals, including lead, silver, and mercury (see Chapter 2, Section 2.3.2).

Table 4–67 summarizes waste volumes and analyzed waste disposition methods for the soil remediation action alternatives. The soil categories and descriptions correspond to those discussed in Chapter 2, Sections 2.3.2 and 2.4.3, and summarized in Table 2–4.

Table 4–67 Soil Remediation Volumes (cubic yards) by Action Alternative[a]

Waste Characteristics		*Soil Remediation Action Alternatives*				
EIS Soil Category [b]	***Description***	***Cleanup to AOC LUT Values***	***Cleanup to Revised LUT Values***	***Conservation of Natural Resources***	***Analyzed Disposition Method***	***Evaluated Facilities*** [c]
Nonhazardous Soil Not Exceeding Provisional Radiological LUT Values						
1	Chemicals exceeding LUT values, but below risk-based levels and not a hazardous waste; radionuclides at or below provisional LUT values.	741,000	0	0	CA Class I, II, or III waste facility	McKittrick, Buttonwillow, Westmorland, Chiquita Canyon, Antelope Valley, Mesquite [d]
2	Chemicals exceeding risk-based levels, but not a hazardous waste; radionuclides at or below provisional LUT values.	52,000	52,000	52,000		
Subtotal		**793,000**	**52,000**	**52,000**		
Hazardous Soil Not Exceeding Provisional Radiological LUT Values						
3	Chemicals exceeding hazardous waste standards; radionuclides at or below provisional LUT values.	49,000	49,000	49,000	CA Class I or hazardous waste facility	Buttonwillow, Westmorland, US Ecology in Idaho [e]
Soil Exceeding Provisional Radiological LUT Values						
4	Radionuclides above provisional LUT values, but below risk-based levels; chemicals above LUT values, but below risk-based levels.	44,000	44,000	0	LLW/MLLW facility	NNSS, Energy*Solutions* in Utah
5	Radionuclides above provisional LUT values; chemicals above risk-based levels.	44,000	44,000	44,000	LLW/MLLW facility	NNSS, Energy*Solutions* in Utah
6	Radionuclides above risk-based levels; chemicals below LUT values.	3,000	3,000	3,000	LLW/MLLW facility	NNSS, Energy*Solutions* in Utah
Subtotal		**91,000**	**91,000**	**47,000**		
Total		**933,000**	**192,000**	**148,000**		

AOC = *Administrative Order on Consent for Remedial Action*; CA = California; LLW = low-level radioactive waste; LUT = Look-Up Table; MLLW = mixed low-level radioactive waste; NNSS = Nevada National Security Site.

[a] In addition, site workers would generate small quantities of nonhazardous trash and sanitary waste that would be shipped off site to appropriate facilities.

[b] Corresponds to the soil categories described in Chapter 2, Sections 2.3.2 and 2.4.3, and summarized in Table 2–4.

[c] Information about the facilities cited in this table is provided in Chapter 3, Section 3.10.

[d] Only rail delivery was considered for shipment to the Mesquite Regional Landfill.

[e] Only waste determined to be only hazardous would be sent to US Ecology in Idaho.

Note: Table values have been rounded.

Under the Cleanup to AOC LUT Values and Cleanup to Revised LUT Values Alternatives, about 91,000 cubic yards of soil would be removed that would exceed provisional radiological LUT values (Soil Categories 4, 5, and 6). The primary difference between the two alternatives is that 10 years would be required for removal of soil exceeding provisional radionuclide LUT values under the Cleanup to AOC Values Alternative while 2 years would be required under the Cleanup to Revised LUT Values Alternative. This difference affects the schedules under the two alternatives for delivery of radioactive waste to the evaluated LLW/MLLW disposal facilities. Under the Conservation of Natural Resources Alternative, about 47,000 cubic yards of soil would be removed that would exceed risk-assessment-based values for radionuclides (Soil Categories 5 and 6). Soil removal would require slightly more than 1 year of work. Excavated soil under all action alternatives would be a combination of LLW and MLLW.

Under all action alternatives, about 49,000 cubic yards of soil (Soil Category 3) would be classified as hazardous waste requiring disposition at permitted California Class I or out-of-state hazardous waste facilities. Ten years would be required for removal of this hazardous soil waste under the Cleanup to AOC LUT Values Alternative while 2 years would be required under both the Cleanup to Revised LUT Values and Conservation of Natural Resources Alternatives.

Under the Cleanup to AOC LUT Values Alternatives, about 793,000 cubic yards of soil would be generated that would be classified as nonhazardous waste, and would contain radionuclides at or below provisional LUT values but with chemicals that exceed chemical LUT values (Soil Categories 1 and 2). About 741,000 cubic yards of this soil (or 93 percent) would contain chemicals in concentrations below risk-based levels (Soil Category 1), and the remaining 52,000 cubic yards would contain chemicals in concentrations above risk-based levels (Soil Category 2). Ten years would be required for removal of this soil waste from Area IV and the NBZ. Under the Cleanup to Revised LUT Values and Conservation of Natural Resources Alternatives, about 52,000 cubic yards of soil would be generated that would be classified as nonhazardous waste and would contain radionuclides in concentrations at or below provisional radionuclide LUT values and chemicals in concentrations above risk-based levels (Soil Category 2). Slightly more than 2 years would be required to remove this soil from Area IV and the NBZ under the Cleanup to Revised LUT Values Alternative, while 2 years would be required under the Conservation of Natural Resources Alternative.[27]

Excavated soil for delivery to an LLW or MLLW disposal facility would be contained within steel boxes, lift-liners or similar soft-sided waste containers, or lined intermodal containers. Soil classified as hazardous waste would be similarly contained for transport. Soil classified as nonhazardous waste would be transported by a method that precludes emissions of dust to the extent practical, such as transport in lined and covered dump trucks. For delivery to a disposal facility under the truck/rail option, the soil would be placed within containers for rapid and dust-free transfer to railcars. Under either the truck or truck/rail option, excavated soil would be shipped to offsite facilities in compliance with DOT regulations.

Federal regulations require treatment of RCRA hazardous wastes before disposal. For soil, DOE expects that treatment capability (including treatment to alternative standards pursuant to 40 CFR 268.49) would be available at the disposal facility, although a standalone facility could be used if required (treated soil from a standalone facility would be shipped to a permitted disposal facility). Another option could be to seek a "contain" determination for the soil (see text box in Chapter 3, Section 3.10.3).

Impacts on Waste Disposal Capacities

Table 4–68 compares projected waste volumes under the soil remediation action alternatives against the disposal capacities of the evaluated facilities (available or projected capacities, as summarized in Table 4–65), with the comparison expressed as the percentage of the disposal capacities for the facilities.

[27] The difference in removal times under the two alternatives is due to the reduced volume of soil requiring disposal as LLW or MLLW under the Conservation of Natural Resources Alternative as compared to that for the Cleanup to Revised LUT Values Alternative. Because of this, it is possible under the Conservation of Natural Resources Alternative to remove all nonhazardous soil during 2 years without exceeding DOE's allotment for daily heavy-duty truck round trips under the Transportation Agreement between DOE, NASA, and Boeing (Boeing 2015a). This is not possible under the Cleanup to Revised LUT Values Alternative because of the additional shipments of soil under this alternative to LLW/MLLW facilities.

Table 4–68 Percent of Disposal Facility Capacities under the Soil Remediation, Building Demolition, and Groundwater Remediation Action Alternatives

Facility	Waste Accepted	Available or Projected Waste Capacity (cubic yards)	Action Alternatives					
			Soil Remediation			Building Demolition	Groundwater Remediation	
			Cleanup to AOC LUT Values	Cleanup to Revised LUT Values	Conservation of Natural Resources	Building Removal	Groundwater Monitored Natural Attenuation	Groundwater Treatment
Antelope Valley	Non-hazardous	20,050,000	4.0	0.26	0.26	0.0061	6.5×10^{-5}	-[a]
Chiquita Canyon	Non-hazardous	96,000,000	0.83	0.054	0.054	0.0013	1.4×10^{-5}	-[a]
Mesquite	Non-hazardous	400,000,000[b]	0.20	0.013	0.013	0.00031	-[c]	-[a]
McKittrick	Non-hazardous	5,500,000	14	0.95	0.95	0.022	1.8×10^{-4}	-[a]
Buttonwillow	Hazardous	10,000,000	0.49/7.9[d]	0.49/0.529[d]	0.49/0.52[d]	0.0012	-[e]	0.0032
Westmorland	Hazardous	5,000,000	0.98/16[d]	0.98/1.0[d]	0.98/1.0[d]	0.0024	-[e]	0.0063
US Ecology in Idaho [f]	Hazardous	10,000,000	0.49	0.49	0.49	0.0012	-[e]	0.0032
Energy-*Solutions*	LLW/ MLLW	8,000,000	1.1	1.1	0.59	0.13	-[e]	0.021
NNSS	LLW/ MLLW	1,950,000	4.7	4.7	2.4	0.55	-[e]	0.087

AOC = *Administrative Order on Consent for Remedial Action*; LLW = low-level radioactive waste; LUT = Look-up Table; MLLW = mixed low-level radioactive waste; NNSS = Nevada National Security Site.

[a] Because nonhazardous waste would not be generated under the Groundwater Treatment Alternative, there would be no shipment of nonhazardous waste to offsite facilities.

[b] Converted from a projected capacity of 600 million tons assuming a waste density of 1.5 tons per cubic yard.

[c] Shipment of waste to the Mesquite Regional Landfill under the truck/rail option is not evaluated for nonhazardous waste under the Groundwater Monitored Natural Attenuation Alternative because only small volumes would be generated intermittently.

[d] Under the soil remediation action alternatives, the Buttonwillow and Westmorland Landfills were evaluated for receipt of both hazardous and nonhazardous soil. The first listed value is the percent of capacity assuming receipt of all hazardous waste under the alternative; the second listed value is the percent of capacity assuming receipt of all nonhazardous waste under the alternative.

[e] Because neither hazardous nor LLW/MLLW would be generated under the Groundwater Monitored Natural Attenuation Alternative, there would be no shipments of these wastes to offsite facilities.

[f] Only waste determined to be only hazardous would be sent to US Ecology in Idaho.

Under the Cleanup to AOC LUT Values and Cleanup to Revised LUT Values Alternatives, shipment of LLW and MLLW would represent 4.7 percent of the waste capacity at NNSS and 1.1 percent of the waste capacity at Energy*Solutions* in Utah; under the Conservation of Natural Resources Alternative, shipment of LLW and MLLW would represent 2.4 percent of the waste capacity at NNSS and 0.59 per cent of the waste capacity at Energy*Solutions* in Utah.

Under the Cleanup to AOC LUT Values Alternative, shipment of LLW and MLLW would occur during 10 years, with up to three average daily truck deliveries to an authorized disposal facility, assuming all LLW and MLLW was sent to a single facility. There are no permit limits on the annual or daily quantities to be received at NNSS or Energy*Solutions* in Utah; however, there could be logistical considerations. Trucks or trains delivering waste to LLW and MLLW facilities are typically inspected in detail (e.g., for external radiation and removable contamination levels) when arriving at and departing the disposal facilities. In addition, waste containers are typically organized and stacked in disposal units at LLW and MLLW facilities. Hence, it can typically require more time to process a truck or train delivery at an LLW or MLLW facility than at other disposal facilities. With the current number of personnel and scope of operations, a reasonable limit regarding the number of delivery trucks that could be daily processed at NNSS is about 30 (Gordon 2015). This approximate limit was also conservatively assumed for truck delivery to Energy*Solutions* in Utah.[28] Waste deliveries at this rate would represent about 10 percent of 30 daily deliveries assumed as the upper limit for LLW and MLLW disposal. No concerns about waste acceptance at this daily rate are expected.

Under the Cleanup to Revised LUT Values Alternative, shipment of LLW and MLLW would occur during 2 years. Assuming all such waste was delivered by truck to a single disposal facility, an average of 14 daily truck deliveries under the Cleanup to Revised LUT Values Alternative would represent nearly half of the 30 daily deliveries assumed as an upper limit for LLW and MLLW disposal. Deliveries at this daily rate could require close coordination with the disposal facility operators to eliminate any logistical concerns – that is, ensuring that sufficient personnel, equipment, and active disposal unit space would be available to address all the waste expected for delivery to the facility from different waste generators. Logistical concerns regarding receipt of waste at any facility may be reduced by sending waste to multiple authorized facilities.

Under the Conservation of Natural Resources Alternative, shipment from SSFL would occur during slightly over 1 year, and during the first year there would be an average of 14 daily truck deliveries to an authorized disposal facility, assuming all LLW and MLLW were sent to a single facility. Potential logistical concerns under this assumption would be the same as those for the Cleanup to Revised LUT Values Alternative, but would last for 1 year rather than 2 years, and may be reduced by sending waste to multiple facilities.

There would be many fewer deliveries of LLW and MLLW to Energy*Solutions* in Utah under the truck/rail option than under the truck option. This is because a single rail delivery would deliver the equivalent of multiple truck deliveries. The number of daily waste deliveries to NNSS under the truck/rail option would be the same as that under the truck option, however, because the waste would be trucked to NNSS from an intermodal facility. As under the truck option, deliveries to any single LLW or MLLW facility under the truck/rail option may be reduced by sending waste to multiple facilities.

Under all action alternatives, the projected volume of hazardous soil would represent 1 percent or less of the disposal capacities of all evaluated facilities (see Table 4–68). Waste deliveries to the facilities would occur over 10 years under the Cleanup to AOC LUT Values Alternative, and 2 years under both the Cleanup to Revised LUT Values and Conservation of Natural Resources Alternatives. Considering all three action alternatives, the daily shipment of hazardous soil from SSFL could be up to about 160 tons. Assuming all hazardous soil was delivered to a single disposal facility, waste in these quantities would not impact the daily or annual waste acceptance limits (if applicable) at any of the Class I and hazardous waste sites evaluated in this EIS (see Table 4–68). In any event, because multiple Class I and hazardous waste facilities are available in California and nearby states, there would be adequate disposal capacity for hazardous soil from Area IV remediation.

Shipment of nonhazardous soil is projected to require 10 years under the Cleanup to AOC LUT Values Alternative, slightly more than 2 years under the Cleanup to Revised LUT Values Alternative, or 2 years under the Conservation of Natural Resources Alternative. Assuming all nonhazardous soil was sent to a single disposal facility, waste in the projected quantities would not exceed the total

[28] Standard operating hours for the Energy*Solutions* facility are longer than those for NNSS; however, arrangements may be made at both facilities to receive waste outside of normal operating hours.

landfill capacities at any evaluated facility (see Table 4–68). The projected soil volume would represent about 14 percent of the projected disposal capacity at the McKittrick Waste Treatment Site under the Cleanup to AOC LUT Values Alternative, or 0.95 percent of the projected disposal capacity at this facility under both the Cleanup to Revised LUT Values and Conservation of Natural Resources Alternatives. The soil volumes would represent smaller percentages of the projected disposal capacities at the other evaluated facilities. In addition, under the Cleanup to AOC LUT Values Alternative, the daily shipment of nonhazardous soil from SSFL could range up to about 490 tons. If all waste was delivered to a single facility, it would represent about 12 percent of the McKittrick Waste Treatment Site's permitted daily limit of 4,000 tons and smaller fractions of the permitted daily limit of the other evaluated facilities (see Table 4–65). Deliveries at this daily rate should be acceptable given careful planning and waste delivery scheduling. In addition, multiple landfills are available. Therefore, nonhazardous soil from Area IV remediation would not lack disposal capacity.

4.10.2 Building Demolition Alternatives

Impacts under the building demolition alternatives are summarized and compared in **Table 4–69**.

Table 4–69 Waste Management Impacts under the Building Demolition Alternatives

Waste	*Building No Action Alternative*	*Building Removal Alternative*
LLW and MLLW	No impacts are expected on offsite waste capacity.	Generation of about 10,600 cubic yards of waste. No impacts on total waste capacity are expected at any facility. Under either the truck or truck/rail option, no logistical concerns are expected for receipt of truck or rail shipments.
Hazardous	No impacts are expected on offsite waste capacity.	Generation of about 120 cubic yards of waste. No impacts on total waste capacity are expected at any facility. Under either the truck or truck/rail option, no exceedance of daily or annual receipt limits is expected at any evaluated facility.
Nonhazardous debris	No impacts are expected on offsite waste capacity.	Generation of about 1,220 cubic yards of waste. No impacts on total waste capacity are expected at any facility. Under either the truck or truck/rail option, no exceedance of daily or annual receipt limits is expected at any evaluated facility.
Recyclable steel, concrete, and asphalt	No impacts are expected on offsite recycle capacity.	Generation of about 3,540 cubic yards of recycle material. No impacts on receipt of recycle material are expected at any facility.

LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste.

4.10.2.1 Building No Action Alternative

Under the Building No Action Alternative, DOE-owned buildings in Area IV would not be removed. Site maintenance activities would generate very small quantities of waste as described in Chapter 3, Section 3.10.2. All waste would be shipped off site for disposition at appropriate facilities, with no impacts on the capacities of these facilities.

4.10.2.2 Building Removal Alternative

Waste Generation

Waste from removal of the DOE-owned buildings would consist primarily of steel, concrete, and asphalt, and may include hazardous materials such as lead-based paint or mercury switches, or toxic materials such as PCBs or asbestos-containing material.[29] Radioactive waste from building removal may include strontium-90, cesium-137, cobalt-60, nickel-63, plutonium-239, plutonium-241, or

[29] Hazardous waste for this EIS includes listed and characteristic wastes defined under California regulations, a larger universe of wastes than those defined under EPA's RCRA regulations.

americium-241 (see Appendix H, Table H–3). **Table 4–70** summarizes volumes and evaluated waste and recycle facilities under the Building Removal Alternative.

Wastes from buildings with histories of radioactive material use would include LLW, MLLW, and materials surveyed and determined not to contain radioactive materials in excess of standard release criteria, such as those in the U.S. Nuclear Regulatory Commission's Regulatory Guide 1.86. These wastes include hazardous waste, asbestos-containing material, and nonhazardous building debris. DOE assumed for analysis that all such waste would be transported to LLW or MLLW disposal facilities, although some may not require such disposition. Under these assumptions, 10,500 cubic yards of LLW and 140 cubic yards of MLLW were analyzed under the Building Removal Alternative, or a total of about 10,600 cubic yards of LLW and MLLW. Both evaluated LLW disposal facilities can also accept MLLW for disposal.

Table 4–70 Building Removal Alternative Waste and Recycle Material Volumes

Waste	*Volume (cubic yards)* [a]	*Evaluated Disposition Method*	*Evaluated Facilities* [b]
Waste from Buildings with No Radioactive History			
Hazardous [c]	120	CA Class I or hazardous waste facility	Buttonwillow, Westmorland, US Ecology in Idaho [d]
Nonhazardous debris	1,220	CA Class II or Class III waste facility	Chiquita Canyon, Antelope Valley, McKittrick, Mesquite [e]
Recyclable steel, concrete, and asphalt	3,540	Nonhazardous recycle facility	Kramer Metals; Standard Industries; P.W. Gillibrand
Waste from Buildings with a Radioactive History			
LLW	3,280	LLW/MLLW facility	NNSS, Energy*Solutions*
Free released nonhazardous debris [f]	7,220	LLW/MLLW facility	NNSS, Energy*Solutions*
Total evaluated as LLW:	**10,500**		
MLLW	18	LLW/MLLW facility	NNSS, Energy*Solutions*
Free released hazardous debris [g]	126	LLW/MLLW facility	NNSS, Energy*Solutions*
Total evaluated as MLLW:	**144**		
Total hazardous, nonhazardous and radioactive waste:	**12,000**		
Total waste and recycle material:	**15,500**		

CA = California; LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; NNSS = Nevada National Security Site.

[a] Estimated volumes are from North Wind 2014. Demolition materials would be transported offsite in approximately 1,500 heavy-duty truck loads (see Chapter 2, Table 2–5).

[b] Waste disposal at any facility would be consistent with facility-specific waste acceptance criteria. See Chapter 3, Section 3.10, for information about the facilities in this table.

[c] Includes regulated materials such as lead, lead paint, mercury switches, PCBs, and asbestos-containing material. PCBs are included with hazardous waste quantities for purposes of analysis and are regulated in California under state regulations, the Toxic Substances Control Act, and RCRA. All asbestos-containing containing material was assumed to be friable and require disposal in a hazardous waste facility; however, California classifies asbestos-containing material as hazardous waste if it is friable and the asbestos content in the material is greater than or equal to 1 percent. California considers nonfriable bulk asbestos-containing material to be nonhazardous regardless of the asbestos content.

[d] Only waste determined to be only hazardous would be sent to US Ecology in Idaho.

[e] The Mesquite Regional Landfill was analyzed for receipt of nonhazardous debris under the truck/rail option only.

[f] Nonhazardous debris that has been surveyed and determined not to contain radioactive materials in excess of regulatory release standards. LLW/MLLW disposal was assumed for analysis.

[g] Includes regulated materials such as lead, lead paint, mercury switches, PCBs, and asbestos-containing material that have been surveyed and determined not to contain radioactive materials in excess of regulatory release standards. LLW/MLLW disposal was assumed for purposes of analysis.

Note: Table values have been rounded.

About 120 cubic yards of hazardous waste would be generated and transported to California Class I or out-of-state hazardous waste facilities.[30] For purposes of analysis, toxic materials such as PCBs or asbestos-containing material were included with the hazardous waste deliveries. About 1,220 cubic yards of nonhazardous debris would be generated and transported to permitted California Class III waste facilities for disposal, while about 3,540 cubic yards of recyclable steel, concrete, and asphalt would be transported to California recycle facilities.

A variety of waste containers could be used, including drums, boxes, roll-off containers, intermodal containers, cargo containers, or lift-liners. Some waste unsuitable for transport within waste containers could be shipped without packaging, although shipment would occur in a manner to preclude release of airborne contamination (e.g., stabilization of removable contamination). Waste from removal of DOE buildings would be shipped to offsite facilities in compliance with DOT regulations.

Federal and state regulations require treatment of RCRA hazardous waste before disposal. Depending on the waste stream and its characteristics, treatment capacity may be available at the disposal facility or at a different, standalone facility. Treated waste from a standalone facility would be shipped to a permitted disposal facility.

Impacts on Waste Capacities

Table 4–68 compares projected waste volumes under the Building Removal Alternative against the disposal capacities of the evaluated facilities (available or projected capacities, as summarized in Table 4–65), with the comparison expressed as the percentage of the disposal capacities for the facilities.[31] The projected LLW and MLLW volume would represent only fractions of the disposal capacities of NNSS and Energy*Solutions* in Utah. No impacts on disposal capacity are expected.

Assuming all LLW and MLLW were delivered by truck to a single disposal facility, waste deliveries could occur at an average of five daily trucks over a 5-month period for each of 2 years. If all shipments were made under the truck/rail option to Energy*Solutions* in Utah, rail shipments with LLW/MLLW from SSFL would arrive every few days at these facilities instead of daily. This is because a single rail shipment would contain the equivalent of multiple individual truck shipments.[32] If shipments were made under the truck/rail option to NNSS in Nevada, the same number of average daily truck shipments would arrive at the site (average five per day) because the waste would be trucked to NNSS from an intermodal facility.

Because 5 daily trucks under the Building Removal Alternative would represent only about 17 percent of the approximate limit (30 daily trucks) assumed for receipt of LLW or MLLW at a licensed facility, there should be no logistical difficulties with accepting the waste at either evaluated disposal facility. Furthermore, any issues could be resolved through careful scheduling of waste delivery, through shipment of waste over the course of a year rather than a few months, by implementing the truck/rail option, or by distributing the waste shipments among multiple facilities.

Assuming all shipments were by truck, there would be less than one average daily delivery to an assumed single hazardous waste or single nonhazardous waste facility. Whether shipment occurred by the truck or truck/rail option, wastes from building removal would represent only small fractions

[30] The California classification system for nonhazardous and hazardous waste landfills is summarized in Chapter 3, Section 3.10.

[31] No disposal capacity comparisons are made for the evaluated recycle facilities because waste disposal would not occur at these facilities.

[32] For purposes of analysis, a single rail shipment was assumed to contain the equivalent of 16 truck shipments (see Appendix H, Section H.7.2).

of the daily or yearly acceptance limits and total disposal capacities at any of the evaluated waste disposal facilities (see Table 4–68). No impacts on disposal capacity are expected.

Assuming all shipments were by truck, there would be less than two average daily shipments of nonhazardous recycle material to a single assumed recycle facility. Although three recycle facilities were evaluated for this EIS, additional recycle facilities exist in the SSFL vicinity, including standalone facilities and facilities associated with a landfill (e.g., the Chiquita Canyon and Antelope Canyon Landfills). No impacts on available capacity are expected.

4.10.3 Groundwater Remediation Alternatives

Impacts under the groundwater remediation alternatives are summarized and compared in **Table 4–71**.

Table 4–71 Waste Management Impacts under the Groundwater Remediation Alternatives

Waste	Groundwater No Action Alternative	Groundwater Remediation Action Alternatives	
		Groundwater Monitored Natural Attenuation	Groundwater Treatment
LLW/MLLW	No expected waste generation.	No expected waste generation.	Total generation of about 1,700 cubic yards of waste. No impacts on total waste capacity are expected for any evaluated facility. Under either the truck or truck/rail option, no logistical concerns are expected for receipt of truck or rail shipments at any evaluated facility.
Hazardous	No expected waste generation.	No expected waste generation.	Total generation of about 26 cubic yards of waste. No impacts on total waste capacity are expected for any evaluated facility. No exceedance of daily or annual receipt limits is expected at any evaluated facility.
Nonhazardous	No expected waste generation.	Generation of about 10 cubic yards of waste consisting of well installation cuttings. No impacts on total waste capacity are expected for any evaluated facility. No exceedance of daily or annual receipt limits is expected at any evaluated facility.[a]	No expected waste generation.
Well installation and purge water	No impacts are expected on the capacity of the permitted wastewater treatment plant that would receive approximately 250 gallons of purge water annually from Area IV.	Generation of about 5,000 gallons of water from well installation plus about 250 gallons per year of purge water.[a] No impacts are expected on the capacity of the permitted wastewater treatment plant that would receive this water.	No expected waste generation.

LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste.

[a] These wastes are not expected to be classified as LLW or MLLW, but if determined otherwise when generated, would be safely transported to appropriate facilities for disposition.

Feasibility studies and technology evaluations are under way for remediation of groundwater at Area IV, and the groundwater treatment remedies to be implemented will be selected through a groundwater remedial investigation plan. The remedies selected and implemented will be in accordance with the 2007 CO (DTSC 2007) and RCRA requirements. The principal and minor groundwater plumes from DOE activities are described in Chapter 2, Section 2.6. **Table 4–72** summarizes the expected wastes from remediation of these plumes assuming installation and monitoring of monitoring wells and use of the candidate treatment technologies summarized in

Chapter 2, Section 2.6.3. These wastes could include well installation and purge water, nonhazardous cuttings from well installation, and groundwater treatment media such as granulated activated carbon, filter media, or ion-exchange resins. Table 4–72 additionally summarizes waste from excavation of 1,050 cubic yards of bedrock in the RMHF area that contains strontium-90; after preparation for shipment off site, the disposal volume is estimated to be about 1,700 cubic yards.

Table 4–72 Waste Generation from Well Installation and Monitoring and Potential Groundwater Treatment Technologies

Technology	*Waste Generation and Management*
Well installation	Wastes would include well installation cuttings and water. The cuttings would be transported by truck to a nonhazardous waste facility, and well installation water would be shipped in tanker trucks to a permitted wastewater treatment plant.[a] Installation of five wells would generate approximately 10 cubic yards of soil and rock cuttings plus about 5,000 gallons of well installation water.
Groundwater monitoring	Purge water is the primary waste stream from groundwater monitoring. Purge water would be collected and shipped in tanker trucks to a permitted wastewater treatment plant. Under the current sampling regime, 1 tanker-truck shipment would be annually required to transport purge water to a permitted wastewater treatment plant.
Pump and treat	Wastes include treatment media, such as filter material, GAC, and ion-exchange resins, which would be contained within tanks or drums with quick-disconnect fittings for easy replacement of the treatment units. Treatment units would be replaced about once a month, with the replaced units being trucked off site to a vendor's facility for processing of the treatment media. About 1,000 pounds of treatment media would be processed annually from each pump and treat system.
Enhanced groundwater treatment (chemical, biological)	Waste would primarily consist of groundwater monitoring purge water, which would be managed as discussed for "Groundwater monitoring." If combined with pump and treat technologies, additional solid and liquid wastes could be generated which would be managed as discussed for "Pump and treat."
Soil vapor extraction	Wastes would primarily consist of spent media (e.g., GAC) from treatment units and treatment unit condensate. Each treatment unit would contain about 1,000 pounds of GAC, be about the size of a 55-gallon drum, and be equipped with quick-disconnect fittings for easy replacement. Treatment units would be replaced as required, and the replaced units would be transferred off site by truck and processed by a vendor.
Dewatering perched water	Wastes would primarily consist of spent media (e.g., GAC) from the treatment units. Each treatment unit would contain about 1,000 pounds of GAC and be equipped with quick-disconnect fittings for easy replacement. Treatment units would be replaced about once a year, and the replaced units would be transferred off site by truck and processed by a vendor.
Monitored natural attenuation	Waste would primarily consist of purge water, which would be managed as discussed for "Groundwater monitoring."
Source removal	Waste would primarily consist of sandstone bedrock, which, after excavation, would be placed in containers for shipment to an LLW disposal facility. The in-place volume of the contaminated bedrock is about 1,050 cubic yards; the containerized volume shipped for disposal would total about 1,700 cubic yards.

GAC = granular activated carbon; LLW = low-level radioactive waste.

[a] These wastes are not expected to be classified as low-level or mixed low-level radioactive waste, but if determined otherwise when generated would be transported to appropriate facilities for disposition.

Source: Appendix D.

4.10.3.1 Groundwater No Action Alternative

Under the Groundwater No Action Alternative, current groundwater monitoring would continue. There would be delivery of about 250 gallons of purge water from groundwater monitoring operations to a permitted wastewater treatment plant, annually requiring 1 tanker truck. No impacts are expected on plant capacity.

4.10.3.2 Groundwater Remediation Action Alternatives

Waste Generation

Under the Groundwater Monitored Natural Attenuation and Groundwater Treatment Alternatives, small quantities of solid and liquid wastes would be generated; waste characteristics would depend on the suite of groundwater remediation remedies that are implemented.

Under the Groundwater Monitored Natural Attenuation Alternative, five additional monitoring wells would be installed. Assuming an average well depth of about 150 feet, installation of five wells would generate about 10 cubic yards of well cuttings (see Appendix D) which would be collected within containers (e.g., sludge boxes), as well as about 5,000 gallons of waste water from well installation that would be collected within onsite tanks pending shipment in tanker trucks to a permitted wastewater treatment plant in accordance with its waste acceptance criteria (see Appendix D). Assuming the wells are installed at different times and onsite storage of waste is minimized, there would be five total truck shipments of well cuttings waste using medium-duty trucks and five total tanker truck shipments.

Groundwater monitoring and shipments of purge water would continue. The duration of groundwater monitoring would vary, depending on the plume, from approximately 10 years to 150 years. As constituents in groundwater attenuate or decay, the scope of the site monitoring program could decrease.

Under the Groundwater Treatment Alternative, because waste quantities depend on the treatment remedies implemented for each plume, and the specific remedies to be implemented are yet to be specified, a conservative estimate was made of the types and quantities of wastes that could be generated from remediation of each plume, and the waste quantities summed. This was done for each evaluated plume by assuming remedies among those being currently evaluated (see Table 4–22) that would result in generation of the largest quantity of waste:

- For the RMHF strontium-90 source, although various remedies including groundwater table lowering are being evaluated, the largest waste generation would be source removal. Bedrock containing strontium-90 would be excavated, placed into containers, and delivered to an LLW disposal facility. Waste from removal of bedrock would be generated during about 20 working days, have a disposal volume after containerization of about 1,700 cubic yards (see Appendix D), and require about 128 heavy-duty truck shipments from SSFL (see Chapter 2, Table 2–5).
- For the FSDF-Area TCE, the HMSA TCE perched water, Building 4100/4056 landfill TCE, and the Building 4057 Warehouse PCE plumes, remedies could include pump and treat, enhanced groundwater (chemical or biological) treatment, or soil vapor extraction. For the HMSA TCE perched water plume, an additional potential remedy is perched zone dewatering. Considering the information in Table 4–72, the largest waste quantities (and truck shipments) from remediation of these plumes would be from pump and treat systems with chemical or biological enhancements. Each of four assumed systems would treat groundwater in onsite treatment units assumed to contain treatment media such as filter media, granular activated carbon, or ion-exchange resins. Once a month, each onsite treatment unit would be replaced and shipped off site in trucks to a vendor's facility where the media within the treatment units may be regenerated for reuse or disposed of. Because the treatment media could contain hazardous constituents, it was assumed that the media, or waste from a regeneration process, would be managed as hazardous waste. About 1,000 pounds of treatment media would be processed annually from each pump and treat system (see Appendix D), so that remediation of four plumes would annually generate about

4,000 pounds of hazardous waste, and this waste generation would continue for about 5 years (see Chapter 2, Section 2.6.3). Five-year generation of 20,000 pounds of treatment media would result in an annual hazardous waste volume of about 5.3 cubic yards and a total hazardous waste volume of about 26 cubic yards.[33]

- For the RMHF TCE, the Metals Clarifier TCE, and tritium plumes, the chemical or radioactive constituents in the plumes are expected to attenuate or decay to their MCLs within about 10 years, or the TCE concentration is only slightly above the TCE MCL. For this reason, it was assumed that groundwater treatment for these plumes would consist of monitored natural attenuation with no waste generation beyond that addressed for the Groundwater Monitored Natural Attenuation Alternative for groundwater monitoring of Area IV (about 250 gallons per year of purge water).

Impacts on Waste Disposal Capacities

Under the Groundwater Monitored Natural Attenuation Alternative, well installation cuttings would be generated in very small quantities with no expected impacts on offsite capacities (see Table 4–68). Well installation and purge water would be shipped to a permitted wastewater treatment plant, in accordance with its waste acceptance criteria, with no expected impacts on plant capacity.

Waste under the Groundwater Treatment Alternative would primarily consist of about 1,700 cubic yards of containerized bedrock containing strontium-90. This waste volume would have no impact on total disposal capacities at NNSS or Energy*Solution*s in Utah (see Table 4–68). Offsite shipments would be scheduled so that the daily average for all heavy-duty trucks to or from SSFL would be in accordance with the Transportation Agreement among DOE, NASA, and Boeing (Boeing 2015a). If the waste was shipped over the projected 20-working-day period for bedrock removal, shipments would be delivered to an assumed single disposal facility at a daily average of about six trucks per day; however, if shipments would be spread over a longer period, the daily average would be less. These shipments are not expected to present logistical concerns at the evaluated facilities, and the daily rate for delivery to any single facility may be reduced by shipping to multiple facilities. The truck/rail option may also be considered.

Hazardous waste resulting from monthly replacement of groundwater treatment unit media would be managed and, because the estimated annual waste quantities are about 5.3 cubic yards per year, no impacts are expected regarding receipt of the waste at appropriate facilities.

4.10.4 Waste Management Impacts under All Action Alternative Combinations

Table 4–73 summarizes waste generation and truck shipment under the combined action alternatives. **Table 4–74** compares projected waste volumes from Table 4–73 against the disposal capacities of the evaluated facilities, with the comparison expressed as the percentage of the disposal capacities for the facilities.

Over all combinations of action alternatives, the total LLW/MLLW volume would be up to 103,000 cubic yards, which would not impact the total waste disposal capacity at NNSS or Energy*Solutions* in Utah (see Table 4–74). There would be about 4,550 to 7,980 truck shipments from SSFL that would occur over 4 to 12 years, depending on the combination of action alternatives. Depending on the combination of action alternatives, the average daily number of

[33] Assuming a treatment media density equivalent to granulated activated carbon, approximately 28 pounds per cubic foot (Target 2015).

offsite shipments would range from less than 1 to about 14. Under the truck option and assuming all waste was delivered to a single facility, there would be the same number of daily shipments arriving at that facility. As addressed in Section 4.10.1.2, about 30 waste delivery trucks may be daily processed at NNSS given the current scope of operations and personnel. Fourteen daily trucks would represent about half of this assumed limit, indicating that there could be logistical concerns at that facility to ensure that personnel, equipment, and active disposal space are available for these deliveries plus deliveries from other waste generators. It was assumed that there could be similar concerns for waste deliveries to Energy*Solutions* in Utah. However, these concerns may be alleviated through careful scheduling and coordination with the disposal facility operators. Under the truck/rail option, there would be the same number of daily deliveries to NNSS, but reduced daily deliveries (all by rail) to Energy*Solutions* in Utah compared to those under the truck option.

Table 4–73 Waste Summaries under the Action Alternative Combinations

Waste	*Action Alternative Combination*	*Total Volume (cubic yards)*	*Total Shipments*	*Shipment Duration (years)*	*Average Shipments per Day*	*Average Tons per Day*
LLW/MLLW (building debris, soil, source removal material)	AOC LUT + BR + GWMNA	102,000	7,850	12	2 – 5	37 - 77
	AOC LUT + BR + GWT	103,000	7,980	12	2 – 5	37 - 77
	Revised LUT + BR + GWMNA	102,000	7,850	4	5 – 14	77 – 270
	Revised LUT + BR + GWT	103,000	7,980	4	5 – 14	77 – 280
	CR + BR + GWMNA	57,600	4,550	3 [a]	<1 - 14	9 – 270
	CR + BR + GWT	59,300	4,680	3 [a]	<1 - 14	9 – 280
Hazardous waste (building debris, soil, groundwater treatment media) [b]	AOC LUT + BR + GWMNA	49,100	3,690	12	<1 - 2	1 – 31
	AOC LUT + BR + GWT	49,100	3,930	12	<1 - 2	1 – 31
	Revised LUT + BR + GWMNA	49,100	3,690	4	<1 - 7	1 – 150
	Revised LUT + BR + GWT	49,100	3,930	7	<1 - 8	<1 – 150
	CR + BR + GWMNA	49,100	3,690	4	<1 - 7	1 – 150
	CR + BR + GWT	49,100	3,930	7	<1 - 8	<1 – 150
Nonhazardous waste (building debris, soil, well installation cuttings)	AOC LUT + BR+ GWMNA	794,000	59,600	12	<1 – 25	9 – 490
	AOC LUT + BR + GWT	794,000	59,600	12	<1 – 25	9 – 490
	Revised LUT + BR + GWMNA	53,200	4,020	4 [c]	<1 – 8	9 – 160
	Revised LUT + BR + GWT	53,200	4,020	4 [c]	<1 – 8	9 – 160
	CR + BR + GWMNA	53,200	4,020	4	<1 – 8	9 – 160
	CR + BR + GWT	53,200	4,020	4	<1 – 8	9 - 160
Recycle material	All action alternative combinations	3,540	340	2	<2	25

< = less than; AOC = *Administrative Order on Consent for Remedial Action*; AOC LUT = Cleanup to AOC LUT Values Alternative; BR = Building Removal Alternative; CR = Conservation of Natural Resources Alternative; GWMNA = Groundwater Monitored Natural Attenuation Alternative; GWT = Groundwater Treatment Alternative; LLW = low-level radioactive waste; LUT = Look-Up Table; MLLW = mixed low-level radioactive waste; Revised LUT = Cleanup to Revised LUT Values Alternative.

[a] Shipment of LLW and MLLW under these action alternative combinations is projected to occur over slightly more than 3 years.

[b] Total waste volumes among the action alternative combinations differ by only 26 cubic yards, due to the assumed hazardous waste shipments under the Groundwater Treatment Alternative. There is a more noticeable difference in the total number of hazardous waste shipments among the action alternative combinations because of the small waste payload in each hazardous waste shipment under the Groundwater Treatment Alternative.

[c] Shipment of nonhazardous waste under these action alternative combinations is projected to occur over slightly more than 4 years.

Note: An average waste shipment is assumed to weigh 20 tons. Because all calculations have been rounded, values such as average tons per day may not precisely equate to the values that could result from multiplying the average number of shipments per day by 20 tons.

Table 4–74 Percentages of Waste Disposal Capacity under the Action Alternative Combinations

Facility	*Waste Accepted*	*Available or Projected Waste Capacity (cubic yards)*	*Percent of Capacity*
Antelope Valley	Nonhazardous	20,050,000	0.27 to 4.0
Chiquita Canyon	Nonhazardous	96,000,000	0.055 to 0.83
Mesquite	Nonhazardous	400,000,000 [a]	0.013 to 0.20
McKittrick	Nonhazardous	5,500,000	0.97 to 14
Buttonwillow	Hazardous	10,000,000	0.49 / 0.53 to 7.9 [b]
Westmorland	Hazardous	5,000,000	0.98 / 1.1 to 16 [b]
US Ecology in Idaho [c]	Hazardous	10,000,000	0.49
Energy*Solutions*	LLW/MLLW	8,000,000	0.7 to 1.3
NNSS	LLW/MLLW	1,950,000	3.0 to 5.3

LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; NNSS = Nevada National Security Site.
[a] Converted from a projected capacity of 600 million tons assuming a waste density of 1.5 tons per cubic yard.
[b] The Buttonwillow and Westmorland Landfills were evaluated for receipt of all hazardous waste as well as nonhazardous soil. The first value is the percent of capacity assuming receipt of all hazardous waste; the second value is the percent of capacity assuming receipt of all nonhazardous waste.
[c] Only waste determined to be only hazardous would be sent to US Ecology in Idaho.
Note: Calculations have been rounded.

The total hazardous waste volume (about 49,100 cubic yards for all action alternative combinations) would not impact the total disposal capacity at any evaluated hazardous waste facility (see Table 4–74). There would be about 3,690 to 3,930 truck shipments from SSFL that would occur over 4 to 12 years, depending on the combination of action alternatives, with an average daily number of offsite shipments ranging from less than 1 to about 8. Average daily tonnages would range from less than 1 ton to about 150 tons. Under the truck option, there would be the same number of daily deliveries at any assumed single disposal facility. The projected shipments would not impact the daily or yearly receipt limit, if applicable, at any of the evaluated facilities. Under the truck/rail option, there would be the same number of daily deliveries to the Buttonwillow or Westmorland facilities in California, because these facilities lack direct rail accessibility, but reduced daily shipments (all by rail) to US Ecology in Idaho.

The total nonhazardous waste volume would range from about 53,200 to 794,000 cubic yards. As shown in Table 4–74, the high end of the range would represent about 14 percent of the capacity being constructed or planned at the McKittrick Waste Treatment Site in California (assuming all waste was sent to that site). There would be about 4,020 to 59,600 truck shipments from SSFL over 4 to 12 years, depending on the combination of action alternatives. Over this time, the average daily number of offsite shipments would range from less than 1 to about 25, and the average daily tonnage would range from about 1 ton to about 490 tons. Under the truck option, there would be the same number of daily deliveries to any of the evaluated facilities, assuming all waste was shipped to a single facility. The projected shipments would not exceed an annual or daily receipt limit at any of the evaluated facilities, but would represent 12 percent of the daily limit at the McKittrick Waste Treatment Site in California. Under the truck/rail option, waste would be shipped to the Mesquite Regional Landfill in California at a rate that would represent up to 2 percent of the site's daily waste acceptance limit.

About 3,540 cubic yards of recycle material would be delivered to offsite recycle facilities over 2 years under all combinations of action alternatives. There would be less than two average shipments per day, assuming shipments occurred each year over a 5-month period, but less than one per day if the shipments were spread over a working year. There is adequate recycle capacity in the vicinity of SSFL, so no impacts on this capacity are expected.

Therefore, no combination of action alternatives would generate waste that would lack disposal capacity. The evaluated facilities have adequate total capacities, and the shipments are not expected to exceed daily acceptance limits, if applicable. Careful coordination with some disposal facilities operators may be needed to avoid any logistical concerns regarding waste receipt scheduling. Nonetheless, any concerns regarding capacities or scheduling logistics at any single facility may be alleviated by measures such as use of multiple facilities (multiple facilities exist for all wastes evaluated in this EIS) or use of the truck/rail option for delivery of waste to rail-accessible facilities.

4.10.5 Impact Threshold Analysis

Under all alternatives, no waste would be generated that would lack capacity for offsite disposition; thus, an impact threshold as summarized in Table 4–2 would not be exceeded. There would be no need to store waste until offsite waste management capacity became available. The principal rational for this determination is the existence of multiple treatment and disposal facilities that could receive the wastes projected under any alternative and the extensive waste management capacities at these facilities.

4.11 Cultural Resources

This section evaluates potential impacts on cultural resources. Cultural resources include archaeological resources (both pre-contact and post-contact eras); architectural resources (physical properties, structures, or built items); and traditional cultural resources. Traditional cultural resources include properties of traditional religious and cultural importance to Native American tribes such as traditional cultural properties, within the context of applicable laws and regulations.

Background

DOE would comply with Section 106 of the National Historic Preservation Act (NHPA), including consultation with the California Office of Historic Preservation's SHPO, before implementing ground-disturbing actions under any alternative. As part of NHPA compliance, DOE is consulting with the federally recognized Santa Ynez Band of Chumash Indians (also serving as a cooperating agency), with whom DOE will also consult on a Government-to-Government basis as required by Executive Orders 13007 and 13175, and the Presidential *Memorandum on Government-to-Government Relations with Native American Tribal Government.*

DOE is in the process of developing a Section 106 agreement document (a Programmatic Agreement with the California Office of Historic Preservation, the Advisory Council on Historic Preservation [if they choose to participate], and the Santa Ynez Band of Chumash Indians).[34] This agreement would establish standard operating procedures for DOE to address cultural resource issues. DOE would continue to comply with Section 106 in accordance with existing regulations and accepted practices, as detailed in 36 CFR Part 800, and would continue Government-to-Government consultation with the Santa Ynez Band of Chumash Indians.

[34] A programmatic agreement pursuant to 36 CFR 800.14(b) is the most suitable agreement document for SSFL for a number of reasons. For example, the alternatives evaluated in this EIS are complex and it not possible to determine all potentially adverse effects; furthermore, effects are likely to be similar and repetitive.

The area of potential effects (APE) for archaeological, architectural, and traditional cultural resources includes all areas within the boundaries of Area IV and the NBZ. As part of the Section 106 consultation process, SHPO has agreed with the APE defined by DOE (OHP 2015). Although the APE includes only Area IV and the NBZ, a record search included all of SSFL and extended for a radius of 1 mile beyond the boundary of SSFL.

The 2010 AOC (DTSC 2010a) allows exemptions from the requirement to clean up chemical and radioactive contaminants to local background concentrations for "Native American artifacts that are formally recognized as Cultural Resources." For cultural resources, these exemptions would result in exclusion zones around cultural resources that are either listed on or eligible for listing on the *National Register of Historic Places* (NRHP) (i.e., historic properties), or resources that are listed on the *California Register of Historical Resources*. Statutory requirements and regulations concerning the cultural resource area are described in Chapter 8.

Technical Approach

Data were obtained from a variety of references to determine potential impacts. These data include the input from two records searches involving the South Central Coastal Information Center and other archival sources (SCCIC 2009, 2014). Details about this review are provided in Appendix F.

Area IV and the NBZ were surveyed for archaeological and architectural resources. In Area IV and the NBZ, 26 sites and 53 isolates have been recorded (four of the sites in Area IV overlap into Area III; refer to Appendix F, Table F–2). DOE developed and implemented an extended phase 1 testing program to evaluate the NRHP eligibility of selected cultural resources. This program of limited subsurface excavation was developed in consultation with SHPO and EIS cooperating agencies, including the Santa Ynez Band of Chumash Indians and the SSFL Sacred Sites Council. SHPO is in the process of reviewing DOE's determination of archaeological site eligibility resulting from the evaluation program.[35]

The Santa Ynez Band of Chumash Indians has filed paperwork with the *State of California Native American Heritage Commission Sacred Lands Inventory* nominating the entire SSFL as a Native American sacred site (referred to herein as the Sana Susana Sacred Site), and believes that the site is eligible for inclusion on the NHRP as a traditional cultural property (NAHC 2014).[36]

The methodology for determining impacts on cultural resources is discussed in greater detail in Appendix B, Section B.11.

4.11.1 Soil Remediation Alternatives

Impacts on historical properties (i.e., archaeological or architectural resources that are eligible for listing on the NRHP) and traditional cultural resources under the soil removal alternatives are summarized and compared in **Table 4–75**.

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[35] SHPO is reviewing the eligibility of structural architectural resources in Area IV. The status of all resources will be updated as information is collected and SHPO and the tribes provide input.

[36] The documentation for the traditional cultural resource is not consistent in naming this resource, but the last sentence states: "…the Elder's Council of the Santa Ynez Band of Chumash Indians has requested that the entire former Santa Susana Field Lab be described as the Santa Susana Sacred Sites and Traditional Cultural Property by the State of California" (NAHC 2014).

Table 4–75 Cultural Resources Impacts under the Soil Remediation Alternatives

Resource	*Soil No Action Alternative*	*Soil Remediation Action Alternatives*		
		Cleanup to AOC LUT Values	*Cleanup to Revised LUT Values*	*Conservation of Natural Resources*
Archaeological	No historic properties would be affected.	Same as the Soil No Action Alternative.	Same as the Soil No Action Alternative.	Same as the Soil No Action Alternative.
Architectural	No historic properties would be affected.	Same as the Soil No Action Alternative.	Same as the Soil No Action Alternative.	Same as the Soil No Action Alternative.
Traditional Cultural Resources	No adverse impacts are expected.	During 10 years of soil removal, adverse impacts on the integrity of traditional cultural resources are possible from changes in setting, augmented site access during remediation, disturbance of landscape (130 acres), and potential discovery of unanticipated archaeological sites.	Adverse impacts are possible similar to those under the Cleanup to AOC LUT Values Alternative, but of reduced likelihood. There would be reduced changes in setting because soil removal would occur for slightly more than 2 years rather than 10 years, reduced duration of site access during remediation, less disturbance of landscape (40 acres), and less soil removed which would reduce the potential for discovery of unanticipated archaeological sites.	Adverse impacts are possible similar to those under the Cleanup to Revised LUT Values Alternatives, but of reduced likelihood. There would be slightly reduced changes in setting because soil removal would occur for 2 years, slightly reduced duration of site access during remediation, less disturbance of landscape (32 acres), and less soil removed which would further reduce the potential for discovery of unanticipated archaeological sites.

AOC = *Administration Order on Consent for Remedial Action*; LUT = Look-Up Table.

4.11.1.1 Soil No Action Alternative

Archaeological and Architectural Cultural Resources

Under the Soil No Action Alternative, no ground disturbance from soil cleanup would occur that would affect the remaining DOE buildings in Area IV. Impacts on archaeological and historic architectural properties would be managed through existing management plans and standard operating procedures or through agreements that could be developed with the Office of Historic Preservation, the Santa Ynez Band of Chumash Indians, and other interested parties. Archaeological sites present on Area IV and the NBZ would continue to be protected from outside intrusion through restricted access to these areas. Because there are no ongoing or planned projects that would affect known archaeological sites, adverse effects on unanticipated archaeological sites are unlikely. No historic properties would be affected.

Traditional Cultural Resources

Under the Soil No Action Alternative, ongoing activities would continue. Aspects of management pertinent to traditional cultural resources include security measures and access control. DOE has initiated and established Government-to-Government consultation with the Santa Ynez Band of Chumash Indians and has also conferred with the Santa Ynez Band of Chumash Indians and other non-federally-recognized tribes through the SSFL Sacred Sites Council, in compliance with Section 106 of the NHPA.

Through these relationships, access to properties of traditional religious and cultural importance to the tribes would be maintained as required by NHPA and other governing laws and orders, at the current landowner's (Boeing's) discretion. Traditional cultural resources identified within the APE include the 26 archaeological sites and 53 isolates recorded on Area IV and the NBZ and encompassed by the Santa Susana Sacred Site. No impacts are expected on those portions of the traditional cultural resources present at SSFL that are located in Area IV or the NBZ.

4.11.1.2 Cleanup to AOC LUT Values Alternative

Archaeological and Architectural Cultural Resources

Area IV and the NBZ have been surveyed for archaeological resources. DOE conducted an extended phase 1 testing program to determine the NRHP eligibility of archaeological sites located where chemical or radioactive remediation would be required. The testing results addressed the archaeological sites considered eligible for listing; archaeological sites that are not eligible; and the archaeological sites that were not evaluated because they would not be affected by cleanup activities.

No structures (architectural resources) in Area IV or the NBZ are listed or eligible for listing on the NRHP. SHPO has concurred with the structure eligibility findings (OHP 2010).[37] DOE has identified 26 archaeological sites and 53 isolates, and is in consultation with SHPO and the Santa Ynez Band of Chumash Indians regarding eligibility of the archaeological sites.

Activities associated with remediation of chemicals and residual radionuclides in soil fall into two major categories: soil removal and natural attenuation. About 933,000 cubic yards of soil would be removed, disturbing about 130 acres of land outside the proposed exemption areas. Replacement of soil at about 75 percent of the original volume (see Appendix D) would restore some natural contours, but the landscape would differ from the original ground surface topography. Because all known NRHP-eligible archaeological sites are excluded from cleanup requirements, within exclusion zones allowed by the 2010 AOC (DTSC 2010a) as proposed exceptions to the requirement to remediate chemical and radionuclide contaminants to local background concentrations, there would be no excavation of eligible archaeological site material under the Cleanup to AOC LUT Values Alternative. Therefore, any impacts from soil remediation would result from a change in setting to NRHP-eligible sites that would last for approximately 10 years. Because NRHP eligibility of an archaeological site is usually based on information potential (criterion D), setting is not an essential aspect of a site's integrity and NRHP eligibility; for this reason, for the archaeological sites located at SSFL, the effect of a change to a setting would not be adverse. However, as discussed under the Traditional Cultural Resources subsection below, a change in setting could affect important aspects of an archaeological site's characteristics that contribute to a traditional cultural resource, other than information potential.

Staging for soil removal activities is unlikely to impact archaeological sites. The main staging area for soil remediation would be situated on existing concrete foundations on flat ground where buildings have been removed. The secondary staging area would also occupy the location of a previously demolished building. Temporary staging areas would be placed on asphalt, concrete, or previously disturbed ground. No historic properties would be affected.

Traditional Cultural Resources

The Cleanup to AOC LUT Values Alternative could have adverse impacts on traditional cultural resources at Area IV and the NBZ. Although NRHP-eligible archaeological sites are exempt from direct ground-disturbing activities, adverse impacts are possible on archaeological sites that are not eligible for listing on the NRHP, but are contributing elements to the Santa Susana Sacred Site, as well as its landscape. As addressed in the Archaeological and Cultural Resources subsection, soil

[37] SHPO has indicated to DOE that they will review their previous concurrence with the non-eligibility of structures in Area IV (DOE 2014d).

replacement for the disturbed land would restore a semblance of natural contours, but the landscape would differ from the original topography. Although this would not be an adverse effect on an archaeological site evaluated for its information potential alone, it could cause potential adverse impacts on the setting of the traditional cultural resource and its contributing elements. Adverse impacts could also arise from the changes in setting to Area IV and the NBZ resulting from the 10 years required for soil removal. Improved access and increased traffic related to cleanup activities could impact traditional cultural resources by introducing more people and the possibility for vandalism (Hedquist et al. 2014; Nickens et al. 1981). DOE is consulting with SHPO, the Santa Ynez Band of Chumash Indians, and the SSFL Sacred Sites Council to develop a Section 106 agreement document that is expected to include stipulations and standard operating procedures for continued protection of traditional cultural resources and resolution of potential adverse impacts.

4.11.1.3 Cleanup to Revised LUT Values Alternative

Archaeological and Architectural Cultural Resources

Potential impacts on archaeological and architectural cultural resources would be similar to, but reduced from, those under the Cleanup to AOC LUT Values Alternative (Section 4.11.1.2) because less area would be disturbed, reducing the potential for finding previously unrecorded resources. No historic properties would be affected. Under the Cleanup to Revised LUT Values Alternative, less soil would be removed (192,000 cubic yards) and fewer acres (40 acres outside the proposed exemption areas) would be disturbed than those under the Cleanup to AOC LUT Values Alternative. Changes in setting would occur for slightly more than 2 years rather than 10 years. Disturbance of 40 acres of land under this alternative would represent about 30 percent of the affected acreage under the Cleanup to AOC LUT Values Alternative. As discussed in Section 4.11.1.2, soil replacement would restore some natural contours, but they would differ from the original ground surface topography. However, because of the reduced acreage, there would be less change in setting from implementing this alternative compared to changes in setting under the previous alternative. There would be no effect on archaeological sites at Area IV or the NBZ because setting does not form an integral part of these NRHP-eligible sites' integrity.

Traditional Cultural Resources

Potential impacts on traditional cultural resources would be similar to those under the Cleanup to AOC LUT Values Alternative, but be of less likelihood because of the reduced area to be disturbed and the shorter duration of the cleanup activity. As addressed in the Archaeological and Cultural Resources subsection, soil replacement for the disturbed land would restore some natural contours, but they would differ from the original ground surface topography, causing potential adverse impacts on the setting of the traditional cultural resource. Adverse impacts could also result from changes in setting which would occur during the slightly more than 2 years required for soil removal, direct disturbance of archaeological sites not exempt from cleanup by the AOC, and increased traffic and improved access to Area IV and the NBZ. As addressed in Section 4.11.1.2, the Section 106 agreement document under development with SHPO, the Santa Ynez Band of Chumash Indians, and the SSFL Sacred Sites Council is expected to include procedures for protection for traditional cultural resources and resolution of potential adverse impacts.

4.11.1.4 Conservation of Natural Resources Alternative

Archaeological and Architectural Cultural Resources

Potential impacts on archaeological and architectural cultural resources would be similar to, but reduced from, those under both the Cleanup to AOC LUT Values Alternative (Section 4.11.1.2) and Cleanup to Revised LUT Values Alternative (Section 4.11.1.3). No historic properties would be affected. However, under the Conservation of Natural Resources Alternative, less soil would be removed (148,000 cubic yards) and fewer acres would be disturbed (32 acres outside the proposed exemption areas) compared to the other soil remediation action alternatives. Changes in setting would extend over a shorter period (2 years). Disturbance of 32 acres of land would represent about 25 percent of the affected acreage under the Cleanup to AOC LUT Values Alternative. As discussed in Sections 4.11.1.2 and 4.11.1.3, soil replacement would restore some natural contours, but they would differ from the original ground surface topography. However, because of the reduced acreage, there would be less change in setting from implementing this alternative compared to changes in setting under the previous two action alternatives. There would be no effect on archaeological sites at Area IV or the NBZ because setting does not form an integral part of these NRHP-eligible sites' integrity.

Traditional Cultural Resources

Potential impacts on traditional cultural resources would be similar to those under the Cleanup to AOC LUT Values Alternative (Section 4.11.1.2) and Cleanup to Revised LUT Values Alternative (Section 4.11.1.3), but of reduced likelihood because of the reduced area that would be disturbed. As addressed in the Archaeological and Cultural Resources subsection, soil replacement for the disturbed land would restore some natural contours, but they would differ from the original ground surface topography, causing potential adverse impacts on the setting of the traditional cultural resource. Adverse impacts could also result from a changes in setting during the 2 years required for soil removal, direct disturbance of archaeological sites not exempted from cleanup by the AOC, and increased traffic and improved access to Area IV and the NBZ. As addressed in Section 4.11.1.2, the Section 106 agreement document under development with SHPO, the Santa Ynez Band of Chumash Indians, and the SSFL Sacred Sites Council is expected to include procedures for protection for traditional cultural resources and resolution of potential adverse impacts.

4.11.2 Building Demolition Alternatives

Impacts to historic properties (i.e., archaeological or architectural resources that are eligible for listing on the HRHP) and traditional cultural resources under the alternatives addressed under the building demolition alternatives are summarized and compared in **Table 4–76**.

Table 4–76 Cultural Resources Impacts under the Building Demolition Alternatives

Resource	*Building No Action Alternative*	*Building Removal Alternative*
Archaeological	No historic properties would be affected.	Same as the Building No Action Alternative.
Architectural	No historic properties would be affected.	Same as the Building No Action Alternative.
Traditional	No adverse impacts are expected.	Same as the Building No Action Alternative.

4.11.2.1 Building No Action Alternative

Under the Building No Action Alternative, DOE would not remove any DOE-owned structures. Access to Area IV and the NBZ, including sites of traditional religious and cultural importance, would be controlled through existing management plans and standard operating procedures.

Archaeological and Architectural Cultural Resources

There are no ongoing activities or plans under this alternative that would affect historic properties or known archaeological sites in the vicinities of DOE-owned buildings. Archaeological sites present elsewhere on Area IV and the NBZ would continue to be protected from outside intrusion through restricted access to areas containing these sites. DOE would consult as needed with SHPO, the Santa Ynez Band of Chumash Indians, and the SSFL Sacred Sites Council should unanticipated archaeological sites be discovered in the vicinities of the DOE-owned buildings.

Traditional Cultural Resources

DOE has initiated and established Government-to-Government consultation with the Santa Ynez Band of Chumash Indians. Through this relationship, access to properties of traditional religious and cultural importance to tribes would be maintained as required by NHPA and other governing laws and orders. No adverse impacts are expected on traditional cultural resources in Area IV and the NBZ while land management remains under the control of the current landowner, Boeing. There would be no adverse effect on historic properties; however, buildings would remain that may be considered intrusive in the context of the viewscape of traditional cultural resources (refer to Appendix B, Section B.11).

4.11.2.2 Building Removal Alternative

Under the Building Removal Alternative, all DOE-owned buildings within Area IV would be removed.

Archaeological and Architectural Cultural Resources

Because none of the buildings in Area IV are considered eligible for listing on the NRHP, no historic properties would be affected by removal of DOE buildings. SHPO has concurred with the findings of the structural architectural survey in Area IV (Post/Hazeltine Associates 2009) that none of the standing structures was eligible for listing on the NRHP (i.e., none of them is considered to be a historic property) (OHP 2010). A summary description of the remaining DOE buildings is provided in Chapter 2, Section 2.5, and a detailed description is provided in Appendix D, Section D.1.

Known NRHP-eligible archaeological sites would not be affected because no sites are located in the immediate vicinity of buildings to be demolished. However, if unexpected archaeological resources are present beneath existing foundations, subsurface vaults, or concrete slabs, removal could adversely impact such resources. Building demolition would be monitored by a cultural resource specialist and a Native American monitor. DOE is consulting with SHPO, the Santa Ynez Band of Chumash Indians, and the SSFL Sacred Sites Council to develop a Section 106 agreement document that is expected to include stipulations and standard operating procedures for continued protection for traditional cultural resources and resolution of potential adverse impacts.

Traditional Cultural Resources

The built structures in Area IV are not specifically included in the SSFL-wide Santa Susana Sacred Sites designated by the Santa Ynez Band of Chumash Indians; therefore, no impacts are expected from demolition of the remaining DOE structures within Area IV. However, it is possible that previously unknown and unrecorded archaeological resources could be located when the structures are demolished, as discussed in the Archaeological and Architectural Cultural Resources subsection. Should this occur, consultation would be necessary to determine the status of these resources relative to the Santa Susana Sacred Site. Removal of structures at Area IV would have a 2-year effect on the setting, but removal could be considered beneficial because potentially intrusive structural elements would be eliminated from the viewscape of traditional cultural resources. There would be no adverse effect on historic properties. The Section 106 agreement document discussed in the Archaeological and Architectural Cultural Resources subsection would provide continued protection for traditional cultural resources and resolution of potential adverse impacts.

4.11.3 Groundwater Remediation Alternatives

Impacts to historic properties (i.e., archaeological or architectural resources that are eligible for listing on the NRHP) and traditional cultural properties under the groundwater remediation alternatives are summarized and compared in **Table 4–77**.

Table 4–77 Cultural Resources Impacts under the Groundwater Remediation Alternatives

Resource	*Groundwater No Action Alternative*	*Groundwater Monitored Natural Attenuation Alternative*	*Groundwater Treatment Alternative*
Archaeological	No historic properties would be affected.	Same as the Groundwater No Action Alternative.	Same as the Groundwater No Action Alternative.
Architectural	No historic properties would be affected.	Same as the Groundwater No Action Alternative.	Same as the Groundwater No Action Alternative.
Traditional	No adverse impacts are expected.	Changes to setting are possible from installation of five additional monitoring wells.	Changes to setting are possible from installation of groundwater treatment systems.

4.11.3.1 Groundwater No Action Alternative

Archaeological and Architectural Cultural Resources

Current groundwater monitoring activities would continue. Impacts on historic properties are unlikely, but the resources would be managed through existing management plans and standard operating procedures or through agreements developed in consultation with the Office of Historic Preservation, the Santa Ynez Band of Chumash Indians, and other interested parties.

Traditional Cultural Resources

Current groundwater monitoring activities would continue. DOE would continue to consult with SHPO, the Santa Ynez Band of Chumash Indians, and the SSFL Sacred Sites Council on aspects of management pertinent to traditional cultural resources such as environmental monitoring and security measures. Control of access to sites of traditional religious and cultural importance would continue, and no impacts are expected on traditional cultural resources.

4.11.3.2 Groundwater Monitored Natural Attenuation Alternative

Archaeological and Architectural Cultural Resources

Ongoing monitoring activities could be augmented by installation of five additional monitoring wells and by more frequent sampling. Impacts on historic properties are unlikely. Monitoring activities would have no effect on archaeological resources because the APE has been surveyed for archaeological sites; new wells would avoid identified sites. Well installation would be monitored by a cultural resources specialist and a Native American monitor. In the unlikely event that an unanticipated archaeological site was encountered during well installation, it would be protected in accordance with applicable regulations and the Section 106 agreement document discussed in Section 4.11.1.2.

Traditional Cultural Resources

Ongoing monitoring activities are unlikely to impact traditional cultural resources in Area IV and the NBZ. However, the addition of five wells could impact the setting of the Santa Susana Sacred Site by the introduction of additional, modern, landscape elements. As addressed in Section 4.11.1.2, the Section 106 agreement document under development with SHPO, the Santa Ynez Band of Chumash Indians, and the SSFL Sacred Sites Council is expected to include procedures for protection for traditional cultural resources and resolution of potential adverse impacts.

4.11.3.3 Groundwater Treatment Alternative

Archaeological and Architectural Cultural Resources

The Groundwater Treatment Alternative would have no effect on architectural cultural resources because none has been identified as being eligible for listing on the NRHP. SHPO has concurred with this finding (OHP 2010). Groundwater treatment at Area IV and the NBZ is a potential, but unlikely, source of impacts on archaeological resources. The strontium-90 bedrock source in the RMHF area is not near any known archaeological site. If pump and treat systems or soil vapor extraction systems were included in the technologies selected for Area IV, efforts would be made to place treatment units on gravel parking or other previously disturbed areas. Installation of surface piping to support the treatment systems, if required, would avoid known archaeological sites. If required to support groundwater treatment operations, injection chemical storage tanks would be collocated with treatment units and would involve little to no additional surface disturbance. Although changes to the setting of a historic property have occurred in other locations due to the near proximity of equipment or machinery, because no buildings or structures have been identified as historic properties, no structural historic properties would be affected at Area IV or the NBZ. The relatively short-term inclusion of groundwater treatment equipment would be unlikely to affect an archaeological historic property because setting is not considered an essential aspect of archaeological site eligibility at Area IV or the NBZ.

In the unlikely event that an unanticipated archaeological site was encountered during installation and operation of groundwater treatment equipment, it would be protected in accordance with applicable regulations and the Section 106 agreement document discussed in Section 4.11.1.2.

Traditional Cultural Resources

Adverse impacts, in the form of a loss of integrity of traditional cultural resources at SSFL Area IV and the NBZ could arise from changes in setting during the installation of groundwater treatment systems (e.g., storage tanks, overland piping) and then during the 5-year operation of these systems. As addressed in Section 4.11.1.2, the Section 106 agreement document under development with SHPO, the Santa Ynez Band of Chumash Indians, and the SSFL Sacred Sites Council is expected to include procedures for protection for traditional cultural resources and resolution of potential adverse impacts.

4.11.4 Cultural Resources Impacts under All Action Alternative Combinations

Archaeological and Architectural Cultural Resources

No combination of action alternatives would have an effect on architectural cultural resources because none has been identified as eligible for listing on the NRHP (i.e., no historic structures) and no impacts on this resource class have been determined under NEPA criteria.

For archaeological resources, proposed exemptions to the 2010 AOC (DTSC 2010a) requirement to remediate chemical and radioactive contaminants to LUT values would allow DOE to avoid impacts on archeological sites that are listed or eligible for listing on the NRHP (i.e., historic properties) or otherwise significant under NEPA or CEQA eligibility criteria. For this reason, the potential adverse effects would be similar but would vary somewhat among the alternatives. Under all alternatives, if an unanticipated archaeological resource is encountered, DOE would comply with applicable regulations and the Section 106 agreement document discussed in Section 4.11.1.2. This agreement document is currently under development and would include a provision for unanticipated archaeological finds. However, based on the intensive survey for archaeological sites, finding a previously unrecorded archaeological resource is unlikely.

The High Impact Combination would have the greatest potential to encounter unanticipated archaeological resources, primarily because this combination includes the Cleanup to AOC LUT Values Alternative, which would cause the largest soil disturbance of any of the soil remediation action alternatives. The Building Removal Alternative would be unlikely to encounter unanticipated archaeological resources. Comparing the two groundwater remediation action alternatives, the Groundwater Monitored Natural Attenuation Alternative would involve more ground disturbance and construction and, thus, would have greater potential to encounter unanticipated archaeological resources, if present. If both groundwater remediation action alternatives were implemented, the potential for effects on unanticipated archaeological resources would essentially be the same as those from implementing the Groundwater Treatment Alternative alone.

The Low Impact Combination would have the least potential to encounter unanticipated archaeological resources, primarily because this combination includes the Conservation of Natural Resources Alternative, which would cause the least soil disturbance of any of the soil remediation action alternatives. As discussed above, the Building Removal Alternative would be unlikely to encounter unanticipated archaeological resources, and between the two groundwater remediation action alternatives, the Groundwater Monitored Natural Attenuation Alternative would have less potential to encounter unanticipated archaeological resources.

Traditional Cultural Resources

The 2010 AOC (DTSC 2010a) proposed an exemption from cleanup actions for "Native American artifacts that are formally recognized as Cultural Resources." This proposed exemption applies to historic properties, i.e., those that are listed on, or eligible for listing on the NRHP. However, traditional cultural resources that include properties of traditional religious and cultural importance that do not meet the NRHP criteria could also be protected under the proposed exemption. The Santa Ynez Band of Chumash Indians has nominated the entire SSFL, an area that includes all archaeological sites, regardless of NRHP eligibility, as well as all isolates and the landscape, as a Native American sacred site. They believe that the site is eligible for inclusion on the NRHP as a traditional cultural property. In 2014, they filed paperwork nominating the site to be included in the *State of California Native American Heritage Commission Sacred Lands Inventory* (NAHC 2014). DOE is consulting with SHPO, the Santa Ynez Band of Chumash Indians, and the SSFL Sacred Sites Council to develop an agreement intended to resolve adverse impacts through avoidance, minimization, or mitigation of impacts during and subsequent to cleanup activities.

Under all action alternatives, there could be changes in setting as cleanup progresses in Area IV and the NBZ, both of which are included in the Santa Susana Sacred Site; after cleanup is complete, this impact would be removed, but the affected areas will have been re-contoured, which would change the setting of the traditional cultural resource. Also, for traditional cultural resources, potential effects on archaeological sites are considered under all action alternative combinations because the Santa Susana Sacred Site includes all archaeological sites regardless of NRHP eligibility, as well as all isolates and the landscape.

The High Impact Combination would have the greatest potential to impact traditional cultural resources, primarily because this combination would have the longest cleanup duration and the most landscape alternation. The Building Removal Alternative would be unlikely to encounter unanticipated archaeological resources and would remove structures that could be considered intrusive. Between the two groundwater remediation action alternatives, the Groundwater Treatment Alternative would involve more ground disturbance and construction, and thus a greater potential to encounter unanticipated archaeological resources or alter the landscape. The Groundwater Treatment Alternative would have a greater potential to affect the Santa Susana Sacred Site; and would involve more-extensive aboveground treatment facilities that could temporarily affect its setting. This potential for impacts would be essentially the same if both groundwater remediation action alternatives were implemented.

The Low Impact Combination would have the least potential to encounter unanticipated archaeological resources, primarily because this combination includes the Conservation of Natural Resources Alternative, which would have shortest cleanup duration and least landscape alternation of any of the soil remediation action alternatives. As discussed above, the Building Removal Alternative would be unlikely to encounter unanticipated archaeological resources and would remove structures that could be considered intrusive. Between the two groundwater remediation action alternatives, the Groundwater Monitored Natural Attenuation Alternative would involve less ground disturbance and construction, have less potential to affect the Santa Susana Sacred Site, and create less-extensive structures (well heads) that could affect its setting.

DOE is consulting with SHPO, the Santa Ynez Band of Chumash Indians, and the SSFL Sacred Sites Council to develop an agreement intended to resolve adverse impacts through avoidance, minimization, or mitigation of impacts during and subsequent to cleanup activities.

4.11.5 Impact Threshold Analysis

For architectural and archaeological resources, the threshold for an adverse effect centers on whether the action alters the significance of the resource relative to NRHP criteria or similar criteria developed for NEPA and the California Office of Historic Preservation (refer to Appendix B, Section B.11). Because there would be no adverse effect on architectural or archaeological resources at Area IV and the NBZ under any alternative, an impact threshold, as summarized in Table 4–2, would not be crossed and no mitigation would be needed. For traditional cultural resources, the threshold could be met, resulting in potential adverse impacts under all three of the soil remediation action alternatives and the groundwater remediation action alternatives. No adverse impacts on traditional cultural resources are expected under the Building Removal Alternative or any no action alternative. As needed, mitigation would be determined through consultation and agreement with SHPO, the Santa Ynez Band of Chumash Indians, and the SSFL Sacred Sites Council.

4.12 Socioeconomics

This section evaluates the potential socioeconomic impacts of the alternatives. The regional economy is defined in Chapter 3, Section 3.12, and the methods used to assess potential socioeconomic impacts are presented in Appendix B, Section B.12. The ROI for the socioeconomic environment is defined as the geographic area that encompasses the regional economy where impacts could occur. More than one ROI was considered because impacts could occur in the SSFL ROI and in the ROIs for the facilities receiving recycle materials and waste. The SSFL ROI is Los Angeles and Ventura Counties. The ROIs for the recycle and waste disposal facilities are the counties containing the facilities.

DOE activities are expected to have very minor socioeconomic impacts on the communities along the major highways used for travel between SSFL and the evaluated recycle and facilities. Truck drivers from Los Angeles and Ventura Counties may stop at local truck stops, food stores, and gas stations while in transit, which would increase sales in these areas, but this economic benefit would be minor. Similarly, no socioeconomic impacts are expected in communities along the rail lines to the disposal facilities evaluated under the truck/rail option.

The analysis focused on socioeconomic impacts that could occur during site remediation operations rather than impacts after site remediation is complete. Because the use of Area IV and the NBZ following remediation is uncertain, assessments of positive or adverse impacts associated with future site use would be speculative.

To evaluate the potential socioeconomic impacts of shipping recycle material or waste to the evaluated facilities, it was assumed that all recycle material or all waste would be sent to each evaluated facility authorized for receipt of that material or type of waste. It is recognized, however, that multiple facilities are available for each type of recycle material or waste, and that impacts at any individual facility may be reduced by shipping waste to multiple facilities.

4.12.1 Soil Remediation Alternatives

Impacts under the soil remediation alternatives are summarized and compared in **Table 4–78**.

4.12.1.1 Soil No Action Alternative

Under the Soil No Action Alternative, no soil would be removed at Area IV and the NBZ and there would be no socioeconomic impacts from DOE activities above baseline conditions. The current Area IV workforce of two employees would continue.

4.12.1.2 Cleanup to AOC LUT Values Alternative

Employment

Not including truck drivers, soil removal would annually employ 25 persons, including management, workers, and biology, cultural resources, and Native American monitors. Soil would be removed over 10 years.

Soil removal would have a minor beneficial impact on the economy in Los Angeles and Ventura Counties by providing employment and increasing sales for industries that provide equipment, supplies, and rentals. It was assumed that site workers would originate primarily from Ventura and Los Angeles Counties because approximately 117,000 construction workers live in the region (see Chapter 3, Tables 3–37 and 3–38). Because of the large existing local workforce, employment for soil removal would not generate substantial new spending or economic activity in these counties.

Truck Traffic

The alternative would result in increased employment of truck drivers, which would have a minor beneficial impact on the regional economy because it is expected that truck drivers would come primarily from Los Angeles and Ventura Counties. The number of truck drivers that may be annually required would depend on the quantities of the different types of waste to be shipped, backfill requirements, and the distances to the evaluated disposal facilities (and thus, the number of daily round trips a single truck driver could make). Assuming wastes are shipped to the most distant evaluated facilities and considering shipment under both the truck and the truck/rail options, up to 35 truck drivers may be annually required during 9 years of soil removal and a reduced annual number during the final year of soil removal. These requirements are small, and there is an adequate regional pool of truck drivers. Chapter 3, Tables 3–37 and 3–38, summarize truck transportation employment during 2012 in Los Angeles and Ventura Counties, respectively. In 2012, approximately 7,200 employees were employed in specialized freight trucking in the two counties, plus approximately 26,600 employees in general truck transportation. Employment of local truck drivers would not generate new sales in the region because these workers would likely spend money in the region with or without the project.

Table 4–78 Socioeconomic Impacts under the Soil Remediation Alternatives

Region of Influence	***Resource***	***Soil No Action Alternative***	***Soil Remediation Action Alternatives***		
			Cleanup to AOC LUT Values	***Cleanup to Revised LUT Values***	***Conservation of Natural Resources***
Los Angeles and Ventura Counties	Employment	The current SSFL workforce would continue, with no expected employment impacts.	Soil remediation would increase Area IV employment by 25 workers over 10 years, with minor beneficial socioeconomic impacts.	Soil remediation would increase Area IV employment by 25 workers over slightly more than 2 years, with minor beneficial socioeconomic impacts.	Soil remediation would increase Area IV employment by 25 workers over 2 years, with minor beneficial socioeconomic impacts.
	Truck traffic	No socioeconomic impacts are expected.	Increased traffic during 10 years of soil removal is not expected to have socioeconomic impacts on businesses along the evaluated routes between SSFL and major highways. Other than Woolsey Canyon Road, traffic volume can be reduced by use of multiple routes between SSFL and major highways.	Similar potential socioeconomic impacts as those under the Cleanup to AOC LUT Values Alternative, except the duration of increased traffic would last for slightly more than 2 years rather than 10 years.	Similar potential socioeconomic impact as those under the Cleanup to AOC LUT Values Alternative, except the duration of increased traffic would last for 2 years rather than 10 years.
	Infrastructure and municipal services	No socioeconomic impacts are expected.	Traffic could damage pavement on roads used by heavy-duty trucks, which could affect government finances. DOE may need to negotiate with local governments to contribute its portion of the cost for maintenance and repair of affected roads. No impacts are expected on other municipal services such as police or fire services.	Same as the Cleanup to AOC LUT Values Alternative, except there would be fewer truck round trips which would have a smaller potential for damage of road pavement.	Same as the Cleanup to Revised LUT Values Alternative, except there would be fewer truck round trips which would have a smaller potential for damage of road pavement.
	Housing	No socioeconomic impacts are expected.	Workers would be primarily employed from the SSFL ROI, with no impacts on housing availability.	Same as the Cleanup to AOC LUT Values Alternative.	Same as the Cleanup to AOC LUT Values Alternative.
	Local government revenue	No socioeconomic impacts are expected.	Although increased funds spent on road repair could impact funding for other services, taxes due to purchases of materials and fuel and rental of equipment, and fees for project activities, could increase revenues for local governments during the 10 years of remediation.	Potential funding impacts and benefits would be reduced compared to the Cleanup to AOC LUT Values Alternative because of the shorter operational duration of slightly more than 2 years.	Potential funding impacts and benefits would be slightly reduced compared to the Cleanup to Revised LUT Values Alternative because of a slightly shorter operational duration of 2 years.
Disposal facilities	Truck traffic	No socioeconomic impacts are expected on businesses in the vicinities of the offsite disposal facilities.	Because of the small numbers of daily deliveries of soil to the evaluated radioactive and hazardous waste facilities, no socioeconomic impacts are expected on businesses near these facilities. For deliveries of nonhazardous soil to the evaluated facilities, no or minimal socioeconomic impacts are expected on businesses near these facilities. Disposal fees could increase revenues for public or private entities. Any adverse impacts would be minimized by shipping soil waste to multiple authorized disposal facilities, by use of multiple local routes (as available) to a disposal facility, or by shipping waste by rail to rail-accessible facilities.	Similar to the Cleanup to AOC LUT Values Alternative, except that there would be increased daily deliveries to the evaluated radioactive and hazardous waste facilities, and significantly reduced daily and total deliveries to the evaluated nonhazardous waste facilities. There would be reduced disposal fees at the evaluated hazardous waste facilities. No socioeconomic impacts on local businesses are expected for delivery to any evaluated facility.	Similar to the Cleanup to Revised LUT Values Alternative, except that the total number of shipments to radioactive waste facilities would be reduced, meaning that disposal fees that could provide revenues for public or private entities would be reduced. No socioeconomic impacts on local businesses are expected for delivery to any evaluated facility.

AOC = *Administrative Order on Consent for Remedial Action*; LUT = Look-Up Table; ROI = region of influence.

Traffic conditions could affect the economy in Los Angeles or Ventura County if the conditions impacted sales at businesses along the evaluated routes between SSFL and major highways. Three of the four evaluated routes (see Section 4.8.2) use Topanga Canyon Boulevard, which is lined with retail businesses, restaurants, hotels, multi-family residential developments, schools, and urban recreation areas or parks. A small number of businesses also exist along some of the other evaluated roads, such as the West Hills Plaza at the corner of Valley Circle Boulevard and Roscoe Boulevard. Truck drivers and site workers traveling along Topanga Canyon Boulevard or other evaluated roads could stop for food, fuel, or other items which could benefit business, although the impact would be minimal.

Although the most significant increase in traffic under the alternative would occur on Woolsey Canyon Road (see Section 4.8.2.1.2), this increase is not expected to result in socioeconomic impacts on businesses because of the lack of retail establishments on this road. Traffic on other evaluated roads would not increase by more than a few percent, assuming all traffic traversed each road, with no change in their LOS ratings, and thus, minimal potential for impacts on businesses. Assuming all traffic traversed Topanga Canyon Boulevard, the weekday average daily traffic on this road would increase by 0.34 percent during the first 9 years of soil removal and 0.27 percent during the final year (see Appendix H, Table H–20). In addition, other than Woolsey Canyon Road, traffic on all evaluated roads could be reduced by routing traffic among multiple routes between SSFL and major highways. Therefore, no socioeconomic impacts are expected on businesses along these roads.

Infrastructure and Municipal Services

As addressed in Section 4.8.2.1.2, increased heavy-duty truck traffic could accelerate deterioration of Woolsey Canyon Road or other roads, which may require resurfacing earlier than anticipated. If local roads deteriorate, city or state governments may need to reallocate funds to resurface impacted roads, which could delay other road resurfacing projects. Due to the complexity of government financing and budgeting, it is not possible to identify other services that could be affected if more money is spent on road resurfacing. Recognizing that there may be damage to the local roads from the approximately 116,000 heavy-duty truck round trips required for remediation of Area IV and the NBZ, DOE may need to negotiate with local governments to contribute its portion of the cost for maintenance and repair of the affected roads.

The alternative would not require additional municipal services such as police or fire services.

Housing

Soil removal and backfill shipment would not impact the availability of local housing. The construction and transportation industries in Los Angeles and Ventura Counties provide a sufficient labor pool to employ workers and truck drivers for this alternative. Workers would not need to move to the area and find housing.

Local Government Revenue

As described above, accelerated deterioration of roads would increase government expenses and decrease availability of funding for other services. On the other hand, taxes from purchases of materials and fuel and rental of equipment, and permitting fees for project activities, would increase revenues for local governments.

Disposal Facilities

Chapter 3, Table 3–40, lists nine facilities evaluated for receipt of soil under the Cleanup to AOC LUT Values Alternative, including six disposal facilities in California, one in Nevada, one in Utah, and one in Idaho. To access some facilities, trucks would need to travel on local roads. Although truck drivers traveling along local roads to the disposal facilities could stop for food, fuel, or other items which could benefit business, it was assumed for analysis that noticeably increased traffic volume could discourage stops by others traversing the road and cause adverse impacts on businesses.[38]

LLW and MLLW Facilities. The number of waste delivery trucks arriving at an LLW or MLLW disposal facility would average up to about 3 per day over multiple years, assuming all LLW and MLLW would be sent to a single disposal facility. Two facilities were evaluated: NNSS and Energy*Solutions* in Utah. Because trucks would not need to travel near local businesses to access either NNSS or Energy*Solutions* in Utah and the number of trucks would be minimal, there would be no socioeconomic impacts on businesses in the vicinities of these facilities.

Hazardous Waste Facilities. Deliveries of soil classified as hazardous waste to a single assumed hazardous waste facility (the Buttonwillow or Westmorland Landfill or US Ecology in Idaho) would average up to about 2 per day. These daily deliveries would not result in noticeable increases in traffic in the vicinities of the evaluated facilities and thus, no socioeconomic impacts on businesses.

Nonhazardous Waste Facilities. Deliveries of soil classified as nonhazardous waste to a single assumed nonhazardous waste facility would occur over 10 years, and these deliveries would average about 25 per day for the first 9 years of soil removal and 16 per day during the final year. Three California Class III facilities were evaluated for nonhazardous soil: the Chiquita Canyon Sanitary Landfill, Antelope Valley Landfill, and Mesquite Regional Landfill. In addition, the McKittrick Waste Treatment Site (a California Class II facility) was evaluated, as were the Buttonwillow and Westmorland Landfills (both California Class I facilities). As discussed below, the projected deliveries are not expected to have significant socioeconomic impacts on businesses in the vicinities of the evaluated disposal facilities.

To access the Chiquita Canyon Sanitary Landfill, trucks would likely travel on Interstate 5 and exit at Henry Mayo Drive, a four-lane highway with turning lanes. Because the landfill is located immediately adjacent to Henry Mayo Drive, no disruptions are expected on businesses on local roads; therefore, waste deliveries to the Chiquita Canyon Sanitary Landfill would not result in economic impacts. Trucks delivering waste to the Antelope Valley Landfill would probably travel on State Route 14 (Aerospace Highway), a multiple-lane access-controlled highway, until leaving this highway at the Avenue S or Palmdale Boulevard exit and then taking local roads to the facility. Particularly if the Avenue S exit were used, trucks would not need to pass through major commercial areas of Palmdale and trucks would not disrupt customers from going to businesses. There would be no socioeconomic impacts on businesses due to trucks delivering waste to the Antelope Valley Landfill.

There would be no socioeconomic impacts due to truck traffic near the Mesquite Regional Landfill because only rail delivery of waste to this site was evaluated.

Assuming all nonhazardous soil was delivered to the Buttonwillow Landfill, there would be an increase in truck traffic at the town of Buttonwillow, assuming deliveries were made using State Route 58 (Blue Star Memorial Highway) traveling west and southwest from Interstate 5. Assuming all nonhazardous soil was delivered to the McKittrick Waste Treatment Site again using State

[38] Disposal facility operators would collect fees for disposal of materials, which could increase local revenues. Some disposal facilities are operated by private entities, and others are publicly operated. Depending on the size and structure of the private entity, the increased revenues may or may not have a substantial impact on the local economy. Increased revenues for publicly operated facilities would increase funding for local government services. This would be a nominal economic benefit to the regional economies of the disposal facilities.

Route 58 from Interstate 5, there would be an increase in traffic at the towns of Buttonwillow and McKittrick. The McKittrick Waste Treatment Site is located slightly south of the town of McKittrick, while the Buttonwillow Landfill is on Lokern Road, which intersects with State Route 58 north of the McKittrick Waste Treatment Site, about 12 miles down State Route 58 from the town of Buttonwillow.

The town of Buttonwillow is a major stop for motorists traveling on Interstate 5, and Blue Star Memorial Highway (State Route 58), which is a four-lane road through town, currently experiences truck traffic for agricultural purposes or from trucks stopping while traversing Interstate 5. Alternatively, trucks could access either site using State Routes 166 and 33 from Interstate 5 rather than State Route 58; in this case, trucks would avoid passing through Buttonwillow, but would pass through Taft and other towns on State Routes 166 and 33. In addition to agriculture, Taft is in an area of oil and gas production in California, and therefore, experiences truck traffic from oil and gas and agricultural industries. Trucks would pass through the town of McKittrick if State Routes 166 and 33 were used for deliveries to the Buttonwillow Landfill, but not if trucks used State Route 58 through the town of Buttonwillow for these deliveries.

Given these considerations and the expectation that truck deliveries to the Site would be spread over several hours,[39] the additional truck traffic from SSFL to the McKittrick Waste Treatment Site or Buttonwillow Landfill would have minimal impacts on businesses along the truck routes. Impacts would be reduced if trucks were split among the routes to the disposal facilities: State Route 58 and State Routes 166 and 33.

The Westmorland Landfill is located off State Route 78. There are two exits off State Route 78, and the routes from both exits to the Westmorland Landfill are located in a farming area. Because trucks would not need to travel near local businesses to access the Westmorland Landfill, no socioeconomic impacts are expected on any businesses near this facility.

Summary. Shipments of LLW, MLLW, and hazardous soil would arrive at disposal facilities authorized to receive these wastes in insufficient numbers (2-3 shipments per day) to impact businesses.

Shipments of nonhazardous soil to disposal facilities authorized to receive this waste would arrive at frequencies up to 25 per day; no socioeconomic impacts on businesses are expected in the vicinities of the Chiquita Canyon and Antelope Valley Landfills, and minimal impacts are expected on businesses in the vicinities of the McKittrick Waste Treatment Site and Buttonwillow Landfills. The increased traffic would also lead to increased opportunities at some businesses for sales of food, fuel, or other items, as well as increased disposal facility revenues from waste disposal services that could be partially used, depending on site-specific arrangements, to increase funding for local government services.

To the extent that any adverse impacts could occur in the vicinity at any disposal facility, these impacts may be minimized by shipping soil waste to multiple authorized disposal facilities, by use of multiple local routes (as available) to a disposal facility, or by shipping waste by rail to rail-accessible facilities.

[39] During the work week, the McKittrick Waste Treatment Site accepts waste from 7:00 AM to 10:00 PM, while the Buttonwillow Landfill accepts waste from 9:00 am to 5:00 PM. The minimum number of operating hours for the two facilities is 8 hours in a day. Delivery of 25 trucks per day would result in an average frequency of 1 additional loaded truck, or less, every 19 minutes, to the site. This additional traffic is unlikely to be noticeable.

4.12.1.3 Cleanup to Revised LUT Values Alternative

Employment

The same annual number of remediation workers is projected as those under the Cleanup to AOC LUT Values Alternative, but soil removal would occur over slightly more than 2 years rather than 10 years. Soil removal would have a minor beneficial impact on the regional economy in Los Angeles and Ventura Counties by providing employment and increased sales for industries providing equipment, supplies, and rentals. As discussed for the Cleanup to AOC LUT Values Alternative, because of the large existing local workforce, employment for soil removal would not generate substantial new spending or economic activity in the SSFL ROI.

Truck Traffic

Significantly fewer heavy-duty truck round trips would occur compared to that under the Cleanup to AOC LUT Values Alternative; however, because of the emphasis on early removal of soil containing radionuclides above provisional LUT values and soil classified as hazardous, an increased number of truck drivers may be required for the first 2 years of soil removal (up to 93 drivers, assuming shipment of waste to the most distant evaluated disposal facilities and considering shipment under both the truck and the truck/rail options). This is primarily because of the distances that may be required during these 2 years for transport of the radioactive and hazardous soil wastes to disposal facilities, so that the truck drivers would be less able to make multiple daily round trips. (Truck driver requirements would be much smaller during the final year of soil removal.) Still, truck driver requirements would be small in comparison to the large pool of truck drivers in Los Angeles and Ventura Counties. As discussed in Section 4.12.1.2, in 2012 in the two counties, approximately 7,200 employees were employed in specialized freight trucking and 26,600 employees were employed in general truck transportation. Employment of local truck drivers would not generate new sales in the two counties because these workers would likely spend money in the counties with or without the project.

The potential for impacts on businesses along the evaluated routes between SSFL and major highways would be similar to that under the Cleanup to AOC LUT Values Alternative, except that the duration of increased weekday traffic would be much less (slightly more than 2 years rather than 10 years). Other than Woolsey Canyon Road, traffic could be reduced compared to projected levels by distributing the traffic among multiple routes to and from SSFL.

Infrastructure and Municipal Services

As addressed for the Cleanup to AOC LUT Values Alternative, increased heavy-duty truck traffic could accelerate deterioration of Woolsey Canyon Roads or other roads, which may require resurfacing earlier than anticipated. The potential for this accelerated deterioration would be smaller, however, than that for the Cleanup to AOC LUT Values Alternative because there would be considerably fewer truck round trips on the roads between SSFL and major highways. Recognizing that there may be damage to the local roads from the approximately 23,800 heavy-duty truck round trips required for remediation of Area IV and the NBZ, DOE may need to negotiate with local governments to contribute its portion of the cost for maintenance and repair of the affected roads.

Housing

Impacts would be the same as those under the Cleanup to AOC LUT Values Alternative.

Local Government Revenue

Socioeconomic impacts would be smaller than those under the Cleanup to AOC LUT Values Alternative because the Cleanup to Revised LUT Values Alternative has less potential for impacts on road infrastructure along the routes used for heavy-duty truck traffic. Compared to the Cleanup to AOC LUT Values Alternative, there would be less potential for increased revenues for local governments resulting from taxes from purchases of materials and fuel and rental of equipment, and permitting fees for project activities.

Disposal Facilities

The same disposal facilities were evaluated under this alternative as those under the Cleanup to AOC LUT Values Alternative.

LLW and MLLW Facilities. About 14 average daily truck deliveries would arrive at a single assumed LLW or MLLW disposal facility over 2 years. Neither NNSS nor Energy*Solutions* in Utah is located near residential or urban areas, and trucks would not need to travel near local businesses on local roads to access the facilities. Daily deliveries to both facilities would be within the ranges that have been received in the past. An increase of 14 average daily truck deliveries would represent about a 0.38 percent increase compared to the average daily traffic for U.S. Highway 95 near NNSS, and a 0.85 percent increase compared to the average daily traffic for Interstate-80 near Energy*Solutions* in Utah (see Appendix H, Table H–24). The total volume of waste delivered to NNSS from Area IV remediation would be in accordance with the waste volumes projected for delivery to NNSS as evaluated in the *Final Environmental Impact Statement for Continued Operation of the Department of Energy/National Nuclear Security Administration Nevada National Security Site and Off-Site Locations in the State of Nevada* (DOE/EIS-0426) (DOE 2013a) and cited in its December 30, 2014, Record of Decision (79 FR 78421). Therefore, no socioeconomic impacts on businesses are expected in the vicinities of the evaluated facilities.

Hazardous Waste Facilities. The average daily number of waste delivery trucks arriving at a hazardous waste facility would be about 7 over 2 years. These shipments would be unlikely to noticeably increase traffic volume at any evaluated hazardous waste facility. Should all hazardous waste be delivered to the Buttonwillow or Westmorland Landfill, the potential for increased traffic and thus economic impacts would be much less than those evaluated in Section 4.12.1.2 for disposal of nonhazardous waste at these facilities. Should all hazardous waste be delivered to US Ecology in Idaho, an increase of 7 average daily truck deliveries would represent about a 3 percent increase compared to the current average daily traffic for State Highway 78 near the disposal facility (see Appendix H, Table H–24). This would not represent a noticeable increase in traffic, and in any event, trucks would not need to travel near businesses on local roads in order to access the facility.

Nonhazardous Waste Facilities. If all nonhazardous waste was shipped to a single disposal facility, there would be about 8 average daily deliveries to that facility during the first 2 years of soil removal, and much less than 1 average daily delivery during the final year. The increase in truck traffic to the evaluated disposal facilities would be about a third of that for the Cleanup to AOC LUT Values Alternative (Section 4.12.1.2), with no socioeconomic impacts on businesses in the vicinities of the facilities.

Summary. No adverse socioeconomic impacts are expected on businesses in the vicinities of the evaluated facilities authorized for disposal of LLW, MLLW, hazardous, or nonhazardous waste. Nonetheless, any adverse socioeconomic impacts in the ROI of any single disposal facility could be reduced if the waste were shipped to multiple authorized disposal facilities, if multiple routes were used for waste delivery (as available) to any individual facility, or if waste were shipped by rail to rail-accessible facilities.

4.12.1.4 Conservation of Natural Resources Alternative

Employment

Not including truck drivers, soil removal would employ 25 people at SSFL, including management, workers, and biology, cultural resources, and Native American monitors. Soil removal would occur over 2 years and would have a minor beneficial impact on the regional economy in Los Angeles and Ventura Counties by providing employment and increased sales for industries providing equipment, supplies, and rentals. Nonetheless, for the same reasons presented in Section 4.12.1.2, employment for soil removal activities would not generate substantial new spending or economic activity in these two counties.

Truck Traffic

A smaller total number of heavy-duty truck round trips would occur compared to the Cleanup to Revised LUT Values Alternative; however, because of the emphasis on early removal of soil containing radionuclides above provisional LUT values and soil classified as hazardous, up to 93 drivers may be required during the first year of soil removal. (There would a reduced requirement for truck drivers during the final year of soil removal.) As under the Cleanup to Revised LUT Values Alternative, truck driver requirements would be small in comparison to the large pool of truck drivers in Los Angeles and Ventura Counties, which includes 7,200 drivers employed in specialized freight trucking and 26,600 drivers employed in general truck transportation. Employment of local truck drivers would not generate new sales in these two counties because these workers would likely spend money in the counties with or without the project.

The potential for impacts on businesses along the evaluated routes between SSFL and major highways would be similar to that under the Cleanup to AOC LUT Values Alternative, except that the duration of increased weekday traffic would be much less (2 years rather than 10 years). Other than Woolsey Canyon Road, traffic may be reduced compared to projected levels by distributing the traffic among multiple routes to and from SSFL.

Infrastructure and Municipal Services

Economic impacts would be reduced compared to those under the Cleanup to AOC LUT Values or Cleanup to Revised LUT Values Alternative. Although there could be some road deterioration resulting from the approximately 18,400 heavy-duty truck round trips for soil remediation under this alternative, there would be less potential for road deterioration than that under the previous two action alternatives because of the comparatively reduced heavy-duty truck traffic.

Housing

Impacts would be the same as those under the Cleanup to AOC LUT Values Alternative.

Local Government Revenue

Socioeconomic impacts would be smaller than those under the previous two action alternatives because the Conservation of Natural Resources Alternative has less potential for impacts on road infrastructure along the routes used for heavy-duty truck traffic. Compared to the previous two action alternatives, there would be less potential for increased revenues for local governments resulting from taxes from purchases of materials and fuel and rental of equipment, and permitting fees for project activities.

Disposal Facilities

The same disposal facilities were evaluated under this alternative as those under the Cleanup to AOC LUT Values Alternative. Socioeconomic impacts would be reduced compared to those under the Cleanup to Revised LUT Values Alternative for delivery of waste to LLW/MLLW facilities. Assuming all LLW/MLLW was sent to a single disposal facility, there would be 14 average daily truck deliveries to that facility during the first year of soil removal, and much less than one average daily truck delivery during the final year. Socioeconomic impacts would be the same as those for the Cleanup to Revised LUT Values Alternative for delivery of waste to hazardous and nonhazardous disposal facilities. Although no adverse socioeconomic impacts are expected in the vicinity of any evaluated disposal facility, any impacts that may occur may be minimized if the waste were shipped to multiple authorized disposal facilities, if deliveries were made using multiple routes (as available) to individual facilities, or if waste were shipped by rail to rail-accessible facilities.

4.12.2 Building Demolition Alternatives

Impacts under the building demolition alternatives are summarized and compared in **Table 4–79**.

Table 4–79 Socioeconomic Impacts under the Building Demolition Alternatives

Region of Influence	*Resource*	*Building No Action Alternative*	*Building Removal Alternative*
Los Angeles and Ventura Counties	Employment	No socioeconomic impacts are expected. The current workforce would continue.	Building removal would employ 26 workers at SSFL with minor beneficial socioeconomic impacts.
	Regional truck traffic	No socioeconomic impacts are expected.	Increased traffic during 2 years of building demolition is not expected to have socioeconomic impacts on businesses along the evaluated routes between SSFL and major highways.
	Infrastructure and municipal services	No socioeconomic impacts are expected.	Road pavement deterioration would increase expenses for local governments. No other impacts are expected on municipal services such as police or fire services.
	Housing	No socioeconomic impacts are expected.	Because workers would be primarily employed from Los Angeles and Ventura Counties, workers would already be living in the ROI and would not need new housing. Therefore, there would be no impacts on housing availability.
	Local government revenue	No socioeconomic impacts are expected.	Increased expenses for local governments because of pavement deterioration; increased tax revenues due to purchases of materials and fuel and rental of equipment, and fees for project activities.
Recycle and disposal facilities	Truck traffic	No socioeconomic impacts are expected.	No noticeable increases in traffic volumes are expected at the evaluated recycle and disposal facilities, with no socioeconomic impacts on businesses in the regional ROIs.

ROI = region of influence.

4.12.2.1 Building No Action Alternative

Under the Building No Action Alternative, no DOE buildings would be removed at Area IV, and no socioeconomic impacts would result from DOE activities. The current workforce of two employees at Area IV and the NBZ would continue.

4.12.2.2 Building Removal Alternative

Employment

Up to 26 workers would be involved with DOE demolition activities, not including truck drivers. Personnel would include management, workers, and biology, cultural resources, and Native American monitors. About 2 years would be required for building demolition, with demolition work primarily concentrated during about 5 months of each year.

Activities associated with the Building Removal Alternative would have minor beneficial impacts on the economies of Los Angeles and Ventura Counties by providing employment and increased sales for industries providing equipment, supplies, and rentals. As with the soil remediation action alternatives (Section 4.12.1), it was assumed that site workers would originate primarily from Ventura and Los Angeles Counties. Because of the large existing local workforce, building demolition employment would not generate substantial new spending or economic activity in these counties.

Truck Traffic

Nonradioactive materials from building demolition would be recycled to the extent possible or otherwise disposed of in facilities located in California and Idaho; radioactive materials would be transported to Federal or commercial LLW or MLLW disposal facilities in Nevada or Utah.

The alternative would result in increased employment of truck drivers, which would have a minor beneficial impact on the economies of Los Angeles and Ventura Counties because it is expected that the truck drivers would come primarily from these counties. Up to 26 truck drivers may be required, depending on the distances to the evaluated facilities (and thus, the number of daily round trips a single truck driver could make). These requirements are small, and there is an adequate regional pool of truck drivers for the alternative as addressed in Section 4.12.1.2. Employment of local truck drivers would not generate new sales in Los Angeles and Ventura Counties because these workers would likely spend money in these counties with or without the project.

As addressed in Section 4.12.1.2, businesses exist along some of the evaluated roads between SSFL and major highways, with a high concentration of businesses along Topanga Canyon Boulevard. As addressed in Section 4.8.2.2.2, depending on shipment scheduling, the average daily traffic on Woolsey Canyon Road could increase during weekdays by up to 5.3 percent. Nonetheless, this increase is not expected to result in socioeconomic impacts because of the lack of businesses on this road. The average daily traffic on evaluated roads other than Woolsey Canyon Road would increase by less than 2 percent during weekdays, with no change in LOS rating, and, in the case of Topanga Canyon Boulevard, by no more than 0.25 percent, with again no change in LOS rating. Traffic levels on all roads except Woolsey Canyon Road could be reduced by distributing traffic among multiple routes between SSFL and major highways. Therefore, no socioeconomic impacts are expected on businesses along these roads.

Infrastructure and Municipal Services

Socioeconomic impacts could result if additional demands are placed on public infrastructure, which could affect local government funding and budgeting.

As addressed in Section 4.8.2.2.2, increased heavy-duty truck traffic under this alternative could—to some extent—accelerate deterioration of roads that would require resurfacing. Recognizing that there may be damage to the local roads from the approximately 2,420 heavy-duty truck round trips associated with building removal under this alternative, DOE may need to negotiate with local governments to contribute its portion of the cost for maintenance and repair of the affected roads.

The alternative would not require additional municipal services such as police or fire services.

Housing

DOE operations would not impact the availability of local housing. As discussed in Section 4.12.1.2, the construction and transportation industries in Los Angeles and Ventura Counties provide a sufficient labor pool to employ workers and truck drivers for the alternative. Workers generally would not need to move to the area and find housing.

Local Government Revenue

As described above, accelerated deterioration of roads could occur to some extent, which could increase government expenses and decrease the availability of funding for other services. On the other hand, purchases of materials and fuel and rental of equipment, and permitting fees for project activities, could increase revenues for local governments.

Disposal and Recycle Facilities

Chapter 3, Table 3–40, lists the facilities evaluated for receipt of waste and recycle materials under the Building Removal Alternative, including six disposal facilities and three recycle facilities in California, and one disposal facility each in Nevada, Utah, and Idaho. To access some facilities, trucks would need to travel on local roads.

LLW and MLLW Facilities. Assuming all LLW and MLLW were sent to a single disposal facility, about 5 daily waste delivery trucks would arrive at that facility over 2 years of building demolition, assuming shipment occurs during 2 to 5 months in each year. The daily number of delivery trucks would be reduced if waste was shipped throughout each working year. Because trucks would not need to travel near local businesses to access NNSS or Energy*Solutions* in Utah and the number of trucks would be minimal, there would be no socioeconomic impacts on businesses in the vicinities of these facilities.

Hazardous Waste Facilities. Daily truck deliveries to an assumed single hazardous waste facility would average much less than one per day. Three facilities were evaluated: the Buttonwillow and Westmorland Landfills and US Ecology in Idaho. This nominal increase in truck traffic would have no socioeconomic impacts on businesses in the vicinities of these facilities.

Nonhazardous Waste Facilities. Daily truck deliveries to an assumed single nonhazardous waste facility would average less than one per day. Four California facilities were evaluated: the Chiquita Canyon Landfill, Antelope Valley Landfill, McKittrick Waste Treatment Site, and Mesquite Regional Landfill. This nominal increase in truck traffic would have no socioeconomic impacts on businesses near the Chiquita Canyon Landfill, Antelope Valley Landfill, or McKittrick Waste Treatment Site. Truck traffic near the Mesquite Regional Landfill would not increase because only rail delivery of waste to this site was evaluated.

Recycle Facilities. Deliveries to an assumed single recycle facility would average up to two trucks per day, assuming that all deliveries were made during 2 to 5 months in each of 2 years. The daily number of delivery trucks would be reduced if waste was shipped throughout each working year. Three facilities near SSFL were evaluated: P.W. Gillibrand, Standard Industries, and Kramer Metals. The minimal increased daily deliveries would have no impacts on traffic volume in the vicinities of any of these recycle facilities, and, thus, no socioeconomic impacts on businesses in the vicinities of these facilities.

4.12.3 Groundwater Remediation Alternatives

Impacts under the groundwater remediation alternatives are summarized and compared in **Table 4–80**.

Table 4–80 Socioeconomic Impacts under the Groundwater Remediation Alternatives

Region of Influence	*Groundwater No Action Alternative*	*Groundwater Monitored Natural Attenuation Alternative*	*Groundwater Treatment Alternative*
Los Angeles and Ventura Counties	No socioeconomic impacts are expected on employment or sales, infrastructure and municipal services, housing availability, or local government revenues.	Minimal beneficial socioeconomic impacts from worker employment and purchases of equipment and supplies. No socioeconomic impacts on businesses in the SSFL vicinity and no damage to pavement from additional traffic that could increase expenses for local governments.	Minimal beneficial socioeconomic impacts from worker employment and purchases of equipment and supplies. No socioeconomic impacts on businesses in the SSFL vicinity and minimal damage to pavement from additional traffic that could increase expenses for local governments.
Disposal facilities	No socioeconomic impacts are expected on businesses in the vicinities of the offsite waste management facilities.	Same as the Groundwater No Action Alternative.	Same as the Groundwater No Action Alternative.

4.12.3.1 Groundwater No Action Alternative

Under the Groundwater No Action Alternative, current groundwater monitoring would continue, and there would be no socioeconomic impacts in Los Angeles and Ventura Counties and the evaluated disposal facilities. The current groundwater monitoring workforce, consisting of 10 workers for 1 month each year, would continue.

4.12.3.2 Groundwater Monitored Natural Attenuation Alternative

Well installation would require a few temporary workers and a few additional truck round trips to transport equipment, supplies and waste (see Section 4.8.2.3.2). In addition, the groundwater monitoring workforce described for the Groundwater No Action Alternative would continue. Thus, there would be minimal beneficial socioeconomic impacts in Los Angeles or Ventura Counties from purchases of well installation supplies or truck driver or worker employment. There would be no socioeconomic impacts on local businesses nor damage to pavement from additional traffic. There would be no impacts on the availability of local housing and no socioeconomic impacts on businesses in the vicinities of the evaluated waste disposal facilities.

Groundwater monitoring would have no impacts on the economies of Los Angeles and Ventura Counties. Existing staff would perform monitoring tasks when needed, with no additional required employment. Purchases of monitoring equipment and analysis of samples would have minimal impacts on the economies of the two counties. Offsite shipment of purge water from groundwater monitoring would result in no socioeconomic impacts from truck driver or worker employment and no impacts on the availability of local housing. There would be no socioeconomic impacts on local businesses nor damage to pavement from additional traffic. There would be no socioeconomic impacts on businesses in the vicinities of the permitted water treatment plants receiving purge water.

4.12.3.3 Groundwater Treatment Alternative

Under the Groundwater Treatment Alternative, multiple treatment remedies may be considered for each plume. For purposes of analysis, a combination of treatment remedies was assumed that would envelope the potential collateral impacts that could result from implementing these remedies (see Section 4.10.3.2). It was assumed that heavy-duty truck shipments of waste bedrock and backfill would occur, as well as truck shipments for delivery of groundwater treatment equipment, periodic delivery of supplies, and periodic replacement of groundwater treatment media (see Section 4.8.2.3.3). Daily shipments in heavy-duty trucks, however, would be constrained in accordance with the Transportation Agreement (Boeing 2015a), and there would be no noticeable increase in traffic in the SSFL vicinity (see Section 4.8.2.3.3) with no socioeconomic impacts on local businesses. There would be minimal potential for damage to pavement on local roads.

Installation of groundwater treatment systems and removal of bedrock containing strontium-90 would require approximately 5 workers over 6 months in a single year; monitoring the performance of the installed groundwater treatment systems would be done by the same workers conducting groundwater monitoring. That is, existing staff would perform groundwater treatment and monitoring tasks when needed, with no added employment and no impacts on the availability of local housing. Purchases of groundwater treatment equipment and supplies would have minor beneficial impacts. Overall, groundwater treatment system installation and operation would have minor beneficial impacts on the economies of Los Angeles and Ventura Counties.

Assuming shipments of excavated bedrock were made over the course of a year consistent with the Transportation Agreement (Boeing 2015a), shipment of excavated bedrock to a single assumed offsite LLW or MLLW facility would occur at an average rate of less than one delivery per day. This shipment frequency would have no socioeconomic impacts on businesses in the vicinities of the evaluated LLW/MLLW disposal facilities. In addition, there would be about four offsite shipments of groundwater treatment media per month, which would have no socioeconomic impacts on businesses in the vicinities of any of the evaluated hazardous waste facilities assuming shipment of the media to these facilities.

4.12.4 Socioeconomic Impacts under All Action Alternative Combinations

Because the Building Removal Alternative is considered under all combinations of action alternatives and there is very little difference in impacts between the two groundwater action alternatives, the differences in impacts between the different combinations of action alternatives depend primarily on the soil remediation alternative being considered.

Employment

For most years under the High Impact Combination, the number of onsite workers would range from 25 to 26 workers over 12 years of operation. In addition, during 1 year there would be a need for an additional five workers over about 6 working months to install groundwater treatment equipment and remove bedrock containing strontium-90. Under the Low Impact Combination, the number of onsite workers would be 25 to 26 for 4 years, plus 6 workers in 1 year working an average of 5 days for each well to install 5 wells. In addition, for all evaluated years there would be 10 workers working an average of 1 month per year for environmental monitoring.

Under any combination of action alternatives, site activities would have a minor beneficial impact on the economy in Los Angeles and Ventura Counties by providing employment and increasing sales for industries that provide equipment, supplies, and rentals. Because workers would likely primarily originate from these two counties, new spending or economic activity in the region would be minimal.

Truck Traffic

The High Impact Combination would result in increased traffic in the SSFL vicinity over 12 years, with the most noticeable increase occurring on Woolsey Canyon Road. However, the additional vehicle traffic is not expected to result in socioeconomic impacts on businesses on this road, and traffic on other evaluated roads would increase by no more than 2.8 percent, assuming all traffic traversed each road, with minimal potential for impacts on businesses. The largest concentration of retail establishments, restaurants, and other businesses would occur on Topanga Canyon Road. The projected increase in average daily traffic (0.15 to 0.36 percent) is not expected to have noticeable impacts on businesses along this road (see Appendix H, Table H–21).

Traffic under the Low Impact Combination would increase in the SSFL vicinity, primarily over the first 4 years, with much smaller increases thereafter. Again, the additional vehicle traffic is not expected to result in socioeconomic impacts on businesses on Woolsey Canyon Road, and average daily traffic on other evaluated roads would increase by no more than 2.7 percent, assuming all traffic traversed each road, with minimal potential for socioeconomic impacts on businesses. The average daily traffic on Topanga Canyon Boulevard under the Low Impact Combination would increase by 0.15 to 0.35 percent during the first 4 years of site remediation, and by less than 0.01 percent thereafter, which is not expected to have noticeable socioeconomic impacts on businesses along Topanga Canyon Boulevard (see Appendix H, Table H–21).

Under any combination of action alternatives, the increased truck traffic would be insufficient to cause socioeconomic impacts in Los Angeles and Ventura Counties.

Infrastructure and Municipal Services

Under any combination of action alternatives, there could be damage to local roads from the potentially large number of trucks associated with remediation of Area IV and the NBZ, which could range from 20,800 heavy-duty truck round trips under the Low Impact Combination to 119,000 heavy-duty truck round trips under the High Impact Combination. Recognizing this, DOE may need to negotiate with local governments to contribute its portion of the cost for maintenance and repair of affected roads. No impacts on other municipal services are expected.

Housing

Under any combination of action alternative, workers would be primarily employed from Los Angeles and Ventura Counties with no impacts on housing availability.

Local Government Revenue

The High Impact Combination would have the largest adverse and beneficial impacts on local government revenue because increased truck traffic would occur for 12 years. The Low Impact Combination would have the smallest adverse and beneficial impacts on local government revenue because increased heavy-truck traffic would primarily occur for 4 years. Adverse impacts could result from increased expenses for pavement repair, while beneficial impacts could result from increased revenues from fuel taxes, fees, or other project expenses.

Disposal Facilities

Disposal facility impacts depend on the quantities of radioactive, hazardous, and nonhazardous wastes to be delivered. There are significant differences among the combinations of action alternatives for shipment of LLW and MLLW. As shown in Table 4–73, LLW and MLLW would be delivered to an assumed single disposal facility at average daily rates ranging from 2 to 5 deliveries for either combination of action alternatives that includes the Cleanup to AOC LUT Values Alternative, with deliveries occurring over 12 years. For combinations of action alternatives that include the Cleanup to Revised LUT Values or the Conservation of Natural Resources Alternative, deliveries would range up to 14 per day over a period of slightly more than 3 years to 4 years. Peak deliveries (14 per day) under these action alternative combinations would last for only 1 to 2 years. For the reasons given in Section 4.12.1.3, this truck traffic is not likely to have socioeconomic impacts on businesses in the vicinities of the evaluated disposal facilities.

There is almost no difference among the combinations of action alternatives for shipment of hazardous waste. Hazardous waste would be shipped under the Building Removal Alternative and in equal quantities under all soil remediation action alternatives. The only difference among all action alternatives is that very small quantities of hazardous waste (about 26 cubic yards) might be generated under the Groundwater Treatment Alternative. As shown in Table 4–73, the largest average daily truck deliveries to a single assumed hazardous waste facility would be 8 deliveries. For the reasons given in Section 4.12.1.3, this frequency of truck traffic is not likely to have socioeconomic impacts on businesses in the vicinities of the evaluated disposal facilities.

The differences among the combinations of action alternatives for shipment of nonhazardous waste are primarily due to differences in soil volumes removed under the soil remediation action alternatives. As shown in Table 4–73, under the combination of the Cleanup to AOC LUT Values, Building Removal, and Groundwater Treatment Alternatives, waste would be shipped to disposal facilities over 12 years, and the average number of heavy-duty trucks received at a single assumed waste disposal facility could range up to 25 per day. Under the combination of the Cleanup to Revised LUT Values, Building Removal, and Groundwater Treatment Alternatives, waste would be shipped to disposal facilities over slightly over 4 years, and the average number of heavy-duty trucks received at a single assumed waste disposal facility could range up to about 8 per day. Under the combination of the Conservation of Natural Resources, Building Removal, and Groundwater Treatment Alternatives, waste would be shipped to disposal facilities over 4 years, and the average number of heavy-duty trucks received at a single assumed waste disposal facility could range up to about 8 per day (Table 4–73). Assuming all nonhazardous waste was shipped to a single nonhazardous waste facility, no or minimal socioeconomic impacts would be expected on businesses in the vicinities of the facilities because of the locations of the facilities and/or the ease of access from major highways.

Deliveries to an assumed single recycle facility would average up to two trucks per day, assuming all deliveries were made during 2 to 5 months in each of 2 years. The daily number of delivery trucks would be reduced if waste was shipped throughout each working year. The minimal increased daily deliveries would have no impacts on traffic volumes in the vicinities of any of these recycle facilities, and, thus, no socioeconomic impacts on businesses in the vicinities of these facilities.

Potential socioeconomics impacts on businesses in the vicinity of any single facility accepting recycle material or radioactive, hazardous, or nonhazardous waste for disposal are minimal (at worst) and may be further reduced by shipping waste to multiple authorized facilities; by using multiple routes (as available) for delivery to individual facilities; or by shipping waste by rail to rail-accessible disposal facilities.

4.12.5 Impact Threshold Analysis

Socioeconomic impacts were evaluated relative to the economies in Los Angeles and Ventura Counties and the counties where the disposal and recycle facilities are located. An impact threshold for Los Angeles County would be crossed if adverse impacts were determined for any of the thresholds for the socioeconomic resource area that are summarized in Table 4–2 and addressing employment, truck traffic, infrastructure and municipal, housing, and local government impacts. It is not expected that an impact threshold would be crossed, except that increased truck traffic could contribute to pavement deterioration along some of the evaluated roads. The degree of pavement deterioration depends on the action alternative and would be largest under the Cleanup to AOC LUT Values Alternative. An impact threshold for the evaluated recycle and disposal facilities is one where increased truck traffic could adversely impact the sales and revenues of local businesses. It is not expected that an impact threshold would be crossed, because the potential for adverse socioeconomic impacts in the vicinities of the evaluated disposal facilities ranges from none to minimal, and the minimal impacts that may occur in the vicinities of some analyzed facilities may be reduced by use of multiple routes for trucks to and from SSFL, use of multiple waste disposal facilities, use of multiple routes (as available) for delivery to individual disposal facilities, or use of rail transportation to rail-accessible facilities.

4.13 Environmental Justice

This section evaluates the potential for disproportionately high and adverse environmental justice impacts on Native American tribes and minority and low-income populations. Environmental justice is the fair treatment of people of all races, income, and cultures with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Environmental justice communities are defined in Chapter 3, Section 3.13.1.

SSFL and Regional Regions of Influence

Impacts were analyzed for the SSFL ROI and for the ROIs for the representative recycle and waste disposal facilities (regional ROIs). The SSFL ROI comprises the census tracks and block groups encompassing and adjacent to the SSFL property and the roads between SSFL and major highways. It includes census tracts and block groups within approximately 1 mile of the SSFL boundary. The regional ROIs include the census tracts near the evaluated recycle or waste disposal facilities, particularly the routes in the vicinities of the recycle and waste disposal facilities that may be traversed by heavy-duty trucks delivering material or waste to these facilities.

Minority and low-income populations within the SSFL ROI are described in Chapter 3, Section 3.13.1. **Table 4–81** summarizes minority and low-income populations for the recycle and disposal facilities evaluated in the regional ROIs. The values for the minority and low-income columns indicate the population percentages in the evaluated census tracks for the listed facilities, with values given in **bold** notation for minority populations exceeding 50 percent and low-income populations exceeding 20 percent. This table was compiled from data in Section 3.13.2.

As indicated in Table 4–81, neither minority nor low-income communities are present in the census tracts near the Buttonwillow, McKittrick, US Ecology in Idaho, and P.W. Gillibrand facilities; therefore, no environmental justice impacts are expected in the populations near these facilities.

In addition, no minority communities live in the vicinities of the two evaluated LLW/MLLW disposal facilities (Energy*Solutions* in Utah and NNSS). However, low-income communities live in the vicinities of both sites, although neither facility is located near heavily populated residential or urban areas. In addition, both facilities may be accessed directly from major highways, which would minimize the potential for traffic impacts.

There are both minority and low-income communities living in the vicinity of the Westmorland Landfill; however, this facility may be accessed directly from a major highway, which would minimize the potential for traffic impacts.

Table 4–81 Minority and Low-Income Populations in the Regional Regions of Influence

Facility	*Waste or Material Evaluated*	*Minority (population percent)*	*Low-Income (population percent)*
Waste Disposal Facilities in California			
Antelope Valley	Nonhazardous soil and debris	**62.8**	6.8
Chiquita Canyon	Nonhazardous soil and debris	**63.9**	**20.4**
Mesquite [a]	Nonhazardous soil and debris	6.0	**32.3**
Buttonwillow	Hazardous waste, asbestos-containing material, and nonhazardous soil and debris	40.6	9.1
Westmorland	Hazardous waste, asbestos-containing material, and nonhazardous soil and debris	**80.8**	**23.7**
McKittrick	Nonhazardous soil and debris	40.6	9.1
Waste Disposal Facilities Outside California			
US Ecology in Idaho [b]	Hazardous waste and asbestos-containing material	31.3	19.2
Energy*Solutions* in Utah [b]	LLW and MLLW	49.3	**23.0**
NNSS [b]	LLW and MLLW	29.6/12.6 [c]	**31.9**/9.7 [c]
Recycle Facilities in California [d]			
Kramer Metals	Nonhazardous recycle material	**99.0**	26.2
Standard Industries	Nonhazardous recycle material	**51.0**	7.6
P.W. Gillibrand	Nonhazardous recycle material	31.8	6.45

LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; NNSS = Nevada National Security Site.
[a] Waste delivery by the truck/rail option only.
[b] Waste delivery by the truck option, as well as the truck/rail option.
[c] The values are for census tracts 9603 and 9604.01, respectively.
[d] Waste disposal does not occur at the three listed recycle facilities; some of the listed nonhazardous waste disposal facilities also conduct recycle operations.
Source: Census 2013a, 2013b.

As noted in Chapter 3, Section 3.13.1.1, Native Americans are considered in all minority counts as defined by the U.S. Census. In addition, based on the 2010 U.S. Census, no federally recognized tribes or Indian Trust Assets are present within the SSFL ROI or the regional ROIs (Census 2010d). See Chapter 3, Section 3.11, and Section 4.11 for additional information on cultural resources at Area IV and the NBZ.

Method of Analysis

The method used to evaluate the potential environmental justice impacts of the alternatives is described in Appendix B, Section B.13. For most of the resource areas evaluated in this EIS, remediation activities would result in few, if any, impacts on persons in the SSFL ROI or the regional ROI. For example, although remediation activities would require the use of heavy equipment that would generate noise that could be perceived by nearby residents, the increased noise is not expected to be disruptive (see Section 4.7). If impacts are not high in the SSFL ROI, then there would be no disproportionately high and adverse impacts to environmental justice communities in the SSFL ROI.

Therefore, the environmental justice analysis evaluates: (1) the impacts on human health among members of the public; and (2) the impacts of increased traffic (including trucks and other vehicles) due to remediation activities. The evaluation of impacts on human health focuses on radiation doses and risks and chemical risks that could occur due to building removal, soil remediation, or groundwater remediation. No alternative would result in emissions of pollutants such as nitrogen oxides, sulfur dioxide, carbon monoxide, or particulates that could materially contribute to exceedance of an NAAQS (see Section 4.6).

Increased traffic is used as an indicator of multiple, potentially detrimental, traffic-related conditions, including congestion resulting in travel difficulties; ease of access to desired destinations; increased noise; increased risk of traffic accidents; and increased emissions of pollutants from vehicles. That is, the more traffic, the greater the potential for these traffic-related conditions to adversely impact members of the public, including members of environmental justice communities. For the regional ROIs, the environmental justice analysis evaluates the impacts of increased traffic within the facility vicinities.

Although Native American tribes or minority or low-income populations may exist along the major highways between SSFL and the evaluated recycle and disposal facilities, it was assumed that once trucks access a major highway, they would represent only a small fraction of the total traffic on that highway. Therefore, it was also assumed that the action alternatives would not create any disproportionately high and adverse impacts on environmental justice communities in the vicinities of these major highways.

4.13.1 Soil Remediation Alternatives

Impacts under the soil remediation alternatives are summarized and compared in **Table 4–82**.

4.13.1.1 Soil No Action Alternative

Human Health

Soil remediation pursuant to the 2010 AOC (DTSC 2010a) would not occur. As discussed in Section 4.9.2.1, members of the public would be restricted from accessing the site through fencing, signage, and routine visits by site security personnel. The annual radiation doses that could be received by a hypothetical future onsite suburban resident (assuming a breakdown in site stewardship 100 years in the future) and a current recreational user would each represent only fractions of DOE's limit in DOE Order 458.1 for members of the public of 100 millirem in a year. These radiation doses are dominated by doses from naturally occurring radioisotopes from uranium and thorium decay chains. Because of the variability in natural background from location to location, there would be less chance of a chemically or radiologically induced cancer incidence or death than that from average background soil. The incremental noncarcinogenic hazard index would be much less than one. Because of this, there would be no disproportionately high and adverse impacts on Native American tribes and minority and low-income populations in the SSFL ROI.

Traffic

No traffic impacts are expected above baseline conditions in the SSFL ROI and regional ROIs. Therefore, no disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI and the regional ROIs.

Table 4–82 Environmental Justice Impacts under the Soil Remediation Alternatives

Region of Influence	*Resource Area*	*Soil No Action Alternative*	*Soil Remediation Action Alternatives*		
			Cleanup to AOC LUT Values	*Cleanup to Revised LUT Values*	*Conservation of Natural Resources*
SSFL	Human health	Annual radiation doses received by a hypothetical future (after 100 years) onsite suburban resident or hypothetical current recreational user would represent fractions of DOE's limit in DOE Order 458.1, *Radiation Protection of the Public and the Environment*, for members of the public of 100 millirem in a year, and are dominated by doses from naturally occurring radioisotopes. The risk of chemically or radiologically induced cancer incidence or death from man-made activity would be less than that from average background soil. The incremental noncarcinogenic hazard index would be much less than 1. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI.	After remediation is complete, risks to an onsite suburban resident or recreational user from exposure to chemical and radioactive constituents in soil would be less than those under the Soil No Action Alternative. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI.	After remediation is complete, risks to a hypothetical onsite suburban resident or recreational user would be less than those under the Soil No Action Alternative, but higher than those under the Cleanup to AOC LUT Values Alternative. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI.	After remediation is complete, risks to a hypothetical suburban resident or recreational user would be less than those under the Soil No Action Alternative, but higher than those under the Cleanup to AOC LUT Values and slightly higher than those under the Cleanup to Revised LUT Values Alternative. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI.
	Traffic	No traffic impacts are expected in the SSFL ROI above baseline conditions. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI.	During the 10 years of soil removal, weekday traffic in the SSFL ROI would increase but the evaluated routes would traverse minority and non-minority communities, as well as low-income and non-low-income communities, and would not pass through Native American lands. This indicates that traffic impacts on Native American, minority, or low-income populations would be the same as those experienced by the general population. Therefore, no disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI.	Same as the Cleanup to AOC LUT Values Alternative, except that soil removal and associated increased traffic would occur for slightly more than 2 years rather than 10 years.	Same as the Cleanup to AOC LUT Values Alternative, except that soil removal and associated increased traffic would occur for 2 years rather than 10 years.

Region of Influence	Resource Area	Soil No Action Alternative	Soil Remediation Action Alternatives		
			Cleanup to AOC LUT Values	Cleanup to Revised LUT Values	Conservation of Natural Resources
Regional (disposal facilities)	Traffic	No traffic impacts are expected in the regional ROIs above baseline conditions. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the regional ROIs.	There would be no noticeable increase in traffic in the vicinities of the disposal facilities evaluated for receipt of radiologically contaminated or hazardous soil, and no or minimal impacts in the vicinities of the facilities evaluated for receipt of nonhazardous soil. By using multiple disposal facilities or rail transport to rail-accessible facilities, traffic in the vicinities of the evaluated disposal facilities would be reduced. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the regional ROIs.	Larger traffic increases in the regional ROIs for radioactive and hazardous waste disposal facilities compared to the Cleanup to AOC LUT Values Alternative, but traffic increases in the regional ROIs of the nonhazardous waste facilities would be much smaller. Increased traffic would occur for a much shorter duration than that under the Cleanup to AOC LUT Values Alternative. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the regional ROIs.	Similar traffic increases in the regional ROIs for radioactive, hazardous, and nonhazardous waste disposal facilities as the Cleanup to Revised LUT Values Alternative, except that increased traffic to radioactive waste facilities would occur for a shorter duration. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the regional ROIs.

AOC = *Administrative Order on Consent for Remedial Action*; LUT = Look-Up Table; ROI = region of influence.

4.13.1.2 Cleanup to AOC LUT Values Alternative

4.13.1.2.1 Santa Susana Field Laboratory Region of Influence

Human Health

After remediation is complete, impacts on an onsite suburban resident or recreational user from exposure to chemical and radioactive constituents in soil would be less than those under the Soil No Action Alternative. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI.

Traffic

Traffic to or from Area IV would use Woolsey Canyon Road. As indicated in Section 4.8.2.1.2, the projected increase in average daily traffic on this road (up to 7.3 percent) could cause a change in its LOS rating, with weekday motorist delays (or perception of delays) on this road and at its intersection with Valley Circle Boulevard during the hours of waste and backfill shipment. The largest increase in average daily traffic on the remaining evaluated roads would be less than 2 percent, which is not expected to change their LOS ratings.

Although some traffic-related impacts could occur, the routes between SSFL and major highways would traverse minority and non-minority communities, as well as low-income and non-low-income communities, and would not pass through Native American lands. This indicates that any traffic-related impacts on Native American, minority, and low-income populations would be the same as those experienced by the general population. Other than Woolsey Canyon Road, traffic volumes on affected roads may be reduced by using multiple routes to major highways. Therefore, the alternative is not expected to have disproportionately high and adverse impacts on Native American tribes and minority and low-income populations in the SSFL ROI.

4.13.1.2.2 Regional Regions of Influence

Waste shipments would represent only small fractions of the daily acceptance limits, if any, of the evaluated radioactive and hazardous waste disposal facilities (see Section 4.10.1.2). This indicates that deliveries would be within the daily ranges normally experienced at these facilities. In addition, as addressed in Section 4.12.1.2, the number of average daily shipments to the evaluated facilities would be insufficient to cause noticeable increases in traffic in the facility ROIs, with no expected traffic impacts.

Truck shipments of nonhazardous soil from SSFL would average up to 25 per day during 9 years of soil removal and 16 per day during the final year of soil removal. Shipments would be in compliance with DOT regulations and the authorized requirements of the facilities receiving the waste. Waste deliveries would represent fractions of the daily acceptance limits of any of the evaluated facilities. Because there is little risk of exceeding the permitted acceptance limits, there would be little risk of truck traffic in the facility vicinity exceeding the current range in daily traffic levels. In addition, of the evaluated nonhazardous waste facilities, only the Antelope Valley, Chiquita Canyon, and Westmorland Landfills have ROI minority populations exceeding 50 percent and/or low-income populations exceeding 20 percent (see Table 4–81). (The Mesquite Regional Landfill has an ROI low-income population exceeding 20 percent, but only rail traffic is evaluated for waste delivery to this facility.) As addressed in Section 4.12.1.2, both the Chiquita Canyon and Westmorland Landfills are directly accessible from four-lane highways (either divided or with turning lanes). Increased traffic would not be expected to noticeably increase traffic volume on these highways. Regarding the Antelope Valley Landfill, the increase in traffic on Route 14 near the facility would be only about 0.072 percent and would not change its LOS rating. The likely local route between Route 14

(Avenue S exit) and the landfill would traverse a four-lane road for a portion of the route and would then pass through a low-population-density area. Traffic impacts, therefore, would be minimal.

Given the above considerations, increased traffic would result in no or minimal impacts on Native American, low-income, or minority populations in the ROIs of the evaluated disposal facilities. Furthermore, the number of truck deliveries to any evaluated facility may be reduced if multiple disposal facilities were used, if multiple routes (as available) were used in the vicinities of individual facilities, or if waste were shipped to one or more rail-accessible facilities. Thus, the alternative is not expected to have disproportionately high and adverse impacts on Native American tribes and minority and low-income populations in the regional ROIs for the evaluated facilities.

4.13.1.3 Cleanup to Revised LUT Values Alternative

4.13.1.3.1 Santa Susana Field Laboratory Region of Influence

Human Health

After remediation is complete, potential impacts on an onsite suburban resident or recreational user would be the same as those under the Cleanup to AOC LUT Values Alternative. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations.

Traffic

As indicated in Section 4.8.2.1.3, soil removal would increase weekday average daily traffic on Woolsey Canyon Road by 7.2 to 7.3 percent during 2 years, and by 0.23 percent in a subsequent year. The projected increase in traffic on this road could change its LOS rating, with motorist delays during weekdays during the hours of waste and backfill shipment. The largest increase in average daily traffic on the remaining evaluated roads would be less than 2 percent. These increases would not cause noticeable changes to traffic volumes on these remaining roads or their current LOS ratings.

Although some traffic-related impacts could occur, the routes would traverse minority and non-minority communities, as well as low-income and non-low-income communities, and would not pass through Native American lands. This indicates that any traffic-related impacts on Native American, minority, or low-income populations would be the same as those experienced by the general population. Other than Woolsey Canyon Road, traffic volumes on affected roads can be reduced by using multiple routes to major highway systems.

Therefore, the alternative is not expected to have a disproportionately high and adverse effect on Native American tribes and minority and low-income populations in the SSFL ROI.

4.13.1.3.2 Regional Regions of Influence

As addressed in Section 4.12.1.3, this alternative could result in 14 daily shipments to an assumed single LLW/MLLW disposal facility during 2 years. Although the ROI for Energy*Solutions* in Utah has a low-income population exceeding 20 percent, and the NNSS ROI has a minority population exceeding 50 percent, both facilities are directly accessible from access-controlled divided highways. The projected waste shipments would not be expected to noticeably increase traffic volumes on these highways, with no expected traffic impacts. As addressed in Section 4.12.1.3, this alternative could result in an increase during 2 years of about 7 daily shipments to an assumed single hazardous waste disposal facility. Of these facilities, only the Westmorland Landfill ROI has a minority population exceeding 50 percent or a low-income population exceeding 20 percent. This landfill is in a sparely populated area and can be directly accessed from Highway 78. Traffic volume on this highway is thus not expected to noticeably increase, with no expected traffic impacts.

Assuming all nonhazardous waste was sent to a single disposal facility, potential traffic impacts would be significantly reduced compared to those evaluated under the Cleanup to AOC LUT Values Alternative (Section 4.13.1.2.2). Rather than up to 25 average daily trucks arriving at a single assumed disposal facility over 9 years, there would be an average of 8 daily trucks during only 2 years (with a few deliveries during a following year). Therefore, possible increased traffic volume at the evaluated facilities would be about a third of those for the Cleanup to AOC LUT Values Alternative (which was determined to result in no or minimal traffic impacts)

Given the above considerations, increased traffic would result in no or minimal impacts on Native American, low-income, or minority populations in the ROIs of the evaluated disposal facilities. Furthermore, the number of truck deliveries to any evaluated facility may be reduced if multiple disposal facilities were used, if multiple routes (as available) were used in the vicinities of individual facilities, or if waste were shipped to one or more rail-accessible facilities. Thus, the alternative is not expected to have disproportionately high and adverse impacts on Native American tribes and minority and low-income populations in the regional ROIs for the evaluated facilities.

4.13.1.4 Conservation of Natural Resources Alternative

4.13.1.4.1 Santa Susana Field Laboratory Region of Influence

Human Health

After remediation is complete, potential impacts on an onsite suburban resident or recreational user from exposure to chemical and radioactive constituents in soil would be less than those under the Soil No Action Alternative, but greater than those under the Cleanup to AOC LUT Values Alternative. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations.

Traffic

Soil removal could increase weekday average daily traffic on Woolsey Canyon Road by 7.2 percent during a single year, and by 5.1 percent in a subsequent year. The projected increase in traffic could change the LOS rating for this road, with weekday motorist delays during the hours of waste and backfill shipment. The largest increase in average daily traffic on the remaining evaluated roads would be less than 2 percent. These increases would not cause noticeable changes to traffic volumes on these roads or their current LOS ratings.

Although some traffic-related impacts could occur, the routes would traverse minority and non-minority communities, as well as low-income and non-low-income communities, and would not pass through Native American lands. This indicates that any traffic-related impacts on Native American, minority, or low-income populations would be the same as those experienced by the general population. Other than Woolsey Canyon Road, traffic volumes on affected roads can be reduced by using multiple routes to major highway systems.

Therefore, the alternative is not expected to have a disproportionately high and adverse effect on Native American tribes and minority and low-income populations in the SSFL ROI.

4.13.1.4.2 Regional Regions of Influence

As addressed in Section 4.12.1.4 under the Conservation of Natural Resources Alternative, the projected increase in traffic in the ROI of a single assumed LLW/MLLW facility would occur over about half as many years as that under the Cleanup to Revised LUT Values Alternative. Rather than a single assumed LLW/MLLW facility receiving an average of 14 daily truck deliveries during 2 years, under the Conservation of Natural Resources Alternative, this same facility would receive an average of 14 daily deliveries for only 1 year. (In a subsequent year the average daily delivery would be less than 1.) Average daily deliveries to a single assumed hazardous waste facility or a single assumed nonhazardous waste facility would be the same as those for the Cleanup to Revised LUT Values Alternative.

Therefore, increased traffic would result in no or minimal impacts in the ROIs of the evaluated disposal facilities. Furthermore, the number of truck deliveries to any evaluated facility may be reduced if multiple disposal facilities were used, if multiple routes (as available) were used in the vicinities of individual facilities, or if waste were shipped to one or more rail-accessible facilities. Thus, the alternative is not expected to have disproportionately high and adverse impacts on Native American tribes and minority and low-income populations in the regional ROIs for the evaluated facilities.

4.13.2 Building Demolition Alternatives

Impacts under the building demolition alternatives are summarized and compared in **Table 4–83**.

Table 4–83 Environmental Justice Impacts under the Building Demolition Alternatives

Region of Influence	*Resource Area*	*Building No Action Alternative*	*Building Removal Alternative*
SSFL	Human health	No human health impacts are expected on members of the public because access to the Area IV buildings is restricted. There would be no disproportionately high and adverse impacts on Native American tribes and minority and low-income populations in the SSFL ROI.	Following building removal, there would be no human health impacts on members of the public in the SSFL ROI; therefore, no disproportionately high or adverse impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI.
	Traffic	No traffic impacts in the SSFL ROI are expected above baseline conditions. There would be no disproportionately high or adverse impacts on Native American tribes and minority and low-income populations in the SSFL ROI.	There could be a change in the LOS of Woolsey Canyon Road from a B rating to a C rating, assuming waste and backfill was shipped during 2 to 5 months in each working year, but no change if shipments were distributed over the entirety of each working year. There would be no change in the LOS rating for other evaluated roads between SSFL and major highways. Because the routes would traverse minority and non-minority communities as well as low-income and non-low-income communities, and would not pass through Native American lands, potential traffic impacts on Native American, minority, or low-income populations would be the same as those experienced by the general population. Therefore, no disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI.
Regional (recycle and disposal facilities)	Traffic	No traffic impacts in the regional ROIs are expected above baseline conditions. There would be no disproportionately high or adverse impacts on Native American tribes and minority and low-income populations in the regional ROIs.	There would be no noticeable increase in heavy-duty truck traffic in the vicinities of the evaluated recycle and waste disposal facilities. Nonetheless, use of multiple facilities or rail transport to rail-accessible facilities would reduce truck traffic in the vicinities of the evaluated facilities. Therefore, no disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the regional ROIs.

LOS = level of service; ROI = region of influence.

4.13.2.1 Building No Action Alternative

Human Health

No DOE-owned buildings would be removed. As addressed in Section 4.9.3.1, no impacts are expected on members of the public because the radioactive contamination at Area IV would be contained within the buildings, or under pavement outside the buildings, and access to the buildings is restricted by fencing, locks on building doors, and site personnel. Because there would be no health impacts on members of the public in the SSFL ROI, no disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI.

Traffic

Traffic would not increase in the SSFL ROI or regional ROIs above baseline conditions. Because there would be no traffic impacts, no disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI and the regional ROIs.

4.13.2.2 Building Removal Alternative

4.13.2.2.1 Santa Susana Field Laboratory Region of Influence

Human Health

Following removal of the DOE-owned buildings, there would be no impacts attributable to the buildings to an onsite suburban resident or recreational user (see Section 4.9.3.2). Therefore, no disproportionately high and adverse impacts are expected on Native American and minority and low-income populations.

Traffic

Traffic to and from Area IV would use Woolsey Canyon Road. As indicated in Section 4.8.2.2.2, assuming waste and backfill was shipped to or from Area IV during a 2- to 5-month period in each of 2 years, the projected increase in weekday average daily traffic (3.4 percent in the first year of building removal and 5.3 percent in the second year) could change the LOS for this road from a B rating to a C rating, with weekday motorist delays during the hours of waste and backfill shipment. The largest increase in weekday traffic on the remaining evaluated roads would be less than 2 percent, which would not cause noticeable changes to traffic volumes on these roads or change their LOS ratings. If waste and backfill were instead shipped throughout each working year, the average daily traffic on Woolsey Canyon Road would increase by less than 1 percent, with smaller increases on other evaluated routes between SSFL and major highways. In this case, no evaluated road would experience a change in its LOS rating.

Although some traffic impacts are possible, depending on shipment scheduling, the routes would traverse minority and non-minority communities, as well as low-income and non-low-income communities, and would not pass through Native American lands. This indicates that any traffic impacts on Native American, minority, or low-income populations would be the same as those experienced by the general population. Other than Woolsey Canyon Road, traffic volumes on the evaluated roads can be reduced by using multiple routes to major highway systems.

Therefore, the alternative is not expected to have disproportionately high and adverse impacts on Native America tribes and minority and low-income populations in the SSFL ROI.

4.13.2.2.2 Regional Regions of Influence

As described in Section 4.12.2.2, this alternative would not result in noticeable increases in heavy-duty truck traffic in the vicinities of the evaluated recycle and waste disposal facilities. Nonetheless, use of multiple facilities or rail transport to rail-accessible facilities would reduce truck traffic in the vicinities of the evaluated facilities. Therefore, the alternative is not expected to have disproportionately high and adverse impacts on Native American tribes and minority and low-income populations in the regional ROIs.

4.13.3 Groundwater Remediation Alternatives

Impacts under the groundwater remediation alternatives are summarized and compared in **Table 4–84**.

Table 4–84 Environmental Justice Impacts under the Groundwater Remediation Alternatives

Region of Influence	*Resource Area*	*Groundwater No Action Alternative*	*Groundwater Monitored Natural Attenuation Alternative*	*Groundwater Treatment Alternative*
SSFL	Human Health	No health impacts are expected on members of the public. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI.	Same as the Groundwater No Action Alternative.	Same as the Groundwater No Action Alternative.
	Traffic	No traffic is expected above baseline conditions. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI.	Because the increase in average daily traffic on the evaluated roads is very small (much less than 1 percent), no traffic impacts are expected. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI.	The increase in average daily traffic on the evaluated roads would be slightly greater than that under the Groundwater Monitored Natural Attenuation Alternative, but the peak-year increase would still average less than 1 percent, with no expected traffic impacts. Therefore, no disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI.
Regional (disposal facilities)	Traffic	No traffic is expected above baseline conditions. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the regional ROIs.	There would be no noticeable increase in traffic in the vicinity of any facility receiving waste under this alternative, with no expected traffic impacts. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the regional ROIs.	There would be no noticeable increase in traffic in the vicinity of any facility receiving waste under this alternative, with no expected traffic impacts. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the regional ROIs.

ROI = regional of influence.

4.13.3.1 Groundwater No Action Alternative

Human Health

Under the Groundwater No Action Alternative, current groundwater monitoring would continue. As discussed in Section 4.9.4.1, this alternative is not expected to result in impacts to the health of members of the public. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI.

Traffic

No traffic is expected above baseline conditions in the SSFL ROI and the ROIs of the evaluated disposal facilities. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI and the regional ROIs.

4.13.3.2 Groundwater Monitored Natural Attenuation Alternative

4.13.3.2.1 Santa Susana Field Laboratory Region of Influence

Human Health

Potential health impacts on members of the public would be the same as those under the Groundwater No Action Alternative. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI.

Traffic

The weekday average daily traffic on Woolsey Canyon Road would increase by 0.16 percent during 1 year (see Appendix H, Table H–20). Traffic volumes would be smaller on this road during other years when implementing the alternative and on other roads between SSFL and major highways. These increases would be unnoticeable and would not result in traffic-related impacts. Thus, no disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI.

4.13.3.2.2 Regional Regions of Influence

Traffic

There would be five shipments of well installation cuttings to offsite nonhazardous waste facilities and five shipments of well installation water to a permitted wastewater treatment plant in accordance with its waste acceptance criteria. Even if all shipments occurred within a single year, there would be no noticeable increase in traffic in the vicinity of any facility receiving nonhazardous waste or purge water, with no traffic-related impacts. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the regional ROIs.

4.13.3.3 Groundwater Treatment Alternative

4.13.3.3.1 Santa Susana Field Laboratory Region of Influence

Human Health

Impacts would be the same as those under the Groundwater No Action Alternative. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI.

Traffic

The average daily traffic on the evaluated roads would be slightly increased compare to that under the Groundwater Monitored Natural Attenuation Alternative, but the peak-year increase in weekday average daily traffic would still average less than 1 percent on any evaluated road, which would be essentially unnoticeable. Because there would be no traffic-related impacts, no disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI.

4.13.3.3.2 Regional Regions of Influence

Traffic

Shipments of waste under this alternative would primarily consist of excavated bedrock delivered to radioactive waste facilities. Conservatively assuming all of this radioactive waste were shipped off site during the projected period of bedrock excavation and sent to a single disposal facility, there could be an average of approximately six daily shipments to that facility, which is less than half that evaluated under the Cleanup to Revised LUT Values and Conservation of Natural Resources Alternatives (see Sections 4.13.1.3.2 and 4.13.1.4.2). Assuming that shipments would be more widely spaced throughout a single year, the average daily delivery rate at any single facility would be lower. (If the waste was shipped throughout the working year, the average daily delivery rate would be about 0.5 per day, or one delivery every other working day.) No noticeable increase in traffic is expected in the ROI of any evaluated facility, with no traffic-related impacts. Therefore, no disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the regional ROIs.

Assuming groundwater treatment media were shipped periodically from SSFL to a hazardous waste facility, there would be approximately four truck shipments per month, which would not result in traffic-related impacts at any of the evaluated hazardous waste facilities. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the regional ROIs.

4.13.4 Environmental Justice Impacts under All Action Alternative Combinations

4.13.4.1 Santa Susana Field Laboratory Region of Influence

Human Health

Under any combination of action alternatives, the risks to a member of the public of both the incidence of cancer and a cancer fatality would be dominated by impacts from background levels of chemical and radioactive constituents. Therefore, there would be no disproportionately high and adverse impacts on Native American tribes and minority and low-income populations.

Traffic

Under the High Impact Combination, the largest increase in weekday traffic would occur on Woolsey Canyon Road, where over 12 years, the average daily traffic would conservatively increase by 3.4 to 7.6 percent (see Appendix H, Table H–21). This projected increase could change the LOS rating for this road, with motorist delays during weekdays during the hours of waste and backfill shipment. If both groundwater remediation action alternatives were implemented, there would be essentially the same increase in average daily traffic as those presented above, with the same potential impacts.

Under the Low Impact Combination, the largest increase in weekday traffic would occur on Woolsey Canyon Road, where over 4 years, the average daily traffic would conservatively increase by 3.5 to 7.4 percent during 4 years (see Appendix H, Table H–21). Thereafter, there would be small numbers of annual shipments of purge water and environmental samples associated with groundwater monitoring. The annual impacts would be similar to those for the High Impact Combination but the impact duration would be much shorter.

To summarize, all combinations of action alternatives would increase traffic levels on Woolsey Canyon Road, with much smaller increases on other evaluated roads between SSFL and major highways. However, the evaluated routes would traverse minority and non-minority communities, as well as low-income and non-low-income communities, and would not pass through Native American lands. This indicates that impacts on Native American, minority, or low-income populations would be the same as those experienced by the general population. Other than Woolsey Canyon Road, traffic volumes on the evaluated roads can be reduced by using multiple routes to major highway systems. No disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI.

4.13.4.2 Regional Regions of Influence

Traffic

Regional environmental justice impacts depend on the quantities of radioactive, hazardous, and nonhazardous wastes that would be delivered to the disposal facilities and the schedules for these deliveries.

There is a significant difference among the combinations of action alternatives regarding the shipped quantities of radioactive waste, primarily resulting from differences in soil removals under the soil remediation action alternatives. As shown in Table 4–73, total volumes could range from 57,600 cubic yards to 103,000 cubic yards, and the average daily deliveries to a single assumed LLW/MLLW facility could range from less than 1 to about 14. As discussed in Sections 4.13.1.2.2, 4.13.1.3.2, and 4.13.1.4.2, even if all waste deliveries were made to a single LLW/MLLW disposal facility, the projected frequency of truck traffic would not result in noticeable traffic-related impacts in the ROI for that facility.

There is almost no difference among the combinations of action alternatives regarding the total quantity of hazardous waste (about 26 cubic yards of waste), although the daily deliveries to the evaluated disposal facilities would differ as would the duration of the deliveries. As discussed in Sections 4.13.1.2.2, 4.13.1.3.2, and 4.13.1.4.2, even if all waste deliveries were made to a single hazardous waste disposal facility, the projected frequency of truck traffic (up to 8 truck deliveries per day) would not result in noticeable traffic-related impacts in the ROI for that facility.

There are significant differences among the combinations of action alternatives for shipped quantities of nonhazardous waste; these differences primarily result from differences in the soil volumes removed under the soil remediation action alternatives. As shown in Table 4–73, under the combination of the Cleanup to AOC LUT Values Alternative, Building Removal Alternative, and either groundwater remediation action alternative, about 794,000 cubic yards of nonhazardous waste (soil, debris, etc.) would be shipped to disposal facilities over 12 years. The average number of heavy-duty trucks received at nonhazardous sites could range up to 25 per day. As addressed in Section 4.13.1.2.2, the potential impacts of increased traffic in the vicinities of those facilities with low-income or minority populations in their ROIs would be none to minimal.

As shown in Table 4–73, under the combination of the Cleanup to Revised LUT Values or Conservation of Natural Resources Alternative, the Building Removal Alternative, and either groundwater remediation action alternative, about 53,200 cubic yards of nonhazardous waste would be generated. This waste would be shipped to disposal facilities over approximately 4 years. The average number of heavy-duty trucks delivered to a single assumed nonhazardous waste facility could be up to 8 per day during 2 years; daily deliveries during other years would be smaller. This frequency of truck traffic likely would not result in significant traffic-related impacts in the ROI for that facility.

As shown in Table 4–73, under any combination of action alternatives, about 3,540 cubic yards of recycle material would be shipped to recycle facilities during 2 years of building demolition. As addressed in Section 4.12.4, the minimal increased daily deliveries would have no impacts on traffic volumes in the vicinities of any of these recycle facilities.

The number of truck deliveries to any single facility may be reduced if multiple facilities were used, if multiple routes (as available) were used in the vicinities of individual facilities, or if waste were shipped to one or more rail-accessible disposal facilities. Considering this and the above analysis, no combination of action alternatives would have disproportionately high and adverse impacts on Native American tribes and minority and low-income populations in the regional ROIs for the evaluated recycle and disposal facilities.

4.13.5 Impact Threshold Analysis

An impact threshold would be crossed if it were determined that there could be disproportionately high and adverse impacts on Native American tribes or minority or low-income populations. As addressed in Section 4.9, for any alternative or combination of action alternatives, the incidence of cancer or a cancer fatality to a member of the public following Area IV remediation would be very low and dominated by impacts from background levels of radioactive and chemical constituents.

Because the risks would not create disproportionately high and adverse impacts on any evaluated environmental justice group, the impact threshold would not be exceeded.

Although traffic could increase on the evaluated roads resulting from DOE activities at Area IV, the evaluated routes would traverse minority and non-minority communities, as well as low-income and non-low-income communities, and would not pass through Native American lands. This indicates that impacts on Native American, minority, or low-income populations would be the same as those experienced by the general population. Thus, no disproportionately high and adverse impacts are expected on Native American tribes and minority and low-income populations in the SSFL ROI.

Traffic would be increased at the evaluated recycle and disposal facilities; however, these increases would be minimal. Considering this and measures that may be implemented to minimize impacts at any single affected facility (e.g., by shipping waste to multiple facilities), no noticeable increase in traffic would be expected at any evaluated facility. Thus, no disproportionately high and adverse effect are expected on Native American tribes and minority and low-income populations in the regional ROIs.

4.14 Sensitive-aged Populations

This section evaluates the potential for disparate (i.e., markedly distinct) impacts resulting from implementing the alternatives on sensitive-aged populations, including children under 18 years and persons 65 years and over.

As discussed in Chapter 3, Section 3.14, Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, addresses the increasing concern to protect children from environmental hazards. In addition, Section 3.14 reviews similar concerns for aging populations. Methods used to evaluate the potential impacts on sensitive-aged populations are described in Appendix B, Section B.14.

This section focuses on the impacts of increased traffic due to remediation activities near areas such as schools or recreation areas with high concentrations of sensitive-aged populations. Similar to the discussion in Section 4.13 for Native American tribes and minority and low-income populations, for most of the resource areas evaluated in this EIS, remediation activities would result in minimal, if any, impacts on sensitive-aged persons. Although Section 4.13 identified human health in the SSFL ROI for environmental justice consideration, the ensuing analysis determined that for any alternative or combination of action alternatives, the incidence of cancer or a cancer fatality to a member of the public following Area IV and NBZ remediation would be very low and dominated by impacts from background levels of chemical and radioactive constituents. Because of this, there would be no disproportionately high and adverse impacts on Native American tribes and minority and low-income populations. By similar reasoning, there would be no disparate impacts on sensitive-aged populations.[40]

This section, therefore, focuses on increased traffic as an indicator of multiple, potentially detrimental, traffic-related conditions, including congestion resulting in travel difficulties; ease of access to desired destinations; increased noise; increased risk of traffic accidents; and increased emissions of pollutants from vehicles. Special consideration is given to truck transport routes in proximity to schools and recreation areas where children are likely to be present.

[40] The assessments of impacts to hypothetical receptors in Section 4.9 considered age-weighted exposure estimates including receptors under age 18.

Like the environmental justice analysis, there are multiple ROIs for sensitive-aged populations: an SSFL (site-specific) ROI and a group of ROIs for the representative recycle and waste disposal facilities (regional ROIs). The SSFL ROI comprises the block groups encompassing and adjacent to the SSFL property and local roads to and from the site, within approximately 1 mile of the SSFL boundary. The nearest recreation area to SSFL is Sage Ranch Park, which may be accessed using Woolsey Canyon Road. In addition, housing developments exist adjacent to a portion of this road, where children may be reasonably expected to be present, although no schools have been identified on or near this road. Other recreation areas and schools on or near the evaluated routes between SSFL and major highways include the Chatsworth Nature Preserve, the Lazy J Ranch Park, and the El Camino Real High School.

The regional ROIs include the census tracts near the evaluated recycle or waste disposal facilities, particularly the routes in the vicinities of the recycle and waste disposal facilities that may be traversed by heavy-duty trucks delivering material or waste to these facilities. For the regional ROIs, the analysis evaluates the impacts of increased traffic within the facility vicinities. **Table 4–85** summarizes the sensitive-aged populations for the evaluated recycle and waste disposal facilities. The values in the table columns for children and persons 65 years and over indicate the population percentage in the evaluated census tracts for the listed facilities. The children column additionally indicates whether a school or recreation area is located within 1 mile of a recycle or waste disposal facility. This table was compiled from data summarized in Chapter 3, Section 3.14.

Table 4–85 Sensitive-aged Populations near the Representative Recycle and Waste Disposal Facilities

Facility	*Waste or Material Evaluated*	*Children (number <5 years, recreation or school area)*	*Persons Aged 65 Years and Over (population percent)*
Waste Disposal Facilities in California			
Antelope Valley	Nonhazardous soil and debris	403 (R)	8.6
Chiquita Canyon	Nonhazardous soil and debris	155	5.2
Mesquite [a]	Nonhazardous soil and debris	52	3.8
Buttonwillow	Hazardous waste, asbestos-containing material, and nonhazardous soil and debris	No information	7.4
Westmorland	Hazardous waste, asbestos-containing material, and nonhazardous soil and debris	25	4.6
McKittrick	Nonhazardous soil and debris	112 (S)	7.4
Waste Disposal Facilities Outside California			
US Ecology in Idaho [b]	Hazardous waste and asbestos-containing material	251	18.0
Energy*Solutions* in Utah [b]	LLW and MLLW	187	3.9
NNSS [b]	LLW and MLLW	No information	15.0/36.1 [c]
Recycle Facilities in California [d]			
Kramer Metals	Nonhazardous recycle material	234 (S, R)	7.1
Standard Industries	Nonhazardous recycle material	628 (S, R)	10.0
P.W. Gillibrand	Nonhazardous recycle material	520 (R)	11.8

< = less than; LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; NNSS = Nevada National Security Site; R = recreation area within 1 mile; S = school within 1 mile.

[a] Waste delivery by the truck/rail option only (see Appendix D, Section D.4).

[b] Waste delivery by the truck option, as well as the truck/rail option.

[c] The values are for census tracts 9603 and 9604.01, respectively.

[d] Waste disposal does not occur at the three listed recycle facilities; some of the listed hazardous waste disposal facilities also conduct recycle operations.

Source: Census 2013a.

As shown in Table 4–85, schools are located within 1 mile of the McKittrick, Kramer Metals, and Standard Industries facilities; and recreation areas are located within 1 mile of the Antelope Valley Landfill and the Kramer Metals, Standard Industries, and P.W. Gillibrand facilities. As described, in Chapter 3, Section 3.14, most remaining representative facilities are located in remote areas with low population densities.

Although sensitive-aged populations may exist along the major highways between SSFL and the evaluated recycle and disposal facilities, it was assumed that once trucks access a major highway, they would represent a small fraction of the total traffic on that highway. Therefore, it was assumed that the alternatives would not cause disparate impacts on sensitive-aged populations in the vicinities of major highways.

4.14.1 Soil Remediation Alternatives

Impacts under the soil remediation alternatives are summarized and compared in **Table 4–86**.

4.14.1.1 Soil No Action Alternative

DOE activities would not increase traffic volumes above baseline conditions in the SSFL ROI or the regional ROIs. Thus, no disparate impacts are expected on sensitive-aged populations.

Table 4–86 Sensitive-aged Population Impacts under the Soil Remediation Alternatives

Region of Influence	*Soil No Action Alternative*	*Soil Remediation Action Alternatives*		
		Cleanup to AOC LUT Values	*Cleanup to Revised LUT Values*	*Conservation of Natural Resources*
SSFL	No traffic impacts are expected above baseline conditions in the SSFL ROI, with no disparate impacts on sensitive-aged populations.	Over the 10-year duration of soil removal, there could be an increased risk to pedestrians along or crossing Woolsey Canyon Road, but this risk would be experienced by persons of all ages. There is not expected to be a significantly larger population of sensitive-aged persons in the group that could experience this risk compared to groups of persons living elsewhere in the SSFL ROI. Traffic volumes and therefore risks to pedestrians along other evaluated routes are not expected to be noticeably larger than those under baseline conditions. Therefore, no disparate impacts are expected on sensitive-aged populations in the SSFL ROI.	Same as the Cleanup to AOC LUT Values Alternative, except that soil removal would occur for slightly more than 2 years rather than 10 years. No disparate impacts are expected on sensitive-aged populations in the SSFL ROI.	Same as the Cleanup to AOC LUT Values Alternative, except that soil removal would occur for 2 years rather than 10 years. No disparate impacts are expected on sensitive-aged populations in the SSFL ROI.
Regional (disposal facilities)	No traffic impacts are expected above baseline conditions in the regional ROIs, with no disparate impacts on sensitive-aged populations.	There would be no noticeable increase in traffic in the vicinities of the disposal facilities evaluated for receipt of radiologically contaminated or hazardous soil, and no or minimal increase in traffic in the vicinities of disposal facilities evaluated for receipt of nonhazardous soil. Nonetheless, by using multiple disposal facilities or rail transport to rail-accessible facilities, traffic may be reduced along any route that may pass by or near a school or recreation area. Thus, no disparate impacts are expected on sensitive-aged populations in the regional ROIs.	Larger traffic increases in the regional ROIs for radioactive and hazardous waste disposal facilities compared to the Cleanup to AOC LUT Values Alternative, but much smaller traffic increases in the regional ROIs of the nonhazardous waste facilities. Soil removal and associated increased traffic would occur for a much shorter duration than that under the Cleanup to AOC LUT Values Alternative. No disparate impacts are expected on sensitive-aged populations in the regional ROIs.	Similar traffic increases in the regional ROIs for radioactive, hazardous, and nonhazardous waste disposal facilities as the Cleanup to Revised LUT Values Alternative, except that soil removal and associated increased traffic would occur for a shorter duration. No disparate impacts are expected on sensitive-aged populations in the regional ROIs.

AOC = *Administrative Order on Consent for Remedial Action*; LUT = Look-Up Table; ROI = region of influence.

4.14.1.2 Cleanup to AOC LUT Values Alternative

4.14.1.2.1 Santa Susana Field Laboratory Region of Influence

As indicated in Section 4.1.1.2, the weekday average daily traffic on Woolsey Canyon Road would increase by up to 7.3 percent over baseline conditions during 10 years of soil removal. The average daily traffic on roads past or near other recreational areas, such as Chatsworth Nature Preserve or the Lazy J Ranch Park, would increase by no more than 2.7 percent, or about a third or less than that for Woolsey Canyon Road, with no change in LOS ratings for the evaluated roads.

The most significant potential risk is considered to be to persons, including children and persons aged 65 years and over, that may be walking along or crossing Woolsey Canyon Road during weekdays when shipments of waste and backfill to or from SSFL are projected to occur. Although the speed limit for this road is low (30 miles per hour), it is winding.

Although there could be increased risks to pedestrians along or crossing Woolsey Canyon Road, these risks would be experienced by persons of all ages. There is not expected to be a significantly larger population of sensitive-aged persons in the group that could experience this risk compared to groups of persons living elsewhere in the SSFL ROI. Considering the information in Chapter 3, Tables 3–48 and 3–49, the percentages of sensitive-aged populations in the census block group containing the residential area on Woolsey Canyon Road are less than the medium values in the ranges for sensitive-aged populations over all evaluated census block groups. Traffic volumes and therefore risks to pedestrians along other evaluated routes are not expected to be noticeably larger than those under baseline conditions. In addition, traffic on all roads, except Woolsey Canyon Road, may be reduced by distributing traffic among the evaluated traffic routes, which would reduce traffic on roads other than Woolsey Canyon road that pass by or are in the vicinity of schools or recreation areas. Therefore, no disparate impacts are expected on sensitive-aged populations in the SSFL ROI.

4.14.1.2.2 Regional Regions of Influence

As described in Section 4.13.1.2.2, waste shipments would represent only small fractions of the daily acceptance limits, if any, of the evaluated radioactive or hazardous waste facilities (see Section 4.10.1.2). This indicates that deliveries would be within the daily ranges normally experienced at these facilities. In addition, as addressed in Section 4.12.1.2, the average daily shipments to the evaluated facilities would be insufficient to cause noticeable increases in traffic volume in the facility vicinities. Therefore, the alternative is not expected to have disparate impacts on sensitive-aged populations in the regional ROIs for the radioactive and hazardous waste facilities.

Truck shipments of nonhazardous soil from SSFL would average up to 25 per day during multiple years. Shipments would be in compliance with DOT regulations and the authorized requirements of the facilities receiving the materials or waste. Waste deliveries would represent fractions of the daily acceptance limits of any of the evaluated facilities. Because there is little risk of exceeding current permitted acceptance limits, there would be little risk of truck traffic in the facility vicinity exceeding the current range in daily traffic levels. In addition, of the facilities evaluated for nonhazardous waste disposal, only the Antelope Valley Landfill has a recreation area in its vicinity of the facility while only the McKittrick Waste Treatment Site has a school in its vicinity. The cited recreation area is accessed from Tierra Subida Avenue in Palmdale, California, and is across the street from the entrance to the Antelope Valley Landfill; the cited school is in the town of McKittrick, California, on State Route 58 directly across the street from the intersection of State Route 58 with State Route 33. As discussed in Section 4.13.1.2.2, the most direct local route to the Antelope Valley Landfill between Route 14 (Avenue S exit) and the landfill would traverse a four-lane road for a portion of the route and then pass through a low-population-density area. Trucks approaching the Landfill would need to reduce speed significantly to turn into the landfill, and empty trucks leaving the landfill would initially be at slow speeds. Traffic impacts and risks to sensitive-aged persons in the vicinity of the recreation area would be minimal. Trucks approaching the school in McKittrick would need to comply with speed restrictions, including a speed limit of 25 miles per hour in the vicinity of the school when children are present. In addition, trucks would need to further reduce speed to make a complete stop at the stop sign at the intersection of State Route 58 and State Route 33. Therefore, traffic impacts and risks to sensitive-aged persons in the vicinity of the school would be minimal.

To summarize, assuming all nonhazardous soil was delivered to a single facility, the potential impacts of increased traffic in the vicinities of facilities with nearby schools and or recreation areas would be minimal. Nonetheless, the number of truck deliveries to any single facility may be reduced if multiple disposal facilities were used or if waste was shipped to rail-accessible facilities. Thus, the alternative is not expected to have disparate impacts on sensitive-aged populations in the regional ROIs.

4.14.1.3 Cleanup to Revised LUT Values Alternative

4.14.1.3.1 Santa Susana Field Laboratory Region of Influence

As indicated in Section 4.8.2.1.3, soil removal would increase weekday average daily traffic on Woolsey Canyon Road by 7.2 to 7.3 percent during 2 years, which could change its LOS rating during these years, and by much less than 1 percent in a subsequent year. The largest increase in average daily traffic on the remaining evaluated roads would be no more than 2.7 percent, with no change in LOS ratings for these roads.

Although there could be an increased risk pedestrians along or crossing Woolsey Canyon Road, this risk would be experienced by persons of all ages and its duration would be about a fifth of that for the Cleanup to AOC LUT Values Alternative. For the same reasons (see Section 4.14.2.2.1), there is not expected to be a significantly larger population of sensitive-aged persons in the group that could experience this risk compared to persons living elsewhere in the SSFL ROI. Traffic volumes along other evaluated routes are not expected to be significantly larger than those under baseline conditions. In addition, total traffic on all roads, other than Woolsey Canyon Road, may be reduced by using multiple routes to major highway systems. Therefore, no disparate impacts are expected on sensitive-aged populations in the SSFL ROI.

4.14.1.3.2 Regional Regions of Influence

As addressed in Section 4.13.1.3.2, this alternative could result in an increase of 14 daily shipments during each of 2 years to an assumed single LLW/MLLW disposal facility. Neither the ROI for Energy*Solutions* in Utah nor the ROI for NNSS contains a school or recreation area, and both facilities are directly accessible from divided highways. Increased traffic under the alternative would not be expected to noticeably increase traffic volume on these highways. As addressed in Section 4.13.1.3.2, this alternative could result in an increase of up to 7 daily shipments to an assumed single evaluated hazardous waste disposal facility. No school or recreation facility has been identified in the ROIs of the three evaluated facilities (the Buttonwillow and Westmorland Landfills in California and US Ecology in Idaho).

Assuming all nonhazardous waste was sent to a single disposal facility, potential traffic impacts would be significantly reduced compared to those under the Cleanup to AOC LUT Values Alternative (see Section 4.14.1.2.2). Rather than an average 25 daily trucks arriving at a single assumed disposal facility, there would be an average of 8 daily trucks. Therefore, possible increased traffic volume at the evaluated facilities would be about a third of those for the Cleanup to AOC LUT Values Alternative (which was judged to result in minimal traffic impacts).

Given the above considerations, the potential impacts of increased traffic in the vicinities of the evaluated facilities with sensitive-aged populations in the facility ROIs would be minimal. Nonetheless, the number of truck deliveries to any single facility may be reduced if multiple disposal facilities were used or if waste were shipped to one or more rail-accessible facilities. Thus, the alternative is not expected to have disparate impacts on sensitive-aged populations in the regional ROIs for the evaluate disposal facilities.

4.14.1.4 Conservation of Natural Resources Alternative

4.14.1.4.1 Santa Susana Field Laboratory Region of Influence

Potential impacts in the SSFL ROI would be reduced compared to those under the Cleanup to AOC LUT Values or Cleanup to Revised LUT Values Alternative. Peak traffic increases under the Conservation of Natural Resources Alternative would not exceed those for these latter two alternatives, and would occur for only 1 year rather than multiple years. In addition, increased traffic under the alternative would occur for a total of 2 years.

Although there could be an increased risk to pedestrians along or crossing Woolsey Canyon Road, this risk would be experienced by persons of all ages and its duration would be about a fifth of that for the Cleanup to AOC LUT Values Alternative. For the same reasons (see Section 4.14.2.2.1), there is not expected to be a significantly larger population of sensitive-aged persons in the group that could experience this risk compared to persons living elsewhere in the SSFL ROI. Traffic volumes on other evaluated routes are not expected to be noticeably larger than those under baseline conditions. In addition, traffic on all roads, other than Woolsey Canyon Road, may be reduced by using multiple routes to major highway systems. Therefore, no disparate impacts are expected on sensitive-aged populations in the SSFL ROI.

4.14.1.4.2 Regional Regions of Influence

As addressed in Section 4.12.1.4, under the Conservation of Natural Resources Alternative, the projected increase in traffic in the ROI of a single assumed LLW/MLLW facility would occur over about half as many years as that under the Cleanup to Revised LUT Values Alternative. Rather than a single assumed LLW/MLLW facility receiving an average of 14 daily truck deliveries during 2 years, under the Conservation of Natural Resources Alternative, this same facility would receive an average of 14 daily deliveries for only 1 year. (In a subsequent year the average daily delivery would be less than 1.) Average daily deliveries to a single assumed hazardous waste facility or a single assumed nonhazardous waste facility would be the same as those for the Cleanup to Revised LUT Values Alternative. No disparate impacts are expected on sensitive-aged populations in the regional ROIs.

4.14.2 Building Demolition Alternatives

Impacts under the building demolition alternatives are summarized and compared in **Table 4–87**.

Table 4–87 Sensitive-aged Population Impacts under the Building Demolition Alternatives

Region of Influence	*Building No Action Alternative*	*Building Removal Alternative*
SSFL	No traffic impacts are expected above baseline conditions in the SSFL ROI, with no disparate impacts on sensitive-aged populations.	Assuming shipment of waste and backfill during a 2- to 5-month period in each working year, there could be an increased risk to pedestrians along or crossing Woolsey Canyon Road, but this risk would be experienced by persons of all ages. On Woolsey Canyon Road and all other evaluated roads in the SSFL vicinity, traffic volumes could be reduced by shipping waste and backfill throughout each working year, and, on all evaluated roads except Woolsey Canyon Road by using multiple routes to the major highway systems, which would reduce traffic along any route that may pass by or near a school or recreational area. Therefore, no disparate impacts are expected on sensitive-aged populations in the SSFL ROI.
Regional (recycle and disposal facilities)	No traffic impacts are expected above baseline conditions in the regional ROIs, with no disparate impacts on sensitive-aged populations.	There would be no noticeable increase in heavy-duty truck traffic in the vicinities of the evaluated recycle and waste disposal facilities. Nonetheless, use of multiple recycle and disposal facilities or rail transport to rail-accessible disposal facilities could reduce traffic through communities or locations (e.g., schools, recreation areas) where sensitive-aged populations may be present along the transit routes to some facilities. Thus, no disparate impacts are expected on sensitive-aged populations in the regional ROIs.

ROI = region of influence.

4.14.2.1 Building No Action Alternative

DOE activities would not result in traffic above baseline conditions in the SSFL ROI or the regional ROIs. Thus, no disparate impacts are expected on sensitive-aged populations.

4.14.2.2 Building Removal Alternative

4.14.2.2.1 Santa Susana Field Laboratory Region of Influence

Traffic to and from Area IV would use Woolsey Canyon Road. As indicated in Section 4.13.2.2.1, assuming waste and backfill is shipped to or from Area IV during a 2- to 5-month period in each of 2 years, the projected increase in weekday average daily traffic (3.4 percent in the first year of building removal and 5.3 percent in the second year) could change the LOS rating for Woolsey Canyon Road. The largest increase in average daily traffic on the remaining evaluated roads would be less than 2 percent, with no change in LOS ratings. If waste and backfill were instead shipped throughout each working year, the average daily traffic on Woolsey Canyon Road would increase by less than 1 percent, with smaller increases on other evaluated routes between SSFL and major highways. In this case, no change in LOS rating would be expected for any evaluated road.

Assuming waste and backfill was shipped to or from Area IV over a 2-to 5-month period in each of 2 years, there could be increased risks to pedestrians walking along or crossing Woolsey Canyon Road, although these risks would be smaller than those for any of the soil remediation action alternatives. As discussed in Section 4.14.1.2.1, these risks would be experienced by persons of all ages. Traffic volumes on other evaluated routes are not expected to be noticeably larger than those under baseline conditions. Traffic volumes on all evaluated routes, including Woolsey Canyon Road, would not be expected to be noticeably larger than those from baseline conditions assuming waste and backfill was shipped throughout each working year rather than over 2 to 5 months. In addition, other than Woolsey Canyon Road, traffic volumes on the evaluated roads may be reduced by using multiple routes to major highway systems, which would reduce traffic along any road that passes by or near schools or recreation areas. Given the above analysis, no disparate impacts are expected on sensitive-aged populations in the SSFL ROI.

4.14.2.2.2 Regional Regions of Influence

As determined in Section 4.13.2.2.2, the alternative would not result in a noticeable increase in heavy-duty truck traffic in the vicinities of the evaluated recycle and disposal facilities. Thus, no disparate impacts are expected on sensitive-aged populations in the regional ROIs.

4.14.3 Groundwater Remediation Alternatives

Impacts under the groundwater remediation alternatives are summarized and compared in **Table 4–88**.

Table 4–88 Sensitive-aged Population Impacts under the Groundwater Remediation Alternatives

Region of Influence	*Groundwater No Action Alternative*	*Groundwater Monitored Natural Attenuation Alternative*	*Groundwater Treatment Alternative*
SSFL	No traffic impacts are expected above baseline conditions, with no disparate impacts on sensitive-aged populations.	Because the increase in average daily traffic on the evaluated roads is so small (much less than 1 percent), no disparate impacts are expected on sensitive-aged populations.	The increase in average daily traffic on the evaluated roads would be slightly greater than that under the Groundwater Monitored Natural Attenuation Alternative, but the peak-year increase in average daily traffic would still be less than 1 percent. Thus, no disparate impacts are expected on sensitive-aged populations.
Regional (disposal facilities)	No traffic impacts are expected above baseline conditions, with no disparate impacts on sensitive-aged populations.	There would be no noticeable increase in traffic in the vicinity of any facility receiving waste under this alternative. No disparate impacts are expected on sensitive-aged populations.	There would be no noticeable increase in traffic in the vicinity of any facility receiving waste under this alternative. No disparate impacts are expected on sensitive-aged populations.

4.14.3.1 Groundwater No Action Alternative

Current groundwater monitoring would continue. DOE activities would not result in additional traffic above baseline conditions in the SSFL ROI or the regional ROIs. Thus, no disparate impacts are expected on sensitive-aged populations.

4.14.3.2 Groundwater Monitored Natural Attenuation Alternative

4.14.3.2.1 Santa Susana Field Laboratory Region of Influence

As indicated in Section 4.13.3.2.1, minor increases in weekday average daily traffic (much less than 0.1 percent on all roads in any year) under the Groundwater Monitored Natural Attenuation Alternative would not result in noticeable traffic-related impacts on any evaluated road. Therefore, there would be no disparate impacts on sensitive-aged populations in the SSFL ROI.

4.14.3.2.2 Regional Regions of Influence

There would be five shipments of well installation cuttings to offsite facilities as well as five shipments of well installation water to a permitted wastewater treatment plant. Even if all ten shipments occurred within a single year, there would be no noticeable increase in traffic in the vicinity of any facility receiving nonhazardous waste or well installation water. This alternative would have no disparate impacts on sensitive-aged populations in the regional ROIs.

4.14.3.3 Groundwater Treatment Alternative

4.14.3.3.1 Santa Susana Field Laboratory Region of Influence

The projected increase in weekday average traffic on the evaluated roads would be slightly greater than that under the Groundwater Monitored Natural Attenuation Alternative, but as indicated in

Section 4.13.3.3.1, the peak-year increase would still be less than 1 percent. Thus, this alternative would have no disparate impacts on sensitive-aged populations in the SSFL ROI.

4.14.3.3.2 Regional Regions of Influence

Waste would primarily entail excavated bedrock to be transported to radioactive waste disposal facilities. Conservatively assuming all waste were sent to a single disposal facility, the average daily shipment rate to the facility would be no more than about six (see Section 4.13.3.3.2); and as noted in Section 4.14.1.3.2, neither the ROI for Energy*Solutions* in Utah nor the ROI for NNSS contains a school or recreation area, and both facilities are directly accessible from major divided highways. Thus, no disparate impacts are expected on sensitive-aged populations in the regional ROIs.

Assuming groundwater treatment media were shipped periodically from SSFL to a hazardous waste facility, there would be no noticeable increase in traffic in the vicinity of any facility receiving waste under this alternative (see Section 4.13.3.3.2). Therefore, there would be no disparate impacts on sensitive-aged populations in the regional ROIs.

4.14.4 Sensitive-aged Population Impacts under All Action Alternative Combinations

4.14.4.1 Santa Susana Field Laboratory Region of Influence

Under the High Impact Combination, the largest increase in traffic would occur on Woolsey Canyon Road, where over 12 years, the weekday average daily traffic would conservatively increase by 3.4 to 7.6 percent (see Appendix H, Table H–21). If both groundwater remediation action alternatives were implemented, there would be essentially the same increase in average daily traffic, with the same potential impacts. This increased traffic could result in increased risks to pedestrians along or crossing Woolsey Canyon Road, although these risks would be experienced by persons of all ages. Traffic volumes on other evaluated roads are not expected to be noticeably larger than those under baseline conditions.

Under the Low Impact Combination, the largest increase in average daily traffic would occur on Woolsey Canyon Road, where over 4 years, the weekday daily traffic would conservatively increase by 3.5 to 7.4 percent (see Appendix H, Table H–21). Thereafter, there would be small numbers of annual shipments of purge water and environmental samples associated with groundwater monitoring. Increases in traffic on the evaluated roads would be similar on an annual basis to those under the High Impact Combination but would have a much shorter duration.

As discussed in Section 4.14.1.2.1, there is not expected to be a significantly larger population of sensitive-aged persons in the group that could experience this risk along Woolsey Canyon Road compared to groups of persons living elsewhere in the SSFL ROI. Traffic volumes on other evaluated routes are not expected to be noticeably larger than those under baseline conditions. In addition, traffic on all roads, other than Woolsey Canyon Road, that pass by or are in the vicinity of schools or recreation areas could be reduced by distributing traffic among the evaluated traffic routes. Under any combination of action alternatives, therefore, no disparate impacts are expected on sensitive-aged populations in the SSFL ROI.

4.14.4.2 Regional Regions of Influence

As discussed in Section 4.13.4.2, even if all waste deliveries were made to a single LLW/MLLW or hazardous waste disposal facility, the deliveries are not expected to result in noticeable increases in traffic, with no adverse impacts on the general public. Furthermore, no schools or recreation areas have been identified in the ROIs of the evaluated radioactive and hazardous waste facilities (see

Table 4–85). Therefore, no disparate impacts are expected on sensitive-aged populations in the ROIs of these facilities.

As shown in Table 4–73,[41] the combination of the Cleanup to AOC LUT Values Alternative, the Building Removal Alternative, and either groundwater remediation action alternative would generate the most nonhazardous waste to be shipped to disposal facilities over 12 years. Assuming all nonhazardous waste was shipped to a single assumed facility as evaluated in Sections 4.14.1.2.2 and 4.14.1.3.2, traffic-related impacts are expected to be minimal at the two evaluated facilities (Antelope Valley and the McKittrick Waste Treatment Site, both in California) with a school or recreation area in their vicinities. The combination of either the Cleanup to Revised LUT or Conservation of Natural Resources Alternative, the Building Removal Alternative, and either groundwater action alternative combination would generate the least amount of nonhazardous waste, which would be shipped to disposal facilities over approximately 4 years. As addressed in Section 4.13.4.2, the average number of heavy-duty trucks delivered to a single assumed nonhazardous waste facility could be up to 8 per day during 2 years; daily deliveries during other years would be smaller. The impacts of this increased traffic at any single assumed facility would be minimal. Furthermore, the number of truck deliveries to any single facility may be reduced if multiple disposal facilities were used or if waste were shipped to one or more rail-accessible facilities. For any combination of action alternatives, therefore, no disparate impacts are expected on sensitive-aged populations in the ROIs for the evaluated nonhazardous waste facilities.

4.14.5 Impact Threshold Analysis

An impact threshold would be crossed if it was determined that there could be disparate impacts on sensitive-aged populations. Although operations could result in increased traffic along Woolsey Canyon Road sufficient to affect its LOS rating, and there could be an increased risk to pedestrians in the vicinity of Woolsey Canyon Road because of this increased traffic, this risk would be experienced by persons of all ages. There is not expected to be a significantly larger population of sensitive-aged persons in the group that could experience this risk compared to persons living elsewhere in the SSFL ROI. Traffic volumes on other evaluated roads are not expected to be significantly larger than those under baseline conditions, with no significant risk to pedestrians of any age above baseline conditions. Therefore, no disparate impacts on sensitive-aged populations are expected in the SSFL ROI.

Traffic increases would be minimal at the evaluated recycle facilities. Only two of the evaluated disposal facilities (Antelope Valley and the McKittrick Waste Treatment Site) have schools or recreation areas in their vicinities. Although truck traffic could increase at these facilities by up to 29 trucks per day, truck speed would be very low in their vicinities. Traffic-related impacts on sensitive-aged populations on the transit routes near these facilities would be thus minimal. These minimal impacts may be reduced by measures such as shipping waste to multiple facilities or shipment of waste to rail-accessible facilities. Thus, no disparate impacts are expected on sensitive-aged populations.

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[41] Of the two ground remediation action alternatives, only the Groundwater Monitored Natural Attenuation Alternative is projected to generate nonhazardous waste (about 10 cubic yards). Thus, neither groundwater remediation action alternative would contribute significantly to the total amount of nonhazardous waste generated under any combination of action alternatives.

Chapter 5
Cumulative Impacts

5.0 CUMULATIVE IMPACTS

5.1 Methodology and Assumptions

The "Council on Environmental Quality Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act" (Title 40, *Code of Federal Regulations*, Parts 1500-1508 [40 CFR Parts 1500-1508]) state: "Cumulative impact is the impact on the environment which results from the incremental impact of the 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). Thus, the cumulative impacts of an action can be viewed as the total effects on a resource, ecosystem, or human community of that action and all other activities affecting that resource, irrespective of the proponent (EPA 1999). Cumulative impacts can result from individually minor, but collectively significant, actions taken over a period of time. Cumulative impacts can also result from spatial (geographic) and/or temporal (time) crowding of environmental disturbances (i.e., concurrent human activities and the resulting impacts on the environment are cumulative if there is insufficient time for the environment to recover).

The region of influence (ROI) for cumulative impacts varies by resource area. The composite of the ROIs for the resource areas comprises the overall ROI. The overall ROI for cumulative impacts is a 10-mile radius from the Santa Susana Field Laboratory (SSFL) boundary. Cumulative impacts are not expected to occur beyond this 10-mile radius because of the nature of the proposed remediation activities at SSFL (e.g., limited air emissions from construction equipment and soil disturbance), the reduction of effects with distance from SSFL, and the control measures that would be used to limit impacts (e.g., water spraying to reduce dust emissions).

The approach used to identify and estimate potential cumulative impacts for this *Draft Environmental Impact Statement for Remediation of Area IV and the Northern Buffer Zone of the Santa Susana Field Laboratory (Draft SSFL Area IV EIS)* was to:

- review literature and contact individuals and organizations to identify past, present, and reasonably foreseeable future actions at SSFL and in the ROI;
- review available environmental documentation to understand the impacts of the actions identified at SSFL and in the ROI; and
- describe the cumulative impacts.

Cumulative impacts were assessed by combining the potential effects of the alternatives analyzed in this environmental impact statement (EIS) with the effects of other past, present, and reasonably foreseeable future actions in the ROI. Many of these actions would occur at different times and locations and, therefore, their estimated impacts may not be truly cumulative. For example, the set of actions that could impact air quality would occur at different times and locations across the ROI; therefore, it is unlikely that the maximum predicted impacts on a downwind receptor would be cumulative. A more detailed discussion of the cumulative impacts methodology is provided in Appendix B, Section B.14.

5.2 Past and Present Actions at the Santa Susana Field Laboratory

The past actions at SSFL have affected the environment, which is described in Chapter 3 of this EIS. The most important impact of past actions is residual chemical- and radionuclide-impacted materials from rocket engine testing, nuclear energy research, demolition and facility removal, and soil and groundwater remediation.

5.3 Reasonably Foreseeable Future Actions at the Santa Susana Field Laboratory

Reasonably foreseeable future actions at SSFL included in the cumulative impact analysis of this EIS are planned demolition, remediation, and waste transportation activities to be conducted by the U.S. Department of Energy (DOE), National Aeronautics and Space Administration (NASA), and The Boeing Company (Boeing). Future actions that are speculative or are not well defined were not analyzed, including the future use of SSFL.

This EIS presents the potential environmental impacts of DOE alternatives (for building demolition, soil remediation, and groundwater remediation) for Area IV and the Northern Buffer Zone (NBZ). Each set of alternatives addresses the specific component that would be remediated, thereby enabling independent evaluation and comparison of the potential impacts of each type of remediation that might be undertaken. Decisions will be made for each of the three components, so the combined impacts of their implementation were also evaluated. The minimum and maximum impacts for the combined action alternatives are used in this chapter to estimate cumulative impacts.

NASA is performing remediation activities for NASA-owned properties (in Areas I and II) at SSFL. The environmental impacts of these activities were evaluated in the *Final Environmental Impact Statement for Proposed Demolition and Environmental Cleanup Activities at Santa Susana Field Laboratory* (*NASA FEIS*) (NASA 2014a). The *NASA FEIS* included an evaluation of the potential environmental consequences of NASA's proposed action of demolishing existing structures and remediating groundwater and soil on NASA-administered properties at SSFL. The Record of Decision (ROD) (NASA 2014b) announced NASA's decision to proceed with the demolition activities described in the Proposed Action in the *NASA FEIS*. In consideration of technical, environmental, economic, and legal factors, NASA deferred its decision on the specific techniques to be used to accomplish the environmental (soil and groundwater) cleanup required to meet the 2007 *Consent Order for Corrective Action* (2007 CO) (DTSC 2007) and the 2010 NASA *Administrative Order on Consent for Remedial Action* (DTSC 2010b). NASA deferred the decision on soil and groundwater to allow it to complete soil and groundwater fieldwork, additional archeology surveys, and cleanup technology feasibility studies. NASA plans to conduct additional National Environmental Policy Act (NEPA) analysis when the results of the additional studies are available.

Boeing's potential remediation activities will be performed in accordance with the 2007 CO (DTSC 2007), as directed by the California Department of Toxic Substances Control (DTSC), on Boeing-owned parcels at SSFL, referred to as Administrative Areas I and III and the Southern Undeveloped Land (Southern Buffer Zone), as well as in adjacent northern offsite areas (NBZ) where contaminants have migrated. The objective of the Boeing Remediation Project is to remove, treat, or contain contaminants in soil/sediment, surface water, groundwater, and vadose zone bedrock as directed by DTSC in accordance with the 2007 CO. The goal of remediation is to achieve risk-based soil/sediment contaminant levels that are protective of a hypothetical suburban resident and onsite ecological receptors, and to restore groundwater quality (a performance standard specified by DTSC). Boeing has completed demolition and removal of all buildings and other structural features in Areas I and III, except for the guard shack and fire station at the entrance area of Area I as well as the recently constructed Groundwater Extraction Treatment system building in Area I. Boeing may leave the guard shack, the fire station and the Groundwater Extraction Treatment system building for future use. Boeing has also completed removal of the buildings and other structural features it owns in Area IV, with the exception of the Building 4005 slab, Building 4009, Building 4011 (low bay), Building 4055, Building 4100, the water line to former Building 4015, and a chain link fence and driveway (Boeing 2015e).

As required by the California Health and Safety Code, DTSC is preparing a program environmental impact report (EIR) under the California Environmental Quality Act (CEQA) to evaluate the potential impacts of proposed remedial actions at SSFL from the combined actions of DOE, NASA, and Boeing. Impacts from DOE's proposed actions are being evaluated in the program EIR as part of a larger proposed action of remediating the entire SSFL. The draft program EIR is expected to be published after DOE's *Draft SSFL Area IV EIS*. Information from the program EIR will be included in DOE's *Final SSFL Area IV EIS*.

Table 5–1 presents the key information for DOE, NASA, and Boeing activities that was used to estimate cumulative impacts. **Figure 5–1** shows the areas that would be disturbed by DOE, NASA, and Boeing soil excavation activities. Due to their small size, the areas disturbed by DOE, NASA, and Boeing building demolition activities are not shown on Figure 5–1; acreages disturbed for building demolition activities are provided in Table 5–1.

5.4 Other Reasonably Foreseeable Future Actions in the Region

Activities in the ROI that could contribute to cumulative impacts could include new residential development, new industrial and commercial ventures, resource investigation and development, new utility and infrastructure development, new waste treatment and disposal facilities, and contaminated site remediation. Appendix D, Figure D–3, shows the locations of 129 other reasonably foreseeable actions in the ROI. Table D–6 presents key information for each of these actions. Only those actions that have the potential to contribute to cumulative impacts are described in Chapter 5.

Information on residential, commercial, and industrial development was collected from the cities of Agoura Hills, Calabasas, Hidden Hills, Los Angeles, Simi Valley, Thousand Oaks, and Westlake Village, and information regarding anticipated future activities that could contribute to cumulative impacts was collected from Los Angeles and Ventura Counties. Local school systems were also contacted. Larger projects that are more likely to contribute to cumulative impacts include:

- Colton Lee Manufactured Housing Community – construction of up to 60 dwelling units 1 mile northeast of SSFL.
- Sterling Properties – Dayton Canyon is the site of a proposed housing development called Sterling Properties. One hundred and fifty single-family homes are planned on 359.4 acres 1 mile east of SSFL.
- The Market Place – construction of 72 townhomes, 36 senior condominiums, and a commercial building 4 miles northwest of SSFL.
- Hidden Creeks Estates – construction of 188 single-family residences, associated roadways and infrastructure, a 15.5-acre public park, and a new 15.8-acre equestrian boarding facility on 259 acres 5 miles north of SSFL.
- Hummingbird Nest Ranch – conversion of existing equestrian and residential facilities and construction of new facilities, including a hotel, equestrian center, conference center, and pool, on 124.6 acres 5 miles north of SSFL.
- MGA Entertainment, Inc., Mixed-Use Campus Project – construction of 700 rental housing units, a running track, an amphitheater, and 256,000 square feet of office space on 23.6 acres 5 miles east of SSFL.
- Runkle Canyon Residential Project – Construction of 298 single-family homes, 25 custom homes, and 138 senior condominiums on 1,595 acres 5 miles west of SSFL

Table 5–1 Information for the DOE, NASA, and Boeing Remediation Activities at the Santa Susana Field Laboratory

Impacts Information	*Responsible Party*			*Totals*
	NASA [a]	*Boeing* [b]	*DOE* [c]	
Land disturbed (acres)				
– Area Disturbed for Soil Removal	139 to 220	55.3 [d]	32 to 130	**226 to 405**
– Area Disturbed for Building Removal	Not provided	Not provided	8.4	**8.4**
Total	139 to 220	55.3	40 to 138	**235 to 414**
Employment (persons)				
– Onsite Employees	50 to 75	100	25 to 26 Building removal activities = 26 Soil excavation = 25 Groundwater treatment = <1 [e]	**175 to 201**
– Truck Drivers - Truck drivers for occasional deliveries or pickups are not included in long-term employment.	Assume 32 to 160 truck drivers when the high value is for a scenario where hazardous waste disposal facilities are a 2-day truck trip from SSFL.[f]	Assume 9 to 42 truck drivers when the high value is for a scenario where hazardous waste disposal facilities are a 2-day truck trip from SSFL.[f]	Assume up to 32 truck drivers during the first few years when 96 truck trips are split between DOE, NASA, and Boeing; thereafter a maximum of 95 truck drivers under a scenario where the hazardous waste disposal facilities are a 2-day truck trip from SSFL.[f]	**73 to 297** [g]
Total	82 to 123	116 to 132	57 to 121	**248 to 498**
Resources used				
– Backfill for Soil Excavation (cubic yards)	202,000 to 290,000	113,000	111,000 to 700,000	**426,000 to 1,100,000**
– Backfill for Building Removal (cubic yards)	Not provided	Not provided	13,500	**13,500**
– Backfill for Bedrock Removal (cubic yards)	None expected	None expected	0 to 1,280	**0 to 1,280**
Total	202,000 to 290,000	113,000 [d]	125,000 to 715,000	**440,000 to 1,120,000**
Resources used				
– Water (gallons/day)	200,000	10,000 to 14,000	3,000 to 16,000	**213,000 to 230,000**
Waste generated (cubic yards)				
– Soil Excavation	607,000 to 870,000	336,000	148,000 to 933,000	**1,090,000 to 2,140,000**
– Building Removal	66,100	Not provided	15,500	**81,600**
– Bedrock Removal and Groundwater Remediation	Not provided	Not provided	10 to 1,730	**10 to 1,730**
Total	673,000 to 936,000	336,000	164,000 to 950,000	**1,170,000 to 2,220,000**

Impacts Information	*Responsible Party*			*Totals*
	NASA [a]	*Boeing* [b]	*DOE* [c]	
Truck trips				
– Soil Disposal	40,000 to 57,000	21,900	11,100 to 70,000	**73,000 to 149,000**
– Backfill, Equipment, and Supplies	13,100 to 19,100	7,370	8,390 to 46,900	**28,900 to 73,400**
– Building Demolition Debris	3,970	Not provided	1,500	**5,470**
– Bedrock Disposal and Other Groundwater Remediation Waste	Not provided	Not provided	20 to 370	**20 to 370**
Total	57,100 to 80,100	29,300	20,800 to 119,000	**107,000 to 228,000**

Boeing = The Boeing Company; NASA = National Aeronautics and Space Administration.

[a] Source: NASA 2015b.

[b] Source: Boeing 2015d.

[c] Source: Chapter 4 of this EIS.

[d] Boeing has identified six areas of potential soil borrow in the Southern Buffer Zone that could be used as sources of clean backfill for Boeing remediation activities. The areas total approximately 20 acres of undeveloped land (MWH 2015). The analyses in this EIS assume Boeing would obtain backfill from offsite sources.

[e] A small number of workers would be required to install groundwater wells and treatment systems that would each work for less than a year. Annual monitoring operations would also require a small number of workers that would each work for less than a year.

[f] For hazardous waste disposal facilities that are a 2-day trip from SSFL, trucks could leave each day for 3 days before some of the trucks would begin returning to SSFL for another load on the fourth day. All evaluated radioactive waste disposal facilities are assumed to be a 2-day truck trip from SSFL.

[g] The ranges of DOE, NASA, and Boeing truck drivers have been added together to obtain a conservative estimate of total truck drivers. It is unlikely that the maximum numbers of truck drivers would occur at the same time for DOE, NASA, and Boeing activities at SSFL.

Notes:

- Sums presented in the table may differ from those calculated from table entries due to rounding.
- Values rounded to three significant figures.

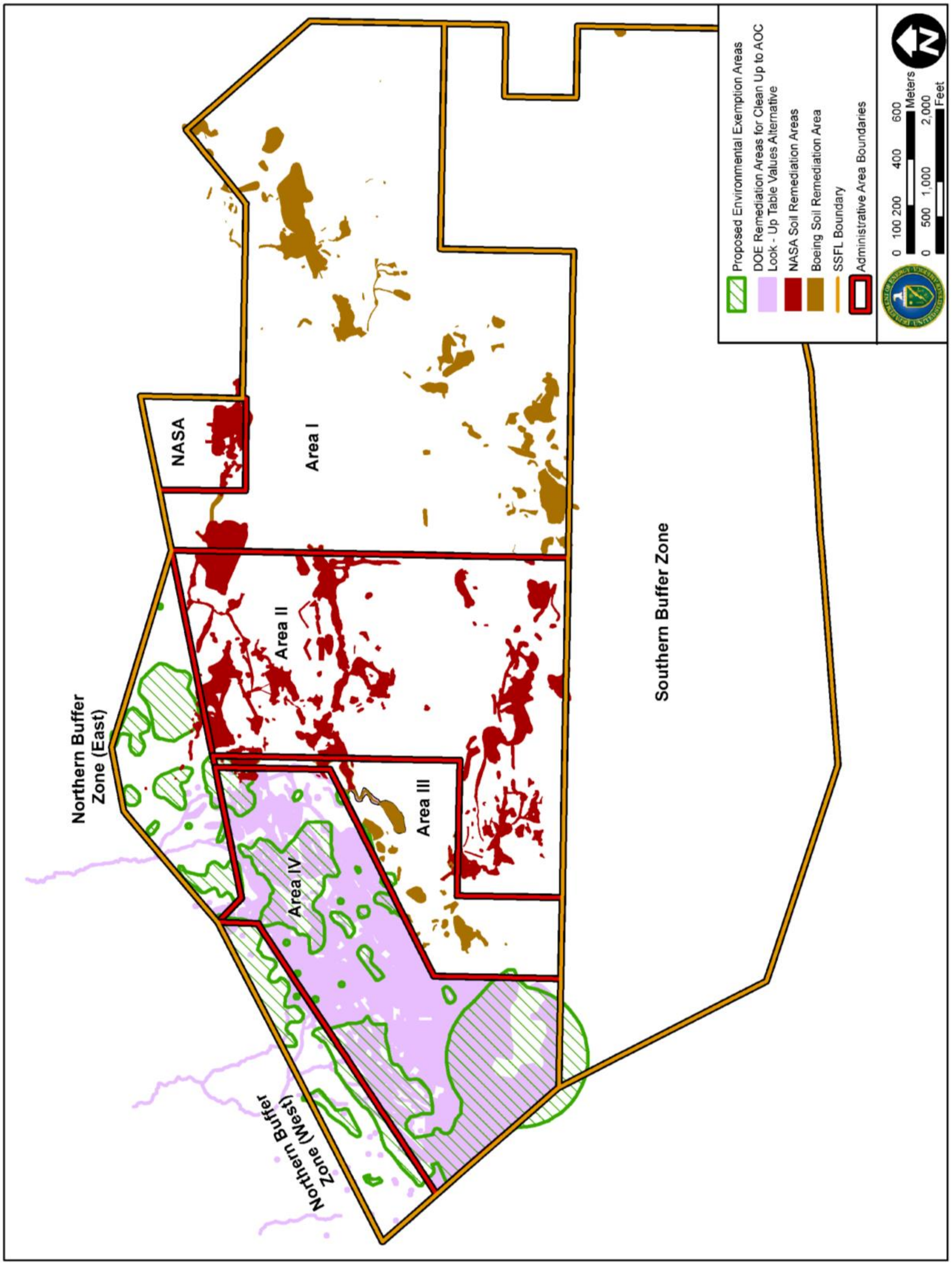

Figure 5–1 Areas Disturbed for DOE, NASA, and Boeing Soil Excavation

- The Village at Westfield Topanga Project – Phased development of a 444,744 square-foot shopping center, 275-room hotel, grocery store, office, and community/cultural center on 30 acres 6.8 miles northeast of SSFL.
- Lost Canyons – Master planned development for 364 single-family lots, infrastructure, streets, and common area improvements on 1,770 acres 7 miles northwest of SSFL.

Information about future activities that could contribute to cumulative impacts was also collected from the National Park Service; U.S. Environmental Protection Agency (EPA) Superfund Program; California Department of Parks and Recreation; California Department of Transportation; DTSC; California State Land Commission; California Energy Commission; California Public Utilities Commission; City of Simi Valley/Waterworks District No. 8; Las Virgenes Municipal Water District; Los Angeles Department of Water and Power, Metropolitan Water District; Southern California Edison; Southern California Gas Company; and Golden State Water Company.

Portions of the Santa Monica Mountains National Recreation Area are within 10 miles of SSFL. A number of activities were identified that are expected to occur within this area during the period of analysis for this EIS (NPS 2015a). These include trail management, invasive plant management, and management and operations at King Gillette Ranch (NPS 2015b, 2015c, 2015d).

The SSFL is included in the study area of the *National Park Service Rim of the Valley Corridor Draft Special Resource Study and Environmental Assessment (Draft ROTV EA)* issued in April 2015 (NPS 2015e). The "Rim of the Valley" encompasses the mountains encircling the San Fernando, La Crescenta, Santa Clarita, Simi, and Conejo Valleys of Los Angeles and Ventura Counties. As stated in the environmental assessment (EA), the purpose is to determine the suitability and feasibility of designating all or a portion of the corridor as a unit of Santa Monica Mountains National Recreation Area and the methods and means for protection and interpretation of the corridor by the National Park Service; other Federal, state, or local government entities; or private or non-governmental organizations.

The *Draft ROTV EA* includes alternatives to determine whether the area would be suitable as an addition to the Santa Monica Mountains National Recreation Area. Alternatives range from building a collaborative partnership to explore means of establishing an interconnected system of parks, habitats, and open space connecting urban neighborhoods and the surrounding mountains, to expanding the boundaries and providing new authoritative management to improve recreation and habitat connectivity for the Santa Monica Mountains National Recreation Area. Additional lands would only be acquired and incorporated from willing landowners. Because this proposed action would result in preservation of existing open space, it is unlikely to contribute substantially to adverse cumulative impacts.

The California State Land Commission leases oil and gas development rights on state lands. All leased parcels are outside the 10-mile radius of SSFL (CSLC 2014) and, therefore, are not expected to contribute to cumulative impacts.

A number of city, county, state, and private agencies manage water resources in the ROI. These include the City of Simi Valley/Waterworks District No. 8; Las Virgenes Municipal Water District; Los Angeles Department of Water and Power, Metropolitan Water District; Calleguas Municipal Water District (CMWD); and Golden State Water Company. No major water projects were identified as occurring within 10 miles of SSFL (ESA 2015b).

The California Public Utilities Commission and California Energy Commission regulate utility development in California. No new power plant projects, solar power development, and wind power projects are within 10 miles of SSFL (CEC 2014, 2015; CPUC 2015a). The following transmission line and natural gas projects are within 10 miles of SSFL:

- Southern California Edison Presidential Substation Project – The substation site will be located in the City of Thousand Oaks, approximately 3 miles northwest of SSFL, and the subtransmission source lines will be located in both unincorporated Ventura County and the City of Thousand Oaks (CPUC 2015b).
- Southern California Edison Moorpark-Newbury 66-kilovolt Subtransmission Line Project – The subtransmission line will extend between Southern California Edison's Moorpark Substation and Newbury Substation, within a portion of its existing Moorpark-Ormond Beach 220-kilovolt Transmission Line right-of-way and within a portion of its existing Moorpark-Newbury-Pharmacy 66-kilovolt Subtransmission Line right-of-way, approximately 8 miles west of SSFL. The project will include 9 miles of new 66-kilovolt subtransmission lines, new tubular steel poles to carry the line, and associated infrastructure within Moorpark and Newbury substations to facilitate the new line (CPUC 2015c).
- Southern California Gas Aliso Canyon Turbine Replacement Project – This project includes removal from service of the existing gas turbine-driven compressor station located at the Aliso Canyon natural gas storage field on 3,600 acres 9 miles east-northeast of SSFL. The turbine-driven compressor station will be replaced with three variable frequency compression trains installed in a new compressor station. Other associated facilities will be upgraded as part of the project, including enlargement of an existing Southern California Edison electrical easement and upgrades of up to 8.2 miles of subtransmission lines in the area of the proposed project; upgrades will consist of conductor wire replacement and tower/pole replacement (CPUC 2015d).

Information on transportation projects was collected to determine whether major projects could impact the region around SSFL. Many transportation projects are ongoing or planned (Caltrans 2015a, 2015b). Most of these are relatively minor maintenance, upgrade, and resurfacing projects; some are more-substantial improvement, reconstruction, and rehabilitation projects. The more substantial projects include:

- U.S. Highway 101/Palo Comado Canyon Road Interchange Improvement Project – The proposed project will include widening the Palo Comado Canyon Road and the Palo Comado Canyon bridge across U.S. Highway 101 and modifying the interchange ramps to improve traffic circulation, safety, and bicycle/pedestrian access (Caltrans 2015d; City of Agoura Hills 2015). This project is approximately 5 miles south of SSFL.
- Lost Hills Road/U.S. Highway 101 Lost Hills Road Overcrossing Replacement and Interchange Modification Project – This project will widen and replace the existing Lost Hills Road Bridge and modify the interchange. The project area includes the bridge and the on- and off-ramps located at the U.S. Highway 101/Lost Hills Road interchange (Caltrans 2015d; City of Calabasas 2014). This project is approximately 5 miles south of SSFL.
- U.S. Highway 101/State Route 23 Interchange Improvement Project – This project will add a lane to the southbound State Route 23/northbound U.S. Highway 101 connector; construct sound walls along U.S. Highway 101 at various locations; add a lane to the northbound and southbound U.S. Highway 101 freeway at various locations; widen three bridges (northbound side only); realign Moorpark Road northbound on-ramp and add a lane to the Moorpark Road northbound off-ramp; and realign the Hampshire Road northbound

on- and off-ramps (Caltrans 2015a, 2015c, 2015d). This project is approximately 8 miles southwest of SSFL.

The EPA National Priorities List (also known as the Superfund sites list) was reviewed to determine whether these sites could contribute to cumulative impacts at SSFL. No Superfund sites are located within 10 miles of SSFL (EPA 2015d). DTSC also actively pursues cleanup of contaminated sites through the Brownfields initiatives, Voluntary Cleanup Program, EPA Clean Energy Financing Programs, and California State Superfund Program. There are approximately 75 State of California sites within 10 miles of SSFL, including the various DOE, NASA, and Boeing remediation projects at SSFL (DTSC 2015).

5.5 Results of the Cumulative Impact Analysis

The results of the cumulative impacts analysis are presented in the following sections. The level of detail provided for each resource area depends on the extent of the potential cumulative impacts. Many resource areas did not require a detailed analysis because of minimal or localized impacts from SSFL activities and an assessment that, cumulatively, there would be no appreciable impacts on these resource areas.

5.5.1 Land Resources

As described in Chapter 3, Section 3.1, land resources include land use, recreation, infrastructure, and visual resources. The ROI for land resources encompasses SSFL Area IV, the NBZ, and the surrounding areas (approximately 1 mile from SSFL) that could be affected by the proposed activities. The following sections describe the results of the analysis of the cumulative effects of the proposed DOE, NASA, and Boeing actions at SSFL.

Land Use

The DOE, NASA, and Boeing administered areas (not including the NBZ and Southern Buffer Zone) comprise approximately 290, 452, and 785 acres, respectively, of the 2,850-acre SSFL. As shown in Table 5–1, DOE, NASA, and Boeing remediation activities at SSFL would disturb between 226 and 405 acres of land via soil excavation. Boeing has identified potential borrow areas for backfill in the Southern Buffer Zone. If soil is taken from these borrow areas, an additional 21 acres could be disturbed.

DOE remediation activities at SSFL would disturb between 32 and 130 acres of land via soil excavation and 8.4 acres of land via building removal. DOE's action alternatives would be consistent with Ventura County Plans (Ventura County 2011a, 2015a) and Boeing's, as the landowner, intent (Boeing 2016b) that the area be left as undeveloped open space. DOE does not plan to leave any buildings for future use. Thus, DOE actions would not contribute to cumulative land use effects.

Recreation

As shown in Table 5–1, the combination of DOE remediation alternatives with NASA and Boeing remediation activities at SSFL would require between 107,000 and 228,000 truck trips for waste disposal and deliveries. As analyzed in Chapter 4, Section 4.1, the average daily truck trips for DOE would normally range from less than 32 to 48 (with possible occasional peak days of 96). As described in Section 4.1, traffic would increase along routes to and from SSFL, especially during soil removal. The increased traffic could discourage weekday use of Sage Ranch Park. Traffic increases along other roads would be less and could be reduced by using multiple transportation routes between SSFL and the major highways. Therefore, impacts on recreational areas along other portions of the route would be less than those along Woolsey Canyon Road. Consistent with the Transportation Agreement between DOE, NASA, and Boeing (Boeing 2015a), the number of average daily truck round trips for DOE in combination with NASA and Boeing, would not be expected to exceed 96 daily round trips. Therefore, the cumulative impacts of DOE, NASA, and Boeing shipments would be similar in intensity to the highest impacts of DOE shipments alone, except that these impacts would occur for a longer period of time.

Infrastructure

As described in Chapter 4, Section 4.1, potable water, natural gas, sewage, and communication services to all DOE buildings have been severed. Therefore, the only utility on site that could be affected is electrical service. Electrical service would be terminated prior to building demolition. With the exception of the drought-related considerations discussed below, no DOE activity would cause either an increase in demand or a disruption or re-routing of an existing utility and, therefore, would not contribute to cumulative effects.

CMWD is the expected primary source of water for all DOE, NASA, and Boeing activities at SSFL. For DOE, NASA, and Boeing operations, the cumulative water use is estimated to be about 57 to 58 million gallons per year (213,000 to 230,000 gallons per day). Boeing is estimated to require about 10,000 to 14,000 gallons per day, DOE is estimated to require 3,000 to 16,000 gallons per day, and NASA is estimated to require about 200,000 gallons per day. DOE water use would be approximately 7 percent of the total SSFL water use.

Chapter 3, Tables 3–1 and 3–2, provide CMWD's projections for its imported and local water supply. In an average year, the district has a combined imported and local water supply of 177,644 acre feet per year (CMWD 2011). Maximum projected cumulative water use at SSFL (58 million gallons per year [180 acre feet per year]) would be about 0.1 percent of CMWD's combined imported and local water supply. However, this projection may not reflect conditions going forward. Southern California has been under drought conditions for several years, and the governor has mandated water conservation measures. After twice proclaiming in 2014 that severe drought conditions in California had resulted in states of emergency, on April 1, 2015, Governor Brown issued Executive Order B 29 15, which directed the State Water Resources Control Board to impose restrictions that would achieve a statewide 25 percent reduction in potable water usage through February 28, 2016 (CA EO 2015). On July 2, 2014, the CMWD Board of Directors passed a resolution appealing for extraordinary water conservation efforts and a minimum 20 percent reduction in water use in its service area (CMWD 2014). As a result, Californians reduced their potable urban water use by 24 percent compared to 2013 usage (New York Times 2016). In May 2016, California suspended the mandatory 25 percent reduction and directed local communities to set their own conservation standards (SWRCB 2016). Southern California remains in a severe drought condition.

The projected cumulative water use may be controversial because of the existing California drought conditions and the need, as expressed by California and CMWD officials, to significantly reduce water consumption. Water conservation measures would be implemented to reduce water demands to the extent possible; however, any increase in use during current water supply conditions would create a cumulative effect on CMWD's and the overall State of California's water supplies. Other activities in the region, including those listed in Appendix D, Table D–6, would contribute to cumulative water use.

Aesthetics and Visual Quality

The majority, if not all, of the DOE, NASA, and Boeing buildings would be removed from SSFL, along with considerable quantities of soil. Building foundations and soil excavations would be backfilled and re-contoured as necessary, and disturbed areas would be stabilized and revegetated.

In the short term, building removal and soil cleanup from the combined projects could degrade views at SSFL. Soil cleanup and building removal activities would mirror similar views of existing industrial operations, so there would be minimal changes in visual quality from existing conditions.

In the long-term, the removal of DOE, NASA, and Boeing buildings would improve viewer perceptions of existing landscape features in both foreground and background views. Soil grading and revegetation of the building demolition areas would introduce new surface textures and colors in areas that were previously barren. In the long term, these modifications would benefit the expanded views and cause generally beneficial long-term cumulative effects on aesthetics and visual quality.

5.5.2 Geology and Soils

This analysis of cumulative impacts for geology and soils considers the same ROI described in Appendix B, Section B.2. The ROI for geological and soil resources includes the area within the outer boundaries of Area IV and the NBZ.

There would be minimal impacts on bedrock geology or unique landforms from DOE remediation activities at SSFL. Therefore, the proposed DOE activities would not contribute to cumulative impacts on these resources in the ROI. Similarly, there would be no appreciable impacts on paleontological resources from DOE activities and, therefore, no additions to cumulative impacts.

In addition to the DOE soil, building, and groundwater remediation activities evaluated in this EIS for Area IV and the NBZ, reasonably foreseeable actions contributing to cumulative impacts on soil include the soil, building, and groundwater remediation activities to be performed by NASA and Boeing, as described in Table 5–1.

Loss of soil with the mineralogical and biological composition and soil function capable of supporting the unique vegetation of SSFL would be generally proportional to the area of previously undisturbed soil that would be affected by remediation activities, although the potential for erosion of the disturbed soil and backfill in Areas I, II and III and the Southern Buffer Zone is generally higher than that for Area IV because the slopes in these NASA and Boeing Areas are generally steeper than the slopes found throughout most of Area IV. The total area potentially disturbed, and thereby subject to increased erosion via wind and rain, is approximately between 235 and 414 acres. The DOE activities would disturb approximately 40 to 138 acres, representing 17 to 33 percent of the total disturbed area. Although best management practices (BMPs) would be used to slow the flow of runoff and thereby decrease its scouring action and associated erosion, some soil loss is expected. Loss of soil with the qualities that support the unique vegetation of the SSFL would be a long-term adverse impact, the size of which depends on the amount of disturbed and lost soil.

Boeing has identified potential borrow areas for backfill in the Southern Buffer Zone. If soil is taken from these borrow areas, an additional approximately 20 acres could be disturbed (MWH 2015).

Other construction activities in the region, such as those listed in Appendix D, Table D–6, also could disturb soils. Although construction stormwater pollution prevention plan requirements and BMPs would limit soil erosion, some soil erosion is still likely to result. If the soils are similar in character to those present at SSFL, adverse cumulative impacts to these soil types could result.

Between 440,000 and 1,120,000 cubic yards of backfill could be required for all activities at SSFL. Most of this backfill is expected to come from local offsite sources. The DOE activities would require 125,000 to 715,000 cubic yards of backfill, representing 28 to 64 percent of the total volume. For DOE and NASA, all backfill material must meet specified values (e.g., AOC [2010 *Administrative Order on Consent for Remedial Action* (2010 AOC) (DTSC 2010a)] Look-Up Table [LUT] values, revised LUT values, or risk assessment-based levels). It is unlikely that a source of backfill meeting the LUT values will have the same physical and chemical properties (e.g., particle size distribution, porosity, chemical composition, and percentage of organic matter) as existing SSFL soils. The lack of available sources of backfill soil matching the characteristics of SSFL soils may result in substitution of soils that may not support native vegetation, including rare plant species. Therefore, cumulative and significant impacts could result if DOE, NASA, and Boeing have difficulty locating appropriate soils to fill areas disturbed by building demolition and soil and rock excavation.

Other construction activities in the region, such as those listed in Table D–6, also could require soils for backfill, but are just as likely to result in excess soil from foundation excavation and slope cutting. Therefore, these activities are not likely to consume a large quantity of soils and contribute to a shortage of this resource.

5.5.3 Surface Water Resources

This section analyzes cumulative impacts on surface water within and adjacent to DOE-administered areas of SSFL. This analysis of cumulative impacts for surface water resources considers the same ROI that was evaluated in Chapter 4, Section 4.3, which includes Area IV, the larger SSFL site, and offsite drainages that connect with the Arroyo Simi/Calleguas Creek and Bell Creek/Los Angeles River waterways.

Activities in the ROI with the potential to contribute to cumulative surface water impacts include both the onsite remediation activities at SSFL proposed by DOE, NASA, and Boeing (described in Section 5.3) and the offsite construction projects that would cause ground disturbance and could generate soil erosion and sediment loading in runoff during construction within the Arroyo Simi/Calleguas Creek and Bell Creek/Los Angeles River watersheds (described in Section 5.4).

The potential water quality and flood control capacity impacts generated by the remediation activities proposed at SSFL by NASA and Boeing would be similar to the effects for the remediation actions proposed by DOE. These effects include the potential for increased soil erosion and sediment loading in precipitation runoff in areas where soil is disturbed by remediation activities. Similar to DOE remediation activities, remediation actions by NASA and Boeing would incorporate BMPs designed to filter sediments and other contaminants from surface water runoff and prevent increases in runoff velocity and volume. In addition to these BMPs, the SSFL stormwater control and National Pollutant Discharge Elimination System stormwater control and monitoring system would remain in place during and following soil excavation and backfilling. Similar to the DOE actions, the NASA and Boeing remediation actions would have the beneficial effect of removing potential sources of surface water contaminants.

Other reasonably foreseeable offsite ground-disturbing projects in the ROI would have the potential to increase soil erosion and sediment loading in runoff and, in the case of new housing and commercial developments, introduce new impervious surfaces that could increase runoff velocities and volumes. Similar to the actions proposed at SSFL, these offsite developments would be subject to compliance with stormwater pollution prevention plans that would limit the potential for increased soil erosion and sediment loading in runoff during construction and operation.

As indicated in Chapter 4, Section 4.3, with the implementation of BMPs and Mitigation Measure SW-1, which precludes excavation of soils to bedrock during the December through May rainy season, no adverse impacts are expected on surface water quality on site and in regional waterways, or on the flood control capacity on site or in regional waterways, under any combination of DOE alternatives. Given that DOE's actions would generate no impacts on surface water quality or on local and regional flood control capacity, these actions would not be expected to contribute to cumulative impacts.

5.5.4 Groundwater Resources

This analysis of cumulative impacts for groundwater resources considers the same ROI described in Appendix B, Section B.4. The ROI for groundwater resources includes Area IV, the NBZ, and offsite areas to the north of the NBZ, where the groundwater discharges through seeps and springs.

Impacts on the quantity and quality of groundwater at SSFL from DOE, NASA, and Boeing soil, building, and groundwater remediation activities could produce cumulative impacts. However, because groundwater is relatively deep and is not expected to be withdrawn during soil excavation, impacts on the quantity of site groundwater from soil excavation are expected to be minimal and therefore would not contribute to cumulative impacts. If required, dewatering during demolition of one of the DOE buildings would have a short-term, localized impact on water levels. This activity would extract approximately 200,000 gallons of groundwater. The water would be treated (if necessary) and discharged on site. Because this activity would extract a relatively small quantity of water over a short period of time over a small area, it is not expected to contribute to cumulative impacts. Because the other DOE, NASA, and Boeing buildings and structures have shallow foundations, demolition is not expected to require dewatering. In addition, the source of water used for dust suppression during remediation activities is likely to be CMWD; therefore, SSFL groundwater would not be affected, and there would be no addition to cumulative impacts.

A variety of technologies are being considered by DOE, NASA, and Boeing to address cleanup of the chemical and radioactive constituents. Some of the technologies (e.g., treatment and re-injection, monitored natural attenuation) would have essentially no impact on groundwater quantity; others (e.g., groundwater extraction and treatment systems) would withdraw groundwater for treatment and then discharge treated groundwater through permitted outfalls to surface drainages where some portion of the water would recharge the aquifer, some would evaporate, and some would flow off site. Because of the relatively small size of SSFL compared to the adjacent groundwater basins and the relatively small quantities of groundwater that would be withdrawn, none of the proposed groundwater remedial technologies are expected to have an appreciable impact on the quantity of groundwater available for use by populations in adjacent groundwater basins. Therefore, these activities would minimally contribute to cumulative impacts on groundwater availability. After groundwater treatment is completed, groundwater levels at SSFL are expected to return to levels determined by infiltration of precipitation and natural groundwater flow.

Groundwater cleanup activities at SSFL would have a long-term beneficial impact on groundwater quality and, therefore, would not contribute to adverse cumulative impacts. The length of time required to attain the full benefit would depend on the selected technologies and the timing of source area remediation (i.e., soil excavation, soil treatment, and bedrock excavation).

5.5.5 Biological Resources

Biological resources include vegetation; wildlife; wetlands and aquatic habitats; and rare, threatened, endangered, or sensitive species. The ROI for the proposed project encompasses areas that could be impacted by remediation activities, including Area IV, the NBZ, and downslope areas that could be affected by runoff from Area IV or the NBZ or by accelerated erosion or sedimentation. For cumulative impacts analysis, the ROI expands to include all of SSFL and nearby areas where the same resources would be affected by the proposed project and the activities of other projects.

The major potential cumulative impacts associated with reasonably foreseeable actions in the ROI in combination with DOE's proposed actions at Area IV and the NBZ include the following:

- Vegetation clearing and soil removal could cause long-term loss of individuals and habitat of federally or state-listed endangered, threatened, rare, and otherwise sensitive plant and animal species from:
  - loss of habitat and mortality of individuals of species unable to escape the construction zone;
  - temporary loss of habitat due to animals avoiding activities, noise, and dust generated by humans and equipment during remediation (behavioral avoidance);
  - wildlife displaced from their habitat by construction activity may become more susceptible to predation and intra-species competition and less able to obtain adequate food and cover;
  - diminished reproduction of nearby wildlife (such as nest failures) due to the activities, noise, and dust generated by humans and equipment during remediation; and/or
  - possible effects on regional wildlife movements (wildlife corridors) as a result of behavioral avoidance of the activity and cumulative loss of plant cover.
- Lack of sources of soil matching onsite soil types and meeting LUT values in sufficient quantities to be used as backfill to replace removed soil may result in substitution of soils that may not support native vegetation, including rare plant species. Additionally, depending on the source and characteristics of the soil, imported soils used as backfill may lead to infestations by invasive species, with consequent impacts on nearby plants and animals.
- Loss or degradation of habitat could be caused by the spread of invasive species or soil pathogens promoted by extensive disturbed areas (creating open habitat for invasive species establishment) and the spreading of propagules (seed, plant parts capable of rooting) or pathogenic soil micro-organisms (e.g., oak root fungus) transported in soil or mud by movement of humans, vehicles, and equipment from site to site.
- Loss or degradation of adjacent habitat could be caused by erosion, sedimentation, turbidity, or dust deposition as a result of excavation and earthmoving activities.
- Beneficial cumulative impacts to biological resources could result from returning land to a more natural state after building removal and removal of radionuclides and other hazardous constituents during soil and groundwater cleanup.

At SSFL, the combined soil excavation activities of DOE, NASA, and Boeing would cause profound disturbance (removal of vegetation and soils) over a minimum of 226 acres and a maximum of 405 acres (see **Table 5–2**), compared to a minimum of 32 acres and a maximum of 130 acres for DOE alone. Proposed 2010 AOC (DTSC 2010a) exemption areas would protect most sensitive plant species and unique habitats, including designated critical habitat, on Area IV and the NBZ. On NASA and Boeing properties, acreages that would be impacted by remediation include some localized and unique habitats, as well as formerly widespread and common habitats that have been greatly reduced as a result of urban and suburban expansion in the surrounding valleys, foothills, and canyons. These losses would increase the importance of remaining habitat and open space on SSFL and its vicinity for wildlife and plants. The effects of vegetation and soil removal could result in long-term impacts due to the time and intense effort needed to restore the habitat.

Table 5–2 Comparison of Biological Resource Impact Indicators for DOE and all Santa Susana Field Laboratory Remediation Activities

Impact Indicator	*Total for DOE, NASA, and Boeing*	*DOE Only*	*DOE Percent of Total*
Area Disturbed for Vegetation and Soil Removal (acres)	226 to 405 [a]	32 to 130	14 to 32
Area Disturbed for Building Removal (acres)	8.4	8.4	100
Truck Trips	107,000 to 228,000	20,800 to 119,000	19 to 52

Boeing = The Boeing Company; NASA = National Aeronautics and Space Administration.

[a] Approximately 21 acres of additional undeveloped land in the Southern Buffer Zone could be disturbed if Boeing uses these areas as sources of clean backfill.

Notes:

- Sums presented in the table may differ from those calculated from table entries due to rounding.
- Values rounded to three significant figures.

Nearly 8.4 additional acres (see Table 5–2) would be disturbed by building demolition and removal related to DOE activities. Demolition and removal of buildings and paved areas such as parking lots would open additional habitat for revegetation. The feasibility of revegetation with native plant species would depend on factors related to the original construction of the buildings, such as the original site preparation (e.g., excavation for foundations or basements, degree of pre-construction compaction); subsequent disturbance associated with demolition, remediation, and removal (due in part to the depth of contamination); and the amount of backfill required, if any.

Additional impacts could result if backfill soils do not match existing onsite soil types. The lack of sources of backfill soil meeting the AOC LUT values and matching the physical, chemical, and biological characteristics of the onsite soil types may result in substitution of soils that may not support native vegetation, including rare plant species. There may not be sufficient suitable backfill available to satisfy the cumulative demands of DOE, NASA, and Boeing for appropriate soils to fill areas disturbed by soil and rock excavation and building demolition. It may be easier for Boeing to locate appropriate backfill because it is not subject to the requirements of the 2010 AOC (DTSC 2010a).[1] Table 5–1 provides estimates of the range in cumulative volumes of soil removed and the volumes of backfill required for DOE, NASA, and Boeing remediation activities. The analyses in this EIS assume Boeing would obtain backfill from offsite sources.

The number of truck trips required to haul away excavated soils and deliver clean backfill is related to the volume of soil removed (degree of soil disturbance), which relates to the difficulty in securing adequate backfill and restoration, and was used as a proxy for the noise and human activity that would occur in the performance of related activities (e.g., site clearing, excavating affected soil, loading trucks, spreading imported topsoil). Additionally, the truck trips would increase the potential for adverse effects from animal-vehicle collisions on wildlife populations on site and along the travel routes. For the combined DOE, NASA, and Boeing remediation activities, a minimum of 107,000 and a maximum of 228,000 large truck trips with a capacity of 20 to 23 tons would be required, compared to a minimum of 20,800 and a maximum of 119,000 trips of similar-sized trucks for DOE remediation activities alone (see Table 5–2).

[1] Boeing has identified six areas of potential soil borrow in the Southern Buffer Zone that could be used as sources of clean backfill for Boeing remediation activities. The areas total approximately 20 acres of undeveloped land. Prior to use of these areas as soil borrow sites, appropriate surveys and permitting, as well as DTSC approval, would be required (MWH 2015).

Simultaneous implementation of remediation activities by DOE, NASA, and Boeing would create cumulative disturbance of habitat and could interfere with regional movement of wildlife species such as mountain lion, bobcat, and ringtail. Three factors that would reduce the impacts on wildlife movement through SSFL during remediation are: (1) remediation activities involving heavy earthmoving equipment would be relatively localized to previously developed portions of the site and would disturb up to 405 acres, about 14 percent of the 2,850-acre site, leaving approximately 86 percent of the SSFL land area, including the majority of the previously undeveloped habitat, not directly affected; (2) construction activities would cease at night, when most mammal species (including mountain lion, bobcat, and ringtail) are active and moving about; and (3) posted speed limits (generally 15 to 25 miles per hour, with slower speeds for haul trucks) would result in low vehicle speeds, reducing the potential for animal-vehicle collisions.

As shown on Figure D–3, projects outside SSFL are generally sufficiently distant from SSFL to minimize the potential for cumulative effects with the remediation projects on SSFL. However, certain proposed projects (such as Sterling Properties in Dayton Canyon) that would be developed on land that supports endangered or threatened species or sensitive habitats and of the same type that would be affected by SSFL remediation activities (e.g., oak woodlands and habitat for Braunton's milk-vetch and Santa Susana tarplant), could have cumulative adverse impacts on those resources. CEQA review and applicable plans, policies, and regulations would afford some protection to these resources. The degree of cumulative impacts would depend on how the projects are ultimately designed and permitted, however.

Sensitive native habitats that would be affected by remediation include Venturan coastal sage scrub, dipslope grassland, northern mixed chaparral, sandstone outcrops, California walnut woodland, coast live oak woodland and savanna, wetlands, vernal pools, and riparian habitat. The proposed exemption areas in Area IV and the NBZ, within which remediation impacts would be minimized, contain some of these habitats.

With regard to sensitive species, the Santa Susana tarplant occurs in SSFL Areas I through IV and the buffer zones and almost exclusively in fissures in sandstone outcrops and in nearby sandy soils. It has the potential to be directly affected by DOE, NASA, and Boeing remediation activities, but the degree to which it would be directly affected by remediation activities is probably low because most individuals grow in small fissures in sandstone outcrops that would generally not be removed or otherwise directly affected as part of remediation because of their location outside of areas affected by chemicals or radionuclides. However, this species appears to be very vulnerable to invasive species, especially fountain grass (*Pennisetum setaceum*), which has been noted to thrive in sandy soils on SSFL and elsewhere, including the fissures in sandstone outcrops where the Santa Susana tarplant grows. The spread of fountain grass initially along roadways and paths would be facilitated by remediation activities because vehicles and personnel would inadvertently spread the seeds and because new unoccupied habitat would be created by remediation activities. Fountain grass acts as a threat through both direct competition and through its potential to spread fire into the habitat of the Santa Susana tarplant. Mitigation of this potential cumulative impact would require cooperation between the responsible parties, including DOE, NASA, and Boeing, as well as incorporating and implementing control measures for this species as part of an invasive species (weed) management plan (see Chapter 6, Table 6–1, measure 5-9).

The impacts of the DOE, NASA, and Boeing remediation activities would be cumulative and substantial, given the close proximity of the three projects in both time and space, the extent of the habitat affected, and the co-occurrence of most of the same vegetation and wildlife species and habitats across SSFL. Proposed exemption areas in Area IV and the NBZ would confer protection of some of the most sensitive biological resources because physical disturbance within these areas would be minimized. The land disturbances of the combined DOE, NASA, and Boeing soil remediation activities, excluding disturbances within the proposed exemption areas, would be considerably larger than those of the DOE activities alone and would directly affect up to 14 percent (405 acres) of the 2,850-acre SSFL site.

5.5.6 Air Quality and Climate Change

5.5.6.1 Criteria Pollutants

The following cumulative air quality analysis evaluated potential impacts within the same three domains as those considered for project-specific impacts in Chapter 4, Section 4.6, of this EIS: (1) Ventura County and the area directly adjacent to SSFL; (2) the South Coast Air Basin; and (3) regions beyond Ventura County and the South Coast Air Basin (see Chapter 3, Figure 3–24, for the locations of SSFL, Ventura County, and the South Coast Air Basin). The analysis focused on a domain adjacent to SSFL, because this is where emissions from DOE remediation activities, in combination with emissions from other projects in the region, would be the most concentrated and would therefore have the greatest potential to contribute to an exceedance of an ambient air quality standard beyond the SSFL boundary.

Ventura County

The projects that would have the greatest potential to combine with emissions from the DOE Area IV remediation activities would include the cleanup actions proposed by NASA and Boeing at SSFL. The areas of soil excavation related to these three actions on SSFL are shown in Figure 5–1.

Tables 5–3 and **5–4** present annual and daily emissions estimates, respectively, for DOE, NASA, and Boeing cleanup activities. These emissions would occur within Ventura County and entirely on SSFL, except that vehicular emissions would occur along the access road between SSFL and Los Angeles County. The data for DOE in Tables 5–3 and 5–4 represent peak annual emissions that would occur in the third year of the remediation project. Estimates of emissions for the Boeing activities are not currently available. However, assuming that excavation volumes are relative indicators of emissions, the Boeing emissions presented in Tables 5–3 and 5–4 were estimated by factoring DOE emissions by the ratio of Boeing/DOE peak annual excavation volumes (168,000/107,000 cubic yards). The *NASA FEIS* (NASA 2014a) emissions are higher than those estimated for the DOE Area IV actions, especially emissions of PM_{10} (particulate matter less than 10 microns in diameter) and $PM_{2.5}$ (particulate matter less than 2.5 microns in diameter). This is the case, as the NASA cleanup activities would disturb more ground and would excavate/backfill more soil volumes in a peak year compared to DOE activities (see Table 5–1). The *NASA FEIS* also calculated emissions using different methods from those used for this EIS, such as use of the California Emissions Estimator Model (Environ 2013) by the *NASA FEIS* versus use of specific equipment usage data derived for this EIS. In addition, the *NASA FEIS* presents uncontrolled fugitive dust emissions, whereas this EIS analysis presents controlled levels of fugitive dust emissions due to the use of BMPs and compliance with Ventura County Air Pollution Control District Rule 55 (Fugitive Dust), which restricts emissions of fugitive dust from being visible beyond the property line of a source. If the DOE fugitive dust BMP emission reduction factor were applied to the NASA emissions, annual and daily PM_{10} and $PM_{2.5}$ emissions for NASA remediation activities on SSFL would be about 73 percent lower than those presented in Tables 5–3 and 5–4.

The bottoms of Tables 5–3 and 5–4 present the range of total annual and daily emissions that would result assuming DOE, NASA, and Boeing cleanup activities occurred at the same time at SSFL.

Table 5–3 Range of Annual Emissions that would occur within Ventura County due to Cleanup Activities at the Santa Susana Field Laboratory

Scenario/Source	*Emissions (tons per year)*					
	VOC	*CO*	*NOx*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*
DOE Area IV and NBZ Alternatives						
Off-road equipment	0.34 – 0.37	2.2 – 2.4	2.8 – 3.1	a	0.14 – 0.15	0.13 – 0.14
On-road vehicles	0.12	0.5	2.6	0.01	0.04	0.03
Fugitive dust					19 – 26	4.5 – 4.8
Annual Emissions Range	**0.47 – 0.49**	**2.7 – 2.9**	**5.5 – 5.8**	**0.01**	**20 – 27**	**4.6 – 5.0**
NASA Area I and II Alternatives						
Demolition – Year 1	2.0	11	20	a	2.0	1.0
Excavation – Years 2 and 3	1.0 – 1.7	9.0 – 16	14 – 26	a	850 – 2,000	180 – 420
Annual Emissions Range	**1.0 – 2.0**	**9.0 – 16**	**14 – 26**	**a**	**2.0 – 2,000**	**1 – 420**
Boeing Area I and III Alternatives						
Off-road equipment	0.6	3.6	4.7	a	0.2	0.2
On-road vehicles	0.2	0.8	4.1	a	0.1	0.0
Fugitive dust					41	7.4
Annual Emissions Range	**0.8**	**4.5**	**8.8**	**0.0**	**41**	**7.6**
Total Annual SSFL Emissions Range	**2.2 – 3.2**	**16 – 23**	**28 – 41**	**0.01**	**63 – 2,100**	**13 – 430**
Emission Thresholds	**50**	**250**	**50**	**250**	**250**	**250**

Boeing = The Boeing Company; CO = carbon monoxide; NASA = National Aeronautics and Space Administration; NBZ = Northern Buffer Zone; NOx = nitrogen oxides; PM_n = particulate matter less than or equal to *n* microns in aerodynamic diameter; SO_2 = sulfur dioxide; VOC = volatile organic compound.

[a] Peak annual emissions are smaller than 0.01 tons per year.

Notes:

- Peak annual DOE emissions would occur in the third year of the remediation project and, therefore, after completion of building removal activities.
- Peak annual emissions for excavation for the NASA alternatives factored by 870,000 cubic yards/500,000 cubic yards to estimate the most current estimate of activity (NASA 2015b) versus what was considered in the *NASA FEIS* (NASA 2014a).
- Peak annual emissions for Boeing activities estimated by factoring annual DOE emissions by the ratio of Boeing annual/DOE peak annual excavation volumes (168,000 cubic yards/107,000 cubic yards).
- Sums presented in the table may differ from those calculated from table entries due to rounding.

To estimate the ambient cumulative impact of project emissions, the following qualitative analysis conservatively assumed that DOE, NASA, and Boeing cleanup activities would occur at the same time. This analysis considers important factors that affect ambient pollutant impacts, including emission source strength, meteorology, distance between an emissions source and public lands, and dispersion and dilution of the pollutant concentrations. Chapter 3, Figure 3–25 shows that winds in the SSFL vicinity blow primarily from the northwest and the southeast. Review of Figure 5–1 shows that winds blowing from the southeast could combine emissions from all three activities (from Areas II, III, and IV) into the atmosphere. This wind direction would result in the shortest transport distance of cumulative cleanup emissions to the SSFL fence line (about 3,300 feet from the furthest NASA source in Area III to the fence line) and, therefore, potentially the highest offsite pollutant impacts of any wind direction. Given that combustive emissions (volatile organic compounds, carbon monoxide, nitrogen oxides, and sulfur dioxide) from the three proposed activities would occur intermittently from equipment and trucks that would operate over fairly large areas, this substantial transport distance would be far enough to sufficiently disperse these emissions such that they would not contribute to an exceedance of an ambient air quality standard at an offsite location.

Table 5–4 Peak Daily Emissions that would occur within Ventura County due to Cleanup Activities at the Santa Susana Field Laboratory

Activity/Source	*Emissions (pounds per day)*					
	VOC	*CO*	*NOx*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*
DOE Area IV and NBZ Alternatives						
Off-road equipment	2.7 – 2.9	18 – 20	23 – 25	a	1.1 – 1.3	1.0 – 1.1
On-road vehicles	1.0	4.4	21	a	0.4	0.2
Fugitive dust					150 – 210	36 – 39
Daily Emissions Range	**3.7 – 3.9**	**22 – 24**	**44 – 46**	**0.1**	**160 – 210**	**37 – 40**
NASA Area I and II Alternatives						
Demolition – Year 1	16	88	160	a	16	8.0
Excavation – Years 2 and 3	8.0 – 14	72 – 120	110 – 210	a	6,800 – 16,000	1,400 – 3,300
Daily Emissions Range	**8.0 – 16**	**72 – 120**	**110 – 210**	**a**	**16 – 16,000**	**8 – 3,300**
Boeing Area I and III Alternatives						
Off-road equipment	4.5	29	38	0.1	1.9	1.8
On-road vehicles	1.6	6.8	32	0.1	0.6	0.3
Fugitive dust					330	59
Daily Emissions	**6.0**	**36**	**70**	**0.1**	**330**	**61**
Total Daily SSFL Emissions Range	**18 – 26.0**	**130 – 180**	**230 – 320**	**0.2**	**500 – 16,000**	**110 – 3,400**

Boeing = The Boeing Company; CO = carbon monoxide; NASA = National Aeronautics and Space Administration; NBZ = Northern Buffer Zone; NOx = nitrogen oxides; PM_n = particulate matter less than or equal to *n* microns in aerodynamic diameter; SO_2 = sulfur dioxide; VOC = volatile organic compound.

[a] Peak daily emissions are smaller than 0.1 pounds per day.

Notes:

- Based on 250 workdays per year.
- Sums presented in the table may differ from those calculated from table entries due to rounding.

Cumulative sources of fugitive dust (PM_{10} and $PM_{2.5}$) would occur from fixed locations within SSFL. All cleanup activities would include BMPs to minimize emissions of fugitive dust. In addition, all activities would have to comply with Ventura County Air Pollution Control District Rule 55 (Fugitive Dust), which restricts emissions of fugitive dust from being visible beyond the property line of a source. Regardless of these controls and restrictions, the combined fugitive dust emissions from all three cleanup activities are high enough that they potentially could contribute to an exceedance of a PM_{10} or $PM_{2.5}$ ambient air quality standard for a few days per year at an offsite location. Winds blowing from all other directions potentially would result in longer transport distances of cumulative cleanup emissions from SSFL to the fence line and, therefore, lower offsite ambient air quality impacts.

South Coast Air Basin

California is divided geographically into air basins for the purpose of managing the air resources of the state on a regional basis. An air basin generally has similar meteorological and geographic conditions throughout. The state is divided into 15 air basins (ARB 2015a). SSFL is located in the South Coast Air Basin. Emissions within the South Coast Air Basin from proposed DOE activities would occur intermittently from an average of up to 48 daily heavy-duty truck round trips and would extend across 10 to 375 miles of roadways, depending on the route taken to a disposal facility. As a result, these emissions would be dispersed in the atmosphere to the point that they would produce minimal ambient impacts in a localized area. However, numerous cumulative projects, such as those listed in Table D–6, would cause additional emissions impacts within the South Coast Air Basin. Given that the region is in extreme nonattainment for the ambient ozone standards, emissions of ozone precursors (volatile organic compounds and nitrogen oxides) from DOE activities, in combination with ozone precursor emissions from cumulative projects, would have the potential to contribute to an exceedance of an ambient ozone standard within the South Coast Air Basin. Implementation of a green cleanup truck fleet proposed by DOE would minimize project cumulative air quality impacts within the South Coast Air Basin.[2]

Outside Ventura County/South Coast Air Basin

Emissions generated from proposed DOE activities outside of Ventura County and the South Coast Air Basin would occur intermittently from an average of up to 48 daily heavy-duty truck round trips, and they would extend over hundreds of miles of roadways. As a result, these emissions would be substantially diluted in the atmosphere to the point that they would produce minimal ambient impacts in a localized area. Therefore, emissions from proposed DOE activities, in combination with emissions from cumulative projects, would not contribute to an exceedance of an ambient air quality standard outside of Ventura County and the South Coast Air Basin. However, trucks would travel about 100 miles per round trip within the San Joaquin Valley Air Basin if wastes were delivered to the Buttonwillow Landfill. Given that this region is in extreme nonattainment for the ambient ozone standards, emissions of ozone precursors from DOE activities, in combination with ozone precursor emissions from cumulative projects, would have the potential to contribute to an exceedance of an ambient ozone standard within this region. Implementation of a green cleanup truck fleet proposed by DOE would minimize project cumulative air quality impacts outside of Ventura County and the South Coast Air Basin.

5.5.6.2 Climate Change

The potential effects of greenhouse gas (GHG) emissions are, by nature, global and cumulative impacts because worldwide sources of GHGs contribute to climate change. Table 4–40 in Chapter 4, Section 4.6.4, of this EIS presents peak annual and total carbon dioxide emissions from each DOE combination of action alternatives. The total carbon dioxide emissions generated by the maximum DOE remediation alternative combination would be 89,000 metric tons. Using the same methods identified in Section 5.5.6.1 for the estimation of criteria pollutants from DOE cleanup activities, NASA and Boeing cleanup actions would emit about 139,000 and 30,400 total metric tons of carbon dioxide, respectively. The total cumulative carbon dioxide emissions generated by SSFL cleanup activities would amount to 258,000 metric tons. Lesser amounts of indirect GHG emissions would occur from subsequent handling of demolished and excavated materials at the disposal sites. These emissions would produce a negligible contribution to future climate change, the effects of which are identified in Chapter 3, Section 3.6.2, of this EIS. In addition, these emissions would be consistent with local and state GHG plans and policies (see Chapter 8, Section 8.1.5), as they would occur from mobile sources that would comply with the most recent vehicle clean fuels, mileage efficiencies, and emissions regulations (such as the Low Carbon Fuel Standard and Heavy-Duty Truck GHG Regulations). For DOE activities, implementation of potential mitigation AQ-1 (see Chapter 6, Table 6−2) also would maximize the use of clean off-road equipment and the newest fleet of haul trucks, which would minimize GHG emissions from these sources.

Climate change could impact implementation of the proposed alternatives at SSFL and the adaptation strategies needed to respond to future conditions. For the region within Ventura County, the main effect of climate change is increased temperature and aridity, as documented by climate

[2] NASA may purchase emission offsets for the affected counties (counties in which the General Conformity *de minimis* threshold values were exceeded) as a method to conform to the General Conformity Rule (NASA 2014a). The quantity of emissions offsets purchased by NASA would equal the quantity by which the General Conformity *de minimis* threshold values were exceeded.

analyses presented in Chapter 3, Section 3.6.2, of this EIS. These analyses predict that, in the future, the region will experience: (1) increases in temperatures, droughts, and wildfires; and (2) scarcities of water supplies. Current operations at SSFL have adapted to droughts, high temperatures, wildfires, and scarce water supplies. However, exacerbation of these conditions in the future could impede proposed activities during extreme events. For example, SSFL remediation could be impeded if the occurrence of wildfires increased over the duration of the remediation activities.

5.5.7 Noise

Minor cumulative noise impacts would likely result from the DOE, NASA, and Boeing remediation activities at SSFL when combined with other unrelated construction activities in the ROI. Remediation activities conducted by NASA and Boeing would generate noise levels similar to those generated by DOE remediation activities (see Chapter 4, Section 4.7). As described in Chapter 4, Section 4.7.1.2, the nearest residence (or potential residence) is located approximately 5,000 feet from the Area IV boundary and would experience approximately 50 decibels A-weighted (dBA) equivalent sound level during workday hours. Under a scenario in which all three parties are conducting construction activities simultaneously and generating equal noise levels at locations as close to the closest residence as possible, noise levels at the closest residence would be well below 65 dBA community noise equivalent level (CNEL). Therefore, there would be little expected adverse cumulative noise impacts.

In accordance with the Transportation Agreement between DOE, NASA, and Boeing (Boeing 2015a), the maximum total number of truck round trips from SSFL would be limited to 96. The fraction of this total number of trips per day that would be conducted by each of the responsible parties would vary depending on the stage and time phasing of the respective projects. DOE shipments would typically range from 32 to 48 per day, occasionally reaching 96 per day. The trucks used by each of the responsible parties would be similar as would be the noise levels generated by the trucks *en route*. Noise levels associated with 96 truck trips per day along the designated haul routes are listed in Chapter 4, Table 4–43. Assuming the maximum authorized number of daily round trips from Area IV (96 round trips), noise levels in residential and recreation areas along potential haul routes are expected to either be less than 65 dBA CNEL or to increase by less than 3 dBA if baseline noise levels already exceed 65 dBA CNEL (see Chapter 4, Section 4.7). Therefore, the highest potential cumulative noise levels would not increase over the levels described in Chapter 4 for DOE activities alone because the number of DOE, NASA, and Boeing shipments is capped at 96. Although cumulative noise levels would not be greater than the levels from DOE activities alone, these higher levels would occur for a longer period of time.

Offsite residential, commercial, and industrial development projects are conducted on a regular basis in portions of Los Angeles and Ventura County that are adjacent to SSFL and are expected to continue to take place while the SSFL cleanup is under way. These projects typically generate temporary localized elevated noise levels at the construction site, temporary increases in construction truck traffic noise along nearby roads, and localized increases in noise levels during project operation. Construction and operations noise would be localized near the individual project sites following a similar pattern to noise levels described for construction activities on SSFL. Therefore, noise from offsite development projects would generally not be cumulative with activities on SSFL. In a hypothetical scenario where a development project was undertaken adjacent to existing residences, the localized noise of the development project would be dominant, and distant noise generated at SSFL, which is more than 5,000 feet from the closest residence, would not contribute appreciably to overall noise levels. Truck trips in support of other projects in the ROI could potentially follow portions of the same routes used by SSFL trucks. If there were any cumulative increase in truck traffic generated by use of the same routes, the increase would be temporary. Therefore, only minor adverse cumulative noise impacts are expected.

5.5.8 Transportation and Traffic

5.5.8.1 Transportation

Radioactive Material Transportation

The assessment of cumulative impacts for past, present, and reasonably foreseeable future actions involving radioactive material transport concentrates on radiological impacts from offsite transportation throughout the Nation that would result in potential radiation exposure to the general population, in addition to those impacts evaluated in this EIS. Cumulative radiological impacts from transportation are measured using the collective dose to the general population and workers because dose can be directly related to latent cancer fatalities (LCFs) using a cancer risk coefficient.

In addition to the impacts of the EIS alternatives addressed in Chapter 4, Section 4.8, the cumulative impacts from transport of radioactive material consist of impacts from historical shipments of radioactive waste and spent (irradiated) nuclear fuel; reasonably foreseeable actions that include transportation of radioactive material identified in Federal, non-Federal, and private environmental impact analyses; and general radioactive material transportation that is not related to a particular action. The time frame for cumulative nationwide impacts from transport of radioactive material was assumed to begin in 1943 (early years of the Manhattan Project) and extend to 2073 (131 years), based on available information from the source document (DOE 2015a).

Reasonably Foreseeable Actions

The information provided for reasonably foreseeable actions could lead to some double counting of impacts. For example, the low-level radioactive waste (LLW) transportation impacts in the *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* (DOE 1997b) may also be included in the EISs for individual DOE facilities. In addition, for foreseeable actions where no preferred alternative was identified or no record of decision was issued, the impact values are included for the alternative with the largest transportation impacts.

Summary of Radiological Impacts

The transportation impacts related to the remediation alternatives evaluated in this EIS are quite small compared with the overall cumulative transportation impacts associated with the transportation of radioactive materials in the United States (see **Table 5–5**).

As shown in Table 5–5, the total collective worker dose from all types of radioactive material shipments (that is, the alternatives evaluated in this EIS, historical shipments, reasonably foreseeable actions, and general transportation) was estimated to be about 421,000 person-rem (potentially resulting in 252 LCFs) for the period from 1943 through 2073 (131 years). The general population collective dose was estimated to be about 436,000 person-rem (potentially resulting in 262 LCFs) over the same period. Worker and general population collective doses for 12 years of remediation activities at SSFL (the maximum evaluated remediation period) would range from 0.64 to 2.0 person-rem for workers and 0.28 to 0.58 person-rem for the general population. The potential doses from transport of radioactive materials associated with the alternatives in this EIS are very small and insignificant compared to the doses from other nuclear material shipments. Boeing remediation activities are not expected to generate radioactive waste. The worker and general population collective doses related to remediation activities at SSFL would represent less than 0.0005 percent of the total impacts from nationwide transport of radioactive materials.

Table 5–5 Cumulative Transportation-Related Radiological Collective Doses and Latent Cancer Fatalities (1943 to 2073)

Category	*Collective Worker Dose (person-rem)*	*Collective General Population Dose (person-rem)*
DOE Transportation Impacts in this EIS [a]	0.34 to 1.5 [b] 0.14 to 0.46 [c]	0.092 to 0.39 [b] 0.12 to 0.26 [c]
NASA Remediation Activities [d]	0.50	0.19
Boeing Remediation Activities [e]	Not applicable	Not applicable
Subtotal	**0.64 to 2.0**	**0.28 to 0.58**
Other Nuclear Material Shipments		
Past, present, and reasonably foreseeable DOE actions [f]	31,400	36,900
Past, present, and reasonably foreseeable non-DOE actions [f]	5,380	61,300
General radioactive material transport (1943 to 2073) [f]	384,000	338,000
Total collective dose (up to 2073) [g]	**421,000**	**436,000**
Total latent cancer fatalities [h]	**252**	**262**

Boeing = The Boeing Company; NASA = National Aeronautics and Space Administration; rem = roentgen equivalent man.

[a] Range of values for transportation of radioactive materials and waste under the EIS action alternatives from Table 4–52.

[b] Transport by truck.

[c] Transport by truck/rail.

[d] Due to the similarities between DOE and NASA LLW/mixed low-level radioactive waste (MLLW) shipment characteristics (soil, shipping methods, and potential disposal location [Energy*Solutions*, Utah]), the collective worker dose and collective population dose were estimated using the estimated number of NASA LLW/MLLW shipments and the per-shipment risk factors for shipments to Energy*Solutions* used in Appendix H, Table H–4, of this EIS. These estimates are not found in the *NASA FEIS* (NASA 2014a); however, they are presented here as part of the cumulative impacts analysis.

[e] Boeing is not expected to transport LLW/MLLW from SSFL.

[f] From DOE 2015; this reference provides the details of all contributing actions. Most of these activities are unrelated to activities at SSFL.

[g] Total includes the maximum values under the combination of alternatives evaluated in this EIS.

[h] Total LCFs were calculated assuming 0.0006 LCFs per rem of exposure (DOE 2003c).

Notes:

- Sums presented in the table may differ from those calculated from table entries due to rounding.
- Values rounded to three significant figures.

The total number of potential LCFs (among the workers and general population) estimated to result from nationwide radioactive material transportation during the period between 1943 and 2073 is 514 (252 workers and 262 individuals from the general population; see Table 5–5). These potential LCFs averaged over 131 years results in about 4 LCFs per year. Over this same period (131 years), about 74 million people would die from cancer, based on the average annual number of cancer deaths in the United States of about 566,000, with no more than a 1 percent fluctuation in the number of cancer fatalities expected in any given year (CDC 2008, 2011, 2012a, 2012b, 2013). The transportation-related LCFs represent about 0.0007 percent of the total number of cancer deaths expected over the same time period; therefore, this rate is indistinguishable from the natural fluctuation in the total annual death rate from cancer. Note that the majority of the cumulative risk to workers and the general population would be due to general transportation of radioactive material unrelated to remediation activities at SSFL.

Summary of Nonradiological Impacts

Table 5–6 shows the cumulative transportation accident fatalities that could result from DOE, NASA, and Boeing transporting radioactive and nonradioactive waste to offsite disposal facilities and transporting supplies, equipment, and backfill soil from the surrounding area to the SSFL site. Over the duration of DOE, NASA, and Boeing activities at SSFL (assumed to be 12 years), up to 4 (3.5) additional traffic accident fatalities could result.

Table 5–6 Cumulative Transportation-Related Accident Fatalities That Could Result from DOE, NASA, and Boeing Remediation Activities at the Santa Susana Field Laboratory

Category	*Potential Accident Fatalities*
DOE Remediation Activities at SSFL [a]	0.28 – 2.9
NASA Remediation Activities at SSFL [b]	0.26 – 0.34
Boeing Remediation Activities at SSFL [c]	0.24
Subtotal for SSFL	**0.79 – 3.5**
Estimated traffic fatalities occurring in California (2017 – 2028)	43,000
Estimated traffic fatalities occurring in the four neighboring counties (2017 – 2028) [d]	11,400

Boeing = The Boeing Company; NASA = National Aeronautics and Space Administration.

[a] Minimum and maximum values for transportation under the EIS action alternatives from Chapter 4, Tables 4–52 and 4–53.

[b] Number of fatalities that could occur if NASA ships all waste off site for disposal (maximum) or treats some of the waste on site (minimum).

[c] Fatalities that could occur if Boeing ships all waste off site and does not treat any waste on site.

[d] Assumed to be Kern, Los Angeles, Santa Barbara, and Ventura Counties.

Notes:

- Sums presented in the table may differ from those calculated from table entries due to rounding.
- Values rounded to two significant figures.

To put this number of traffic fatalities into perspective, during this same 12-year time frame, an estimated 43,000 traffic fatalities could occur in California, and an estimated 11,400 traffic fatalities could occur in the four neighboring counties (Kern, Los Angeles, Santa Barbara, and Ventura) (CHP 2012). These fatality estimates are based on the average annual number of traffic fatalities in California (3,583) and the four neighboring counties (948) from 2003 to 2012, with no more than a 14 percent fluctuation in the number of traffic fatalities in any given year (CHP 2012). The additional traffic fatalities that could occur as a result of DOE, NASA, and Boeing activities at SSFL represent about 0.008 percent of the total number of traffic fatalities expected in California and about 0.03 percent of the total number of traffic fatalities expected in the four surrounding counties. The potential traffic fatalities from operations at SSFL are indistinguishable from the natural fluctuation in the total annual death rate from traffic fatalities.

5.5.8.2 Traffic

This subsection evaluates cumulative impacts on traffic conditions for roads in the SSFL vicinity that are used by commuting employees, to transport wastes and recyclable materials to offsite facilities, and to deliver equipment and materials to SSFL. Impacts were evaluated by examining changes to average daily traffic volumes on roads in the SSFL vicinity, the level of service (LOS) for these roads, and potential pavement deterioration.

Level of Service

To determine the cumulative impacts of SSFL cleanup activities on LOS, the total additional vehicle traffic from DOE, NASA, and Boeing remediation activities was added to current daily traffic on four potential alternative routes between SSFL and major highways. As shown in Table 5–1, these added vehicles included a maximum of 96 truck round trips and an additional 201 auto round trips, making a total of 297 daily round trips or 594 one way trips. The truck trips are associated with transport of waste, soil, and other materials; the auto trips are associated with employees commuting to SSFL.

As **Table 5–7** shows, the largest percentage increase in traffic is expected on Woolsey Canyon Road (30 percent), while traffic on other roads is expected to increase from less than 1 percent to 11 percent. Approximately 32 percent (96 of 297 trips daily) of this increase is a result of added trucks transporting materials to and from SSFL. The remaining 68 percent (201 out of 297 round trips daily) are attributable to commuting SSFL cleanup workers. These results represent a worst-case scenario for each of the four evaluated routes between SSFL and major highways. This is because 100 percent of SSFL traffic is assigned to a single route. In reality, traffic would use a combination of routes which would diffuse traffic impacts over the road system.

In all but one case, the predicted future LOS would not fall below current conditions. The LOS on Woolsey Canyon Road could degrade from LOS B to C. Motorist delays could occur on Woolsey Canyon Road and at its intersection with Valley Circle Boulevard. Other than Woolsey Canyon Road, traffic volumes on roads near SSFL could be reduced by use of multiple routes between SSFL and the major highways.

Pavement Deterioration

Pavement deterioration impacts were estimated using a low estimate of 107,000 cumulative truck shipments and a high estimate of 228,000 truck shipments (Table 5–1). These estimates were developed based on the cumulative volume of material that would be moved and the transport capability of commercial vehicles. For DOE truck trips, equivalent single axle loads (ESALs) would increase by 45,000 (Low Impact Combination) to 210,000 (High Impact Combination). For NASA and Boeing truck trips, ESALs would increase by 220,000 to 330,000. Estimated cumulative ESALs associated with DOE, NASA, and Boeing truck trips at SSFL would increase by approximately 260,000 to 540,000, depending on the remediation option and the route traveled. The results are summarized in **Table 5–8**. The increase in truck traffic results in a substantial increase in ESALs, with between 17 and 39 percent of this increase attributable to DOE cleanup activities. The largest percentage increase would occur along Route 1 (see Table 4–5 for description of routes) for both the high and low truck shipment scenarios. This increase in vehicle traffic would likely have negative impacts on some roads in the SSFL vicinity and result in their needing repair sooner than currently anticipated.

Table 5–7 Traffic Increases Associated with DOE, NASA, and Boeing Remediation Activities at the Santa Susana Field Laboratory[a]

Road	*From*	*To*	*Current AADT*	*Current LOS*	*SSFL Traffic*	*Percent Change*	*Future LOS*
Route 1							
Woolsey Canyon Road	SSFL entrance	Valley Circle Blvd	2,002	B		30	C
Valley Circle Blvd	Woolsey Canyon Road	Plummer Street	6,316	D		9	D
Plummer Street	Valley Circle Blvd	Topanga Canyon Blvd	5,437	D	594	11	D
Topanga Canyon Blvd	Plummer Street	SR 118 WB Ramps	42,499	D		1.4	D
SR 118	Junction with Topanga Canyon Blvd		130,000	E		0.5	E
Route 2							
Woolsey Canyon Road	SSFL entrance	Valley Circle Blvd	2,002	B		30	C
Valley Circle Blvd	Woolsey Canyon Road	Roscoe Blvd	9,000	D		6.6	D
Roscoe Blvd	Valley Circle Blvd	Topanga Canyon Blvd	7,996	C	594	7.4	C
Topanga Canyon Blvd	Roscoe Blvd	Plummer Street	47,885	D		1.2	D
Topanga Canyon Blvd	Plummer Street	SR 118 WB Ramps	42,499	D		1.4	D
SR 118	Junction with Topanga Canyon Blvd		130,000	E		0.5	E
Route 3							
Woolsey Canyon Road	SSFL entrance	Valley Circle Blvd	2,002	B		30	C
Valley Circle Blvd	Woolsey Canyon Road	Roscoe Blvd	9,000	D		6.6	D
Valley Circle Blvd	Roscoe Blvd	Victory Blvd	20,341	D	594	2.9	D
Valley Circle Blvd	Victory Blvd	U.S. Highway 101	36,237	E		1.6	E
U.S. Highway 101	Junction with Topanga Canyon Blvd		240,000	F		0.2	F
Route 4							
Woolsey Canyon Road	SSFL entrance	Valley Circle Blvd	2,002	B		30	C
Valley Circle Blvd	Woolsey Canyon Road	Roscoe Blvd	9,000	D		6.6	D
Roscoe Blvd	Valley Circle Blvd	Topanga Canyon Blvd	7,996	C	594	7.4	C
Topanga Canyon Blvd	Roscoe Blvd	U.S. Highway 101	46,000	D		1.3	D
U.S. Highway 101	Junction with Topanga Canyon Blvd		240,000	F		0.2	F

AADT = Annual Average Daily Traffic; Blvd = Boulevard; LOS = level of service; SR = State Route; WB = westbound.

[a] LOS estimated using Highway Capacity Manual 2010 Exhibit 16-14 or Exhibit 15-30 (TRB 2010).

Table 5–8 Estimated Increases in Equivalent Single Axle Loads Associated with DOE, NASA, and Boeing Remediation Activities at the Santa Susana Field Laboratory

Activity	Route 1	Route 2	Route 3	Route 4
Baseline ESALs	38,000	74,000	47,000	45,000
ESALs Associated with Cumulative SSFL Remediation	260,000 to 510,000	300,000 to 540,000	270,000 to 520,000	270,000 to 510,000

ESAL = equivalent single axle load, ESALs rounded to the nearest whole number.

5.5.9 Human Health

The human health impacts presented in Chapter 4, Section 4.9, include carcinogenic risk, chemical toxicity, and radiation dose to onsite residents, recreational users, and remediation workers from DOE remediation activities at SSFL. Because quantitative impact estimates of carcinogenic risk, chemical toxicity, and radiation dose are not currently available for NASA and Boeing, cumulative impacts are discussed qualitatively.

As presented in Chapter 4, Section 4.9, impacts on a hypothetical onsite resident or recreational user are based on the time spent by a resident or recreational user in Area IV. The onsite resident scenario conservatively includes exposure for 24 hours a day, 350 days per year, for 30 years (MWH 2014). A resident can only be in one area at a time and cannot be in two areas simultaneously. Whatever time they spend in one area takes away from the time they could spend in another area. Therefore, the effects are not cumulative and cannot be greater than the greater of the individual area effects.

The impacts from other adjacent areas under control of NASA or Boeing to a resident in Area IV are expected to be insignificant by comparison and would result in a minimal addition to cumulative impacts because these areas are separated by significant distances relative to a residential exposure scenario and air concentrations generally decrease with distance due to dispersion and dilution. Likewise, the contributions from Area IV to hypothetical onsite residents in NASA or Boeing remediation areas also would be small and would make a minimal addition to cumulative impacts for the same reasons.

A hypothetical recreational user could travel across SSFL and be potentially exposed in SSFL areas currently controlled by NASA or Boeing; however, the assumption that the recreation user is exposed 8 hours per day for 75 days per year for 30 years would limit the cumulative impacts of this exposure because the total exposure time would not increase for this receptor, regardless of which area is being traversed. The maximum potential impact on a recreational user would be based on the assumption that all of his or her time is spent in the area of SSFL with the highest impact (see Appendix G for identification). Because the scenario limits the duration of exposure of the recreational user (a recreational user can only be in one area at a time and cannot be exposed to two areas simultaneously), if time were spent in areas with lower impacts, the cumulative effect would be a reduction in impacts.

It is not likely that the same remediation workers would perform remediation work for DOE and NASA and/or Boeing because remediation activities are planned to occur in overlapping years. If workers do perform remediation work in more than one area, they can only be in one area at a time and would not be exposed in two areas simultaneously. Whatever time they spend in one area reduces the time they could spend in another area, and their total annual exposure impacts would still be limited to applicable regulatory standards and guidelines. In addition, because work practices during excavation or demolition (e.g., use of water sprays) would control dust, impacts would largely be localized to the work area. Therefore, it can be reasoned that the contributions from remediation activities in one area of SSFL on remediation workers in an adjacent area would be small and would only minimally add to cumulative impacts on worker health.

5.5.10 Waste Management

Various waste quantities are projected from DOE, NASA, and Boeing remediation activities. Waste generation from DOE activities reflects the range in waste quantities from implementing different combinations of action alternatives (see Chapter 4, Section 4.10). The low end of the range reflects the combination of the Conservation of Natural Resources, Building Removal, and Groundwater Monitored Natural Attenuation Alternatives (Low Impact Combination). The high end of the range reflects the combination of the Cleanup to AOC LUT Values, Building Removal, and Groundwater Treatment Alternatives (High Impact Combination).

As presented in Table 5–1, NASA remediation activities are projected to affect up to 870,000 cubic yards of soil, which represents an increase of about 370,000 cubic yards over that estimated in the *NASA FEIS* (NASA 2014a). Because much of the affected soil contains hazardous constituents (such as petroleum byproducts) that may be treated on site (NASA 2014a), a range in the quantity of waste requiring offsite shipment was assumed. For the high end of the range, 870,000 cubic yards of affected soil would be shipped off site for treatment or disposal. Consistent with the *NASA FEIS* (NASA 2014a), this soil waste was estimated to consist of approximately 10 percent LLW or mixed low-level radioactive waste (MLLW) (about 87,000 cubic yards); 80 percent hazardous waste (about 696,000 cubic yards); and 10 percent nonhazardous waste (about 87,000 cubic yards). For the low end of the range and consistent with the *NASA FEIS* (NASA 2014a), it was assumed that 30 percent of the affected soil (about 263,0000 cubic yards) would be treated on site and would remain on site, and the remaining 70 percent (about 607,000 cubic yards) would be shipped off site for treatment or disposal. The 607,000 cubic yards to be shipped off site was assumed to consist of 87,000 cubic yards of LLW or MLLW; 87,000 cubic yards of nonhazardous waste; and 433,000 cubic yards of hazardous waste.

In addition, NASA is projected to generate about 66,100 cubic yards of waste, recycle, and other material from building demolition, consisting of about 3,170 cubic yards of hazardous waste (principally contaminated concrete); about 28,700 cubic yards of nonhazardous concrete and other building demolition debris; about 23,300 cubic yards of recyclable asphalt; and about 10,900 cubic yards of scrap metal or equipment for export or resale (NASA 2014a).[3]

Boeing expects its remediation waste to principally consist of about 336,000 cubic yards of excavated soil, of which about 15 percent (53,700 cubic yards) would contain hazardous constituents in sufficient concentrations to warrant classification as hazardous waste and the remaining 85 percent (282,000 cubic yards) would be classified as nonhazardous waste (Boeing 2015f).

Table 5–9 lists cumulative volumes of LLW/MLLW, hazardous waste, nonhazardous waste, and recyclable material to be generated from DOE, NASA, and Boeing remediation activities at SSFL. DOE is projected to generate and ship off site about 40 to 54 percent of the cumulative volume of LLW and MLLW, 6 to 9 percent of the cumulative volume of hazardous waste, 12 to 67 percent of the cumulative volume of nonhazardous waste (principally soil), and about 9 percent of the cumulative volume of recycle material.

[3] Converted from tons, assuming 1.5 tons per cubic yards (see Appendix D).

Table 5–9 Total Cumulative Waste Volumes Shipped Off Site from Remediation Activities at the Santa Susana Field Laboratory (cubic yards)

Waste Generators	*LLW and MLLW*	*Hazardous Waste*	*Nonhazardous Waste*	*Recycle Material*
DOE	57,600 to 103,000	49,100	53,200 to 794,000	3,540
NASA	87,000	436,000 to 699,000	116,000	34,200 [a]
Boeing	None expected	53,700	282,000	Not reported
Total	145,000 to 190,000	539,000 to 802,000	451,000 to 1,190,000	37,700
DOE Percentage of Total	40 to 54	6 to 9	12 to 67	9

Boeing = The Boeing Company; LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; NASA = National Aeronautics and Space Administration.

[a] Includes 35,000 tons (about 23,300 cubic yards) of asphalt to be recycled, 8,300 tons (about 5,500 cubic yards) of scrap metal to be shipped to the Port of Los Angeles for export, and 8,100 tons (about 5,400 cubic yards) of equipment to be shipped to equipment dealers in Los Angeles for reuse (NASA 2014a).

Notes:

- Sums presented in the table may differ from those calculated from table entries due to rounding.
- Values rounded to three significant figures.

Source: Boeing 2015f; NASA 2014a, 2015a.

The impacts on waste management facilities from treatment and disposal of the wastes projected in Table 5–9 were estimated. A strict comparison against the total and daily capacities of offsite waste management facilities cannot be easily made, however, because DOE, NASA, and Boeing may send different types of waste under different schedules to different facilities for treatment or disposal. There is overlap, however, in the offsite facilities that DOE, NASA, and Boeing have identified and evaluated for offsite receipt of waste.

For this EIS, DOE identified a large number of waste disposal facilities in Chapter 3, Section 3.10, but selected a reduced number of these facilities as representative for detailed evaluation in Chapter 4. Of the disposal facilities identified by NASA in the *NASA FEIS* (NASA 2014a), all were also identified by DOE in Section 3.10, and some were evaluated as representative in Chapter 4. The five disposal facilities that NASA identified in the *NASA FEIS* that overlap with the facilities evaluated as representative in this EIS are as follows:

- the Chiquita Canyon Landfill in California for nonhazardous waste,
- the Antelope Valley Landfill in California for nonhazardous waste,
- the Buttonwillow Landfill in California for hazardous waste,
- the Energy*Solutions* facility in Utah for LLW and MLLW, and
- the US Ecology facility in Idaho for hazardous waste.

The total waste capacities of all of these facilities are significantly larger than the cumulative volumes of the SSFL remediation wastes, as shown in **Table 5–10**. For this table, it is conservatively assumed that all of each type of waste would be disposed of in each of the five evaluated facilities consistent with the type of waste authorized for each facility.

Table 5–10 Percentage of Total Waste Disposal Capacity by Disposal Facility Assuming Receipt of Cumulative Waste Volumes

Facility	*Waste Accepted*	*Available or Projected Waste Capacity (cubic yards)* [a]	*Percent of Capacity* [b]
Antelope Valley	Nonhazardous	20,050,000	2.3 to 5.9
Chiquita Canyon	Nonhazardous	96,000,000	0.47 to 1.2
Buttonwillow	Hazardous	10,000,000	5.4 to 8.0
US Ecology in Idaho	Hazardous	10,000,000	5.4 to 8.0
Energy*Solutions*	LLW/MLLW	8,000,000	1.8 to 2.4

LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste.
[a] Source: Chapter 4, Table 4-64.
[b] The range in percent of capacity represents the range in waste volumes that could be generated for each type of waste, as shown in Table 5–9. For analysis, it was assumed that all of each type of waste would be sent to each evaluated facility authorized to receive that type of waste.
Note: Values have been rounded.

For example, the maximum projected cumulative nonhazardous waste volume of approximately 1,190,000 cubic yards (Table 5–9) would represent about 1.2 percent of the 96 million cubic yards capacity of the Chiquita Canyon Landfill. This means there would be sufficient total disposal capacity even under the hypothetical (and unrealistic) assumptions that all nonhazardous waste would be sent to either the Chiquita Canyon or Antelope Valley Landfills; all hazardous waste would be sent to Buttonwillow or US Ecology in Idaho; or all LLW/MLLW would be sent to Energy*Solutions* in Utah. Overall, the above comparison shows that sufficient disposal capacity exists for all types of waste generated by DOE, NASA, and Boeing, and any adverse impact on any single facility's capacity can be reduced by sending waste to multiple disposal facilities.

The impacts on any daily capacity limits at a facility will depend on the timing for delivery of wastes appropriate for that facility from DOE, NASA, or Boeing. It is expected that daily shipments of the hazardous and nonhazardous wastes listed in Table 5–9 would represent fractions of the permitted daily tonnage limits at the Chiquita Canyon, Antelope Valley, or Buttonwillow Landfills, as shown in **Table 5–11**. Even so, the schedules for shipment to these and other appropriate facilities can be adjusted as needed to comport with any daily waste acceptance limitations. There are no permitted daily limits for receipt of waste at the Energy*Solutions* or US Ecology facilities. Although there may be logistical concerns with shipping large quantities of waste to these facilities, it is expected that these concerns could be managed by coordination with the facility operators and, as discussed above, any concerns about permitted daily limits or logistical restrictions at any single facility can be alleviated by shipping waste to multiple facilities. Multiple disposal facilities are available for all of the types of waste expected from SSFL remediation.

No daily permitted tonnage limits were determined for the recycle facilities evaluated in Chapter 4 of this EIS, and no impacts on daily capacities are expected, considering the small total quantity of recycle material expected to be generated. Multiple recycle facilities exist in California in addition to those evaluated in this EIS.

Therefore, although the projected cumulative volumes of DOE, NASA, and Boeing remediation waste and recycle material are large (particularly for LLW/MLLW, hazardous waste, and nonhazardous waste), it is not expected that any waste or recycle material would lack adequate management capacity. This is principally because of the extensive waste treatment and disposal capacities that exist in California and in nearby states for all of the identified types of waste, as well as the large recycle capacity that exists in the SSFL vicinity.

Table 5–11 Percentage of Daily Permitted Tonnage Limit by Disposal Facility Assuming Receipt of Cumulative Waste Volumes

Facility	*Waste Accepted*	*Permitted Daily Limit (tons/day)* [a]	*Percent of Daily Tonnage Limit* [b]
Antelope Valley	Nonhazardous	3,564	28
Chiquita Canyon	Nonhazardous	6,500	15
Buttonwillow	Hazardous	10,500	9.4
US Ecology in Idaho	Hazardous	No permitted limit	–
Energy*Solutions*	LLW/MLLW	No permitted limit	–

LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste.

[a] Source: Chapter 4, Table 4-64.

[b] The maximum daily tonnage was determined by assuming the maximum number of daily shipments of each type of waste generated by the combination of DOE, NASA, and Boeing, a waste payload of 20 tons per shipment for DOE waste, and 23 tons per shipment for NASA and Boeing wastes. For analysis, it was assumed that all of each type of waste would be sent to each evaluated facility authorized to receive that type of waste.

Note: Values have been rounded.

5.5.11 Cultural Resources

The assessment of cumulative impacts on cultural resources includes archaeological, architectural, and traditional cultural resources. Cultural resources at SSFL and in the vicinity are summarized in Chapter 3, Section 3.11, and discussed in detail in Appendix F. The methodology for assessing impacts on cultural resources is defined in Appendix B. Cumulative impacts related to archaeological, architectural, and traditional cultural resources were evaluated in the context of an ROI that included detailed information within 1 mile of SSFL, as well as the wider area identified by the overall cumulative impacts approach. The potential for cumulative impacts on cultural resources is discussed qualitatively and builds on the impacts identified in Chapter 4, Section 4.11.

Because of the nonrenewable character of cultural resources, projects with the greatest potential to produce cumulative impacts on cultural resources include development of, construction at, or improved access to previously undisturbed land, especially in areas that retain visual integrity due to remoteness or difficult access. Impacts on archaeological sites could arise from disturbance or destruction. Architectural resources could be affected by demolition and changes in setting or to interiors or façades. Traditional cultural resources could be adversely affected by all of these activities, but also by changes in access or loss of association, particularly regarding settings. Of the 129 actions identified within 10 miles of SSFL (Appendix D, Figure D–3), as many as 21 have the potential to contribute to cumulative effects. These projects include planned residential and commercial development, as well as the NASA and Boeing remediation projects at SSFL (refer to Table D–6).

5.5.11.1 Archaeological Resources

National Register of Historic Places (NRHP)–eligible sites in the DOE-administered portions of Area IV and the NBZ will be protected from impacts (i.e., adverse effects) through implementation of a Programmatic Agreement under Section 106 of the National Historic Preservation Act (NHPA). NRHP-eligible sites will be protected on NASA's and Boeing's areas. Sites that are not individually eligible, but are contributing elements of the Chumash-designated Santa Susana Sacred Site (discussed in more detail in Section 5.5.11.3), could be adversely impacted by cleanup activities, including soil removal, in-ground remediation, and (possibly) by groundwater cleanup (refer to Appendix F, Table F–2). These may include as many as 79 sites and isolates in Area IV and the NBZ, as well as possibly over 100 sites and isolates in NASA and Boeing areas. However, cultural resources that are not NRHP-eligible could be protected under the 2010 AOC (DTSC 2010a) exemption process. Even with avoidance of direct impacts on NRHP-eligible archaeological sites, contributing elements of the Chumash-designated Santa Susana Sacred Site could be adversely affected, adding to cumulative effects on cultural resources. Large-scale developments outside SSFL would contribute to a cumulative adverse impact on cultural resources if archaeological sites are encountered during project construction, are paved over, or are disturbed at a later date due to human activity. The overall trend in the region is toward a reduction in the number and quality of NRHP-eligible archaeological sites, both pre-contact Native American and post-contact, as these impacts accumulate. Where NHPA is applicable, adverse effects to NRHP-eligible sites would be mitigated, but mitigation could include removal of the site. Where NHPA is not applicable, or where sites are not eligible, sites may be removed from the overall inventory of archaeological resources. The protection of NRHP-eligible sites at SSFL would not add to cumulative, regional impacts. However, the overall complement of archaeological sites, particularly those that are not eligible for the NRHP, could continue to be reduced.

5.5.11.2 Architectural Resources

No structures located in DOE-administered Area IV are eligible for listing on the NRHP. The remaining structures in Area IV have been evaluated for NRHP eligibility and do not contribute under any criteria (Post/Hazeltine Associates 2009).

Outside of the DOE area of potential effects (APE), in the NASA- and Boeing-administered areas that were part of the scientific research and development activities in this part of southern California, some structures are eligible for listing on the NRHP. Of particular note are those structures that lie in one of NASA's three historic districts (the Alfa, Bravo, and Coca Test Areas). NASA proposes to preserve one or more NRHP-eligible structures, but demolition of other selected structures could have an adverse impact on the NRHP-listed or eligible built environment and would contribute to the cumulative effect on this resource type in the vicinity of SSFL. However, because there are no NRHP-eligible structures within the DOE APE, DOE cleanup activities would have no cumulative effect on architectural resources.

5.5.11.3 Traditional Cultural Resources

Cumulative adverse effects on traditional cultural resources are likely as cleanup occurs on the rest of SSFL and as development occurs in previously undeveloped land in the region, including in areas with intact landscapes or remote locations where traditional resources may still retain integrity. The Chumash-designated Santa Susana Sacred Site encompasses the entire SSFL. As described in Appendix B, the character-defining traits of this area include all archaeological and natural resources, settings, and viewsheds. Cleanup activities will affect some archaeological resources in Area IV and the NBZ, as well as possibly some archaeological resources in NASA- and Boeing-administered areas. Plants and animals may be disturbed, dislocated, or destroyed. Although project proponents plan to restore habitat through contouring and revegetation of the land, there would be adverse impacts on the land, including settings and viewsheds. Even a temporary change would affect the sacred sites and could be an adverse impact. Loss of defining characteristics of traditional cultural values at other locations within the area considered for cumulative effects would also be added to the cumulative impact on the viewsheds.

In contrast to the adverse impacts just described, beneficial impacts could be achieved through restoration of viewsheds by removal of structures. Removal of contamination could also be perceived as beneficial to the natural resource components of the Chumash-designated Santa Susana Sacred Site.

5.5.12 Socioeconomics

SSFL Employment

As described in Table 5–1, DOE, NASA, and Boeing cleanup activities at SSFL would require up to 201 onsite workers during periods of maximum activity. DOE activities would require 25 to 26 workers (12 to 13 percent of the total workers). It was assumed that workers would originate primarily from Ventura and Los Angeles Counties because about 117,000 construction workers live in the region (see Chapter 3, Tables 3–37 and 3–38).

Cumulatively, SSFL site activities would have a minor beneficial impact on the economy in Los Angeles and Ventura Counties by providing employment and increasing sales for industries that provide equipment, supplies, and rentals. Because workers would likely originate from the region, new spending or economic activity in the region would be minimal.

Truck Drivers and Traffic

As documented in Appendix D, Table D–6, multiple other projects in the ROI would require truck transportation, which could have cumulative effects on employment and local business revenue. As shown in Table 5–1, the total number of daily truck trips for DOE, NASA, and Boeing activities would be limited to 96 trucks. Some drivers would travel long distances on multi-day trips; therefore, additional drivers could be used to maintain 96 daily trips at SSFL. It was estimated that 73 to 297 truck drivers could be employed for the DOE, NASA, and Boeing cleanup activities. In 2012, approximately 7,200 workers were employed in specialized freight trucking in the two counties, plus approximately 26,600 employees in general truck transportation (see Chapter 3, Section 3.12, Tables 3–37 and 3–38). Employment of 73 to 297 truck drivers would be 1 to 4 percent of the available truck drivers in the two counties and therefore would not adversely affect the truck transportation industry. Employment of local truck drivers would not generate substantial new sales in the region because these workers were assumed to spend money in the region with or without the SSFL remediation projects.

As shown in Section 5.5.8.2, Table 5–7, the cumulative increase in traffic for DOE, NASA, and Boeing activities would not change the current LOS rating of D for Topanga Canyon Boulevard. Topanga Canyon Boulevard is the only local road on the route from SSFL to the major interstate highways that has substantial commercial establishments that could experience economic impacts relative to increased traffic. Traffic conditions near businesses would not change substantially from existing conditions, and customers are expected to patronize businesses as usual. Therefore, business sales and revenues would not change substantially under the cumulative condition. Although the most significant increase in traffic (30 percent) would occur on Woolsey Canyon Road (see Section 5.5.8.2), this increase is not expected to result in socioeconomic impacts on businesses because of the lack of retail establishments on this road.

The populations in Los Angeles and Ventura Counties are projected to increase by 9 percent from 2013 through 2030 (California Department of Finance 2014). Population growth could increase traffic levels, but also could increase spending by local and state government agencies on roadways and mass transit projects. Therefore, no conclusions can be reached regarding the effect of future population growth on traffic conditions.

Infrastructure and Municipal Services

As shown in Table 5–1, cleanup activities by DOE, NASA and Boeing would result in a minimum of 107,000 truck trips to a maximum of 228,000 truck trips to and from SSFL over a 12-year period. Some roads surrounding SSFL already need repair (see Chapter 3, Section 3.8.2.3), and increased vehicle traffic could further damage these roads, causing them to require repair sooner than currently anticipated (see Section 5.5.8.2). Impacts on roads would result in impacts on local government funding and expenses, which are described below. DOE would make a substantial incremental contribution to this cumulative impact because the DOE truck trips of 20,800 to 119,000 would be 19 to 52 percent of the total shipments. DOE activities would not require additional services such as police and fire protection, so there would be no cumulative impacts to other municipal services.

Housing Stock and Home Value

Because SSFL workers would likely originate from the region, changes to housing stock and home values are not expected. Therefore, there would be no cumulative effects on housing stock and home values.

Local Government Revenue

As described in Section 5.5.8.2, truck traffic on local roads used for SSFL soil and material transport would likely deteriorate pavement and necessitate more-frequent repairs. Cumulative economic effects to local governments could result from increased expenses for road repair. The DOE cleanup activities would contribute substantially to this cumulative effect because, as described above under Infrastructure and Municipal Services, the DOE truck trips represent 19 to 52 percent of the total shipments for SSFL remediation. Due to the complexity of local government financing and budgeting, it is not possible to identify which other services may be affected if more money is spent on road repair. Recognizing that there may be damage to the local roads from the potentially large number of trucks associated with remediation of Area IV and the NBZ, DOE may need to negotiate with the affected local governments to contribute a portion of the maintenance costs for the affected roads.

Other development projects in the ROI (see Appendix D, Table D–6) could also increase construction truck traffic and produce road damage, although development in general is an ongoing activity that increases and decreases with local, state, and national economic conditions. Therefore, construction truck traffic for these other development projects would be largely a continuation of baseline traffic conditions and would be spread across the roadways in the ROI; therefore, it would be unlikely to contribute to cumulative impacts from DOE remediation activities at SSFL.

Disposal Facility Impacts

As described in Section 5.5.10, DOE, NASA, and Boeing may use some of the same facilities for waste disposal and recycling. For such activities, the maximum daily truck shipments arriving at LLW or MLLW facilities would be 17 trucks (see Appendix D). The maximum daily truck shipments to facilities for other types of waste would be 39 at hazardous waste facilities, 43 trucks at nonhazardous waste facilities, and 4 trucks at recycle facilities (see Appendix D). These increases in truck traffic from DOE, NASA, and Boeing activities are not expected to have a cumulative adverse economic impact to local businesses near disposal facilities because the number of truck trips would be small and multiple disposal facilities may be used.

5.5.13 Environmental Justice

As defined in Chapter 3, Section 3.13, environmental justice is the fair treatment of people of all races, incomes, and cultures with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. This section evaluates the potential for disproportionately high and adverse cumulative effects from implementing the alternatives evaluated in this EIS, in conjunction with cleanup actions proposed by NASA and Boeing, on Native

American tribes and minority and low-income populations. The environmental justice analysis evaluates the impacts in both the SSFL area ROI and near the representative waste disposal facilities.

As discussed in detail in Chapter 3, Section 3.13, American Indians are considered by U.S. census definition in all minority counts in this analysis, and no Indian Trust Assets are present within the identified ROIs (Census 2010b, 2010c). Therefore, there would be no disproportionately high and adverse effects on Native American tribes.

As discussed in Chapter 4, Section 4.13, remediation activities would result in no high and adverse impacts on persons in the SSFL vicinity and near the representative recycle and waste disposal facilities. With no high and adverse impacts on members of the public, there would be no disproportionately high and adverse effects on minority and low-income populations.

DOE, NASA, and Boeing activities combined would require between 107,000 and 228,000 truck round trips for deliveries and waste transport, with the number of daily truck round trips for all activities limited to 96 trucks. As presented in Section 5.5.8.1, the radiation dose from all transportation activities at SSFL would range from 0.64 to 2.0 person-rem for workers and 0.28 to 0.58 person-rem for the general population (see Table 5–5). These values are a small portion (less that 0.0005 percent) of the cumulative dose from transportation activities (421,000 person-rem for workers and 436,000 person-rem for the public) and represent a fatal cancer risk that is indistinguishable from the natural fluctuation in annual cancer deaths.

The environmental justice analysis evaluates the impacts of increased traffic including trucks and other vehicles associated with remediation activities. As shown in Table 5–1, these added vehicles included a maximum of 96 truck round trips and an additional 201 auto round trips, making a total of 297 daily round trips. As Table 5–7 shows, the largest percentage increase in traffic is expected on Woolsey Canyon Road (30 percent), while traffic on other roads is expected to increase from less than 1 percent to 11 percent. Over the duration of soil removal, there could be a degradation of the LOS for Woolsey Canyon Road during weekdays when shipment to or from SSFL would occur; however, because the route would traverse largely non-minority communities and non-low-income communities, there would be no disproportionately high and adverse effects on minority and low-income populations. Because the LOS for other roads would not change, it is not expected that SSFL operations would result in substantial increased traffic in the SSFL vicinity. Therefore, there would be no disproportionately high and adverse effects on minority and low-income populations from increased traffic.

Potential accident fatalities from SSFL activities would range from 1 (0.79) to 4 (3.5) (see Table 5–6) over the evaluated 12-year period of proposed remediation. The additional traffic fatalities that could occur as a result of DOE, NASA, and Boeing activities at SSFL represent about 0.008 percent of the traffic fatalities expected in California (43,000) and about 0.03 percent of the traffic fatalities expected in the four counties nearest SSFL (Ventura, Los Angeles, Santa Barbara, and Kern) (11,400) on an annual basis (see Section 5.5.8.1). Therefore, they are indistinguishable from the annual state and local traffic fatalities and would not significantly contribute to cumulative impacts.

Regardless of the magnitude of combined impacts from DOE, NASA, and Boeing remediation activities at SSFL, proposed remediation activities and their related transportation routes would occur in and traverse both minority and non-minority communities and both low-income and non-low-income communities (see Chapter 3 Section 3.13). Impacts on minority and low-income populations would be the same as those experienced by the general population. Therefore, no disproportionately high and adverse cumulative effects on minority and low-income populations are anticipated.

5.5.14 Sensitive-aged Populations

As defined in Chapter 3, Section 3.14, sensitive-aged populations include children under 18 years of age and persons 65 years or older. This section evaluates the potential for cumulative impacts on sensitive-aged populations from implementing the alternatives evaluated in this EIS, in conjunction with cleanup actions proposed by NASA and Boeing. The analysis of impacts on sensitive-aged populations included evaluation of impacts in both the SSFL ROI and the representative waste disposal facility ROIs (regional ROIs).

Over the duration of soil removal, there could be an increased risk to pedestrians along or crossing Woolsey Canyon Road, but this risk would be experienced by persons of all ages. There is not expected to be a significantly larger population of sensitive-aged persons in the group that could experience this risk compared to persons living elsewhere in the SSFL ROI. Traffic densities and therefore risks to pedestrians along other evaluated routes are not expected to be significantly larger than those under baseline conditions. Therefore, no disparate impacts (markedly different than those on the general population) are expected on sensitive-aged populations in the SSFL ROI.

As discussed in the environmental justice analysis (Section 5.5.13), the combined DOE, NASA, and Boeing remediation activities would result in no high and adverse cumulative effects on persons near the representative waste disposal facilities. If there are no high and adverse cumulative effects on members of the public, there would also be no disparate cumulative impacts on sensitive-aged populations.

Chapter 6
Measures to Minimize Impacts and Mitigation Measures

6.0 MEASURES TO MINIMIZE IMPACTS AND MITIGATION MEASURES

Chapter 6 presents measures that the U.S. Department of Energy (DOE) has identified that would avoid, minimize, rectify, reduce, eliminate, or compensate for potential adverse impacts on the environment (in accordance with Title 40, *Code of Federal Regulations*, Section 1508.20 [10 CFR 1508.20]) resulting from implementation of any of the action alternatives analyzed in this *Draft Environmental Impact Statement for Remediation of Area IV and the Northern Buffer Zone of the Santa Susana Field Laboratory (Draft SSFL Area IV EIS)*.

This environmental impact statement (EIS) uses both minimization measures and mitigation measures. Minimization measures are inclusive of methods, procedures and protocols, design features, and best management practices (BMPs) aimed at reducing the environmental impact of project activities. This EIS includes a range of minimization measures, including those that reduce the environmental footprint; improve safety, efficiency, and sustainability; and are incorporated as part of the alternatives' design. These measures can be physical devices (such as personal protective equipment or erosion prevention features such as berms) or administrative requirements (for example, procedures to reduce chemical or radiation exposures or timing of activities). The minimization measures are incorporated into the alternatives analyzed in Chapter 4 of this EIS.

Mitigation measures are actions or procedures designed to reduce impacts once an adverse impact has been identified as the result of implementing an alternative. As defined in 40 CFR 1508.20, "Mitigation includes: (a) Avoiding the impact altogether by not taking a certain action or parts of an action; (b) Minimizing impacts by limiting the degree or magnitude of the action and its implementation; (c) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment; (d) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and, (e) Compensating for the impact by replacing or providing substitute resources or environments." Mitigation measures are generally identified where impacts from undertaking an action exceed a regulatory threshold or impact threshold defined for each resource in Chapter 4. They can also be used to offset an adverse or unavoidable impact or to achieve a higher level of stewardship. Mitigation measures may also be implemented as a result of stakeholder concerns about impacts, safety concerns, regulator direction, or other circumstances at DOE's discretion.

6.1 Minimization Measures

Several laws, for example, the Clean Water Act, the Clean Air Act, the Migratory Bird Treaty Act, and Endangered Species Act, require DOE to minimize adverse impacts of its activities. As described in Chapter 2, Section 2.2.2, DOE is committed to complying with these requirements by using the principles of "green cleanup" and incorporating various measures to minimize impacts at SSFL Area IV and the Northern Buffer Zone (NBZ).

Implementation of the principles of "green cleanup" is a project, as well as DOE-wide, goal in response to Executive Orders 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*, and 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*. These principles have contributed to a wider range of measures to minimize potential interrelated effects on a range of site resources, including air quality, geology, soils, habitat and wildlife, waste management, safety, cultural resources, energy and water use, and land use compatibility. Green cleanup BMPs evaluated as part of the alternatives are included in **Table 6–1**. Additional green and sustainable remediation BMPs are under evaluation and may evolve during the detailed design of the cleanup after this EIS is completed. Chapter 7, Section 7.1, of this EIS provides more details on this topic and includes additional BMPs under evaluation.

Table 6–1 presents the minimization measures that DOE intends to use as part of the building removal and soil and groundwater remediation action alternatives. Many of the listed minimization measures were developed in conjunction with the California Department of Toxic Substances Control, the National Aeronautics and Space Administration (NASA), and The Boeing Company (Boeing) for the proposed remediation of the entire SSFL. Others are derived from a U.S. Environmental Protection Agency (EPA)–approved list of BMPs that were developed by ASTM International to support the goal of "green and sustainable remediation" (ASTM 2013). Additional recommendations for minimization measures to reduce potential impacts were identified by members of the community in workshops and by DOE in the course of preparing this EIS. The minimization measures included in Table 6–1 range from those generally applicable to large construction and remediation projects to specific measures to address conditions at SSFL.

The impact analyses in Chapter 4 of this EIS are predicated on the assumption that the minimization measures presented in Table 6–1 are implemented as part of the proposed remediation activities. DOE recognizes that any of these measures may change during the EIS process with the input of the public and regulatory agencies. DOE also understands that, in some cases, the application of a minimization measure can be limited by site conditions or other constraints. Where DOE is unable to effectively implement a minimization measure, coordination would take place with appropriate entities (such as local authorities, regulators, or contractors) to find a way to best meet the purpose of the measure in the specific situation.

6.2 Potential Mitigation Measures

In accordance with DOE regulations (10 CFR 1021.331), DOE would prepare a mitigation action plan for those mitigation commitments made in its Record of Decision (ROD) for the proposed remediation activities at SSFL Area IV and the NBZ. The plan would identify specific mitigation measures associated with alternatives selected in the ROD, and would describe plans for implementing the mitigation measures, monitoring their implementation and effectiveness, and reporting the results of mitigation efforts to DOE management and applicable Federal, state, local, and tribal entities and the public. In response to monitoring data, DOE may revise the mitigation action plan to better achieve desired results.

The analysis in Chapter 4 identified adverse impacts for a number of resource areas and described mitigation measures to minimize those impacts. A discussion is included in Chapter 4 of how the mitigation measures would lessen the potential impacts. DOE has worked with appropriate regulators throughout the EIS process to identify and agree upon suitable mitigation measures that would accomplish feasible reductions or protection of affected resources. **Table 6–2** provides a list of potential mitigation measures that DOE will consider in addition to the minimization measures shown in Table 6–1. The potential mitigation measures are listed by resource category and address specific adverse environmental impacts identified in Chapter 4.

For biological resources and cultural resources, mitigation measures are refined and developed as part of the consultation with Federal and state agencies and tribal organizations. DOE is currently coordinating and consulting with the U.S. Fish and Wildlife Service and state regulatory agencies concerning potential impacts on biological resources (including protected wildlife, habitats, and wetlands) for this remediation action. DOE is developing a site-wide biological assessment that covers the entire SSFL site and the remediation activities of DOE, NASA, and Boeing. The site-wide biological assessment, which will cover the impact of combined and cumulative impacts on biological resources, is currently being prepared and the results will be considered in the final EIS to inform the final development of biological mitigations for Area IV and the NBZ.

DOE has initiated consultation with federally and non-federally recognized tribes near SSFL. The consultation includes the State Historic Preservation Officer (SHPO), the federally recognized Santa Ynez Band of Chumash Indians, and the two non-federally recognized tribes, the Fernandeño Tataviam and Gabrielino Tongva. Consultation continues as adverse effects are assessed through the National Historic Preservation Act, Section 106, process. Where adverse effects are identified, 36 CFR 800.6(b) states, "[t]he agency official shall consult with the SHPO/THPO [Tribal Historic Preservation Officer] and other consulting parties to seek ways to avoid, minimize or mitigate the adverse effects." In other words, the best way to reduce an impact is to *avoid* the cultural resource; if avoidance is not an option, then *minimize* the impact as much as possible. A plan to *mitigate* impacts is developed when these first two outcomes are not feasible.

This same approach is recommended and commonly followed for compliance with other laws and rules, including the National Environmental Policy Act (NEPA); Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments* (commonly cited as the basis for Government-to-Government consultation); and Executive Order 13007, *Indian Sacred Sites*, which requires an agency to provide access to and allow ceremonial use of sacred sites. Protective measures begin with consultation to identify impacts and continue with further consultation to determine procedures to address any impacts that are identified.

As DOE plans to minimize or mitigate the identified adverse impacts, a program is developed in consultation with the SHPO and may involve the Advisory Council on Historic Preservation and other cooperating agencies or consulting parties. This is formalized in either a memorandum of agreement or a programmatic agreement.

Table 6–1 Measures to Minimize Impacts of Demolition and Remediation Activities at Santa Susana Field Laboratory and the Northern Buffer Zone

Item Number	*Subtopic*	*Description*
Land Resources (including Aesthetics, Infrastructure, Recreation)		
1-1	Aesthetics	Following completion of remediation activities, new or temporary access roads will be removed and the area restored to the pre-existing condition as soon as practicable. Existing roads will remain to facilitate monitoring activities.
1-2	Aesthetics	No night work will occur for this project, except in the case of emergency repairs or other unavoidable situations, to avoid light and glare from nighttime lighting (see Item Number 5-2).
1-3	Aesthetics	Contractors will use temporary field markers that will be removed following completion of the project.
Geology and Soils		
2-1	Ground disturbance minimization	The project will use existing infrastructure (e.g., roads) to minimize the potential impacts of erosion, landslides, or disturbance of habitat. Where new infrastructure is required, the newly disturbed area will be evaluated to identify potential and effective means of mitigating any impacts before remediation begins.
2-2	Road placement	New or temporary access roads, staging areas, and stockpile areas will follow natural contours and be graded such that cut-and-fill will be minimized. In addition, these areas will be sloped and, if necessary, compacted to prevent the possibility of slope failure. Where new roads and other facilities are necessary, they will be located so as to avoid areas identified by the State of California and field geologists as having the potential for landslides or rock falls. Where such avoidance is not possible, appropriate engineering design and construction measures will be incorporated into the project designs to minimize potential damage to project facilities. Access roads periodically will be inspected, particularly after heavy rains or earthquakes. Access roads and staging in steep portions of the site will be avoided, if possible, after heavy rain events, when increased loads could lead to slope failure.
2-3	Grading and safety	During demolition and remediation activities, a geotechnical engineer will regularly monitor demolition and remediation activities and test soil to ensure working conditions are safe and the materials used in demolition and remediation activities and grading of slopes are consistent with the recommendations presented in the site-specific geotechnical evaluation and the plans and specifications approved by DTSC (the regulatory agency).
2-4	Soil backfilling	Backfilling will proceed in completed excavated areas within 2 weeks of DTSC/EPA verification that the cleanup meets AOC LUT values so that areas of newly exposed soil are not open any longer than necessary.[a]
2-5	Stockpiling and staging	To maintain the SSFL property in an undeveloped, natural condition, previously disturbed areas will be used for stockpiling and equipment storage, and operations will be performed to minimize the potential impacts of erosion, landslides, or disturbance of habitat.[a]
2-6	General measures for geology and soils	Project work plans (see Item Numbers 3-1, 5-3, 5-4, 6-1, 9-1) will incorporate the following measures when and if applicable: • Use onsite/local materials (for example, wood waste for compost, rocks for drainage control), when possible.[a] • Minimize soil compaction and land disturbance during site activities by restricting traffic to confined corridors and protecting ground surfaces with biodegradable covers, where applicable.[a] • Reclaim and stockpile uncontaminated soil for use as fill or other purposes, such as erosion control and excavation backfill. • Use the minimum slope that would maintain proper drainage in designing excavations to reduce the volume of fill material required.[a] • Provide adequate slope in excavated areas to maintain safe and stable soil conditions where workers are present. • Confine short-term onsite storage of containerized debris to unused paved parking lots. No land will be cleared for short-term storage. • Sort debris at the site of removal using a suitable nearby area. • Establish re-contouring of land to protect drainages and prevent erosion.
2-7	Waste soil minimization	Minimize the amount of soil that must be hauled to disposal sites by purposeful excavation of only those areas characterized as requiring removal to keep as much out of disposal facilities as possible.

Item Number	Subtopic	Description
2-8	Post-remediation Monitoring	Post-remediation monitoring requirements for soil corrective actions will consist of periodic sampling to assess soil concentrations following natural degradation processes.
		Surface Water
3-1	Permits and plans	Prior to beginning remediation, a Notice of Intent will be submitted to the State Water Resources Control Board to comply with the state General Construction NPDES Permit. As part of the NPDES Permit conditions, the DOE site contractor will prepare a Water Quality Management Plan, Erosion Control Plan (ECP), and Construction Stormwater Pollution Prevention Plan (SWPPP), each of which will include descriptions of BMPs to reduce the potential for discharge of pollutants in runoff during grading, demolition, and remediation activities. The selected stormwater BMPs will stabilize and minimize erosion of disturbed surfaces. The SWPPP will require all structural and non-structural BMPs to be installed and implemented in accordance with approved plans and specifications prior to the beginning of demolition and remediation activities. The project plans specified above will incorporate the following specific measures when and if applicable: • Use geotextile bags or nets to contain excavated sediment, facilitate sediment drying, and increase ease of sediment placement or transport, when appropriate. • Utilize erosion control products such as silt fences, sand bags, straw wattles, basins, and fiber rolls to aid in capturing sediment runoff, particularly along the bases of slopes, runoff pathways, and drainage ditches. • Provide contaminant control by using de-watering, runoff controls, tire washes, containment for chemical storage areas, demolition and remediation equipment decontamination, stockpile management, spill prevention and control measures, and protective sheeting or tarps on steep slopes prior to rain events. • Restore and maintain surface water banks that mirror natural conditions.[a] • Install and maintain basins to capture sediment runoff along sloped areas and use excavated areas to serve as temporary retention basins; develop rain water retention basins or a collection system with barrels or cisterns to capture precipitation for potential onsite use. • Install earthen berms that utilize onsite/local materials to manage run-on and/or runoff stormwater. • Use gravel roads, porous pavement, and separated pervious surfaces rather than impermeable materials to maximize infiltration. • Cover filled excavations with an appropriate erosion control fabric (preferable biodegradable) or mulch to stabilize soil (prevent erosion) and serve as a substrate for ecosystems.[a] • Use soil stabilization BMPs to help in reseeding success, including soil binders, erosion mats, and erosion control check dams (see Item Number 5-4). • Use plants and amendments that require minimal management and water.[a] • Use captured rainwater, uncontaminated wastewater, or treated water for building demolition and soil and groundwater remediation activities or site restoration activities when possible (e.g., for wash water, irrigation, dust control, constructed wetlands, or other uses.[a] • Establish protocols for proper storage and use of hazardous materials during the building demolition and soil and groundwater remediation phase. • Establish spill response procedures. • Use dust control measures to prevent soil erosion during the remediation phases. • Provide for erosion control through planting and maintenance of native vegetation within the disturbed areas. • Include design features that replicate the natural site drainage patterns to the extent possible, with minimal constructed features to allow for long-term erosion control and successful revegetation (see Item Number 5-4).

Item Number	Subtopic	Description
3-2	Operations and Maintenance Plan	An Operations and Maintenance Plan will outline long-term surface water management and groundwater monitoring requirements. Natural ephemeral drainages that are within the soil disturbance areas will be reconstructed as soon as possible to restore drainage patterns. Man-made drainage features that are impacted by project activities may not need to be restored to pre-disturbance condition, but may need to be replaced to restore the drainage from the site. If drainage needs to be restored, it will be done in a manner that mimics the natural drainage on the site. The long-term groundwater monitoring program will be similar to the interim groundwater monitoring program now in place. Groundwater monitoring and sampling will be performed in accordance with the water quality sampling and analysis plan. Post-remediation monitoring requirements for soil corrective actions may consist of periodic sampling to assess soil concentrations following natural degradation processes (if selected). DOE's responsibilities for monitoring will end when DTSC agrees that DOE's cleanup is complete. If, during groundwater monitoring, chemical concentrations in a perimeter, downgradient well are detected above cleanup requirements and are not within background levels (i.e., above levels already present due to natural occurrence), steps will be taken to further assess and remedy the condition as appropriate. The site contractor will verify these actions to DTSC in semiannual groundwater monitoring reports submitted by DOE.
Groundwater		
4-1	Water use reduction	Water used in the remediation technologies will be treated and re-injected into local aquifers to minimize net water consumption and aquifer depletion, or it will be used for dust suppression.
Biological Resources		
5-1	General biology	General measures to avoid and minimize impacts to biological resources: • One or more qualified Project Biologists, approved by DOE, USFWS, and CDFW and experienced with endangered, threatened, rare, and sensitive species that occur or have the potential to occur in the project site, will be retained by DOE for the duration of demolition, remediation, and restoration activities and will be on site at all times during building demolition and clearing and grubbing of vegetation or habitats that have the potential to support sensitive species, including federally or state-listed species. The Project Biologist(s) will identify work areas, monitor work activity, and oversee and execute the conservation protection measures pertaining to biological resources. • A contractor education program will be conducted by the Project Biologist during all project phases. The education program will cover the potential presence of listed species; the requirements and boundaries of the project; the importance of complying with avoidance, minimization, and compensation measures; and reporting problems and resolution methods. • The project site will be accessed using existing roads, as much as feasible. Parking, driving, lay-down, stockpiling, and vehicle and equipment storage will be limited to previously compacted and developed areas and the designated staging areas as much as feasible (Item Numbers 2-4, 2-5). • At least 7 days before project initiation, the project boundary, including temporary features such as staging parking, and stockpile areas, will be clearly marked with flagging, fencing, or signposts. Any biologically sensitive areas located in the near vicinity of these temporary features will be clearly marked on grading plans and will be avoided by personnel and equipment. • Limits of the demolition, remediation and restoration zones will be clearly marked and delineated in the field. All project-related activities will occur within the designated construction boundary. No unauthorized personnel or equipment (including off-road vehicle access) will be allowed in native habitats outside the construction limits or designated access routes. • Where access must be through native habitats, such as within the proposed biological exemption areas, the Project Biologist will be consulted to determine the most suitable and least environmentally damaging access route to the site. This access route will be clearly marked and will be considered part of the construction zone. • Disturbance in the proposed biological exemption areas would be kept to an absolute minimum using special methods such as the use of balloon-tired, all-terrain-vehicles to access sites and remove affected soil. • To ensure fire does not commence due to project activities, trucks will carry water and shovels or fire extinguishers in the field. Shields, protective mats, or other fire prevention equipment will be used during grinding and welding, and vehicles will not be driven and parked in areas where

Item Number	Subtopic	Description
		catalytic converters could ignite dry vegetation. Site-wide procedures for changing or halting operations when fire hazard reaches a critical level will be developed by the remediation contractor. • All trash will be disposed of properly. All food-related trash will be placed in sealed bins or removed from the site regularly. Following initial project demolition, remediation, and restoration, all equipment, waste, and construction debris will be removed from the site, and the soil will be re-contoured prior to habitat restoration. • The demolition, remediation, and restoration contractors will stage equipment in areas that will create the greatest distance practical between demolition- and remediation-related noise sources and noise-sensitive receptors (e.g., wildlife movement corridors, preserved habitat areas, sensitive habitat areas for endangered species or species of special concern) during all project demolition and remediation activities. • No night work will occur for this project, except in the case of emergency repairs or other unavoidable situations.
5-2	Sensitive habitats	Avoid and minimize disturbance to sensitive upland vegetation, including Venturan coastal sage scrub, dipslope grassland, sandstone outcrops, unburned northern mixed chaparral, sandstone outcrops/northern mixed chaparral, California walnut woodland, and riparian and coast live oak woodland and savanna. The following measures will be taken: • Design final project to avoid or minimize impacts to sensitive native habitats by reducing disturbance. • Restore sensitive habitats that are temporarily disturbed as a result of project implementation to pre-project conditions as soon as possible to prevent net loss of habitat. Areas that cannot be restored within a short period of time (long-term impact) or are permanently impacted by project activities may require additional mitigation to compensate for temporary or permanent loss of sensitive habitats.
5-3	Trees	DOE will develop a Tree Management and Preservation Plan using a certified arborist. The goal of the plan is to offset tree impacts through a sustainable, customized plan that is suitable for the site's unique opportunities for tree preservation, enhancement, and establishment. The plan will identify trees protected by Ventura County, including oak, sycamore, historical and heritage trees (protected trees), or special-status trees (i.e., southern California black walnut) that could be impacted within or adjacent to remediation areas, as well as those located outside of the project footprint that would be preserved. The plan will define direct and indirect impacts and include protection measures and options (such as tree relocation or replacement) within and outside of cleanup areas and the locations of mitigation areas within the DOE project area boundary. The following protection measures may be used: • Fencing of oak and other protected trees adjacent to demolition and remediation activities areas. • Placement of fill, storage of equipment, and grading prohibited within the protective zone (minimum of 5 feet from the drip line or 15 feet from the trunk of the tree, whichever distance is greater) of a tree proposed for preservation. • Limit grade changes near the protective zones of trees. • Retaining walls to protect trees proposed for preservation from surrounding cut and fill. Retaining walls will be placed outside of the protective zone of the tree to be preserved. For trees impacted by project activities, where mitigation is required, the Tree Management and Preservation Plan, which may be separate from or incorporated into the Revegetation and Habitat Restoration Plan (see Item Number 5-4), will specify performance measures, maintenance and monitoring requirements, adaptive management, regulatory authorities, and financial stakeholders.
5-4	Revegetation and habitat restoration	A qualified biologist will prepare a site-specific Revegetation and Habitat Restoration Plan (RHRP), in consultation with USFWS and CDFW that includes a description of existing conditions for DOE's Area IV and NBZ project area, areas of impact, site preparation and revegetation methods, maintenance and monitoring criteria, performance standards, and adaptive management practices. Cover standards will be developed for each plant community target, and cover values will be established for each layer (i.e., herb, shrub, and/or tree layers). The RHRP will be developed and approved by appropriate agencies prior to the initiation of ground disturbance or construction activities. The RHRP will coordinate and supplement the Erosion Control Plan (ECP) (see Item Number 3-1) and Weed Management Plan. The RHRP will address all revegetation efforts associated with the soil disturbances. It will include specific erosion control measures, irrigation requirements, species

Item Number	Subtopic	Description
		composition, seed mix origins and ratios for that particular habitat, weed control, water regimes, maintenance activities, success criteria, and monitoring requirements. The RHRP will apply to all soil disturbance, access, demolition, and remediation sites and will, at a minimum, include the following: • Specification of revegetation methods, including seeding and/or planting of container stock, salvaged plants, cuttings, or other propagules collected or propagated from onsite sources, including any sensitive plant species that would be impacted during soil disturbance or other construction activities. • Establishment of an onsite nursery and use of onsite sources for growing medium (i.e., clean, weed-free soil) and propagules to avoid risk of introducing foreign pathogens, such as *Phytophthora* spp., and unwanted pests, such as Argentine ants, into restoration areas that may subsequently disperse and establish in undisturbed natural areas adjacent to restoration areas. • A schedule for seed and propagule collection for use in revegetation, as well as a schedule for construction and operation of the onsite propagation and growing facility. Propagule collection and propagation of plants in the growing facility will need to be initiated sufficiently in advance of remediation activities (a minimum of two growing seasons prior to the initial need for post-remediation revegetation) in order to generate adequate seed stock and container stock for use in revegetation. • Seed mixes will include only species native to the site and will be collected from onsite sources; for example, a suggested seed mix for Venturan coastal sage scrub could include the following species: California sagebrush (*Artemisia californica*), California buckwheat (*Eriogonum fasciculatum*), coyote brush (*Baccharis pilularis) bla*ck sage (*Salvia mellifera*), purple sage *(S. leucophylla*), and deer weed (*Acmispon glaber).* • Weed-free topsoil below allowable chemical levels, if available, will be salvaged using two lifts: the first to salvage the seed bank and the second to salvage the soil, including soil biota in the root zone. The topsoil will be saved in two separate covered stockpiles close to the project site and replaced accordingly after final reconfiguration of disturbed areas. • After completion of topsoil replacement and related grading and prior to initiation of restoration, graded areas will be inspected by a Project Biologist (or revegetation specialist) to determine whether any remedial measures are required prior to initiation of revegetation. Remedial measures may include re-grading, installation of erosion control methods, weed control, and installation of irrigation, if needed. • Revegetation of disturbed areas will be initiated the first fall after completion of final grading activities and before the winter rainfall season to minimize the need for watering and encourage early establishment of plants to reduce the potential for erosion associated with rain events. Supplemental watering may be required if reseeding/replanting must be conducted after the start of the rainy season. • Incorporate monitoring procedures, including periodic qualitative and quantitative assessments and minimum performance criteria, for revegetation and erosion control. The performance criteria and remedial actions need to consider the uncertainties of revegetation and restoration of sensitive habitats and sensitive plant species. • Appropriate remedial measures will be identified if the restoration is not progressing as expected. At a minimum, remedial measures may include invasive species control (e.g., hand removal, mechanical and herbicide control), reseeding/replanting, supplemental irrigation, and erosion control. • The monitoring and maintenance program duration and frequency will be specified, with a minimum of 5 years of monitoring post restoration, to ensure the restoration sites are successful. RHRP Progress Reports will be submitted annually to all approval agencies. The progress reports will include an introduction, methods, results, and a summary of activities, findings, trends, and recommendations. There should be at least 1 full year of monitoring, with no maintenance (including irrigation and weed control) to ensure the project site is self-sustaining and will not fail without maintenance (including supplemental water) or will not decline due to the presence of aggressive weedy species. • Complement and align the RHRP with the Tree Management and Preservation Plan, ECP, and Weed Management Plan (Item Numbers 3-1, 5-3, 5-9). • Minimize removal of existing vegetation during remediation.
5-5	Soil stabilization	In conjunction with reseeding and when topsoil is unavailable, soil stabilization BMPs will be used, including soil binders, erosion mats, gabion walls (outside of stream channels), and erosion control check dams, where applicable. Furthermore, an updated SWPPP and an ECP will guide erosion control measures for the demolition and remediation activities (described also in Item Number 3-1).

Item Number	*Subtopic*	*Description*
5-6	Protect wildlife during construction.	Minimize direct impacts to general wildlife species, such as snakes, other reptiles, and small mammals during remediation. • The Project Biologist (see Item Number 5-1) will monitor work zones for presence of wildlife species prior to and periodically during work activities. Special attention will be paid to vehicles that have been sitting overnight and any excavated areas that have been left unattended for more than 1 hour. • If an animal species is observed in harm's way during remediation activities, work will halt; the animal will be avoided; and the Project Biologist will be called to the site to move the animal to a safe location.
5-7	Special-status species, including Braunton's milk-vetch	Ensure avoidance and minimization of impacts to Braunton's milk-vetch and other sensitive plant species by implementing the following measures: (Note that these proposed impact avoidance and minimization measures may be revised through consultation and coordination with USFWS and CDFW.) • Prior to access, excavation, demolition, remediation, installation of equipment, or any other activity associated with the proposed project, the Project Biologist will survey all proposed remediation, staging, and access areas, plus a buffer of 500 feet, for presence of federally and state-listed threatened or endangered plants, including Braunton's milk-vetch and Santa Susana tarplant, and other sensitive plant species such as Malibu baccharis, Catalina mariposa-lily, slender mariposa-lily, and Plummer's mariposa-lily. Colonies will be mapped and clearly marked, and numbers of individuals in each colony and their condition will be determined and recorded. Remediation access routes will be adjusted as needed to maximize avoidance of impacts to individuals or colonies of Braunton's milk-vetch or any other sensitive plant species. • The Project Biologist will be responsible for overseeing demolition and remediation to ensure compliance with the conservation measures for preventing unanticipated impacts to Braunton's milk-vetch and any other sensitive plant species. The Project Biologist will be on site during access, vegetation removal, or any other remediation activities with the potential to impact sensitive plant species. • Dust migration in or adjacent to areas that support sensitive species will be minimized by lightly spraying areas of exposed soil with water during excavation activities when weather conditions require the use of dust control measures (see Item Number 6-1). • If any sensitive plants occur within 250 feet of a proposed demolition or remediation area, the Project Biologist will flag their locations and work with the project team to avoid or minimize impacts to the species. • Where impacts to Braunton's milk-vetch or other sensitive plant species are unavoidable, a salvage, propagation, and replanting program will be developed and implemented that includes the following: – Utilize both seed and salvaged (excavated) plants, constituting an ample and representative sample of each colony of the species that would be impacted. The program should consider perpetuating, the genetic lines represented on the impacted sites by obtaining an adequate sample prior to construction, propagating them, and using them in the restoration of that site. The program should also consider that the salvage and transplant of listed species is experimental and often has low success. – Incorporate provisions for recreating suitable habitat and measures for re-establishing self-sustaining colonies of Braunton's milk-vetch and other sensitive plant species on the site. – Include provisions for monitoring and performance assessment, including standards that will allow annual assessment of progress, and provide for remedial action, should the species fail to re-establish successfully. – The program would require approval from USFWS and CDFW prior to its implementation, and activities involving handling of sensitive plant species would require appropriate permits from CDFW. • In addition to restoring suitable habitat and re-establishing colonies of Braunton's milk-vetch and other sensitive plant species populations at sites disturbed by remediation activities, identify other sites suitable for planting to expand populations and help compensate for temporary loss of habitat during project implementation and the uncertainties involved in re-establishment of populations. Expansion of the populations may help offset direct or indirect impacts to these species. In any expansion proposal, maintenance of the genetic diversity of populations on site must be considered.

Item Number	Subtopic	Description
5-8	Special-status species, vernal pools and vernal rock pools	Ensure avoidance of vernal pools and vernal rock pools potentially occupied by riverside fairy shrimp and/or vernal pool fairy shrimp: • Prior to any work within 500 feet of vernal pools or vernal rock pools, surveys should be conducted to determine the presence of federally listed riverside and vernal pool fairy shrimp. Surveys must be conducted by a USFWS-approved fairy shrimp biologist. • To avoid impacts to federally listed fairy shrimp, occupied vernal pools and vernal rock pools within 500 feet of the project boundary would be identified on project construction plans. Occupied fairy shrimp habitat within 250 feet of the project footprint would be clearly identified in the field with flagging or exclusion fencing. Pools occupied by fairy shrimp and other restricted vernal pool areas would be monitored by the Project Biologist during construction; the Project Biologist would be responsible for ensuring compliance with conservation measures and preventing unanticipated impacts to vernal pools and vernal pool species. • Any demolition or remediation that could affect vernal pools or potential habitat for federally listed fairy shrimp associated with vernal pools, rock pools, and vernal pool watersheds, would occur outside of the rainy season (about November 1 to June 1) and in dry conditions only. Following the initial clearing of features, ongoing demolition and remediation activities can occur in the wet season by incorporating specific measures to protect surface water quality in vernal pools (e.g., use of jute netting into the SWPPP [Item Number 3-1], geotextiles, wattling, and other materials), as determined by the Project Biologist, to avoid an increase or decrease of water quantity, sediment transport, and change in water quality runoff to pool basins. Sedimentation into basins will be prevented and soil-disturbing activities during the rainy season or when ground is wet (about November 1 to June 1) would be minimized. • Fueling of equipment and vehicle washing would be allowed only in designated areas and would not occur within 100 feet of any vernal pool or vernal rock pool or other aquatic habitat, including intermittent drainages. • Stockpiled soils would be placed on top of heavy-duty plastic sheeting on areas with an improved asphalt or concrete surface. All stockpiles would be covered with material adequate to prevent soil transport by wind or rainwater. Covers would be maintained in good condition.
5-9	Weeds	A Weed/Invasive Plant Species Management Plan will be implemented to eradicate noxious and invasive species as they appear on sites using state and/or federally approved methodologies. The Weed Management Plan will include strategies and measures to minimize the potential for invasive plant species (i.e. weeds) or soil pathogens to become established in disturbed areas and spread into restoration areas or natural areas. Weeds generally include those species listed by the California Invasive Plant Council and any species that can invade natural or restoration areas and replace or preclude the establishment of native or other more desirable species). All off-road earthmoving equipment such as excavators and/or vehicles will be power-washed before entering the project site to minimize the spread of invasive weeds. While washing wheeled vehicles, the front wheels will be turned lock-to-lock to allow for exposure of surfaces that may hold soil or weed seeds to ensure complete removal of foreign soil and seeds. For areas where vegetation and soil are removed and salvaged, treatment of the area to be disturbed will be implemented to kill weeds and limit weed seed production at least one full growing season prior to initiating any activity, with the objectives of (1) preventing weeds from spreading out of the disturbance area and (2) removing weed sources from salvaged topsoil.
5-10	Birds and nesting	Due to the presence of habitat for nesting migratory bird species within and adjacent to the project site, any grubbing, mowing, and/or removal of surface vegetation, excavation, or other activity involving heavy equipment will not be scheduled between February 1 and August 31 to avoid potential impacts on nesting, if possible. Building demolition will also be conducted outside the breeding/nesting seasons of birds protected by the MBTA (February 1 – August 31) and bats (May 1 through October 31) to the extent possible. For building demolition conducted during the nesting and bat breeding season (February 1 through October 31), pre-demolition surveys for nesting birds and breeding bats would be conducted no more than 10 days prior to site disturbance. Vegetation removal or mowing required to maintain vegetation or access demolition or remediation sites should occur outside the peak breeding season of bird species (February 1 – August 31). If mowing, vegetation removal, or ground disturbance cannot be timed to start before the breeding season and must begin after the breeding season has started, then a nesting bird survey would be required before the start of vegetation removal or excavation, no more than 10 days prior to site disturbance. A qualified biologist, hired by DOE, will perform a nesting bird survey and confirm that

Item Number	Subtopic	Description
		active nests would not be affected. Surveys need not be conducted for the entire project site at one time; they may be phased so that surveys occur shortly before a portion of the site is disturbed. The surveying biologist must be qualified to determine the species, status, and nesting stage without causing intrusive disturbance. The survey will cover all reasonably potential nesting locations on and within 300 feet of the project remediation; this includes ground-nesting species, such as killdeer. A 500-foot radius will be surveyed in areas containing suitable habitat for nesting raptors, such as trees, utility poles, rock crevices, and cliffs. The results of the survey would be submitted to DOE. If active nests for avian species are found, a suitable no-disturbance buffer will be established and avoided. Buffer distances will be established in consideration of species and location and may be modified, as determined by a qualified biologist in consultation with USFWS and CDFW. If ground disturbance is scheduled to occur within a nest buffer area, the project operator will avoid the area by delaying ground disturbance until a qualified wildlife biologist has determined that the birds have fledged and are no longer reliant upon the nest or parental care for survival. If demolition and remediation activities are scheduled to occur during the non-breeding/-nesting season (September 1 through January 31 for suitable bird nesting habitat and November 1 to January 31 for buildings that may have bats), no pre-demolition and remediation surveys or additional measures are required. If demolition and remediation activities begin in the non-breeding season and proceed continuously into the breeding season, no surveys of the active demolition or remediation would be required. However, if there is a break of 10 days or more in demolition and remediation activities during the breeding season, a new nesting bird survey will be conducted before demolition and remediation activities resume.
5-11	California Red-legged frog	To ensure that the unlikely event of California red-legged frog migrating into the proposed work areas does not result in an impact to the species, a qualified biologist will conduct pre-demolition and remediation surveys within work areas containing suitable habitat, as well as biological monitoring during demolition and remediation activities. If California red-legged frog is discovered in work zones before or during demolition and remediation activities, the species will be avoided; demolition and remediation activities will be immediately halted; and consultation will be initiated with USFWS to determine an appropriate response before demolition and remediation activities can begin/restart
5-12	Conservation coordination	During remedial activities, DOE will continue to coordinate with various conservation groups interested in preserving the natural resources at the SSFL property, including those in areas not affected by remediation activities, and in utilizing the site for educational, recreational, and research purposes.[a]
		Air Quality and Greenhouse Gases
6-1	Fugitive dust	DOE will implement fugitive dust control measures to ensure compliance with Ventura County Air Pollution Control District Rule 55, Fugitive Dust. DOE will document these measures in a project Fugitive Dust Control Plan and the ECP. Relevant measures to reduce both onsite and offsite fugitive dust emissions include the following: • Use water spray/mists to minimize dust emissions generated from earth-moving, soil remediation, bulk material handling, and demolition activities and from the movement of vehicles on unpaved roads. • Haul truck speeds in Area IV will not exceed (1) 10 miles per hour on any unpaved surface and (2) 15 miles per hour on any paved surface. Signs will be posted throughout the site to remind equipment operators and truck drivers of the speed limits. • Unpaved Roads: Stabilize heavily used unpaved roads with a non-toxic soil stabilizer or soil wetting agent that would not result in loss of vegetation or increase other environmental impacts. Consider covering unpaved roads with a low-silt-content material such as recycled road base or gravel to a minimum of 4 inches. • Material Loading: Load materials carefully to minimize the potential for spills or dust creation. Implement water spraying as needed to suppress potential dust generation during loading operations. Take care to apply dust suppression water to the top of the load or source material to avoid wetting the truck tires. Do not perform loading during unfavorable weather conditions (such as high winds or rain). Material spilled during loading will be immediately collected for subsequent loading. After loading, trucks will pass through the decontamination and inspection station

Item Number	*Subtopic*	*Description*
		before weighing and departure from SSFL. Trucks will be cleaned of visible soil material per Remediation Plans before they leave the staging and loading areas to prevent tracking soil out. • <u>Track-Out Prevention</u> - To prevent haul trucks from tracking soil onto onsite paved roads, utilize at least one of the following measures at each vehicle egress from unpaved to onsite paved roads: a. Install a pad consisting of washed gravel (minimum size of 1 inch) that is maintained in a clean condition to a depth of at least 6 inches and extending at least 30 feet wide and at least 50 feet long. b. Pave the surface at least 100 feet long and at least 20 feet wide. c. Utilize a wheel shaker/wheel spreading device, also known as a rumble grate, consisting of raised dividers (rails, pipe, or grates) at least 24 feet long and at a sufficient width to allow all wheels of vehicle traffic to travel over grate to remove bulk material from tires and vehicle undercarriages before vehicles exit unpaved roads. d. Install and utilize a wheel-washing system to remove bulk material from tires and vehicle undercarriages before vehicles exit unpaved roads. e. Any other control measure or device that prevents track-out onto onsite paved roads. • <u>Material Hauling</u>: Use properly secured tarps that cover the entire surface area of the load. Maintain a minimum of 6 inches of freeboard or water, or otherwise treat the bulk material to minimize loss of material to wind or spillage. Otherwise, use a container-type enclosure. • <u>Soil Storage Piles</u>: Implement at least one of the following measures: (1) Enclose material in a three- or four-sided barrier equal to the height of the material; (2) apply water at a sufficient quantity and frequency to prevent wind-driven dust; (3) apply a non-toxic dust suppressant that complies with the applicable air and water quality government standards at a sufficient quantity and frequency to prevent wind-driven dust; or (4) install and anchor tarps or plastic over the material. Use surface crusting agents on inactive storage piles. • <u>Paved Roads</u>: Use a street sweeper at least twice per day to remove particulates from onsite, paved roads traveled by haul trucks. Use a PM_{10}-efficient street sweeper that is certified to meet the requirements of South Coast Air Quality Management District Rule 1186. Remove all track-out at the conclusion of each workday or evening shift. • To avoid fugitive dust during high wind conditions, cease soil disturbance activities if onsite wind speeds exceed 25 miles per hour for at least 5 minutes in an hour. • Mix amendments into soil *in situ* whenever possible to minimize dust generation and emissions.[a] • Designate personnel to monitor the dust control program and to increase control measures, as necessary, to minimize the generation of dust. • After completion of project activities in an area, plant approved native seed mixes to replace native vegetation destroyed during excavations, road construction, soil remediation, and other activities as outlined in the project RHRP (see Item Number 5-4).
6-2	Minimize emissions	The project will prohibit the idling of on-road and off-road heavy duty diesel vehicles for more than 5 minutes at a time.
6-3	Traffic management	Waste haul trucks and soil delivery trucks entering and exiting the site will be required to follow an approved Traffic Management/Haul Route Plan that specifies haul routes and the frequency of and maximum truck trips per day (see Item Number 8-1).
6-4	Minimize emissions	Utilize new technologies, such as alternative fuels, new electric or hybrid engines, and/or engines with low emissions to minimize noise and air emissions.

Item Number	*Subtopic*	*Description*
		Noise
7-1	Noise reduction	Short-term demolition and remediation-related noise impacts will be reduced by implementing the following measures: • During all excavation and grading on site, the demolition and remediation contractors will equip all demolition and remediation equipment, fixed or mobile, with properly operating and maintained mufflers, consistent with manufacturers' standards to reduce equipment noise. • Most construction work, including onsite deliveries and offsite hauling, will occur during daylight hours Monday through Friday (excluding holidays); activities may occasionally occur on the weekends. • Construction equipment, fixed or mobile, will be equipped with properly operating and maintained mufflers, consistent with manufacturers' standards. • Limit engine idling of diesel-powered construction equipment to a maximum duration of 5 minutes. • Limit the use of engine compression braking on Woolsey Canyon Road and in neighborhoods to the extent practicable, consistent with the safe operation of heavy-duty trucks (i.e., avoiding overheating of brakes).
		Transportation/Traffic
8-1	Traffic Plan	Prior to the start of construction, the project contractor will prepare a Traffic Management/Haul Route Plan (TM/HRP) to be implemented during implementation of the project remedies. This plan will identify common traffic control requirements for onsite deliveries and offsite hauling to facilitate safe and efficient traffic flow within SSFL and on public roadways. The criteria for haul routes will consider demolition and remediation activities traffic from nearby simultaneous construction activities and avoid direct routing through sensitive habitat areas and areas with residential dwellings, schools, and bike routes unless no alternative route is available. In this case, coordination with requisite authorities or regulators will ensure incorporation of suitable restrictions on travel (such as operating hours) to minimize interface with the sensitive receptors. The plan will provide specific traffic control measures, signs, and delineators to be implemented by the construction and remediation contractor(s) through the duration of demolition and remediation activities and corrective action activities of the DOE project. The plan will also consider construction traffic from nearby simultaneous construction activities and pedestrian safety related to school and bike routes. The TM/HRP will establish, list, and map the trucking routes, days and hours of truck operation, maximum number of trucks per day, and various requirements to provide traffic, pedestrian, and bicycle safety. Truck operators will be provided with a trucking route map and hours of operation allowed.
8-2	Roadway repairs	DOE, NASA, and Boeing will survey the existing conditions of the onsite roads prior to the commencement of work and DOE will contribute to the maintenance and repair necessary to maintain the roads in a baseline condition in accordance with the Transportation and Road Agreement signed by the three parties (Boeing 2015a).
8-3	Truck trips	DOE will coordinate with NASA and Boeing to ensure that all parties will not exceed a maximum of 96 haul trucks per day from SSFL. DOE will be able to utilize all or only a portion of the 96 truck trips (in accordance with the Transportation and Road Agreement signed by NASA, Boeing and DOE in 2015 [Boeing 2015a]).
8-4	Minimize hauling/ truck traffic	The TM/HRP will provide specific direction for the following objectives: • Where feasible, use local disposal facilities to minimize long-distance transport. • Minimize bringing new materials to SSFL that will have to be taken away later • Minimize shipping distances when selecting approved and /or licensed disposal locations.

Item Number	*Subtopic*	*Description*
Human Health and Safety		
9-1	Health and Safety Plan	Prior to demolition and remediation activities, DOE contractors will develop Worker Safety and Health Programs and prepare the site-specific Health and Safety Plan (HASP), in accordance with applicable regulations and DOE Orders. Implementation of the approved HASP is the responsibility of the DOE remediation contractor. Specific measures to reduce the potential physical hazards associated with strong seismic ground shaking, liquefaction, subsidence, unstable soil conditions, temporary slopes and excavations, permanent slopes, and other earthwork-related conditions during demolition and remediation activities will be addressed in accordance with the applicable regulations (DOE Order 440.1B, Change 2, *Worker Protection Program for DOE (Including the National Nuclear Security Administration) Federal Employees*). Specific measures to control the release of chemical and radioactive constituents and to protect workers and the public from exposure to chemical, radioactive, and biological hazards will be addressed in accordance with applicable requirements (10 CFR Part 835, "Occupational Radiation Protection," and DOE Order 458.1, Change 3, *Radiation Protection of the Public and the Environment*). The HASP will address the following specific items: • General hazard identification and control measures; • Identification of anticipated chemical, physical, radiological, and biological hazards anticipated during work; • Project-specific hazard controls, such as for chemical and radioactive constituents, asbestos, lead-based paint, and earthmoving equipment, including decontamination procedures; • Identification of project-specific radiological hazards and safety requirements; • Monitoring requirements (site, equipment, and personnel); • Traffic control measures (coordinated with plans for traffic management/haul route and dust control) (see Item Numbers 6-1, 8-1); • Physical hazard controls, such as for noise and temperature extremes; • Exposure assessment and air monitoring requirements; • Health physics assessments and radiation protection controls; • Biological hazard controls; • Protocols for management of waste with of radionuclide and chemical contaminants; • Personnel training requirements; • Personal protective equipment selection; and • Site controls and emergency response procedures (coordinated with the site SWPPP [Item Number 3-1]). The HASP will be developed to address project activities and incorporate procedures to mitigate potential hazards, including physical chemical, radiological, or biological hazards that might be present at the site. The plan will establish decontamination procedures for, as needed, equipment and personnel. The plan will identify worker health and safety monitoring criteria to be implemented during project activities, if needed. Consistent with 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response Standard, it will identify the safety training requirements for site workers and mandate that training will occur before project activities begin. The plan will require the use of barricades or construction fencing to demarcate work zones to control unauthorized access into these areas. In addition, if dust, chemical, or radiological monitoring is required during demolition or soil and groundwater remediation activities, it will be implemented according to the site-specific HASP, which will list the action limits at which additional controls will be required.
9-2	Hazardous materials	As required by California Health and Safety Code Chapter 6.95 and the California Code of Regulations, Title 19, A Hazardous Materials Business Plan will be developed by the DOE remediation contractor for the Area IV and NBZ project area. This plan will describe appropriate storage, containment, and safety protocols for use of hazardous materials during the remediation; emergency procedures to be followed in the event of a release; instructions for performing fueling and maintenance operations on vehicles and equipment on site; and other protocols to ensure hazardous materials will be stored and handled appropriately.

Item Number	*Subtopic*	*Description*
9-3	Radioactive materials transport	As needed, a licensed radioactive materials hauler will transport radioactive waste materials, in accordance with applicable regulations, to an approved and permitted DOE low-level radioactive waste disposal site or a commercial disposal facility possessing a radioactive materials license.
9-4	Chemical waste	Excavated material that exceeds exempt criteria for hazardous chemicals will be transported by licensed hazardous waste haulers and disposed of at hazardous waste management facilities approved and permitted for the specific hazardous materials. To ensure appropriate containment of excavated materials that exceed exempt criteria for hazardous chemicals, such materials will be placed in lined, sealed containers or wrapped and enclosed by tarps during transport.
9-5	Decontamination	For demolition and soil remediation, activities would incorporate procedures and BMPs to control discharge of contaminants into surface water. Demolition of structures would occur after structures have been decontaminated and/or measures have been taken to minimize the mobility of radionuclide contaminants. Decontamination would take place within the structures to control release of contaminants, using rigorous controls, where needed and practical.
9-6	Hazardous dust control	Use water spray during building demolition and material excavation, as well as during loading of containers/vehicles to reduce dust emissions.
9-7	Safety	During demolition of the more highly contaminated buildings (Buildings 4021 and the 4022 and 4024 sub-grade vaults) and excavation of contaminated bedrock, workers would wear respiratory protection that provides 99 percent efficiency in particulate removal.
		Waste Management
10-1	Hazardous materials and wastes	Handling and storage of hazardous materials and storage and disposal of hazardous wastes will follow protocols in the HASP and SWPPP.
10-2	Waste minimization and recycling	The project activities would incorporate the following BMPs where possible and applicable: • Salvaging of uncontaminated objects/infrastructure with potential recycle, resale, donation, or reuse; [a] • Reuse or recycling of recovered product and materials (for example, cardboard, plastics, asphalt, concrete, etc.); [a] and • Use of filters that can be backwashed to avoid frequent disposal of filters. • Minimize waste by ordering only the amount of materials and supplies needed to perform any task. [a]
		Cultural Resources
11-1	Programmatic Agreement	In consultation with the State Historic Preservation Officer and other consulting parties, DOE is developing a National Historic Preservation Act, Section 106, agreement to minimize or mitigate adverse impacts that could result from implementing the DOE demolition and remediation activities and may involve the Advisory Council on Historic Preservation and other cooperating agencies, such as the federally recognized Santa Ynez Band of Chumash Indians, or consulting parties such as the Santa Susana Field Laboratory Sacred Sites Council. The agreement will direct procedures and protocols to minimize impacts on cultural resources.
11-2	Tribal consultation	Remediation activities will be performed in a manner that respects the significance of the SSFL property to Native American stakeholders. DOE will continue to coordinate with Native American stakeholders on a regular basis to resolve any adverse effects to tribal cultural resources, including the development of measures to avoid, minimize, or mitigate any such effects. DOE will require attendance by and designate a Native American monitor during remedial activities that result in soil disturbance. Any tribal cultural resources encountered during remedial activities will be managed in consultation with Native American stakeholders (e.g., left in place, collected and moved to a secure location, collected for curation).

Item Number	Subtopic	Description
Socioeconomics		
12-1	Local workforce	Whenever feasible, engage California companies and California residents in any new jobs created.
Environmental Justice		
13		See Human Health and Safety, Air Quality, Noise and Transportation/Traffic for applicable measures

AOC = *Administrative Order on Consent for Remedial Action*; BMP = best management practice; Boeing = The Boeing Company; CDFW = California Department of Fish and Wildlife; CFR = *Code of Federal Regulations*; DTSC = Department of Toxic Substances Control; ECP = Erosion Control Plan; EPA = U.S. Environmental Protection Agency; HASP = Health and Safety Plan; LUT = Look-Up Table; MBTA = Migratory Bird Treaty Act; NASA = National Aeronautics and Space Administration; NBZ = Northern Buffer Zone; NPDES = National Pollutant Discharge Elimination System; PM_{10} = particulate matter having diameters less than 10 microns; RHRP = Revegetation and Habitat Restoration Plan; SWPPP = Stormwater Pollution Prevention Plan; TM/HRP = Traffic Management/Haul Route Plan; USFWS = U.S. Fish and Wildlife Service.

[a] BMPs from ASTM International's *Standard Guide for Greener Cleanups* that support the goal of "green and sustainable remediation" (ASTM 2013). See Chapter 7, Table 7–1, for a list of ASTM International BMPs identified as potentially applicable to the green and sustainable remediation of SSFL.

Table 6–2 Potential Mitigations

ID Number	***Mitigation***
With the use of measures in Table 6–1, no mitigations were identified for Land Use, Geology and Soils, Groundwater, Noise, Human Health and Safety, Waste Management, and Environmental Justice.	
Surface Water (SW)	
SW-1	Excavation of soils to bedrock and backfill to initiate revegetation would only be completed outside of the December through May stormwater season to avoid any increases in runoff volume and velocity potentially created by increases in impervious surfaces on site with the exposure of areas of currently covered bedrock.
SW-2	If, as a result of selected alternative implementation, runoff studies indicate the NPDES stormwater control system design capacity would be exceeded, retention structures such as catch basins or retention basins and additional erosion control measures may be added.
Biological Resources (BR)	
BR-1	*Revise the impact avoidance, minimization, and species compensation measures to incorporate the terms and conditions resulting from Endangered Species Consultation with USFWS and CDFW.* The site-wide biological assessment being prepared addresses biological resource issues from the combined actions of DOE, NASA, and Boeing at SSFL. After reviewing the site-wide biological assessment and the associated impact avoidance, impact minimization, and species conservation measures, USFWS would render a Biological Opinion with terms and conditions, and CDFW would issue an Incidental Take Permit that may include additional mitigations or requirements for incorporation into the project and inclusion in DOE's final EIS.
BR-2	*Mitigate for temporary disturbance to USACE jurisdictional wetlands and Waters of the United States.* In accordance with USACE requirements, incorporate terms and conditions and mitigation measures attached to the Section 404 Clean Water Act permit. These measures are generally implemented sequentially as necessary, (1) seeking to avoid impacts, (2) minimizing impacts in space and/or time, and (3) providing replacement habitat ("compensatory mitigation") for impacts that are unavoidable.
Air Quality and Climate (AQ)	
AQ-1	Implement green vehicle fleets with the following specifications: • For off-road equipment, the lower of EPA Non-road Tier 3 emission standards or California average fleet emission factors for a given pollutant. • For on-road trucks, a fleet with trucks no more than 5 years old.
Transportation/Traffic (TR)	
TR-1	DOE would distribute truck traffic on multiple routes to the interstate highways or major state highways in order to disperse impacts in local neighborhoods so that one route does not experience all of the project traffic.
TR-2	A safety concern has been identified where the turn radius of tractor-trailer trucks is potentially too large to navigate the right turn from Woolsey Canyon Road onto Valley Circle Boulevard toward Roscoe Boulevard. The concern is that SSFL haul trucks would turn into the oncoming lane of traffic on Valley Circle Boulevard. One possible mitigation measure for traffic safety could be to position a flagger at the intersection to keep oncoming traffic on Valley Circle Boulevard back 20 feet or more to the south to permit tractor-trailer trucks to make the turn safely. Another possible mitigation is to work with local government to install a traffic light to force traffic traveling north on Valley Circle Boulevard to stop far enough back to allow the trucks to make the turn safely.
Cultural Resources (CR)	
CR-1	DOE is currently consulting with SHPO, the Santa Ynez Band of Chumash Indians, and the Santa Susana Field Laboratory Sacred Sites Council concerning potential impacts on affected sacred sites and traditional cultural resources from implementing the D&D and remediation activities. Because the Santa Ynez Band of Chumash Indians has designated all of SSFL as a sacred site and nominated it as a traditional cultural property, and SHPO is considering whether or not to propose all of SSFL as a NRHP-eligible historic district as defined by NHPA, addressing impacts is governed by a suite of laws, regulations, and Executive Orders, including NEPA, AIRFA, NHPA, and Executive Orders 13007, *Indian Sacred Sites,* and 13175, *Consultation and Coordination with Indian Tribal Governments* (refer to Appendix F). The consultation would eventually result in determining the nature and extent of the mitigation measures needed to achieve compliance with relevant laws and with BMPs, including the development of a project National Historic Preservation Act, Section 106, Agreement.

ID Number	***Mitigation***
CR-2	*Inadvertent Discovery of Human Remains* In the event of discovery or recognition of any human remains during work activities, such activities will cease at the site or any nearby area reasonably suspected to overlie adjacent remains, and the Ventura County Coroner would be contacted; the coroner would determine within 2 working days whether or not investigation of the cause of death is required. NAHC would be contacted within 24 hours if it were determined that the remains are Native American. NAHC would then identify the person or persons it believes to be the most likely descendant from the deceased Native American, who in turn would make recommendations to DTSC regarding the appropriate means of treating, with appropriate dignity, the human remains and any grave goods, consistent with applicable law. This mitigation measure may be altered by the Programmatic Agreement with SHPO and the Santa Susana Field Laboratory Sacred Sites Council.
CR-3	*Inadvertent Discovery of Cultural Resources (not including Human Remains)* If prehistoric or historic-period archaeological resources are encountered, all construction activities within 100 feet would be halted, and the city, county, or agency with jurisdiction would be contacted. A Secretary of the Interior–qualified archaeologist would inspect the find within 24 hours of discovery. If the find were determined to be potentially significant, the archaeologist, in consultation with the city/county/agency and the culturally affiliated Native American group(s) would determine whether preservation in place is feasible. Consistent with CEQA, Section 15126.4(b)(3), this may be accomplished through measures that may include planning construction to avoid the resource; incorporating the resource within open space; capping and covering the resource; or deeding the site into a permanent conservation easement. If avoidance is not feasible, a qualified archaeologist, in consultation with the lead agency and the culturally affiliated Native American group(s), would prepare and implement a detailed treatment plan. Treatment of unique archaeological resources would follow the applicable requirements of the California Public Resources Code, Section 21083.2. Treatment for most resources could consist of (but would not be limited to) sample excavation, artifact collection, site documentation, determination of significance, and historical research, with the aim to target the recovery of important scientific data contained in the portion(s) of a significant resource to be impacted by the project. The treatment plan would include provisions for analysis of data in a regional context, reporting of results within a timely manner, curation of artifacts and data at an approved facility, and dissemination of reports to local and state repositories, libraries, and interested professionals. This mitigation measure may be altered by the Programmatic Agreement with SHPO and the Santa Susana Field Laboratory Sacred Sites Council.
Socioeconomics (SE)	
SE-1	DOE may need to negotiate with the affected local governments to contribute its portion to the maintenance and repair of the affected roads.

AIRFA = American Indian Religious Freedom Act; BMP = best management practice; Boeing = The Boeing Company; CDFW = California Department of Fish and Wildlife; CEQA = California Environmental Quality Act; D&D = decontamination and decommissioning; DTSC = Department of Toxic Substances Control; EIS = environmental impact statement; EPA = U.S. Environmental Protection Agency; NAHC = Native American Heritage Commission; NASA = National Aeronautics and Space Administration; NEPA = National Environmental Policy Act; NHPA = National Historic Preservation Act; NPDES = National Pollutant Discharge Elimination System; NRHP = *National Register of Historic Places*; SHPO = State Historic Preservation Officer; USACE = U.S. Army Corps of Engineers; USFWS = U.S. Fish and Wildlife Service.

Chapter 7
Resource Commitments

7.0 RESOURCE COMMITMENTS

As required by the National Environmental Policy Act (NEPA) Section 102 (2)(C), this *Draft Environmental Impact Statement for Remediation of Area IV and the Northern Buffer Zone of the Santa Susana Field Laboratory (Draft SSFL Area IV EIS)* addresses unavoidable adverse environmental impacts that could result from the proposed project; irreversible and irretrievable commitments of resources; and the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity.

7.1 Sustainability

7.1.1 Background

Broadly defined, sustainability is the endurance of diverse and productive systems, including ecological, economic, and social/political. In other words, sustainability is about creating and maintaining conditions under which humans and nature can exist in productive harmony to support present and future generations. The scientific community generally agrees that, to some degree, human activities are altering the natural and physical conditions on the planet, causing widespread changes that are reflected in climate, biodiversity, and even social stability. Some of the most pressing contributors of these changes are related to use of fossil fuels and dwindling water supplies where they are needed to support human populations.

To address some of these changes, a series of Executive Orders has been issued, including Executive Orders 13123, *Greening the Government through Efficient Energy Management* (1999); 13423, *Strengthening Federal Environmental, Energy, and Transportation Management* (2007); 13514, *Federal Leadership in Environmental, Energy, and Economic Performance* (2009); 13653, *Climate Change Adaption* (2013); and, most recently, 13693, *Planning for Federal Sustainability in the Next Decade* (2015). These Executive Orders lay out broad goals to reduce consumption of energy and water by the Federal Government and in the Nation as a whole in order to balance and sustain future needs. Executive Order 13514 also directs agencies to identify and analyze impacts from energy usage and alternative energy sources in all environmental impact statements (EISs) and environmental assessments of proposals for new or expanded Federal facilities under NEPA. The more recent Executive Order 13693 does not specifically mention NEPA, although the focus on assessment and meeting sustainability goals for greenhouse gas emissions, energy use, and water use is emphasized.

In response, various Governmental departments, including the U.S. Department of Energy (DOE), have adopted orders, directives, and guidelines that establish internal processes to achieve the sustainability goals set forth in the Executive Orders. DOE Order 436.1, *Departmental Sustainability*, provides DOE-specific requirements to ensure that DOE and its contractors comply with current Executive Orders 13693 and 13514. It also requires preparation of a Departmental Strategic Sustainability Performance Plan that details how DOE will achieve its sustainability goals. Additionally, DOE Order 436.1 requires sustainability planning at every DOE site and applies sustainability principles and goals to the site management contracts and the operations of site facilities and fleets, for facility construction and demolition, and for infrastructure improvements. Regulatory agencies, such the U.S. Environmental Protection Agency (EPA) and various state agencies, including California agencies, have also developed and adopted guidelines to address the challenge of sustainability.

7.1.2 Green and Sustainable Remediation

At various sites across the country, accidents and past operations have left a legacy of environmental contamination. While cleanup projects are designed to result in safer and improved environmental conditions, the processes and activities to achieve cleanup goals can themselves have impacts on the environment and can consume energy and water resources. In recognition of this, the EPA Office of Solid Waste and Emergency Response has developed a concise statement of *Principles for Greener Cleanups* (EPA 2009b). The state of California Department of Toxic Substances Control (DTSC) has also adopted an *Interim Advisory for Green Remediation* (2009) that gives direction for remediation actions.

Green and sustainable remediation factors addressed by DTSC in its advisory include evaluation of measures to decrease solid waste production, soil structure disruption, habitat destruction, use of backfill, transportation and traffic, loss of land use and production, use of fossil fuels, and water usage. These are issues that DTSC assesses in its California Environmental Quality Act analyses of remedial projects (for example, cleanup of Santa Susana Field Laboratory [SSFL]).

In partnership with EPA, ASTM International developed *Standard E-2893, Standard Guide for Greener Cleanups* (ASTM 2013), along with a list of "greener cleanup" best management practices (BMPs) specifically geared toward the use of sustainability practices in remediation activities. This comprehensive list of BMPs provides benefits, not just at a specific remediation site, but also at the local, regional, and national levels. For instance, they describe protocols for selecting environmentally friendly materials and managing waste through reuse and recycling; they also support use of the local workforce or businesses that use "green" practices in the interest of sustainability. Many of these BMPs are not essential to comply with specific regulations, but provide an enhanced level of environmental stewardship. Complementing this, the Interstate Technology and Regulatory Council developed *Green and Sustainable Remediation: State of the Science and Practice* (ITRC 2011a) and *Green and Sustainable Remediation: A Practical Framework* (ITRC 2011b) as tools to assist practitioners with planning and integrating sustainable processes into remediation projects. Application of these principles and guides is referred to as "green and sustainable remediation."

> **The Interstate Technology and Regulatory Council provides the following definition of green and sustainable remediation:**
>
> *The site-specific employment of products, processes, technologies, and procedures that mitigate contaminant risk to receptors (during cleanup activities) while making decisions that are cognizant of balancing community goals, economic impacts, and environmental effects.*
>
> *Source: ITRC 2011b.*

DOE is committed to integrating sustainability in its projects, consistent with the requirements of Executive Order 13693, *Planning for Federal Sustainability in the Next Decade*. Impacts on the natural environment would be expected to result from the cleanup of Area IV and the Northern Buffer Zone (NBZ), regardless of which action alternative is selected. DOE is committed to minimizing impacts by using the principles of "green cleanup." This approach is consistent with the DOE Office of Environmental Management's recognition of sustainability as an organizational goal at the highest levels of management (DOE 2015b). To the extent practical, green and sustainable remediation and innovative technology practices will be integrated into all phases of remediation.

Principle elements of green sustainable remediation are:

- Minimize total energy and maximize use of renewable energy
  - Minimize energy consumption (e.g., use energy-efficient equipment)
  - Power cleanup equipment using onsite renewable energy sources
  - Purchase commercial energy from renewable resources

- Minimize air pollutants and greenhouse gas emissions
  - Minimize generation of greenhouse gases
  - Minimize generation and transport of airborne contaminants and dust
  - Use heavy equipment efficiently; reduce diesel emissions
  - Maximize use of machinery equipped with advanced emission controls
  - Use cleaner fuels to power machinery and auxiliary equipment
  - Sequester carbon on site
- Minimize water use and impacts to water resources
  - Minimize water use and depletion of natural water resources
  - Capture, reclaim, and store water for reuse
  - Minimize water demand for revegetation
  - Employ techniques for reduction of stormwater runoff and the potential for contaminants in stormwater
- Reduce, reuse, and recycle materials and waste
  - Minimize consumption of virgin materials
  - Minimize waste generation
  - Use recycled products and local materials
  - Beneficially reuse waste materials
  - Segregate and reuse or recycle materials, products, and infrastructure
- Protect land and ecosystems
  - Minimize areas requiring activity or use limitations
  - Minimize unnecessary soil and habitat disturbance or destruction
  - Minimize noise and lighting disturbance

7.1.3 Green and Sustainable Remediation for DOE Remediation at the Santa Susana Field Laboratory

Chapter 2, Section 2.2.2, of this EIS describes how DOE proposes to implement greener practices into the decontamination and decommissioning (D&D) and remediation activities at SSFL's Area IV and NBZ. For this project, cleanup decisions for all action alternatives would be guided to the extent possible by EPA's *Principles for Greener Cleanups* (EPA 2009b), ASTM International's *Standard Guide for Greener Cleanups* (ASTM 2013), and DTSC's *Interim Advisory for Green Remediation* (DTSC 2009). The purpose of EPA's principles, ASTM's standard guide, and DTSC's Advisory is to improve the decision-making process involved with site cleanup, while assuring the protection of human health and the environment by minimizing the environmental "footprint" of cleanup activities.

Measures to minimize the impacts of remediation currently incorporated into the proposed activities are listed in Chapter 6, Table 6–1. These minimization measures have been developed with cognizance of the concerns and expectations of the cooperating agencies, local communities, state regulators, and responsible parties performing remediation activities at SSFL (DOE, the National

Aeronautics and Space Administration, and The Boeing Company [Boeing]). Many of these measures are already included in the terms and conditions of existing site permits, such as the stormwater pollution prevention plan and general construction National Pollutant Discharge Elimination System permit, but others apply more specifically to the alternatives evaluated in this EIS for soil remediation, building removal, and groundwater treatment. The ASTM International BMPs are another source for the proposed minimization measures in Table 6–1. Key areas of focus are conservation and restoration of the natural ecology, management of stormwater drainage, reduction in water and energy use and greenhouse gas emissions, protection of the health and safety of workers and the surrounding public, and avoidance of impacts on protected biological and cultural resources at the site. The EIS impact analyses are based on implementing the minimization measures included in Chapter 6, Table 6–1. DOE intends to continue reviewing and assessing green practices and incorporating applicable and feasible green BMPs into the cleanup activities throughout the entire cleanup process.

Table 7–1 is a "short list" of the ASTM International greener cleanup BMPs that DOE identified during development of this EIS as potentially applicable to remediation actions in Area IV and the NBZ. Use of selected greener cleanup BMPs in Table 7–1 could achieve a higher level of green and sustainable remediation beyond the minimization measures proposed in Chapter 6, Table 6–1. DOE may implement some of the greener cleanup BMPs in Table 7–1 throughout the cleanup process as the work progresses, in response to conditions at the site and within the surrounding region. The greener cleanup BMPs in Table 7–1 could also be used in the contractor selection process; for example, DOE could give preference to bids that demonstrate inclusion of these BMPs into the proposed remediation work effort at Area IV and the NBZ. It should be noted that DOE would use the minimization measures in Table 6–1 for the action alternatives and would consider including the mitigation measures in Table 6–2 to further reduce impacts. The BMPs in Table 7–1 offer additional measures that DOE would evaluate and decide whether to implement during the cleanup process as opportunities arise. As such, the EIS resource impact analyses are not predicated on implementing the BMPs in Table 7–1.

7.1.4 Benefits of Green and Sustainable Remediation

Integrating green practices into the remediation project provides several benefits. Over time, the use of this enhanced level of environmental management conserves lifetime costs for waste management and energy and water supply. It also lowers lifetime costs of materials and equipment that are specifically designed and maintained for optimal performance. In addition, relationships between project proponent(s), regulating agencies, and potentially affected communities can improve where the public values green and sustainable initiatives. Finally, green BMPs are aimed at reducing the environmental footprint, which translates into reduced impacts on physical, natural, and social resources. Key green and sustainable remediation issues for the remediation of Area IV and the NBZ include the efficient use of water in an arid landscape, appropriate use of land, appropriate use of soil (including backfill), consumption of nonrenewable resources such as fossil fuels, and reduction of the carbon footprint.

> **Water Resources**
>
> Approximately 4.0 to 4.2 million gallons of water a year used for implementing the action alternative combinations at Area IV and the NBZ would not be available for other beneficial uses, including agricultural or domestic needs.

Table 7–1 Applicability of ASTM International Greener Cleanup Best Management Practices to DOE Remediation Activities at the Santa Susana Field Laboratory

Green and Sustainable Remediation Best Management Practice	*Resource Conservation*				*Protection of Environment*				*Waste Management*			*Optimizing Project Work*	Applicability to Area IV Cleanup Actions
	Energy Conservation	*Use of Onsite Materials*	*Water Conservation*	*Use of Natural Resources*	*Air Quality*	*Carbon Foot Print*	*Protection of Resources*	*Project Footprint Reduction*	*Recycling / Reuse*	*Waste Reduction*	*Keeping Materials Out of Landfills*	*Optimizing Project Work*	
– Steam-clean or use phosphate-free detergents or biodegradable cleaning products instead of organic solvents or acids to decontaminate sampling equipment.			✓										Use of solvents or acids is not likely for equipment decontamination.
– For constructed wetlands, maximize use of gravity flow for conveyance of water.	✓												Use of wetlands for water conveyance or treatment is not likely for Area IV cleanup actions.
– Use treated slurry and/or process water for other cleanup activities or non-remedial applications such as irrigation or wetlands enhancement. – Use uncontaminated wastewater or treated water for tasks such as wash water, irrigation, dust control, constructed wetlands, or other uses.[a] – Remediation technologies and dust suppression could supplement water sources with treated water that is re-injected into the local aquifers.[a]			✓										Treated extracted groundwater could be used as a source for dust control water, but only for about 700 gallons per day of makeup water. Use of the water would require state of California approval.
– Employ a closed-loop graywater washing system for decontamination of trucks.			✓										DOE will consider gray water systems in the building D&D and soil removal contractors' scopes of work
– Use captured rainwater for tasks such as wash water, irrigation, dust control, constructed wetlands, or other uses.[a]			✓										Use of captured stormwater runoff is a consideration, but would need to be worked out with the landowner (Boeing) and included in remediation contractors' scopes of work.
– Consider discharging wastewater to a POTW or other regional water treatment plant rather than building and operating an onsite treatment plant, when feasible and environmentally beneficial based on additional analysis.	✓							✓				✓	DOE will use portable toilets and is not considering a site treatment system for domestic wastes; onsite treatment of contaminated groundwater would be in a specialized treatment unit.

Green and Sustainable Remediation Best Management Practice	***Resource Conservation***				***Protection of Environment***				***Waste Management***			***Optimizing Project Work***	***Applicability to Area IV Cleanup Actions***
	Energy Conservation	***Use of Onsite Materials***	***Water Conservation***	***Use of Natural Resources***	***Air Quality***	***Carbon Foot Print***	***Protection of Resources***	***Project Footprint Reduction***	***Recycling / Reuse***	***Waste Reduction***	***Keeping Materials Out of Landfills***	***Optimizing Project Work***	
– Select plant species (including those used for constructed wetlands) that should be compatible with local and regional ecosystems and require minimal water and amendments. – Use plants/amendment/input that require minimal management and water.[a] – Use local plant stock to minimize transportation and increase acclimation survivability (that is, decrease probability of replanting). – Maximize use of native, non-invasive and/or drought-resistant vegetative cover across the site during restoration, including a suitable mix of shrubs, grasses, and forbs to preserve biodiversity and related ecosystem services. – Revegetate excavated areas and/or areas disrupted by equipment or vehicles as quickly as possible using native vegetation, if possible, and restore as close as possible to original conditions.	✓		✓	✓	✓	✓	✓						DOE is considering all of these vegetation actions as part of the project description.
– Plant at the optimum time of the season (for example, late winter/early spring) to minimize irrigation requirements and increase acclimation survivability. – Design systems to allow natural volunteer growth/spreading to fill in entire target area over time (minimize initial planting; fill in over time), if time permits. – Use pre-existing native and non-invasive vegetation for phytoremediation and restoration activities.	✓		✓	✓			✓					✓	– Where practical, DOE will consider seasonal planting of native vegetation. – Use of natural revegetation processes will be considered where practical. – Site revegetation will use native species.
– Minimize clearing of trees throughout investigation and cleanup.	✓						✓						DOE will protect trees as necessary during cleanup.
– Use BMPs that incorporate native landscaping and efficient irrigation.			✓				✓						Site revegetation will use native species.

Green and Sustainable Remediation Best Management Practice	***Resource Conservation***				***Protection of Environment***				***Waste Management***			***Optimizing Project Work***	***Applicability to Area IV Cleanup Actions***
	Energy Conservation	***Use of Onsite Materials***	***Water Conservation***	***Use of Natural Resources***	***Air Quality***	***Carbon Foot Print***	***Protection of Resources***	***Project Footprint Reduction***	***Recycling / Reuse***	***Waste Reduction***	***Keeping Materials Out of Landfills***	***Optimizing Project Work***	
– Use onsite-generated renewable energy (including but not limited to solar photovoltaic, wind turbines, landfill gas, geothermal, biomass combustion, etc.) to fully or partially provide power otherwise achieved through onsite fuel consumption or use of grid electricity. – Use solar power pack system for low-power system demands (for example, security lighting, and system telemetry).	✓			✓	✓	✓							DOE will look for opportunities for onsite renewable energy; DOE will consider such opportunities in the contractors' scopes of work.
– Select facilities with green policies for worker accommodations and periodic meetings. – Contract a laboratory that uses green practices and/or chemicals.	✓		✓		✓	✓							– Facility selection is not part of remediation scope. – DOE will consider green practices in analytical laboratory scope, but laboratories must first meet project analytical and state certification requirements.
– Use local staff (including subcontractors) when possible to minimize resource consumption. – Use local laboratory to minimize impacts from transportation.	✓				✓	✓							– Preference for local onsite workers will be in the DOE contractor scope. – Use of a local laboratory must be balanced with California certification and cleanup level considerations, throughput, and data quality meeting necessary detection limits.
– Use onsite or nearby sources of backfill material for excavated areas, if shown to be free of contaminants.	✓	✓		✓	✓								Use of nearby clean sources of backfill will be considered for sources that meet required values.
– Use onsite/local materials when possible (for example, wood waste for compost, rocks for drainage control).[a]	✓	✓			✓								DOE will consider use of existing excavated bedrock rubble, as sources of onsite fill material.

Green and Sustainable Remediation Best Management Practice	***Resource Conservation***				***Protection of Environment***				***Waste Management***			***Optimizing Project Work***	***Applicability to Area IV Cleanup Actions***
	Energy Conservation	***Use of Onsite Materials***	***Water Conservation***	***Use of Natural Resources***	***Air Quality***	***Carbon Foot Print***	***Protection of Resources***	***Project Footprint Reduction***	***Recycling / Reuse***	***Waste Reduction***	***Keeping Materials Out of Landfills***	***Optimizing Project Work***	
– Survey onsite infrastructure to determine material types and approximate quantities that could be reused or recycled and evaluate opportunities for onsite or local reuse and/or recycling. – Reclaim and stockpile uncontaminated soil for use as fill or other purposes, such as frost prevention and erosion control layers in landfill covers.[a] – Salvage uncontaminated and pest- or disease-free organic debris, including trees downed during site clearing, for use as fill, mulch, compost, or habitat creation. – Salvage uncontaminated objects/infrastructure with potential recycle, resale, donation, or reuse.[a]		✓							✓	✓	✓		– Recycling building material is part of the proposed project. – Uncontaminated soil will be used for regrading where possible. – Mulch that can be shown to be free of weed species can be used for compost and habitat creation. – Recycling building material is part of the proposed project.
– Use recycled content (for example, steel made from recycled metals; concrete and/or asphalt from recycled crushed concrete and/or asphalt, respectively; plastic made from recycled plastic; and tarps made with recycled or bio-based contents instead of virgin petroleum-based contents). – Use geotextile fabric or drainage tubing composed of 100 percent recycled materials, rather than virgin materials, for lining, erosion control, and drainage on landfill covers. – Purchase materials in bulk quantities that are packed in reusable/recyclable containers and drums to reduce packaging waste.									✓	✓	✓		– DOE will consider use of recycled materials in the contractors' scopes of work. – DOE will consider use of such recycled materials in the contractors' scopes of work. – DOE will consider purchase of materials in bulk in the contractors' scopes of work.

Green and Sustainable Remediation Best Management Practice	Resource Conservation				Protection of Environment				Waste Management			Optimizing Project Work	Applicability to Area IV Cleanup Actions
	Energy Conservation	Use of Onsite Materials	Water Conservation	Use of Natural Resources	Air Quality	Carbon Foot Print	Protection of Resources	Project Footprint Reduction	Recycling / Reuse	Waste Reduction	Keeping Materials Out of Landfills	Optimizing Project Work	
– Use products, packing material, and equipment that can be reused or recycled. – Recycle as much non-usable/spent equipment/materials as possible following completion of the project. – To the maximum practical extent, recyclable materials, including nonhazardous remediation and demolition debris, will be reused or recycled, where feasible. – Salvage uncontaminated objects/infrastructure with potential recycle, resale, donation, or reuse value. – Reuse or recycle recovered product and materials (for example, cardboard, plastics, asphalt, concrete, etc.).[a]									✓	✓	✓		DOE will consider recycling as part of the contractors' scopes of work.
– Use SmartWay transportation retrofits (for example skirts, air tabs) on tractor-trailers whenever possible. – Replace conventional vehicles with electric, hybrid, ethanol, or compressed natural gas vehicles.	✓				✓	✓							– DOE will consider SmartWay retrofits in the contractors' scopes of work. – DOE will consider use of alternative vehicles in the contractors' scopes of work.
– Use biodiesel produced from waste or cellulose-based products, preferring local sources wherever readily available to reduce transportation impacts. – Minimize diesel emissions through the use of retrofitted engines, ultra-low or low sulfur diesel or alternative fuels, or filter/treatment devices to achieve BACT or MACT.					✓	✓	✓						– DOE will consider biodiesel in the construction contractors' scopes of work. – DOE will consider retrofitted engines in the construction contractors' scopes of work.
– Use biodegradable hydraulic fluids on hydraulic equipment such as drill rigs.							✓						DOE will consider biodegradable fluids in D&D and soil removal in the contractors' scopes of work.
– Buy carbon offset credits (for example, for airline flights) when in-person meetings are required.					✓	✓							DOE will consider this in the construction contractors' scopes of work.

Green and Sustainable Remediation Best Management Practice	***Resource Conservation***				***Protection of Environment***				***Waste Management***			***Optimizing Project Work***	***Applicability to Area IV Cleanup Actions***
	Energy Conservation	***Use of Onsite Materials***	***Water Conservation***	***Use of Natural Resources***	***Air Quality***	***Carbon Foot Print***	***Protection of Resources***	***Project Footprint Reduction***	***Recycling / Reuse***	***Waste Reduction***	***Keeping Materials Out of Landfills***	***Optimizing Project Work***	
– Enhance existing natural resources, manage surface drainage, prevent soil/sediment runoff, and promote carbon sequestration by incorporating wetlands, bioswales, and other types of vegetation into overall remedial approach.					✓		✓						Wetlands and bioswales are not part of the proposed project.
– Restore and maintain surface water banks in ways that mirror natural conditions.[a]							✓						Drainage channel restoration is not part of the proposed project.
– Mix amendments into soil *in situ* whenever possible to minimize dust generation and emissions.[a]					✓								Use of soil amendments is not part of the proposed project.
– Minimize soil compaction and land disturbance during site activities by restricting traffic to confined corridors and protecting ground surfaces with biodegradable covers, where applicable.[a]							✓	✓					An onsite traffic plan to confine movements to established roads will be developed by a DOE contractor.
– Use excavated areas to serve as retention basins in final stormwater control plans.							✓	✓					DOE will look for opportunities to use excavations for retention basins; placement will need to be addressed with the landowner (Boeing).
– Soundproof all aboveground equipment housing to prevent noise disturbance to surrounding environment.								✓					All aboveground equipment will use appropriate mufflers.
– Cover filled excavations with biodegradable fabric to control erosion and serve as a substrate for ecosystems.[a] – Use bio-based products (for example, erosion control fabrics containing agricultural byproducts). – Use biodegradable seed matting constructed of recycled materials (for example, paper, sawdust, hay).						✓	✓	✓	✓				DOE will consider including use of such products in the soil contractor's scope of work.
– Use dedicated materials (that is, reuse of sampling equipment and nonuse of disposable materials/equipment) when performing multiple rounds of sampling.										✓	✓		Use of dedicated materials will continue to be part of the groundwater sampling scope.
– Prepare, store, and distribute documents electronically using an environmental information management system.										✓			Electronic storage of documents will be part of the contractors' scopes of work.

Green and Sustainable Remediation Best Management Practice	***Resource Conservation***				***Protection of Environment***				***Waste Management***			***Optimizing Project Work***	***Applicability to Area IV Cleanup Actions***
	Energy Conservation	***Use of Onsite Materials***	***Water Conservation***	***Use of Natural Resources***	***Air Quality***	***Carbon Foot Print***	***Protection of Resources***	***Project Footprint Reduction***	***Recycling / Reuse***	***Waste Reduction***	***Keeping Materials Out of Landfills***	***Optimizing Project Work***	
– Establish green requirements (for example, SMPs and BMPs) as evaluation criteria in the selection of contractors and include language in RFPs, RFQs, subcontracts, contracts, etc.												✓	DOE will continue use of green BMPs.
– Minimize the size of the housing for aboveground treatment system and equipment.		✓							✓				The proposed treatment systems are temporary and will not require housing.
– Reuse existing structures for treatment system, storage, sample management, etc.		✓								✓			Building 57 is currently being used for sample equipment storage; sample management is performed in an onsite trailer.
– Institute a process for using demand-response mechanisms to reduce use of electricity while responding to power grid needs.	✓												Groundwater treatment systems have minimal power requirements.
– Use regenerated GAC for use in carbon beds.									✓	✓	✓		DOE will consider use of GAC in contractor's scope of work.
– Consider preheating vapors (preferably passive) to reduce relative humidity prior to treatment with vapor-phase GAC to improve adsorption efficiency if preheating does not produce unacceptable tradeoffs.												✓	DOE will consider for inclusion in contractor's scope of work if SVE is identified as a remedy.
– Maximize the reuse of existing wells for sampling, injections, or extractions, where appropriate, and/or design wells for future reuse.		✓										✓	DOE will continue use of existing wells as a part of the strategy for groundwater remediation.
– Implement a flexible network of piping (under and/or aboveground) which allows for future modular increases or decreases in the extraction or injection rates and treatment modifications.												✓	DOE will use flexible piping in the design of the groundwater treatment system.
– Use timers or feedback loops and process controls for dosing chemical injections.												✓	DOE will incorporate process control feedback in the design of the groundwater treatment system.
– Use in-well downhole real-time data collection systems with remote sensing capabilities for monitoring groundwater parameters to optimize injection of oxidants and reagents.												✓	DOE will include data loggers with remote sensing in the design of the groundwater treatment system.

Green and Sustainable Remediation Best Management Practice	Resource Conservation				Protection of Environment				Waste Management			Optimizing Project Work	Applicability to Area IV Cleanup Actions
	Energy Conservation	Use of Onsite Materials	Water Conservation	Use of Natural Resources	Air Quality	Carbon Foot Print	Protection of Resources	Project Footprint Reduction	Recycling / Reuse	Waste Reduction	Keeping Materials Out of Landfills	Optimizing Project Work	
– Conduct pilot tracer tests to optimize hydraulic delivery of reagents and assure capture of target groundwater zone to be treated aboveground.												✓	DOE will conduct pilot tests prior to full implementation of any groundwater remedy.
– Use gravity flow where feasible to reduce the number of pumps for water transfer after subsurface extraction.	✓											✓	DOE will consider gravity flow in the design of the groundwater treatment system.
– Install a modular renewable energy system that can be used to meet energy demands of multiple activities over the life span of the project (for example, powering field equipment, construction or operational activities, supplying energy demands of buildings).	✓												DOE will consider solar power opportunities for remote sensing instrumentation.
– When nearing asymptotic conditions and/or when continuous pumping is not needed to contain the plume and/or reach clean-up objectives, operate pumping equipment in pulsed mode.	✓											✓	DOE will consider pulsed pumping during operations of treatment systems.
– Use filters (for example, bag/cartridge filters) that can be backwashed to avoid frequent disposal of filters.[a]									✓	✓		✓	DOE will consider using filters that can be backwashed as part of treatment system operations.
– Segregate drilling waste based on location/composition to reduce the volume of drilling waste disposed of offsite; collect needed analytical data to make onsite reuse decisions.									✓	✓		✓	DOE will segregate drilling wastes as part of normal practice.
– Use multi-port sampling system in monitoring wells to minimize the number of wells needing to be installed.												✓	DOE will continue this practice at SSFL.
– Implement a telemetry system to reduce frequency of site visits.												✓	DOE will consider opportunities for incorporating telemetry.

BACT = best available control technology; BMP = best management practice; Boeing = The Boeing Company; D&D = decontamination and decommissioning; GAC = granular activated carbon; MACT = maximum achievable control technology; POTW = publicly owned treatment works; RFP = request for proposal; RFQ = request for quotation; SMP = site management plan; SVE = soil vapor extraction.

[a] ASTM International BMPs incorporated into DOE project commitments as "green and sustainable remediation" measures applicable to soil remediation, building demolition, and groundwater remediation action alternatives. These BMPs are identified in Chapter 6, Table 6–1, Measures to Minimize Impacts of Demolition and Remediation Activities at Santa Susana Field Laboratory and the Northern Buffer Zone, with footnote "a".

Implementing the soil remediation, building demolition, and groundwater remediation action alternatives would affect the use of land, soil, energy, and water for the duration of the project. **Tables 7–2** and **7–3** provide the estimated fuel use and water use, respectively, for each action alternative and action alternative combinations, as described in Chapter 4. Tables 7–2 and 7–3 show that the Cleanup to AOC [2010 *Administrative Order on Consent for Remedial Action* (2010 AOC) (DTSC 2010a)] LUT [Look-Up Table] Values Alternative is the primary consumer of energy (primarily in the form of fossil fuels for vehicles) and water (for dust control). Based on the trip distances described in Chapter 4, Section 4.8, the calculations in Table 7–2 show that using local disposal sites (240-mile round trip) would consume about one-third of the fuel of using distant disposal sites (1,560-mile round trip) for the High Impact Combination of alternatives, thereby achieving improved green and sustainable outcomes, depending on the capacities at local sites to receive the requisite waste types. Green and sustainable remediation methods to reduce fuel use could hinge on reducing the amount of truck hauling to and from the site. Meeting the requirements of the 2010 AOC necessitates large volumes of soil removal (and truck hauling) due to the stringent criteria for the presence of chemical and radioactive constituents. Selecting the Conservation of Natural Resources Alternative for soil remediation under any of the action alternative combinations would result in reduced fuel use.

Water use for the project (summarized in Table 7–3) is described in Chapter 4, Section 4.1.4, as about 4.0 million gallons annually, largely due to the water needed for dust control for the soil remediation action alternatives. Combinations of alternatives that include the Cleanup to Revised LUT Values or Conservation of Natural Resources Alternatives for soil remediation would use much less water overall (over a shorter period of time), resulting in a total use of water of up to 9.0 million gallons (28 acre-feet) compared to the maximum of about 41 million gallons (125 acre-feet) used under the combinations of alternatives that include the Cleanup to AOC LUT Values Alternative for soil remediation.

Table 7–2 Summary of Fuel Usage by Action Alternative

Fuel Use Parameter	Totals by Alternative [a]		
	Horsepower Hours	Vehicle Miles Traveled	Fuel (gallons) [b]
Soil Cleanup to AOC LUT Values Alternative			
Off-road Equipment	6,710,000,		335,000
Haul Trucks – Nearby Disposal Sites		14,400,000	2,330,000
Haul Trucks – Distant Disposal Sites		49,800,000	7,770,000
Total – Nearby Disposal Sites			2,670,000
Total – Distant Disposal Sites			8,100,000
Commuter Vehicles – Gasoline		2,840,000	100,000
Soil Cleanup to Revised LUT Values Alternative			
Off-road Equipment	1,570,000		78,300
Haul Trucks – Nearby Disposal Sites		6,710,000	1,05,000
Haul Trucks – Distant Disposal Sites		20,100,000	3,050,000
Total – Nearby Disposal Sites			1,120,000
Total – Distant Disposal Sites			3,130,000
Commuter Vehicles – Gasoline		592,000	20,900
Soil Conservation of Natural Resources Alternative			
Off-road Equipment	1,150,000		57,400
Haul Trucks – Nearby Disposal Sites		4,280,000	672,000
Haul Trucks – Distant Disposal Sites		14,700,000	2,240,000
Total – Nearby Disposal Sites			730,000
Total – Distant Disposal Sites			2,300,000
Commuter Vehicles – Gasoline		569,000	28,400

	Totals by Alternative [a]		
Fuel Use Parameter	***Horsepower Hours***	***Vehicle Miles Traveled***	***Fuel (gallons)*** [b]
Building Removal Alternative			
Off-road Equipment	388,000		19,400
Haul Trucks – Nearby Disposal Sites		954,000	147,000
Haul Trucks – Distant Disposal Sites		2,190,000	331,000
Total – Nearby Disposal Sites			166,000
Total – Distant Disposal Sites			350,000
Commuter Vehicles – Gasoline		246,000	8,700
Groundwater Monitored Natural Attenuation Alternative			
Off-road Equipment	23,600		1,180
Haul Trucks		3,930	633
Total	1,810		
Commuter Vehicles – Gasoline		130,000	4,210
Groundwater Treatment Alternative			
Off-road Equipment	30,400		1,520
Haul Trucks – Nearby Disposal Sites		93,900	14,500
Haul Trucks – Distant Disposal Sites		209,000	31,600
Total – Nearby Disposal Sites			16,000
Total – Distant Disposal Sites			33,100
Commuter Vehicles - Gasoline		85,300	3,010
High Impact Combination			
Off-road Equipment	7,130,000		356,000
Haul Trucks – Nearby Disposal Sites		15,400,000	2,500,000
Haul Trucks – Distant Disposal Sites		52,200,000	8,130,000
Total – Nearby Disposal Sites			2,850,000
Total – Distant Disposal Sites			8,490,000
Commuter Vehicles - Gasoline		3,180,000	121,000

AOC = *Administrative Order on Consent for Remedial Action*; LUT = Look-Up Table.

[a] Sums presented in the table may differ from those calculated from table entries due to rounding. Round-trip haul mileages range from 70 to 665 miles for nearby disposal sites and 466 to 1,800 miles for distant disposal sites.

[b] All fuels are diesel, except gasoline for commuter vehicles. Totals include diesel fuel from off-road equipment and haul trucks. Fuel usages for each alternative include options to transport waste by truck to representative nearby and distant disposal sites.

Table 7–3 Water Use by Action Alternative

Action Alternative	*Gallons per Year*	*Acre-Feet per Year*	*Percent of CMWD Annual Supply*	*Total (gallons)*	*Total (acre-feet)*
Soil – Cleanup to AOC LUT Values	4,000,000	12	0.007	40,000,000	123
Soil – Cleanup to Revised LUT Values	4,000,000	12	0.007	8,300,000	26
Soil – Conservation of Natural Resources	4,000,000	12	0.007	8,000,000	25
Building Removal	315,000	1	0.0005	630,000	2
GW – MNA	5,000	0.02	0.000009	5,000	0.02
GW – GWT	8,000	0.02	0.0001	8,000	0.02
Water Use by Combination of Action Alternative					
AOC LUT + BR + MNA	4,000,000	12	0.007	41,000,000	125
AOC LUT + BR + GWT	4,000,000	12	0.007	41,000,000	125
Revised LUT + BR + MNA	4,000,000	12	0.007	9,000,000	28
Revised LUT + BR + GWT	4,000,000	12	0.007	9,000,000	28
CR + BR + MNA	4,000,000	12	0.007	8,600,000	26
CR + BR + GWT	4,000,000	12	0.007	8,600,000	26

AOC = *Administrative Order on Consent for Remedial Action*; BR = Building Removal; CMWD = Calleguas Municipal Water District; CR = Conservation of Natural Resources; GW = Groundwater; GWT = Groundwater Treatment; LUT = Look-Up Table; MNA = Monitored Natural Attenuation.

Note: Sums and products presented in the table may differ from those calculated from table entries due to rounding. Water volumes in acre-feet are rounded to the unit value for quantities above one acre-foot and to one significant figure for quantities less than one acre-foot.

7.2 Unavoidable Adverse Environmental Impacts

Unavoidable adverse environmental impacts are the effects on natural and human resources that would remain after minimization measures (Chapter 6, Table 6-1) and mitigation measures (Table 6–2) have been applied. Implementing any of the action alternatives would result in varying degrees of unavoidable adverse environmental impacts. Potentially unavoidable adverse impacts have been identified for land resources, geology and soils, biological resources, air quality and climate change, transportation and traffic, human health, cultural resources, and socioeconomics.

7.2.1 Land Resources

All of the action alternatives would require use of water, principally to suppress dust generated during remediation actions in accordance with Federal, state, and local regulatory requirements such as Ventura County Air Pollution Control District Rule 55 (Fugitive Dust), which restricts emissions of fugitive dust beyond the property line of a source. The source of this water is expected to be primarily the Calleguas Municipal Water District (CMWD). The largest water use would result from implementing the Cleanup to AOC LUT Values Alternative, which could annually require 4.0 million gallons of water over 10 years, totaling 40 million gallons. Implementing either of the other two alternatives would also require an annual 4.0 million gallons per year, but this water use would be required for only slightly more than 2 years under the Cleanup to Revised LUT Values Alternative, totaling 8.3 million gallons, and 2 years under the Conservation of Natural Resources Alternative, totaling 8.0 million gallons. The Building Removal Alternative would annually require about 315,000 gallons of water over 2 years (totaling 630,000 gallons), and the Groundwater Monitored Natural Attenuation and Groundwater Treatment Alternatives would require totals of about 5,000 gallons and 8,000 gallons of water, respectively.

DOE would implement water conservation measures to the extent practicable, such as incorporation of surfactants to reduce water requirements for dust control. Nonetheless, implementing the action alternatives—and particularly any of the soil remediation action alternatives—would unavoidably use water in an arid region that has a water shortage. Water use is an important consideration because of California's current drought conditions. California Executive Order B-29-15 (CA EO 2015) requires a statewide 25 percent reduction in water use, and a CMWD resolution (CMWD 2014) calls for a 20 percent reduction in water use in its service area.

In addition, implementing any of the soil remediation action alternatives or any of the combinations of action alternatives would result in increased traffic in the vicinity of SSFL, particularly on Woolsey Canyon Road, which could discourage weekday use of Sage Ranch Park. As discussed in Section 7.2.5, motorists on Woolsey Canyon Road could experience delays compared to baseline conditions on weekdays during the hours when heavy-duty trucks would be traveling to and from SSFL. These could also be weekday traffic delays at the intersection of Woolsey Canyon Road with Valley Circle Boulevard. Traffic delays or their perception could discourage weekday use of Woolsey Canyon Road to access Sage Ranch Park; however, once visitors arrive there, no reduction in the quality of recreational activities is expected.

7.2.2 Geology and Soils

Potentially unavoidable adverse environmental impacts on soils at SSFL could occur from the need to import large quantities of backfill under any of the soil remediation action alternatives and any of the action alternative combinations. The quantity of backfill would range from 700,000 cubic yards under the Cleanup to AOC LUT Values Alternative to lesser amounts of 144,000 cubic yards under the Cleanup to Revised LUT Values Alternative and 111,000 cubic yards under the Conservation of Natural Resources Alternative. Because the backfill must meet stringent standards for the presence of chemical and radioactive constituents—particularly if the backfill must meet AOC LUT values for chemicals and radionuclides—it may be difficult to locate backfill that matches the composition of the soil being replaced. Because soil is one of the primary factors that sustain the natural site ecology, imported soil that is dissimilar to removed soil could result in adverse environmental impacts on the biological resources present on the site, as discussed in Section 7.2.3. In addition, the use of large quantities of backfill containing very low concentrations of chemical and radioactive constituents would result in an adverse impact on its availability for other users requiring backfill of similar quality.

In addition, although DOE would implement minimization and mitigation measures to control sediment transport off site and runoff volume and velocity during precipitation events, it is not believed possible to completely eliminate the potential for erosion of disturbed areas between the time that an action such as soil removal is conducted under the soil remediation action alternatives and the time the disturbed area is stabilized through re-contouring and revegetation. The concern, which is primarily associated with the occurrence of unusually large rainstorms, is that disturbed soil could suffer a reduction in quality and functional capability due to the scouring action of the moving water. A delay between an action that results in soil removal and area stabilization could occur because of the need for regulatory confirmation that the action is in accordance with the requirements of the 2010 AOC (DTSC 2010a) (e.g., concentrations of chemical and radioactive constituents in the affected area have been reduced to levels below AOC LUT values). Timely confirmation of the remediation action by DTSC would reduce this concern.

7.2.3 Biological Resources

Unavoidable adverse environmental impacts would occur on biological resources under all of the soil remediation action alternatives and all of the action alternative combinations. The largest unavoidable adverse environmental impacts to biological resources would occur under the Cleanup to AOC LUT Values Alternative (see Chapter 4, Section 4.5.1.2). Removing vegetation or disrupting soil from 130 acres of land outside the proposed exemption areas[1] would cause profound disturbance to affected areas and would require a substantial, focused, and prolonged effort to achieve revegetation and restoration of habitat. Of these 130 acres, about 49 acres consist of relatively undisturbed native habitat.

The Cleanup to Revised LUT Values and Conservation of Natural Resources Alternatives would disturb considerably less habitat than the Cleanup to AOC LUT Values Alternative (see Chapter 4, Sections 4.5.1.3 and 4.5.1.4). Under the Cleanup to Revised LUT Values Alternative, about 40 acres of land would be disturbed outside the proposed exemption areas, or about 31 percent of the acreage disturbed under the Cleanup to AOC LUT Values Alternative. Under the Conservation of Natural Resource Alternative, about 32 acres would be disturbed outside the proposed exemption areas, or about 25 percent of the acreage disturbed under the Cleanup to AOC LUT Values Alternative. Under the latter two alternatives, of the land disturbed, about 13 acres consist of relatively undisturbed native habitat.

The Building Removal Alternative or groundwater remediation alternatives would have comparatively small unavoidable adverse environmental impacts on biological resources, and the differences among the alternatives in terms of biological impacts would be minimal.

[1] Proposed exemption areas are areas that would be proposed under the 2010 AOC (DTSC 2010a) where DOE would not conduct remediation unless it was demonstrated that the levels of chemical or radionuclide constituents posed a risk to human health or the environment. Remediation within the proposed exemption areas would occur via focused removal actions that include measures intended to minimize disturbance of vegetation and soils.

All three soil remediation action alternatives, the Building Removal Alternative, and the Groundwater Treatment Alternative would require replacement of soil with backfill (including topsoil) obtained from offsite sources. The replaced soil may have a different composition from the original SSFL soil, resulting in an unavoidable adverse impact on native vegetation and wildlife habitat. The imported soil may not be capable of supporting native vegetation that is the same as or similar to the vegetation types currently present on SSFL. In addition, depending on the type of imported soil and its origin, it may be more susceptible to the establishment and spread of non-native or invasive plant species. This would not only result in a degraded and undesirable plant community in disturbance areas, but could also facilitate the spread of invasive species into adjacent undisturbed habitats, resulting in degradation and potential adverse impacts on endangered, threatened, and rare species and their habitats. Furthermore, the imported soils may not be suitable for the special-status plant species that are likely present in localized areas of the site as a result of unique microhabitat and soil conditions. This would limit the availability of opportunities for onsite mitigation should project-related activities result in the loss of sensitive plant species' individuals and habitat. The result would be a permanent, rather than temporary, loss of native vegetation and wildlife habitat, as well as a potential permanent loss of individuals and habitat for special-status plant species. For a specific example, the federally listed endangered Braunton's milk-vetch is restricted to specific calcareous soils on SSFL and throughout its range. The area of occurrence of these soils is limited both on and off site. Replacement of native soils with different soils could result in the loss of plants and seedbank for the Braunton's milk-vetch and would represent a permanent alteration of federally designated critical habitat for this species, which is protected by the Endangered Species Act.

7.2.4 Air Quality and Climate Change

Air pollutants and greenhouse gases generated from implementing the action alternatives would result in minor to moderate unavoidable adverse environmental impacts due to site activities and the transportation of waste, backfill, equipment, and supplies to or from SSFL. Alternatives requiring smaller amounts of excavation and backfilling, such as the Building Removal Alternative and particularly the Groundwater Treatment Alternative, would be less likely to result in unavoidable adverse impacts because they would generate less waste and would require smaller amounts of backfill compared to the soil remediation action alternatives. For these same reasons, the Cleanup to Revised LUT Values and the Conservation of Natural Resources Alternatives would result in lower unavoidable adverse impacts compared to the Cleanup to AOC LUT Values Alternative.

Potential emissions would be highest under the soil remediation action alternatives due to fugitive dust impacts on areas adjacent to SSFL and nitrogen oxide emissions impacts from truck travel within the South Coast Air Basin. Cumulative impacts due to fugitive dust emissions from the alternatives could contribute to an exceedance of a PM_{10} or $PM_{2.5}$[2] ambient air quality standard for a few days per year adjacent to SSFL (see Chapter 5, Section 5.5.6.1). In addition, cumulative impacts due to nitrogen oxide emissions from the action alternatives would have the potential to contribute to an exceedance of an ambient ozone standard within the South Coast Air Basin. Implementing BMPs for fugitive dust and a mitigation measure of using green cleanup equipment and truck fleets (see Chapter 6) would substantially reduce nitrogen oxide emissions and resulting impacts from the proposed action alternatives.

[2] PM_n = Particulate matter less than or equal to *n* microns in aerodynamic diameter.

7.2.5 Transportation and Traffic

Implementing any of the action alternatives and action alternative combinations would result in unavoidable risks during transport of recycle material and waste from SSFL to offsite facilities and transport of backfill, supplies, and equipment to SSFL. Risks from exposure to radiation would be experienced by truck or train crews transporting radioactive waste to offsite disposal facilities, as well as to members of the public along the transport routes. Risks resulting from possible accidents would be experienced by members of the public during truck transport of radioactive and nonradioactive waste and recycle material from SSFL to offsite facilities, train transport of waste to offsite facilities, or truck transport of backfill, supplies, and equipment to SSFL.

Although truck or train crews and members of the public would receive radiation exposures during incident-free transport of radioactive waste to offsite facilities, these radiation exposures are not expected to cause any latent cancer fatalities (LCFs) among the exposed transport crews or members of the public. This is because the risk of an LCF among either the transport crew or public population was determined to be very small (orders of magnitude less than one), considering all projected waste shipments. The risk of an LCF among the population from possible accidents during transport of radioactive waste is also very small. (The maximum risk of an LCF among populations, considering all possible accidents from the minor to the severe, was calculated to be 5×10^{-9} [1 chance in 200 million of an LCF].)

Independent of the characteristics of the cargo, there would be unavoidable risks of accident fatalities among members of the public resulting from the physical forces imposed by traffic accidents. The largest risks would occur under the High Impact Combination (combined impacts from implementing the Cleanup to AOC LUT Values, Building Removal, and Groundwater Treatment Alternatives) if all backfill, equipment, and supplies were transported in trucks to SSFL and if waste was transported to offsite facilities using a combination of truck and train transport. In this case, there could be up to 3 fatalities among populations along the transport routes due to traffic accidents. The risk of an accident fatality would be smaller (calculated risk: 0.84) if only trucks were used for transport of all waste and materials.

As noted in Section 7.2.1, implementing any of the soil remediation action alternatives or any of the action alternative combinations would result in increases in weekday traffic in the vicinity of SSFL during peak years, including increased heavy-duty truck and personal vehicle traffic. In addition to an increase in traffic volume, the average traffic speed on the road could be reduced due to the increased number of heavy-duty trucks, which would be expected to be slow-moving when shipping soil from SSFL and even slower when delivering backfill to SSFL. The duration of the daily traffic increase is different for each of the combinations of action alternatives, with combinations that include the Cleanup to AOC LUT Values Alternative lasting the longest, about 12 years, compared to about 4 years for combinations that include the Cleanup to Revised LUT Values or Conservation of Natural Resources Alternative. This increased traffic may result in a reduction of the level of service on Woolsey Canyon Road, with motorist delays on this road and at its intersection with Valley Circle Boulevard. The potential for motorist delays on other roads in the SSFL vicinity is much smaller.

On route segments other than Woolsey Canyon Road, these traffic increases can be reduced by directing vehicles (particularly heavy-duty trucks) along different routes between SSFL and major highways. Because there are no routes suitable for heavy-duty trucks other than Woolsey Canyon Road, the additional projected daily traffic on Woolsey Canyon Road cannot be reduced except by extending the duration of the remediation activities at SSFL.

Finally, the larger the increase in heavy-duty truck traffic on the route segments between SSFL and major highways, the more likely that the traffic would cause accelerated damage to pavement on the route segments that would require repair sooner than currently anticipated. The potential for road damage is largest for the soil remediation action alternatives, particularly the Cleanup to AOC LUT Values Alternative, and smallest for the groundwater remediation action alternatives. As discussed in Section 7.2.8, this could result in increased expenses for local governments.

7.2.6 Human Health

Unavoidable risks to involved workers would result from site remediation activities. These risks would include the risk of LCFs resulting from radiation exposures received during activities such as soil or bedrock removal or building demolition, as well as industrial safety risk. Remediation workers would be protected from chemical and radiation exposure through compliance with DOE requirements for worker safety and radiation protection (e.g., Title 10, *Code of Federal Regulations*, Parts 835 and 851). Radiation protection practices would be employed so that doses are as low as reasonably achievable.

In addition, much of the soil remediation work would occur in previously developed areas that are safely accessible to workers, and heavy equipment would be used for soil removal. There are, however, portions of the site where the topography presents challenges to working safely. In particular, steep hillsides present hazards in that heavy machinery could be susceptible to rollover. Additionally, portions of the site in the NBZ and along the southern edge of Area IV are within earthquake-induced landslide zones. DOE would address this risk by seeking an exemption in accordance with provisions in the 2010 AOC (DTSC 2010a) if, during the planning and design of the soil removal project, it were determined that excavating soil in certain areas presented an unacceptable risk to workers.

Finally, there would be an unavoidable risk to site workers performing building removal activities should an earthquake occur during building demolition that would result in collapse of one or more buildings.

7.2.7 Cultural Resources

Unavoidable impacts on traditional cultural resources could result from implementing any of the action alternatives because of the changes in setting that would result from site remediation. Area IV and the NBZ are both included in the Santa Susana Sacred Sites and Traditional Cultural Property. All three of the soil remediation action alternatives would remove chemical and radioactive contaminants, and soil replacement for the disturbed areas would restore a semblance of natural contours, but the landscape would differ from the original topography. Changes in setting would occur during building removal operations under the Building Removal Alternative, although after site remediation is complete, buildings would be removed that could be considered intrusive in the context of the viewscape of traditional cultural resources. Changes in setting would occur under the Groundwater Monitored Natural Attenuation Alternative because of the addition of modern landscape elements in the form of five new wellheads. Changes in setting also would occur during removal of bedrock and installation and operation of groundwater treatment equipment under the Groundwater Treatment Alternative; however, after removal of bedrock, the excavation would be backfilled and the disturbed area revegetated, and after groundwater treatment operations were complete, aboveground equipment and piping would be removed.

Unavoidable impacts on traditional cultural resources could also result from implementing any of the action alternative combinations, primarily because all combinations would require removal of large quantities of soil. After remediation cleanup is complete, the affected areas will have been re-contoured, which would change the setting of the traditional cultural resource.

7.2.8 Socioeconomics

Unavoidable economic impacts would be experienced by governments in the SSFL vicinity that need to repair road pavement if damaged due to the passage of heavy-duty trucks while transporting waste, backfill, equipment, and supplies to or from SSFL. As discussed in Section 7.2.5, the potential for road damage is largest for the soil remediation action alternatives, particularly the Cleanup to AOC LUT Values Alternative, and smallest for the groundwater remediation action alternatives. Recognizing this, DOE may need to negotiate with local governments to contribute its portion of the cost for maintenance and repair of the affected roads.

7.3 Irreversible and Irretrievable Commitments of Resources

This section describes the major irreversible and irretrievable commitments of resources that have been identified under each of the action alternatives. A commitment of resources is irreversible when primary or secondary impacts limit future options for a resource. A commitment of resources is irretrievable when resources that are used or consumed are neither renewable nor recoverable for future use. This section discusses the commitment of resources in four major categories: land, labor, utilities, and materials.

Table 7–4 presents irreversible and irretrievable commitments of resources related to proposed DOE activities at SSFL. These activities potentially include soil remediation, building demolition, and groundwater remediation action alternatives. Only the irreversible and irretrievable commitment of resources associated with the action alternatives are presented in this table because the No Action Alternative for each of these activities would not result in a change in commitments of resources. The potential environmental impacts associated with all of the alternatives being considered for each of these activities are evaluated in Chapter 4.

Outside the proposed exemption areas, the amount of land disturbed under the action alternative combinations could vary from a minimum of 40 acres (for combinations using the Conservation of Natural Resources Alternative for soil remediation) to 48 acres (for combinations using the Cleanup to Revised LUT Values Alternative for soil remediation) to a maximum of about 138 acres (for combinations using the Cleanup to AOC LUT Values Alternative for soil remediation). Although DOE's intent is to restore this land to a condition consistent with Boeing's intended future land use of undeveloped open space (Boeing 2016b), the greater the amount of land disturbed under the different alternatives, the more difficult this task becomes.

None of the action alternatives would require large numbers of personnel. The maximum number of onsite personnel involved in implementing any of the action alternatives would be approximately 26 (not including truck drivers). Table 7–4 includes the total number of person-years estimated under the action alternative combinations, including both onsite personnel and truck drivers. The totals vary because the person-years required for truck drivers depend primarily on whether the different types of waste that are generated are sent to the nearer or the more distant disposal facilities that are evaluated for each type of waste. Assuming all excavated soil was sent to the nearest evaluated disposal facilities, the lowest labor requirements would be under the Conservation of Natural Resources Alternative (85 person-years), considering site workers as well as truck drivers. Assuming all excavated soil was sent to the farthest evaluated disposal facilities, the highest labor requirements would be under the Cleanup to AOC LUT Values Alternative (580 person-years). In addition to the labor required for soil remediation, about 45 to 79 person-years would be needed under the Building Removal Alternative and the groundwater remediation action alternatives. As indicated in Chapter 4, the labor needs are minimal in an area with a large workforce, so they would have no noticeable impacts on employment, housing, or other socioeconomic considerations in the SSFL vicinity.

Table 7–4 Irreversible and Irretrievable Commitments of Resources at the Santa Susana Field Laboratory

	Action Alternatives					
	Building Removal	***Soil Remediation***			***Groundwater Remediation***	
Resource	***Building Removal***	***Cleanup to AOC LUT Values***	***Cleanup to Revised LUT Values***	***Conservation of Natural Resources***	***Monitored Natural Attenuation***	***Groundwater Treatment***
Land Use						
Disturbed land (acres)	8.4	130	40	32	<1	<1
Labor						
Full-time equivalent (person-years) [a]	41 – 68	400 – 580	130 – 260	85 – 180	11	4 – 5
Utilities						
Water use – annual (million gallons) [b]	0.32	4	4	4	0.005 [c]	0.16
Water use – total (acre feet)	2	123	26	25	0.02	0.5
Fuel, gasoline (million gallons) [d]	0.18 – 0.36	2.8 – 8.2	1.1 – 3.2	0.76 – 2.3	0.006	0.019 – 0.037
Materials						
Backfill (cubic yards)	13,500	700,000	144,000	111,000	0	1,275
Landfill Capacity						
Chemicals exceeding AOC LUT values, but below risk-based levels and not a hazardous waste; radionuclides at or below AOC LUT values (cubic yards)	NA	741,000	0	0	NA	NA

< = less than; AOC = *Administrative Order on Consent for Remedial Action*; LUT = Look-Up Table; NA = not applicable.

[a] Estimates for total duration of the alternative, including onsite personnel and offsite truck drivers.

[b] Water was assumed to be obtained from the Calleguas Municipal Water District. Labor person-years are given as a range because the number of truck drivers would vary depending on whether waste was delivered from SSFL to nearer or more distant disposal facilities.

[c] Implementing this alternative would require use of water from the Calleguas Municipal Water District for development of five additional monitoring wells; in addition, approximately 250 gallons of water may be withdrawn annually from Area IV groundwater as part of monitoring well sampling.

[d] Totals include diesel fuel from off-road and haul trucks as well as gasoline associated with commuter vehicles. Fuel usage estimates include options to transport waste and backfill soil from representative nearby and distant sites that may provide such services.

Note: 1 person-year = 2,080 worker hours.

The amount of water associated with implementing any of these alternatives would be approximately 4.0 million gallons annually under the soil remediation alternatives. However, total water use for the action alternative combinations would vary. Assuming the action alternative combination incorporates the Building Removal and Groundwater Treatment Alternatives, total water usage would range from a high of about 41 million gallons (125 acre-feet) under the Cleanup to AOC LUT Values Alternative, to 9.1 million gallons (28 acre-feet) under the Cleanup to Revised LUT Values Alternative, to a low of about 8.8 million gallons (27 acre-feet) under the Conservation of Natural Resources Alternative. If both the Groundwater Monitored Natural Attenuation and Groundwater Treatment Alternatives were implemented, the above totals would increase by about 5,000 gallons of water. Because of existing drought conditions in California, the need to reduce annual water use, as expressed by California officials (CA EO 2015; CMWD 2014), and DOE's recognition that water is a precious resource, DOE is committed to limiting the use of water on this project to the extent practicable.

Similarly, the amount of fuel associated with implementing any of these alternatives would range from approximately 2.8 million to 8.2 million gallons if the Cleanup to AOC LUT Values Alternative were implemented. The larger number would be required if it were determined that: (1) backfill can only be supplied from distant sites, and (2) soil waste meeting the AOC LUT criteria needs to be disposed of at distant locations. Cumulative fuel usage would be much lower if the Cleanup to Revised LUT Values or Conservation of Natural Resources Alternatives were implemented; these alternatives would increase the likelihood that DOE would be able to find suitable backfill from nearby locations because the amount of soil required would be nearly one-third of the amount required under the Cleanup to AOC LUT Values Alternative, and there would be less stringent criteria for the presence of chemical and radioactive constituents of concern.

The amount of backfill associated with implementing these alternatives would vary greatly. The maximum amount of backfill would be about 700,000 cubic yards, assuming implementation of the Cleanup to AOC LUT Values Alternative. The backfill would be used to fill depressions left from excavations by recreating the surface grade on the site, and must meet stringent requirements for chemical and radionuclide content and have suitable properties for re-establishing native plants compatible with the local ecosystem. Finding this much suitable backfill and meeting the above stringent content requirements may require DOE to seek out more-distant sources. Using local or more-distant sources of backfill would be an irretrievable impact, resulting in the unavailability of this backfill for other beneficial uses.

Placement of up to 741,000 cubic yards of soil categorized as nonradiological, nonhazardous waste with chemical concentrations below risk-based levels (but above AOC LUT values under the Cleanup to AOC LUT Values Alternative) in regulated waste landfills would use disposal capacity at facilities that can accept waste with higher levels of chemical contamination. While there is sufficient capacity at existing facilities to meet this project's demand, this irreversible use could shorten the life of the facilities for their planned purposes and limit capacity for non-project hazardous waste.

7.4 Relationship Between Local Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

The relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity for key environmental resources for this EIS is described as follows:

- Land would be disturbed at SSFL as a result of the proposed remediation activities. Activities proposed under the Building Removal Alternative would ultimately reclaim 8.4 acres of land. Under the Cleanup to AOC LUT Values Alternative, 130 acres of land outside the proposed exemption areas would be disturbed. Under the Cleanup to Revised LUT Values or Conservation of Natural Resources Alternatives, about 40 or 32 acres of land would be disturbed, respectively. Under either groundwater remediation action alternative, less than 1 acre of land would be disturbed.
- Placement of up to 741,000 cubic yards of soil categorized as nonradiological, nonhazardous waste with chemical concentrations below risk-based levels (but above AOC LUT values for the Cleanup to AOC LUT Values Alternative) in regulated waste landfills would use disposal capacity at facilities that can accept waste with higher levels of chemical contamination. While there is sufficient capacity at existing facilities to meet this project's demand, this irreversible use could shorten the life of the facilities for their planned purposes and limit capacity for non-

project hazardous waste. This could necessitate earlier facility expansion or development of new regulated disposal facilities.

- Up to 4.0 million gallons of water would be required annually under any of the soil remediation alternatives. A total of about 125 acre-feet of water would be consumed over the lifetime of any action alternative combination incorporating the Cleanup to AOC LUT Values Alternative. This water would be unavailable for agricultural or domestic purposes in an area suffering from water shortages. Action alternative combinations using the Cleanup to Revised LUT Values or Conservation of Natural Resources Alternatives would use substantially less water, totaling about 27 to 28 acre-feet. Use of water is of concern because of the existing California drought conditions and would impact the potential for beneficial use of a limited resource.
- Implementation of any action alternative combination would generate air pollutants and greenhouse gases within the region surrounding SSFL and between the SSFL and distant disposal facilities. These emissions would result in short-term minor to moderate unavoidable adverse environmental impacts, but they would not contribute to an exceedance of an ambient air quality standard, as discussed in Section 7.2.4. No substantial residual environmental effects on long-term environmental productivity (such as climate change) would occur from these emissions.
- Management and disposal of wastes associated with implementing any of the action alternative combinations would require energy to be expended, as well as space, at existing permitted treatment or disposal facilities, but the amounts of waste expected to be generated would not require the establishment of new facilities.

Chapter 8
Laws, Regulations, and Other Requirements

8.0 LAWS, REGULATIONS, AND OTHER REQUIREMENTS

This chapter presents the environmental, safety, and health laws, regulations, orders, and permits that apply or may potentially apply to the proposed alternatives evaluated in this *Draft Environmental Impact Statement for Remediation of Area IV and the Northern Buffer Zone of the Santa Susana Field Laboratory (Draft SSFL Area IV EIS)*.

Federal, State of California, and U.S. Department of Energy (DOE) environmental, safety, and health requirements, as well as applicable local Ventura County and Los Angeles County, California, requirements, are summarized in Section 8.1 of this chapter. Existing Santa Susana Field Laboratory (SSFL) Area IV permits and potential new permits or approvals for implementation of proposed alternatives are identified in Section 8.2.

8.1 Applicable Federal and State Laws and Regulations

The major Federal laws, regulations, Executive Orders (Presidential directives that apply only to Federal agencies), and DOE Orders; State of California laws, regulations, and gubernatorial Executive Orders; and other requirements that may apply to the alternatives analyzed in this environmental impact statement (EIS) are identified in **Table 8–1**. These compliance requirements are summarized in Sections 8.1.1 through 8.1.12 by resource area.

Table 8–1 Potentially Applicable Laws, Regulations, Orders, and Other Requirements

Law, Regulation, Order, or Other Requirement	*Citation/Date*
Environmental Quality	
National Environmental Policy Act of 1969	42 U.S.C. 4321 et seq.
"Council on Environmental Quality Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act"	40 CFR Parts 1500-1508
"National Environmental Policy Act Implementing Procedures"	10 CFR Part 1021
National Environmental Policy Act Compliance Program	DOE Order 451.1B (October 26, 2000; Change 1, September 28, 2001; Change 2, June 25, 2010; Admin Change 3, January 19, 2012)
Protection and Enhancement of Environmental Quality	Executive Order 11514 (March 5, 1970), amended by Executive Order 11991, *Environmental Impact Statements* (May 24, 1977)
Environment, Safety, and Health Reporting	DOE Order 231.1B (June 27, 2011)
California Environmental Quality Act	*California Public Resources Code,* Section 21000 et seq.
Land Resources	
Ventura County General Plan	*California Government Code*, Section 65300 (amended March 24, 2015)
"Ventura County Non-Coastal Zoning Ordinance"	*Ventura County Ordinance Code*, Division 8, Chapter 1 (amended June 2, 2015)
Water Resources	
Federal Water Pollution Control Act of 1972, as amended, known as the Clean Water Act	33 U.S.C. 1251 et seq.
"The National Pollutant Discharge Elimination System"	40 CFR Part 122 et seq.
Safe Drinking Water Act of 1974, as amended	42 U.S.C. 300(f) et seq.
"National Primary Drinking Water Regulations"	40 CFR Part 141 (July 1, 2003)
California Porter-Cologne Water Quality Control Act of 1969, as amended	*California Water Code*, Division 7, "Water Quality"
California Executive Order B-29-15	April 1, 2015
"Establishment of Regional Water Quality Control Boards"	*California Water Code*, Division 7, Chapter 4
"Water"	*Ventura County Code of Ordinance*, Division 4, "Public Health," Chapter 8
Ecological Resources	
Bald and Golden Eagle Protection Act of 1973, as amended	16 U.S.C. 668–668d
Clean Water Act, Section 404, Jurisdictional Wetlands	33 U.S.C. 1251 et seq., Section 404

Law, Regulation, Order, or Other Requirement	***Citation/Date***
Endangered Species Act of 1973, as amended	16 U.S.C. 1531 et seq.
Migratory Bird Treaty Act of 1918, as amended	16 U.S.C. 703 et seq.
"Compliance with Floodplain and Wetland Environmental Review Requirements"	10 CFR Part 1022
Floodplain Management	Executive Order 11988 (May 24, 1977)
Protection of Wetlands	Executive Order 11990 (May 24, 1977)
Invasive Species	Executive Order 13112 (February 3, 1999)
California Endangered Species Act of 1984	*Fish and Game Code*, Section 2050 et seq.
Air Quality and Noise	
Clean Air Act, as amended	42 U.S.C. 7401-7671
"National Ambient Air Quality Standards"	40 CFR Part 50
"General Conformity Rule"	40 CFR Parts 51 and 93
"National Emission Standards for Hazardous Air Pollutants"	40 CFR Part 61
"2007 Heavy-Duty Highway Rule"	40 CFR Part 86
"Control of Emissions from New and In-Use Nonroad Compression-Ignition Engines"	40 CFR Part 89
CEQ Revised Draft Guidance on Consideration of Greenhouse Gas Emissions and Climate Change in NEPA Reviews	42 U.S.C. 4321 et seq.; 40 CFR Parts 1500–1508
California Air Resources Board	*California Code of Regulations*, Title 13, "Motor Vehicles," and Title 17, "Public Health," Division 3
Airborne Toxic Control Measure to Limit Diesel-Fueled Commercial Motor Vehicle Idling	*California Code of Regulations*, Title 13, Division 3, Article 1, Chapter 10, Section 2485
California Executive Order S-3-05	June 1, 2005
California Executive Order B-30-15	April 29, 2015
California Global Warming Solutions Act of 2006	Assembly Bill 32 (September 27, 2006)
Fugitive Dust	*Ventura County Air Pollution Control District Rules and Regulations*, Rule 55
Noise Control Act of 1972, as amended	42 U.S.C. 4901 et seq.
Infrastructure	
Planning for Federal Sustainability in the Next Decade	Executive Order 13693 (March 19, 2015)
Departmental Sustainability	DOE Order 436.1 (May 2, 2011)
Human Health	
Occupational Safety and Health Act of 1970	29 U.S.C. 651 et seq.
"Standards for Protection Against Radiation"	10 CFR Part 20
"Occupational Radiation Protection"	10 CFR Part 835
"Worker Safety and Health Program"	10 CFR Part 851
Worker Protection Program for DOE (Including the National Nuclear Security Administration) Federal Employees	DOE Order 440.1B, Change 2 (March 14, 2013)
Radiation Protection of the Public and the Environment	DOE Order 458.1 Change 3 (January 15, 2013)
Integrated Safety Management Policy	DOE Policy 450.4A (April 25, 2011)
Cultural Resources	
American Indian Religious Freedom Act of 1978, as amended	42 U.S.C. 1996 and 1996a
Antiquities Act of 1906, as amended	54 U.S.C. 320301-320303
Archaeological and Historic Preservation Act of 1960, as amended	54 U.S.C. 312501-312508
Archaeological Resources Protection Act of 1979, as amended	16 U.S.C. 470aa et seq.
Historic Sites, Buildings, and Antiquities Act of 1935, as amended	54 U.S.C. 320101-320106
National Historic Preservation Act of 1966, as amended	54 U.S.C. 300101 et seq.
Native American Graves Protection and Repatriation Act of 1990	25 U.S.C. 3001 et seq.
Protection and Enhancement of the Cultural Environment	Executive Order 11593 (May 13, 1971)
Indian Sacred Sites	Executive Order 13007 (May 24, 1996)
Consultation and Coordination with Indian Tribal Governments	Executive Order 13175 (November 6, 2000)
Preserve America	Executive Order 13287 (March 3, 2003)

Law, Regulation, Order, or Other Requirement	Citation/Date
American Indian Tribal Government Interactions and Policy	DOE Order 144.1 (January 16, 2009; Change 1, November 6, 2009)
Waste Management	
Atomic Energy Act of 1954, as amended	42 U.S.C. 2011 et seq.
Resource Conservation and Recovery Act of 1976, as amended	42 U.S.C. 6901 et seq.
Toxic Substances Control Act of 1976	15 U.S.C. 2601 et seq.
"Licensing Requirements for Land Disposal of Radioactive Waste"	10 CFR Part 61
"EPA Regulations Implementing RCRA"	40 CFR Part 260-282
Radioactive Waste Management	DOE Order 435.1 (July 9, 1999; Change 1, August 28, 2001; Certified, January 9, 2007)
California Executive Order D-62-02	September 30, 2002
"Environmental Health Standards for the Management of Hazardous Waste"	*California Code of Regulations*, Title 22, Division 4.5
"Discharges of Hazardous Waste to Land"	*California Code of Regulations*, Title 23, Division 3, Chapter 15
Consent Order for Corrective Action	State of California, EPA, DTSC: Docket No. P3-07/08-003, August 16, 2007 (DTSC 2007)
Administrative Order on Consent for Remedial Action	State of California, EPA, DTSC: Docket No. HSA-CO 10/11-037, December 6, 2010 (DTSC 2010a)
Transportation	
Hazardous Materials Transportation Act of 1975, as amended	49 U.S.C. 5101 et seq.
"Packaging and Transportation of Radioactive Material"	10 CFR Part 71
"The Hazardous Materials Regulations"	49 CFR Parts 100-185
"Hazardous Materials Regulations"	49 CFR Parts 171-180
Departmental Materials Transportation and Packaging Management	DOE Order 460.2A (December 22, 2004)
Packaging and Transportation Safety	DOE Order 460.1C (May 14, 2010)
Environmental Justice	
Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations	Executive Order 12898 (February 11, 1994)
Protection of Children from Environmental Health Risks and Safety Risks, as amended by Executive Order 13229	Executive Order 13045 (April 21, 1997)
"The Definition of Environmental Justice and the Designation of the California Office of Planning and Research as Coordinating Agency for Environmental Justice"	*California Government Code*, Section 65040.12
Emergency Planning, Pollution Prevention, and Conservation	
Emergency Planning and Community Right-to-Know Act of 1986	42 U.S.C. 11001 et seq.
Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements	Executive Order 12856 (August 3, 1993)
Pollution Prevention Act of 1990	42 U.S.C. 13101 et seq.
"Designation, Reportable Quantities, and Notification"	40 CFR 302
Federal Compliance with Pollution Control Standards, as amended by Executive Order 12580, *Superfund Implementation*	Executive Order 12088 (October 13, 1978)
Comprehensive Emergency Management System	DOE Order 151.1C (November 2, 2005)
California Emergency Services Act	*California Government Code*, Article I

CEQ = Council on Environmental Quality; CFR = *Code of Federal Regulations*; DTSC = California Department of Toxic Substances Control; EPA = U.S. Environmental Protection Agency; NEPA = National Environmental Policy Act; RCRA = Resource Conservation and Recovery Act; U.S.C. = *United States Code*.

8.1.1 Environmental Quality

National Environmental Policy Act of 1969 (Title 42, *United States Code*, Section 4321 [42 U.S.C. 4321 et seq.])

The purposes of the National Environmental Policy Act (NEPA) (Title 42, *United States Code*, Section 4321 [42 U.S.C. 4321] et seq.), as amended, are to: (1) declare a national policy that will encourage productive and enjoyable harmony between man and his environment; (2) promote efforts that will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; (3) enrich the understanding of the ecological systems and natural resources important to the Nation; and (4) establish a Council on Environmental Quality (CEQ). NEPA establishes a national policy that requires Federal agencies to consider the environmental impacts of major Federal actions that significantly affect the quality of the human environment before making decisions and taking actions to implement those decisions. Implementation of NEPA requirements in accordance with CEQ regulations (Title 40, *Code of Federal Regulations*, Part 1500 [40 CFR Part 1500] et seq.) may result in preparation of a categorical exclusion, an environmental assessment and subsequent Finding of No Significant Impact, or an EIS. This EIS was prepared in accordance with NEPA requirements, CEQ regulations, and DOE NEPA implementing procedures (10 CFR Part 1021). DOE Order 451.1B, *National Environmental Policy Act Compliance Program*, establishes DOE requirements and responsibilities for implementing NEPA.

Executive Order 11514, *Protection and Enhancement of Environmental Quality* (March 5, 1970), as amended by Executive Order 11991, *Environmental Impact Statements* (May 24, 1977)

This Executive Order requires Federal agencies to direct their policies, plans, and programs to meet the national environmental goals established by NEPA.

DOE Order 231.1B, *Environment, Safety, and Health Reporting* (June 27, 2011)

This DOE Order establishes requirements for the timely collection, reporting, analysis, and dissemination of data pertaining to environment, safety, and health issues, as required by law or regulations or by DOE. Preparation of Annual Site Environmental Reports is required under this order.

California Environmental Quality Act (California Public Resources Code, Section 21000 et seq.)

The California Environmental Quality Act (CEQA) sets goals to identify significant environmental effects of public agency actions and to avoid or mitigate those environmental effects. CEQA applies to projects proposed to be undertaken or requiring approval by State and local government agencies. Projects must undergo an environmental review process to determine whether a project is subject to or exempt from CEQA, perform an Initial Study to identify the environmental impacts of the project, and determine whether the identified impacts are significant. Based on findings of significance, the lead agency prepares one of the following environmental review documents: a Negative Declaration if it finds no significant impacts; a Mitigated Negative Declaration if it finds significant impacts, but revises the project to avoid or mitigate those significant impacts; or an environmental impact report (EIR) if it finds significant impacts. CEQA guidelines provide criteria for determining whether a project may have significant effects. The purpose of an EIR is to provide State and local agencies, as well as the general public, with detailed information on the potentially significant environmental effects a proposed project is likely to have, discuss ways in which the significant environmental effects may be minimized, and indicate alternatives to the project. The California Department of Toxic Substances Control (DTSC) is preparing a program EIR under

CEQA to evaluate the potential impacts of proposed remedial actions at SSFL from the combined actions of DOE, the National Aeronautics and Space Administration (NASA), and The Boeing Company (Boeing). The program EIR is being developed concurrently with this EIS. Impacts from DOE's proposed actions are being evaluated in the program EIR as part of a larger proposed action of cleaning up the entire SSFL. DTSC is also evaluating alternatives for transportation of soil and debris.

8.1.2 Land Resources

***Ventura County General Plan*, *California Government Code*, Section 65300**

General Plans do not have the force of law. However, they are prepared and implemented by local governments to manage growth and land use in their jurisdictions. In California, General Plans are mandated by state law (*California Government Code*, Section 65300). The *Ventura County General Plan* (Ventura County 2015a) sets forth the countywide goals, policies, and programs the County will implement to manage future growth and land uses. Specific goals, policies, and programs are identified for resources (i.e., air quality, water resources, mineral resources, biological resources, farmland, scenic resources, cultural resources, energy resources, and coastal beaches and sand dunes); hazards; land use; and public facilities and services. Additionally, land use, circulation, housing, conservation, open space, noise, and safety are seven state-mandated elements defined and addressed in the General Plan.

Ventura County has further divided its General Plan into ten geographic planning areas, with Area Plans that contain goals, policies, and programs specific to those areas. SSFL is located in the unincorporated area of Ventura County and is not located within any specific plan area or other project area designated by the General Plan. The *Ventura County General Plan* may be considered by the landowner when making decisions about the end state and future use of SSFL.

"Ventura County Non-Coastal Zoning Ordinance," *Ventura County Ordinance Code*, Division 8, Chapter 1

The Non-Coastal Zoning Ordinance (Ventura County 2015b) governs the use of one's property, covering all areas outside the coastal zone. The range of uses and structures allowed differs from zone to zone (e.g., commercial versus residential zones). Area IV is zoned rural agriculture (RA-5 ac), and the Northern Buffer Zone (NBZ) is zoned open space (OS-160 ac) under the Ventura County Non-Coastal Zoning Ordinance. Under a special land use permit granted in 1954 by Ventura County, SSFL is temporarily designated as a general aerospace industrial research facility (Sapere 2005). Future land use within SSFL would be determined by the landowner (Boeing), subject to applicable zoning restrictions.

8.1.3 Water Resources

Federal Water Pollution Control Act of 1972, as amended (33 U.S.C. 1251 et seq.), commonly known as the Clean Water Act

The Clean Water Act (CWA) was enacted to "restore and maintain the chemical, physical, and biological integrity of the Nation's water." CWA establishes the basic structure for regulating discharges of pollutants into waters of the United States and regulating the quality of surface waters. CWA, Section 313, requires all branches of the Federal Government engaged in any activity that might result in a discharge or runoff of pollutants to surface waters to comply with Federal, state, interstate, and local requirements.

Section 404 gives the U.S. Army Corps of Engineers permitting authority over activities that discharge dredge or fill materials into waters of the United States, including wetlands. The

U.S. Army Corps of Engineers administers the day-to-day program, including making individual and general permit decisions; conducting and verifying jurisdictional determinations; developing policy and guidance; and enforcing Section 404 provisions. The U.S. Environmental Protection Agency (EPA), among other responsibilities, develops and interprets the policies, guidance, and environmental criteria used to evaluate permit applications; determines the scope of geographic jurisdiction and applicability of exemptions; reviews and comments on individual permit applications; has the authority to prohibit, deny, or restrict the use of any defined area as a disposal site; and enforces Section 404 provisions.

CWA also provides guidelines and limitations for effluent discharges from point-source discharges and establishes the National Pollutant Discharge Elimination System (NPDES) Permit Program. The NPDES Permit Program is administered by EPA, pursuant to regulations at 40 CFR Part 122 et seq., and may be delegated to states. Stormwater provisions of the NPDES Permit Program, as set forth in 40 CFR 122.26, require discharge permits for industrial and construction activities disturbing 1 acre or more. EPA has delegated the NPDES Permit Program to California for implementation. California implements Federal and state water quality regulations, including the NPDES Permit Program, through the State Water Resources Control Board and nine Regional Water Quality Control Boards. These boards are part of the California Environmental Protection Agency (CalEPA) and are established under Division 7, Chapter 4, of the *California Water Code*.

The Los Angeles Regional Water Quality Control Board (LARWQCB) is responsible for protecting ground and surface water quality in the Los Angeles region, including the coastal watersheds of Los Angeles and Ventura Counties, along with very small portions of Kern and Santa Barbara Counties. The LARWQCB regulates discharges at Area IV through NPDES Permit Number CA0001309, which was issued to Boeing under the *California Water Code*.

Safe Drinking Water Act of 1974, as amended (42 U.S.C. 300(f) et seq.)

The primary objective of the Safe Drinking Water Act is to protect the quality of public drinking water supplies and sources of drinking water. The implementing regulations, administered by EPA unless delegated to states, establish national primary drinking water standards applicable to public water systems. These regulations (40 CFR Parts 123, 141, 145, 147, and 149) specify maximum contaminant levels, including those for radioactivity, in public water systems. Public water systems are generally defined as systems that have at least 15 service connections used by year-round residents or that regularly serve at least 25 year-round residents. The California State Water Resources Control Board has primacy to enforce Federal and state safe drinking water regulations and is responsible for oversight of about 8,000 public water systems throughout the state.

40 CFR Part 141, "National Primary Drinking Water Regulations"

These regulations set maximum contaminant levels for pollutants in drinking water. The regulations also provide monitoring and analytical requirements, reporting and recordkeeping requirements, special regulations such as prohibition of lead use, maximum contaminant level goals, national primary drinking water regulations, filtration and disinfection rules, and control of lead and copper requirements.

California Porter-Cologne Water Quality Control Act (*California Water Code*, Division 7, "Water Quality")

The purpose of this Act is to preserve, enhance, and restore the quality of the state's water resources and establish the State Water Resources Control Board and nine Regional Water Quality Control Boards as the principal state agencies responsible for maintaining water quality in California. The Act establishes water quality policy, water quality standards enforcement for surface and groundwater, and regulations for the discharge of pollutants from point and non-point sources. It also provides authority to the State Water Resources Control Board to establish water quality principles and guidelines for long-range resources planning.

California Executive Order B-29-15 (April 1, 2015)

With emergency drought conditions persisting throughout California, the State Water Resources Control Board adopted an emergency regulation requiring an immediate 25 percent reduction in overall potable urban water use statewide in accordance with Governor Jerry Brown's Executive Order issued on April 1, 2015.

The Executive Order requires, for the first time in the state's history, mandatory conservation for all residents and directs several state agencies, including the State Water Resources Control Board, to take immediate action to safeguard the state's remaining potable urban water supplies in preparation for a possible fifth year of drought. Governor Brown's January 17 and April 25, 2014, Proclamation and Executive Orders B-26-14 and B-28-14 remain in full force and effect, except as modified by this Executive Order. These modifications further improve on saving water, increasing enforcement against water waste, investing in new technologies, and streamlining Government response.

***Ventura County Code of Ordinance*, Division 8, Public Health, Chapter 8, "Water"**

This county code provides for the protection of groundwater quality, supply, and quantity by regulating the construction, maintenance, operation, use, repair, modification, and destruction of wells and engineering test holes (soil borings). It also ensures that water obtained from wells will be suitable for beneficial use and will not jeopardize the health, safety, or welfare of the people of Ventura County. This code also provides procedures for administrative enforcement of the California Safe Drinking Water Act.

8.1.4 Ecological Resources

Bald and Golden Eagle Protection Act of 1973, as amended (16 U.S.C. 668 et seq.)

This Act makes it unlawful to take, pursue, molest, or disturb bald (American) and golden eagles, their nests, or their eggs anywhere in the United States. A permit must be obtained from the U.S. Department of the Interior to relocate a nest that interferes with resource development or recovery operations. Potential impacts on bald and golden eagles from implementation of the proposed alternatives are analyzed in Chapter 4, Section 4.5, of this EIS.

Clean Water Act, Section 404, Jurisdictional Wetlands (33 U.S.C. 1251 et seq., Section 404)

CWA prohibits the discharge of pollutants (including dredged or fill material) into "waters of the United States," except as authorized by a permit. Joint guidance by EPA and the U.S. Army Corps of Engineers, issued in response to a June 2006 Supreme Court decision, provides new guidelines for determining whether tributaries and wetlands are waters of the United States and are regulated under CWA (EPA and Army 2007). Potential impacts on wetlands from implementation of the proposed alternatives are analyzed in Chapter 4, Section 4.5, of this EIS.

Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.)

The Endangered Species Act is intended to prevent the further decline of endangered and threatened species and to restore these species and habitats. Section 7 of this Act requires Federal agencies with reason to believe that a prospective action may affect an endangered or threatened species or its habitat to consult with the U.S. Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service to ensure the action does not jeopardize the species or destroy its habitat (50 CFR Part 17). If, despite reasonable and prudent measures to avoid or minimize such impacts, the species or its habitat would be jeopardized by the action, a review process is specified to determine whether the action may proceed as an incidental taking. Chapter 3, Section 3.5, of this EIS identifies potential endangered, threatened, or listed species in the affected environment. Potential impacts on those species from implementation of the proposed alternatives are analyzed in Chapter 4, Section 4.5.

DOE has been engaged in ongoing coordination with USFWS and the California Department of Fish and Wildlife (formerly the California Department of Fish and Game) concerning endangered species. DOE is preparing a biological assessment of the entire SSFL site that will address the potential effects of DOE, NASA, and Boeing remediation activities on federally and state-listed rare, threatened, and endangered species. The completed biological assessment will be submitted to USFWS along with a request for formal consultation under provisions of the Endangered Species Act. Ultimately, the consultation would result in the issuance of a Biological Opinion from USFWS. The biological assessment will also be submitted for review and comment to the California Department of Fish and Wildlife, which has participated in the coordination meetings with DOE and USFWS.

Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. 703 et seq.)

The Migratory Bird Treaty Act, as amended, is intended to protect birds that have common migration patterns between the United States, Canada, Mexico, Japan, and Russia. It regulates the harvest of migratory birds by specifying conditions such as mode of harvest, hunting seasons, and bag limits. The Act stipulates that it is unlawful, unless permitted by regulations, to "pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess…any migratory bird…or any part, nest, or egg of any such bird." During the project planning phase and prior to remediation, biological surveys would be conducted to prevent direct harm to the birds and their nests and eggs. Potential impacts on migratory birds from implementation of the proposed alternatives are analyzed in Chapter 4, Section 4.5, of this EIS.

10 CFR Part 1022, "Compliance with Floodplain and Wetland Environmental Review Requirements"

This regulation establishes policy and procedures for DOE responsibilities under Executive Order 11988, *Floodplain Management*, and Executive Order 11990, *Protection of Wetlands*, to avoid direct or indirect support of development in a floodplain or new construction in a wetland to the extent practicable. These provisions are to be addressed whenever possible as part of NEPA or the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Potential impacts on floodplains and wetlands from implementation of the proposed alternatives are analyzed in Chapter 4, Section 4.5, of this EIS.

Executive Order 11990, *Protection of Wetlands* (May 24, 1977)

This Executive Order, implemented by DOE through 10 CFR Part 1022, directs Federal agencies to ensure consideration of wetlands protection in decision-making and to evaluate the potential impacts of new construction proposed in a wetland. Federal agencies are directed to avoid the destruction or modification of wetlands and avoid direct or indirect support of new construction in wetlands if a practicable alternative exists.

Executive Order 13112, *Invasive Species* (February 3, 1999)

This Executive Order establishes the National Invasive Species Council. It requires Federal agencies to act to prevent the introduction of invasive species and provide for their control; to implement restoration with native species; and to minimize actions that could spread invasive species. Potential impacts and habitat reclamation to control invasive species are addressed in Chapter 4, Section 4.5, of this EIS.

California Endangered Species Act of 1984, *Fish and Game Code*, Section 2050 et seq.

This Act parallels the main provisions of the Federal Endangered Species Act and is administered by the California Department of Fish and Wildlife. It establishes that all native species and their habitats that are threatened with extinction, as well as those experiencing a significant decline that, if not halted, would lead to a threatened or endangered designation, will be protected or preserved. The California Endangered Species Act allows for an incidental taking, with accompanying consultation to avoid potential impacts and develop appropriate mitigation planning to offset project-caused losses.

8.1.5 Air Quality and Noise

Clean Air Act, as amended (42 U.S.C. 7401 et seq.)

The Clean Air Act is intended to "protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population." Section 118 of the Clean Air Act (42 U.S.C. 7418) requires each Federal agency with jurisdiction over any property or facility engaged in any activity that might result in the discharge of air pollutants to comply with "all Federal, state, interstate, and local requirements" with regard to the control and abatement of air pollution. Emissions of air pollutants from DOE facilities are regulated by EPA, pursuant to 40 CFR Parts 50–99. Potential air quality impacts from implementation of the proposed alternatives are analyzed in Chapter 4, Section 4.6, of this EIS.

Enforcement of the Federal air quality regulations may be delegated to the states. The California Air Resources Board (ARB) is the state agency charged with coordinating efforts to attain and maintain ambient air quality standards. ARB delegates the responsibility of regulating stationary emission sources within the state to regional air agencies. ARB is responsible for interactions with EPA, for ensuring the local air districts maintain compliance with regulatory requirements, and for regulating vehicular sources. Titles 13 and 17 of the *California Code of Regulations* include sections pertaining to ARB's air management program, including those regulations related to emissions from motor vehicles and non-vehicular sources and airborne toxic control measures.

The Ventura County Air Pollution Control District (VCAPCD) is responsible for enforcing both the Federal and state air pollution regulations in Ventura County. These regulations are primarily meant to ensure that air quality meets Federal and state standards. The *Ventura County Air Pollution Control District Rules and Regulations* consist of 12 regulations, including permits (rules on permit requirements, applications, exemptions, and recordkeeping and reporting) and prohibitions (rules on maximum allowable emissions and National Emission Standards for Hazardous Air Pollutants [NESHAPs]). DOE operates Area IV under VCAPCD Permit Number 00232. Air emissions from activities occurring at Area IV under the proposed alternatives would also be regulated by VCAPCD.

The South Coast Air Quality Management District is responsible for enforcing both Federal and state air pollution regulations in Orange County and the urban areas of Los Angeles, Riverside, and San Bernadino Counties. These regulations are primarily meant to ensure that air quality meets Federal and state standards. To ensure continued progress toward clean air, the South Coast Air Quality Management District, in conjunction with ARB, the Southern California Association of Governments, and EPA, prepared the *Final 2012 Air Quality Management Plan* (SCAQMD 2013), which employs the latest science and analytical tools and incorporates a comprehensive strategy to meet all Federal criteria pollutant standards within the time frames allowed under the Federal Clean

Air Act. The Air Quality Management Plan is updated every 3 years. Trucks and other vehicles transporting materials to Area IV and waste and other materials from Area IV under the proposed alternatives would travel on roads in Los Angeles County and would be subject to regulations for mobile sources.

40 CFR Part 50, "National Ambient Air Quality Standards"

The Clean Air Act requires EPA to set National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. The Clean Air Act establishes two types of NAAQS. *Primary standards* set limits to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. *Secondary standards* set limits to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings.

40 CFR Parts 51 and 93, "General Conformity Rule"

The General Conformity Rule is intended to ensure that Federal activities do not cause or contribute to new violations of the NAAQS, do not cause additional or worsen existing violations, and ensure that attainment of the NAAQS is not delayed. To do so, a Federal agency must demonstrate that its actions conform to the appropriate state implementation plan. Conformity evaluations pertain to Federal proposed actions that would occur in areas that do not attain a NAAQS or are in maintenance (formerly in nonattainment) of a NAAQS. Conformity determinations are required when the annual direct and indirect emissions from a Federal action exceed an applicable *de minimis* threshold. Applicable *de minimis* levels vary by pollutant and the severity of nonattainment conditions.

40 CFR Part 61, "National Emission Standards for Hazardous Air Pollutants"

Emissions of hazardous air pollutants, including radionuclides and asbestos that could be released during operation, demolition, or renovation of DOE facilities, are regulated under the NESHAPs program.

40 CFR Part 86, "2007 Heavy-Duty Highway Rule"

To reduce emissions from on-road, heavy-duty diesel trucks, EPA established a series of cleaner emission standards for new engines, starting in 1988. The 2007 Heavy-Duty Highway Rule provides the final and cleanest standards for engines manufactured in calendar year 2007 and after. Complete phase-in of the 2007 standards for new engines was required by 2010.

40 CFR Part 89, "Control of Emissions from New and In-Use Nonroad Compression-Ignition Engines"

EPA established a series of cleaner emission standards for new off-road diesel engines, culminating in the Tier 4 Final Rule of June 2004. The Tiers 1 through 4 standards required compliance with progressively more-stringent emission standards. Tier 1 standards were phased in from 1996 to 2000 (year of manufacture), depending on the engine horsepower category. Tier 2 standards were phased in from 2001 to 2006, and the Tier 3 standards were phased in from 2006 to 2008. The Tier 4 standards require 90 percent reductions in particulates and nitrogen oxides when compared against current emission levels. The Tier 4 standards were phased in starting with smaller engines in 2008, followed by phase-in of the very largest diesel engines in 2015.

42 U.S.C. 4321 et seq.; 40 CFR Parts 1500–1508, CEQ Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews (August 1, 2016)

On August 1, 2016, CEQ released final guidance that describes how Federal departments and agencies should consider the effects of greenhouse gases (GHGs) and climate change in their NEPA reviews (CEQ 2016). This guidance states that Federal agencies (1) should consider the extent to which a proposed action and its reasonable alternatives would contribute to climate change based on projected GHG emissions and (2) take into account ways in which a changing climate may impact the proposed action and any alternative actions, change an action's environmental effects over the lifetime of those effects, and alter the overall environmental implications of such actions. The guidance emphasizes that agency analyses should be commensurate with projected GHG emissions and climate impacts and should employ appropriate quantitative or qualitative analytical methods to ensure useful information is available to inform the public and the decision-making process in distinguishing between alternatives and mitigations. From these analyses, agencies should consider adaptation measures to address potential impacts of climate change on proposed actions, thereby enabling the selection of smarter, more resilient actions. The final guidance does not propose any quantity of GHG emissions that may significantly affect the quality of the human environment.

***California Code of Regulations*, Title 13, Division 3, Chapter 10, Article 1, Section 2485, Airborne Toxic Control Measure to Limit Diesel-Fueled Commercial Motor Vehicle Idling**

This regulation prohibits heavy-duty diesel trucks from idling for longer than 5 minutes at a time, unless they are queuing, provided the queue is located beyond 100 feet from any homes or schools.

California Executive Order S-3-05 (June 1, 2005)

This Executive Order establishes GHG emission reduction targets, creates the Climate Action Team, and directs the Secretary of CalEPA to coordinate efforts to meet the targets with the heads of other state agencies. The Executive Order also requires the Secretary to report to the governor and legislature biannually on progress toward meeting the GHG targets, GHG impacts to California, and mitigation and adaptation plans. GHG emission reduction targets established for California consist of a reduction to 2000 levels by 2010; to 1990 levels by 2020; and to 80 percent below 1990 levels by 2050.

California Global Warming Solutions Act of 2006, Assembly Bill 32 (September 27, 2006)

Assembly Bill 32 requires California to reduce its GHG emissions to 1990 levels by 2020, a reduction of approximately 15 percent below emissions expected under a "business as usual" scenario.

Pursuant to Assembly Bill 32, ARB has adopted regulations to achieve the maximum technologically feasible and cost-effective GHG emission reductions. The full implementation of Assembly Bill 32 helps mitigate the risks associated with climate change, while improving energy efficiency, expanding the use of renewable energy resources and cleaner transportation, and reducing waste.

Executive Order S-01-07 (January 18, 2007)

This Executive Order established the Low Carbon Fuel Standard, a statewide goal to reduce the carbon intensity of transportation fuels in California by at least ten percent by 2020. This level of emissions reduction accounts for about 19 percent of the goal set forth by Assembly Bill 32.

Executive Order B-16-2012 (March 23, 2012)

This Executive Order reaffirms the State commitment to reduce GHG emissions 80 percent from 1990 levels by 2050 by establishing a parallel target for the transportation sector. It directs state agencies to support and facilitate the rapid commercialization of zero-emission vehicles and associated infrastructure.

Heavy-Duty Truck GHG Regulations

The Heavy-Duty Truck GHG Regulation, adopted by the ARB in 2008, reduces GHG emissions by improving the fuel efficiency of heavy-duty tractors through improvements in tractor and trailer aerodynamics and the use of low-rolling-resistance tires. In 2013, the ARB adopted a regulation establishing GHG emission reduction requirements for all medium- and heavy-duty vehicles and engines manufactured for use in California, harmonizing with the GHG emission reduction rule finalized by EPA and the National Highway Traffic Safety Administration in 2011. For Class 8 heavy-duty vehicles, this Phase I GHG standard will reduce new vehicle emissions by four to five percent per year from 2014-2018.

California Executive Order B-30-15 (April 29, 2015)

This Executive Order establishes a California GHG reduction target of 40 percent below 1990 levels by 2030, the most aggressive benchmark enacted by any government in North America to reduce carbon emissions over the next decade and a half. The Executive Order also specifically addresses the need for climate adaptation and directs the State government to update and incorporate climate change and adaptation strategies into its planning and investment decisions and implement measures under existing agency and departmental authority to reduce GHG emissions.

***Ventura County Air Pollution Control District Rules and Regulations*, Rule 55, Fugitive Dust**

VCAPCD is responsible for enforcing both the Federal and state air pollution regulations in Ventura County. These regulations are primarily meant to ensure that the air quality meets Federal and state standards. The *Ventura County Air Pollution Control District Rules and Regulations* consist of 12 regulations, including permits (rules on permit requirements, applications, exemptions, and record-keeping and reporting) and prohibitions (rules on maximum allowable emissions and NESHAPs). Air emissions from activities occurring at Area IV under the proposed alternatives would be regulated by VCAPCD.

Rule 55, Fugitive Dust, prohibits emissions of fugitive dust from any applicable source such that the dust remains visible beyond the midpoint (width) of a public street or road adjacent to the property line of the emission source or beyond 50 feet from the property line if there is not an adjacent public street or road. This rule also prohibits emissions of fugitive dust from any applicable source such that the dust causes 20 percent opacity or greater during each observation and the total duration of such observations (not necessarily consecutive) is a cumulative 3 minutes or more in any 1 hour. A person conducting active operations shall utilize one or more of the applicable best available control measures to minimize fugitive dust emissions for each fugitive dust source type. No person shall conduct an active operation with a monthly import or export of 2,150 cubic yards or more of bulk material without utilizing at least one of the following measures at each vehicle egress from the site to a public paved road: (1) install a pad consisting of washed gravel (minimum size: 1 inch) maintained in a clean condition to a depth of at least 6 inches and extending at least 30 feet wide and at least 50 feet long; (2) pave the surface at least 100 feet long and at least 20 feet wide; (3) utilize a wheel shaker/wheel spreading device, also known as a rumble grate, consisting of raised dividers (rails, pipe, or grates) at least 24 feet long and a sufficient width to allow all wheels of vehicle traffic to travel over the grate to remove bulk material from tires and vehicle undercarriages before vehicles exit the site; and (4) install and utilize a wheel-washing system to remove bulk material from tires and vehicle undercarriages before vehicles exit the site. No person shall engage in earth-moving activities in a manner that creates visible dust emissions over 100 feet in length.

Additionally, no person shall allow track-out to extend 25 feet or more in length unless at least one of the following three control measures is utilized: (1) track-out area improvement, (2) track-out prevention, and (3) track-out removal.

Noise Control Act of 1972, as amended (42 U.S.C. 4901 et seq.)

Section 4 of the Noise Control Act of 1972, as amended, directs all Federal agencies to carry out "to the fullest extent within their authority" programs within their jurisdictions in a manner that furthers a national policy of promoting an environment free from noise jeopardizing health and welfare. Chapter 4, Section 4.7, of this EIS addresses the potential noise impacts associated with the activities analyzed for each of the alternatives.

8.1.6 Infrastructure

Executive Order 13693, *Planning for Federal Sustainability in the Next Decade* (March 19, 2015)

This Executive Order focuses on improving and strengthening the overall sustainability of the Federal Government. All Federal agencies are required to inventory their GHG emissions, set targets to reduce their emissions by 2025, and develop a plan for meeting a wide range of goals for improving sustainability, such as water efficiency, waste reduction, sustainable community development planning, high-performance buildings, sustainable acquisition, electronics stewardship, and environmental management. DOE Order 436.1, *Departmental Sustainability*, described next, establishes DOE's implementation of sustainability goals.

DOE Order 436.1, *Departmental Sustainability* (May 2, 2011)

This DOE Order defines requirements and responsibilities for managing sustainability at DOE facilities. Sustainability is broadly defined in this order as those actions taken to maximize energy and water efficiency; minimize chemical toxicity and harmful environmental releases; promote renewable and other clean energy development; and conserve natural resources while sustaining assigned mission activities. Under the order, DOE facilities are required to carry out their missions in a sustainable manner that addresses national energy security and global environmental challenges and advances sustainable, efficient, and reliable energy for the future. The order also mandates that DOE develop and commit to implementing an annual Site Sustainability Plan that identifies its respective contribution toward meeting the Department's sustainability goals. Chapter 2, Section 2.1.5, and Chapter 7, Section 7.1, of this EIS discuss DOE's commitment to implementing, to the extent practicable, green and sustainable methods for cleanup of Area IV.

8.1.7 Human Health

Occupational Safety and Health Act of 1970 (29 U.S.C. 651 et seq.)

Section 4(b)(1) of the Occupational Safety and Health Act (OSHA) exempts DOE and its contractors from the occupational safety requirements of OSHA. However, 29 U.S.C. 668 requires Federal agencies to establish their own occupational safety and health programs for their places of employment, consistent with OSHA standards. DOE Order 440.1B, Change 2, *Worker Protection Program for DOE (Including the National Nuclear Security Administration) Federal Employees*, states that DOE will implement a written worker protection program appropriate for the facility hazards that: (1) provides a place of employment free from recognized hazards that are causing or are likely to cause death or serious physical harm to their employees and (2) integrates all requirements contained in paragraphs 4a through 4m of the order; program requirements contained in 29 CFR Part 1960, "Basic Program Elements for Federal Employee Occupational Safety and Health Programs and Related Matters," and applicable functional area requirements contained in Attachment 1; and other related site-specific worker protection activities. Chapter 3, Section 3.9, of this EIS describes the procedures and practices implemented to ensure protection of Energy Technology Engineering Center (ETEC) workers and contractors. Potential impacts on human health associated with the proposed activities are analyzed in Chapter 4, Section 4.9.

10 CFR Part 20, "Standards for Protection Against Radiation"

This regulation establishes standards for protection against ionizing radiation resulting from activities conducted under licenses issued by the U.S. Nuclear Regulatory Commission (NRC). These standards control the receipt, possession, use, transfer, and disposal of licensed material by any licensee so that the total dose to an individual (including doses resulting from licensed and unlicensed radioactive material and from radiation sources other than background radiation) does not exceed the standards for protection against radiation prescribed in the regulations. Through agreements, NRC can delegate certain of its regulatory functions and authority for enforcing these standards to individual states. DOE activities at Area IV and the NBZ are not subject to this regulation because they are conducted under DOE's Atomic Energy Act (AEA) authority. (See the discussion concerning 10 CFR Part 835 and DOE Order 458.1 in the following paragraphs). However, entities external to the site (for example, radioactive waste disposal sites) are NRC- or state-regulated and must comply with these standards.

10 CFR Part 835, "Occupational Radiation Protection"

This regulation establishes radiation protection standards, limits, and program requirements for protecting occupational workers and visitors from ionizing radiation resulting from the conduct of DOE activities. These requirements are applicable to activities being considered in this EIS that could result in the occupational exposure of an individual to radiation or radioactive materials.

10 CFR Part 851, "Worker Safety and Health Program"

This regulation establishes requirements for a worker protection program that reduces or prevents occupational injuries, illnesses, and accidental losses by requiring DOE contractors to provide their employees with safe and healthful workplaces. This regulation also establishes procedures for investigating whether a violation has occurred, determining the nature and extent of any such violation, and imposing an appropriate remedy.

DOE Order 440.1B, Change 2, *Worker Protection Program for DOE (Including the National Nuclear Security Administration) Federal Employees* (March 14, 2013)

This DOE Order establishes the framework for an effective worker protection program to reduce or prevent injuries, illnesses, and accidental losses by providing safe and healthful DOE Federal and contractor workplaces.

DOE Order 458.1 Change 3, *Radiation Protection of the Public and the Environment* (January 15, 2013)

This DOE Order establishes requirements to protect the public and the environment against undue risk from radiation associated with radiological activities conducted under the control of DOE, pursuant to AEA. The objectives of this order are to (1) conduct DOE radiological activities so that exposure to members of the public is maintained within the dose limits established in the order; (2) control the radiological clearance of DOE real and personal property; (3) ensure that potential radiation exposures to members of the public are as low as is reasonably achievable; (4) ensure that DOE sites have the capabilities, consistent with the types of radiological activities conducted, to monitor routine and non-routine radiological releases and to assess the radiation dose to members of the public; and (5) provide protection of the environment from the effects of radiation and radioactive material.

DOE Policy 450.4A, *Integrated Safety Management Policy*, (April 25, 2011)

This directive establishes DOE's policy that work be conducted safely and efficiently and in a manner that ensures protection of workers, the public, and the environment. It directs the implementation of integrated safety management systems to systematically integrate safety into management and work practices at all levels in the planning and execution of work and defines integrated safety management guiding principles and core functions. It further directs organizations to tailor their safety management system to the hazards and risk associated with their work activities and requires decisions impacting safety to be made by technically qualified managers with knowledge of the operations after consideration of the hazards, risk, and performance history. This policy establishes an expectation that all organizations embrace a strong safety culture.

8.1.8 Cultural Resources

American Indian Religious Freedom Act of 1978, as amended (42 U.S.C. 1996 and 1996a)

This Act reaffirms Native American religious freedom rights under the First Amendment and establishes U.S. policy to protect and preserve the inherent and constitutional right of Native Americans to believe, express, and exercise their traditional religions. It includes access to sites on Federal properties integral to religious ceremonies and traditional rites. It also directs agencies to consult with interested Native American groups and leaders to develop and implement policies and procedures to protect and preserve cultural and spiritual traditions and sites. Potential impacts from implementation of the proposed alternatives are analyzed in Chapter 4, Section 4.11, of this EIS.

Antiquities Act of 1906, as amended (54 U.S.C. 320301-320303)

This Act was the first Federal involvement in the protection and management of cultural resources on public lands and allows the President to set aside federally owned land as historic landmarks. It also established that objects of antiquity on Federal lands had to be preserved, restored, and maintained; could only be disturbed under permit from a Federal agency; and could only be disturbed for scientific and educational purposes by qualified personnel. It required that artifacts and associated documents be cared for in public museums; a system be created to establish national historic monuments; and criminal penalties be assessed for violations by any person who excavates, injures, obtains objects from, or destroys any historical ruin or monument on federally owned or controlled land without the permission of the appropriate Federal department. Potential impacts from implementation of the proposed alternatives are analyzed in Chapter 4, Section 4.11, of this EIS.

Archaeological and Historic Preservation Act of 1960, as amended (54 U.S.C. 312501-312508)

The purpose of this Act is to provide for preservation of historical and archaeological data (including relics and specimens) that might otherwise be irreparably lost or destroyed as a result of Federal actions. Potential impacts from implementation of the proposed alternatives are analyzed in Chapter 4, Section 4.11, of this EIS.

Archaeological Resources Protection Act of 1979, as amended (16 U.S.C. 470aa et seq.)

The purpose of this Act is to protect cultural resources on Federal lands older than 100 years and prohibit looting, vandalism, and unauthorized excavation. No one may sell, buy, or trade items from a cultural resource on Federal land. Criminal and civil penalties for violations are mandated, including forfeiture of equipment and vehicles used in any violations. Permits for excavation and removal of cultural resources on Federal lands by qualified persons are obtained from the appropriate Federal agency for the purpose of furthering archaeological knowledge for public benefit. The Federal land manager must contact any Native American tribe or organization with an interest in the cultural resource to be excavated. Recovered items remain the property of the United States and are to be preserved by a qualified institution. Federal agencies cannot reveal the location of a cultural resource if, by doing so, the cultural resource is at risk of being altered or destroyed. Agencies are also to develop plans for surveying lands other than those scheduled for undertakings and to record and report violations of the Act. Potential impacts from implementation of the proposed alternatives are analyzed in Chapter 4, Section 4.11, of this EIS.

Historic Sites, Buildings, and Antiquities Act of 1935, as amended (54 U.S.C. 320101-320106)

This Act established a national policy of preserving historic sites, buildings, and objects of national significance. It gave the Secretary of Interior authority to acquire, restore, and maintain such sites and established the *National Survey of Historic Sites and Buildings* (now known as the *National Register of Historic Places* [NRHP]), the *Historic Sites Survey*, the *Historic American Buildings Survey*, and the *Historic American Engineering Record.*

National Historic Preservation Act of 1966, as amended (54 U.S.C. 300101 et seq.)

The National Historic Preservation Act (NHPA) establishes a leadership role for the Federal Government in the preservation of cultural resources and promotes a policy of cooperation between Federal agencies, states, tribes, and local governments. The Act also created the Advisory Council on Historic Preservation to serve as an independent counsel on historic preservation issues to the President, Congress, and Federal and state agencies. Most importantly, the Act explains the responsibilities of Federal agencies and outlines a process by which significant cultural resources are recognized and protected from undertakings and potential effects. Key sections of NHPA pertaining to this EIS are described below:

- **NHPA Section 106** requires Federal agencies to consider in the planning stages of undertakings the potential impacts on historic properties listed on or eligible for the NRHP and provide consulting agencies, such as the California Office of Historic Preservation and the Advisory Council on Historic Preservation, with sufficient information and time to comment on the effects of the undertaking.
- **NHPA Section 110** requires Federal agencies to inventory cultural resources under their jurisdiction, evaluate and nominate eligible cultural resources for listing on the NRHP, and establish a historic preservation program. Compliance with Section 110 implies monitoring the conditions of historic properties and taking action to preserve them. Section 110 stresses that Federal agencies must take an active role in the preservation and management of all significant cultural resources under their jurisdiction.
- **NHPA Section 112** requires that both agency and contracting personnel conducting cultural resources investigations meet certain professional qualifications and that their investigations meet certain standards. All data and records for historic properties are to be maintained and available for research purposes.
- **NHPA Section 304** directs Federal agencies, after consultation with the Secretary of the Interior, to withhold from the public information regarding the location or character of a cultural resource when such disclosure may cause substantial risk, such as theft or destruction, to the resource.

Potential impacts from implementation of the proposed alternatives are analyzed in Chapter 4, Section 4.11, of this EIS. Consultations under Section 106 with the State Historic Preservation Officer, Advisory Council on Historic Preservation, and Native American tribes are identified in Appendix E.

Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. 3001 et seq.)

This Act requires Federal agencies to consult with Native American tribes regarding human remains and materials in their collections. The Act acknowledges tribal rights to Native American human remains, funerary objects, sacred objects, and objects of cultural patrimony. Persons can be prosecuted who knowingly sell or purchase, use for profit, or transport for sale or profit Native American human remains or objects covered by this Act. In the case of unexpected discoveries of Native American graves or grave goods during activities on Federal lands, the tribes or organizations are to be notified and procedures are to be agreed upon regarding establishment of affiliation and disposition of the remains or objects. The Act provides for the repatriation of these cultural items from Federal archaeological collections and collections held by museums receiving Federal funding to federally recognized tribes when cultural affiliations can be established. This regulation would apply during implementation of the activities analyzed in this EIS. Potential impacts of the proposed activities on cultural resources important to Native Americans are addressed in Chapter 4, Section 4.11.

Executive Order 11593, *Protection and Enhancement of the Cultural Environment* (May 13, 1971)

This Executive Order formally designates the Federal Government as the leader in preserving, restoring, and maintaining the historic and cultural environment of the Nation. It gives Federal agencies the responsibility for locating, inventorying, and nominating cultural resources to the NRHP.

Executive Order 13007, *Indian Sacred Sites* (May 24, 1996)

This Executive Order directs Federal agencies to accommodate access and ceremonial use of Native American sacred sites on their lands by Native American religious practitioners. The confidentiality of these sites is to be maintained by the Federal agency, and their physical integrity is not to be adversely affected.

Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments* (November 6, 2000)

This Executive Order supplements the Executive Memorandum (dated April 29, 1994), *Government-to-Government Relations with Native American Tribal Governments*, and states that each Executive department and agency shall consult, to the greatest extent practicable and to the extent permitted by law, with tribal governments prior to taking actions that affect federally recognized tribal governments. Furthermore, the 1994 Executive Memorandum states that each Executive department and agency shall assess the impact of Federal Government plans, projects, programs, and activities on tribal trust resources and ensure that tribal government rights and concerns are considered during the development of such plans, projects, programs, and activities.

Executive Order 13287, *Preserve America* (March 3, 2003)

This Executive Order re-emphasizes the Federal Government policy to provide leadership in advancing the protection, enhancement, and contemporary use of federally owned historic properties and to promote intergovernmental cooperation and partnerships for the preservation and use of the historic properties. Federal agencies are to maximize their efforts to integrate the policies, procedures, and practices of NHPA and this order into their program activities to efficiently and effectively advance historic preservation objectives in the pursuit of their missions.

DOE Order 144.1, *American Indian Tribal Government Interactions and Policy* (January 16, 2009; Change 1, November 6, 2009)

This DOE Order communicates responsibilities for interacting with Native American governments and transmits the DOE American Indian and Alaska Native Tribal Government Policy, including its guiding principles. This policy outlines the requirements to be followed by DOE in its interactions with federally recognized Native American tribes. It is based on the U.S. Constitution, treaties, Supreme Court decisions, Executive Orders, statutes, existing Federal policies, and tribal laws, as well as the dynamic political relationship between Native American nations and the Federal Government. The policy principles include DOE's responsibilities to implement a proactive outreach effort consisting of notice and consultation regarding current and proposed actions affecting the tribes and to ensure integration of Native American nations into the decision-making processes.

8.1.9 Waste Management

Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 et seq.)

AEA provides fundamental jurisdictional authority to DOE and NRC over governmental and commercial use of nuclear materials, respectively. AEA authorizes DOE to establish standards to protect health and minimize danger to life or property for activities under DOE's jurisdiction. DOE has issued a series of departmental orders to establish an extensive system of standards and requirements to ensure safe operation of DOE facilities and protection of the public. DOE regulations are found in 10 CFR. DOE regulations most relevant to radioactive waste, mixed waste, and materials management include "Nuclear Safety Management" (10 CFR Part 830); "Occupational Radiation Protection" (10 CFR Part 835); and "Byproduct Material" (10 CFR Part 962).

AEA also gives EPA the authority to develop generally applicable standards for protection of the general environment from radioactive materials. EPA has promulgated several regulations under this authority.

Resource Conservation and Recovery Act of 1976, as amended (42 U.S.C. 6901 et seq.)

The transportation, and treatment, storage, and disposal (TSD) of hazardous wastes are regulated by EPA under the authority of the Resource Conservation and Recovery Act (RCRA). EPA regulations implementing RCRA (40 CFR Parts 260–282) define and identify hazardous waste; establish standards for waste transportation and TSD; and require permits for persons engaged in hazardous waste activities. RCRA applies mainly to owners and operators of facilities that generate and manage hazardous waste, imposing management requirements on generators and transporters of hazardous waste and on owners and operators of TSD facilities.

EPA has authorized the State of California (CalEPA, through its DTSC) to implement the state hazardous waste management program in lieu of the Federal RCRA program (e.g., *California Health and Safety Code*, Division 20, Chapter 6.5, "Hazardous Waste Control and California Health and Safety Code;" Division 20, Chapter 6.8, "Hazardous Substance Account;" and Article 5.5, "Cleanup of Santa Susana Field Laboratory").

Two DOE facilities in Area IV are permitted under RCRA: the Radioactive Materials Handling Facility is permitted as an Interim Status (Part A) facility and is inactive pending closure plan approval. The Hazardous Waste Management Facility is no longer used and awaits final closure

(Boeing 2014c). Waste management is discussed in Chapter 3, Section 3.10, and Chapter 4, Section 4.10, of this EIS.

Toxic Substances Control Act of 1976 (15 U.S.C. 2601 et seq.)

The Toxic Substances Control Act provides EPA with the authority to impose strict limitations on the use and disposal of polychlorinated biphenyls (PCBs), chlorofluorocarbons, asbestos, radon, dioxins, lead-based paints, and other chemical substances. Any substances (for example, asbestos) or equipment containing or contaminated with such substances (such as transformers previously containing PCBs) that may result from demolition and disposal of remaining DOE buildings in Area IV would require management and disposal in accordance with this Act and the implementing regulations.

10 CFR Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste"

The regulations in 10 CFR Part 61 establish the procedures, criteria, terms, and conditions upon which NRC issues licenses for land disposal of low-level radioactive waste (LLW) containing byproduct, source, and special nuclear material. These regulations do not apply to high-level radioactive waste or DOE-managed LLW, but do apply to LLW managed in commercial facilities, regardless of the generator. The regulations also apply to LLW such as mixed low-level radioactive waste that is also regulated under other statutory authorities. DOE is evaluating disposal of LLW from building removal and soil remediation in Area IV and the NBZ at commercial LLW facilities. As a LLW generator, DOE would be required to meet the waste acceptance criteria of the disposal facilities licensed under this regulation.

DOE Order 435.1, *Radioactive Waste Management*, and DOE's associated *Radioactive Waste Manual* (DOE M 435.1-1; July 9, 1999; Change 1, August 28, 2001; Certified, January 9, 2007)

The objective of this DOE Order is to ensure that all DOE radioactive waste is managed in a manner that is protective of worker and public health and safety, and the environment. DOE radioactive waste management activities are required to be systematically planned, documented, executed, and evaluated.

California Executive Order D-62-02 (September 30, 2002)

In September 2002, California Executive Order D-62-02 imposed a moratorium on the disposal in California Class III or unclassified waste management units of decommissioned material meeting Federal and state cleanup standards. (Decommissioned materials are defined in the Executive Order as materials with low residual levels of radioactivity that, upon decommissioning of a licensed site, may presently be released with no restrictions on their use.) After September 2002, decommissioned materials from Area IV were sent to California Class I facilities, which are permitted for disposal of hazardous waste.

***California Code of Regulations*, Title 22, Division 4.5, "Environmental Health Standards for the Management of Hazardous Waste"**

California, in order to be authorized to regulate hazardous waste in lieu of EPA, has enacted regulations under Title 22, beginning with Section 66250, that are similar in nature to RCRA regulations. These regulations may be more stringent than EPA's regulations, but may not be less stringent.

***California Code of Regulations*, Title 23, Division 3, Chapter 15, "Discharges of Hazardous Waste to Land"**

Chapter 15 establishes waste and site classifications and waste management requirements for waste treatment, storage, or disposal in landfills, surface impoundments, waste piles, and land treatment facilities. Requirements are minimum standards for proper management of each waste category. Regional boards may impose more-stringent requirements to accommodate regional and site-specific conditions. In addition, the requirements apply to cleanup and abatement actions for certain unregulated discharges to land of hazardous waste (e.g., spills); the State Water Resources Control Board–promulgated sections of Subdivision 1, Division 2, Title 27, of the code apply in a corresponding fashion to unregulated discharges to land of solid waste.

***Consent Order for Corrective Action*, State of California, EPA, DTSC: Docket No. P3-07/08-003 (August 16, 2007)**

The 2007 *Consent Order for Corrective Action* (2007 CO) (DTSC 2007), issued to DOE, NASA, and Boeing, required further characterization of the nature and extent of contamination at SSFL and identified the RCRA studies and work plans that would be prepared. The 2007 CO required cleanup of chemically contaminated soils by June 30, 2017, using the *Final Standardized Risk Assessment Methodology Revision 2 Addendum, Santa Susana Field Laboratory, Ventura County, California* (SRAM) (MWH 2014) Work Plan; completion of DTSC-approved groundwater and unsaturated zone cleanup remedies in the Chatsworth Formation Operable Unit by June 30, 2017, or earlier; and completion of construction of the DTSC-approved long-term soil cleanup remedy in the surficial media operable unit by June 30, 2017, or earlier. The SRAM proposed a risk assessment methodology for determining the areas that would need remediation. A future residential land use was identified for the evaluation of risk, although other plausible receptors (such as recreational users or workers) were also identified.

The *2010 Administrative Order on Consent for Remedial Action* (2010 AOC) (DTSC 2010a) (see next paragraph) superseded the requirements in the 2007 CO (DTSC 2007) for soils and building remediation; however, the requirements for groundwater remediation remain valid and were incorporated by reference into the 2010 AOC.

***Administrative Order on Consent for Remedial Action*, State of California, EPA, DTSC: Docket No. HSA-CO 10/11-037 (December 6, 2010)**

The 2010 AOC remediation cleanup standard end state after cleanup is based on "Look-Up Table" (LUT) values. The standard applies to both chemical and radiological contamination in Area IV and the NBZ. Characterization activities for both chemical and radiological contaminants are identified, and DOE is required to prepare a Soils Remedial Action Implementation Plan. The 2010 AOC provides exemptions to cleanup for species and habitat protected under the Endangered Species Act and Native American artifacts that are formally recognized as cultural resources. An additional exemption (not to exceed 5 percent of the total soil volume) is proposed for other unforeseen circumstances, but only to the extent that the cleanup cannot be achieved through technologically feasible measures. DTSC is responsible for creating LUT values for the chemical and radiological cleanup levels. In the case (for either radionuclides or chemicals) that the minimum detection limits exceed the local background concentrations, the cleanup level specified is the minimum detection limit. No "leave-in-place" alternative (onsite burial or landfill) is allowed. Chemicals and radionuclides in the backfill soil must not exceed local background levels. Verification of cleanup levels and the acceptability of the backfill soil is required by DTSC for chemicals and by EPA for radioactive contaminants. The 2010 AOC (DTSC 2010a) calls for DOE to develop a Soils Remedial Action Implementation Plan that clearly describes a schedule for implementation of the planned remedial actions. The schedule shall ensure that the identified activities can be accomplished by 2017 or sooner.

8.1.10 Transportation

Hazardous Materials Transportation Act of 1975, as amended (49 U.S.C. 5101 et seq.)

The U.S. Department of Transportation (DOT) regulates shippers and carriers of hazardous materials, including radioactive material. Transportation of radioactive materials is regulated jointly by DOT and NRC. DOT's responsibilities include vehicle safety, routing, shipping papers, and emergency response information and shipper/carrier training requirements. NRC regulates users of radioactive material in 17 states and approves the design, fabrication, use, and maintenance of shipping containers for more-hazardous radioactive materials shipments. NRC requires radioactive materials to be shipped in accordance with DOT's hazardous materials transportation safety regulations. DOT regulations prescribe limits on the maximum amounts of radioactivity that can be transported, such that doses from any accidents involving these packages would have no substantial health risks. DOE transport of hazardous materials off site for treatment or disposal, over highways to which the public has access, would be subject to applicable DOT, DOE, and EPA directives. Potential transportation impacts from implementation of the proposed alternatives are analyzed in Chapter 4, Section 4.8, of this EIS.

10 CFR Part 71, "Packaging and Transportation of Radioactive Material"

These NRC regulations specify the packaging, preparation for shipment, and transportation requirements for radioactive materials. These regulations also provide the procedures and standards for NRC approval of packaging and shipping procedures for fissile materials and for quantities of other licensed material in excess of a certain quantity. Packaging and transport of radioactive materials are additionally subject to regulation by other agencies with jurisdiction over the means of transport (for example, DOT, as described in the following two paragraphs).

10 CFR Parts 100-185, "The Hazardous Materials Regulations"

These DOT regulations govern the transportation of hazardous materials in all modes of transportation (i.e., air, highway, rail, and water).

49 CFR Parts 171-180, "Hazardous Materials Regulations"

These DOT regulations establish requirements for classification, packaging, hazard communication, incident reporting, handling, and transportation of hazardous materials.

DOE Order 460.2A, *Departmental Materials Transportation and Packaging Management* (December 22, 2004)

This DOE Order states that DOE operations shall be conducted in compliance with all applicable international, Federal, state, local, and tribal laws, rules, and regulations governing materials transportation that are consistent with Federal regulations, unless exemptions or alternatives are approved in accordance with DOE Order 460.1C (see below). This order also states that it is DOE policy that shipments will comply with the DOT requirements of 49 CFR Parts 100–185, except those that infringe on maintenance of classified information.

DOE Order 460.1C, *Packaging and Transportation Safety* (May 14, 2010)

The objective of this DOE Order is to establish safety requirements for the proper packaging and transportation of DOE offsite shipments, onsite transfers of hazardous materials, and modal transport. ("Offsite" refers to any area within or outside a DOE site to which the public has free and uncontrolled access; "onsite" refers to any area within the boundaries of a DOE site or facility to which access is controlled.)

8.1.11 Environmental Justice

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (February 11, 1994)

This Executive Order requires each Federal agency to identify and address disproportionately high and adverse human health and environmental effects of its programs, policies, and activities on Native American tribes and minority and low-income populations. CEQ, which oversees the Federal Government's compliance with Executive Order 12898 and NEPA, has developed guidelines to assist Federal agencies in incorporating the goals of Executive Order 12898 in the NEPA process. This guidance, published in 1997, was intended to "…assist Federal agencies with their NEPA procedures so that environmental justice concerns are effectively identified and addressed." As part of this process, DOE has performed an analysis to determine whether implementing any of the proposed alternatives would result in disproportionately high or adverse impacts on minority or low-income populations. The results of this analysis are discussed Chapter 4, Section 4.13, of this EIS.

Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks* (April 21, 1997), as amended by Executive Order 13229

This Executive Order requires each Federal agency to make it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children and to ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health or safety risks.

***California Government Code*, Section 65040.12, The Definition of Environmental Justice and the Designation of the California Office of Planning and Research as Coordinating Agency for Environmental Justice**

This section of the *California Government Code* specifies the governor's Office of Planning and Research as the coordinating agency in State government for environmental justice programs and directs the agency to coordinate with Federal agencies regarding environmental justice information. This section also defines environmental justice as the "fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies."

Emergency Planning, Pollution Prevention, and Conservation

Emergency Planning and Community Right-to-Know Act of 1986 (42 U.S.C. 11001 et seq.)

This Emergency Planning and Community Right-to-Know Act (EPCRA) requires that Federal, state, and local emergency planning authorities be provided information regarding the presence and storage of hazardous substances and their planned and unplanned environmental releases, including provisions and plans for responding to emergency situations involving hazardous materials. Executive Order 12856, *Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements*, directs Federal agencies to comply with EPCRA.

Pollution Prevention Act of 1990 (42 U.S.C. 13101 et seq.)

The Pollution Prevention Act establishes a national policy for waste management and pollution control. Source reduction is given first preference, followed by environmentally safe recycling, with disposal or releases to the environment as a last resort. Waste management is discussed in Chapter 3, Section 3.10, and Chapter 4, Section 4.10, of this EIS.

40 CFR 302, "Designation, Reportable Quantities, and Notification"

The regulations in 40 CFR 302 (Sections 302.1-302.8) require facilities to notify Federal authorities of spills or releases of certain hazardous substances designated under CERCLA and CWA. They specify the quantities of hazardous substance spills/releases that must be reported to authorities and delineate the notification procedures for a release that equals or exceeds the reportable quantities.

Executive Order 12088, *Federal Compliance with Pollution Control Standards* (October 13, 1978), as amended by Executive Order 12580, *Superfund Implementation* (January 23, 1987)

This Executive Order directs Federal agencies to comply with applicable administrative and procedural pollution control standards established by, but not limited to, the Clean Air Act, the Noise Control Act, CWA, the Safe Drinking Water Act, the Toxic Substances Control Act, and RCRA.

Executive Order 12856, *Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements* (August 3, 1993)

This Executive Order requires all Federal facilities to comply with the provisions of EPCRA. Reports are required to be submitted pursuant to EPCRA, Sections 302–303 (Planning Notification), 304 (Extremely Hazardous Substances Release Notification), 311–312 (Material Safety Data Sheet/Chemical Inventory), and 313 (Toxic Chemical Release Inventory Reporting).

DOE Order 151.1C, *Comprehensive Emergency Management System* (November 2, 2005)

This DOE Order establishes policy; assigns roles and responsibilities; and provides the framework for developing, coordinating, controlling, and directing DOE's emergency management system (i.e., emergency planning, preparedness, response, recovery, and readiness assurance), commensurate with the potential hazards of a DOE facility.

California Emergency Services Act (*California Government Code*, Article I)

The State of California passed this Act in recognition of its responsibility to mitigate the effects of natural, man-made, or war-caused emergencies that result in conditions of disaster or in extreme peril to life, property, and the resources of the state and to generally protect the health and safety and preserve the lives and property of the people of the state. This Act establishes the authority and framework to ensure that preparations within the state will be adequate to deal with such emergencies.

8.2 Applicable Permits

Implementation of any of the action alternatives proposed in this EIS would require compliance with existing environmental permits and/or modifications to those permits, and could require acquisition of new permits. This section identifies existing environmental permits for DOE's activities in Area IV, as well as potential modifications, new permits, or approvals necessary to implement the proposed alternatives. **Table 8–2** lists the existing permits for Area IV. **Table 8–3** lists potential new permits or approvals that could be required to implement the proposed alternatives evaluated in this EIS.

Table 8–2 Environmental Permits for the Santa Susana Field Laboratory Area IV

Permit/License	*Facility*	*Status*
Ventura County APCD Permit 00232	SSFL	Current.
RCRA TSD (EPA) CAD000629972 (93-3-TS-002)	Hazardous Waste Management Facility (Bldg#133 and Bldg#029)	Inactive
RCRA TSD (EPA) CA3890090001	Radioactive Materials Handling Facility	Draft closure plan submitted in 2007.
LARWQCB NPDES Permit CA0001309	SSFL	Current

APCD = Air Pollution Control District; EPA = U.S. Environmental Protection Agency; LARWQCB = Los Angeles Regional Water Quality Control Board; NPDES = National Pollutant Discharge Elimination System; RCRA = Resource Conservation and Recovery Act; SSFL = Santa Susana Field Laboratory; TSD = treatment, storage, and disposal facility.
Source: Boeing 2014c.

Table 8–3 Potentially Required Permits or Approvals for Implementation of Alternatives in this EIS

Agency	*Permit/Approval*
Federal	
U.S. Fish and Wildlife Service	• Endangered Species Act Section 10 Incidental Take Permit for impacts to federally listed species • Biological Opinion
State of California	
California Department of Toxic Substances Control	• Plans, procedures, specifications, reports, and schedules prepared by DOE for cleanup of area IV as stipulated in the 2010 *Administrative Order on Consent for Remedial Action* (DTSC 2010a).
California Department of Fish and Wildlife	• California Endangered Species Act, Sections 2081(b) and (c), Incidental Take Permit for impacts to state listed species.
California Department of Transportation, District 7	• Permit for use of heavy equipment on state highways
California State Historic Preservation Officer	• Section 106 of the National Historic Preservation Act Consultation (by Federal lead agency, as applicable)
California State Water Resources Control Board	• National Pollutant Discharge Elimination System General Permit for Stormwater Discharges Associated with Construction and Land Disturbance
Local	
Ventura County Air Pollution Control District	• Rule 55, Fugitive Dust, requirements during construction activities • Rule 74.29, Soil Decontamination Operations requirements • Authority to Construct, Permit to Operate
Ventura County Resources Management Agency, Environmental Health, Solid Waste Program	• Waste disposal plans included in Corrective Action Implementation Work Plans
Ventura County, Public Works Agency, Transportation Department	• Haul Route Plan, Construction Traffic Management Plan and/or Traffic Control Plan
Los Angeles County, Public Works Agency, Transportation Department	• Haul Route Plan, Construction Traffic Management Plan and/or Traffic Control Plan
City of Los Angeles, Public Works, Department of Transportation	• Construction Work Site Traffic Control Plan • Haul Route Permit
Ventura County, Resource Management Agency, Watershed Protection District	• Well Permit for decommissioning water supply wells and installation of treatment and monitoring wells
Ventura County, Resource Management Agency, Division of Building and Safety	• Building and Grading Permits
Ventura County, Fire Protection Division	• Hazardous Materials Permit

8.2.1 National Pollutant Discharge Elimination System Permit

NPDES Permit Number CA0001309 is a site-wide permit for SSFL issued to Boeing. Stormwater from Area IV is collected and pumped along with stormwater from other parts of SSFL to a centralized storage and treatment system in Area III. From there, the wastewater is monitored and discharged to Bell Creek, a tributary of the Los Angeles River. The permit also regulates the discharge of stormwater runoff from the northwest slope (Area IV) locations into the Arroyo Simi, a tributary of Calleguas Creek.

The NPDES Permit also requires preparation of a site-wide stormwater pollution prevention plan (SWPPP). The SWPPP is revised as necessary and includes by reference many existing pollution prevention plans, policies, and procedures implemented at the SSFL site. The SWPPP includes the Spill Prevention Control and Countermeasure Plan, which identifies specific procedures for handling oil and hazardous substances to prevent uncontrolled discharges and for responding should a discharge occur.

8.2.2 Resource Conservation and Recovery Act Permit

Two DOE facilities in Area IV are permitted under RCRA. The Radiological Materials Handling Facility is permitted as an Interim Status (Part A) facility and was used primarily for handling and packaging LLW and mixed LLW. The Radiological Materials Handling Facility has been in a safe shutdown mode since May 2007 and is inactive pending closure plan approval. The Hazardous Waste Management Facility includes an inactive storage facility (Building 4029), as well as an inactive facility (Building 4133) that was used for treatment of reactive metal such as sodium. The Hazardous Waste Management Facility is no longer used and awaits final closure (Boeing 2014c).

8.2.3 Clean Air Act Permit

There are currently no DOE facilities operating in Area IV, so there are no air emissions from stationary sources. DOE previously operated under its own air permit, but in 2008 was consolidated under VCAPCD Permit to Operate Number 00232, which covers Areas I, III, and IV. This site is not a major source and, therefore, is not subject to Title V or NESHAPs (Boeing 2014c).

Chapter 9
Native American Histories and Perspectives

9.0 NATIVE AMERICAN HISTORIES AND PERSPECTIVES

Native Americans living in the vicinity of the Santa Susana Field Laboratory (SSFL) have long been associated with the site and have a perspective unlike that of other community members. Their varied interests regarding SSFL include territorial history; cultural connection to and continuity in the region; the presence of archaeological sites, plants, and animals traditionally used; other traditional uses; tribal and group memory, culture, and history; and concern for the environment. They have also expressed the desire to have input on plans for cleanup efforts at SSFL, so that those activities will be designed in consideration of the unique perspectives of Native Americans and conducted in a manner that offers protections to cultural resources.

The U.S. Department of Energy (DOE) takes its responsibilities to provide opportunities for tribal participation in the National Environmental Policy Act (NEPA) process seriously. Laws, regulations, and guidance supporting engagement with tribal entities include NEPA, the National Historic Preservation Act; American Indian Religious Freedom Act; the Presidential *Memorandum on Government-to-Government Relations with Native American Tribal Governments*; and Executive Orders (EOs) 13007, *Indian Sacred Sites*, and 13175, *Consultation and Coordination with Indian Tribal Governments*. To meet its consultation responsibilities, DOE has established government-to-government consultation with the federally recognized Santa Ynez Band of Chumash Indians and instituted forums for consultation with other tribes in the region.

In July 2014, DOE, the National Aeronautics and Space Administration (NASA), The Boeing Company (Boeing), and the California Department of Toxic Substances Control (DTSC) hosted a summit to introduce the intended site cleanup to regional tribal groups and organizations. The summit hosts combined their lists of Native American contacts and invited all to participate (refer to Appendix E, "Consultations," Table E–2).

One outcome of the July 2014 summit was the formation of the Santa Susana Field Laboratory Sacred Sites Council. Independently of DOE, NASA, Boeing, and DTSC, the summit attendees determined that the SSFL Sacred Sites Council would include representatives of the Santa Ynez Band of Chumash Indians, Fernandeño Tataviam and Gabrielino Tongva (the latter also includes the Kizh/Gabrieleno). The SSFL Sacred Sites Council serves as a central point for communication among the tribes and the various entities involved in cleanup at SSFL. Through periodic discussions conducted over teleconferences and during in-person meetings, the SSFL Sacred Sites Council coordinates tribal input to DOE, NASA, Boeing, and DTSC.

DOE understands that the site is important to Native American tribes; every tribal group brings its own unique perspective and history to their understanding of the site. The background information on the affected environment presented in Chapter 3, Section 3.11, Cultural Resources, was compiled based on an academically sourced summary of current knowledge regarding site history, ethnography, archaeological resources, and traditional cultural properties and sacred sites. Section 3.11 may not always be congruent with tribal perceptions of history, especially in regards to territory. For this reason, among others, DOE provided the forums represented by this chapter on the premise that it is appropriate to provide interested tribal parties an opportunity to be included and to contribute Native American perspectives on the site's history and significance. SSFL Sacred Sites Council members were invited to present their own histories, in some cases illustrated with territorial maps reflecting their perspective. DOE presents all submissions as pieces of the larger story regarding the significance of SSFL to the Native peoples who inhabited the site before DOE and its predecessors began operations.

The following sections were authored and submitted by the identified groups and individuals. Respecting the materials as the histories and perspectives of those who submitted them, DOE is presenting them as received, with only minor changes to correct typographical errors and to format them for presentation in this EIS. References cited by the authors are provided in footnotes or listed at the end of each section.

The sections are presented alphabetically, by the tribal name provided by each group in its contribution. The order has no significance in terms of primacy or authority. The following sections are the submittals from the Chumash (Sections 9.1 and 9.2), Fernandeño Tataviam (Section 9.3), and Gabrielino groups, consisting of Gabrielino Tongva (Section 9.4), Kizh/Gabrieleno (Section 9.5), and Tongva Ancestral Territorial Tribal Nation (Section 9.6).

9.1 Chumash

Brian Holguin

The Archaeological Record of the Chumash People: A Brief Overview

The Chumash people occupy almost two hundred miles of California's coastline, stretching from the beaches of Malibu all the way up through San Luis Obispo County. Their territory includes the Northern Channel Islands, which serve as the boundary in the West, while the eastern boundary extends to the western edge of the San Joaquin Valley. The region inhabited by the Chumash shows continuous occupation that can be traced back 13,000 years, with no evidence of cultural upheaval or signs of cultural replacement (Arnold 2001). Chester King's chronology is most commonly used when illustrating the history of the Chumash region through time, therefore it will be applied within this summary (King 1990).

Paleo-Coastal Period: 11,000-7,000 cal. B.C.

During the terminal Pleistocene, the sea level was much lower than it is currently. Due to the lowered sea level, the Northern Channel Islands formed a single landmass, called Santarosae (Johnson et al. 2000). Arlington Springs, an archaeological site located on modern day Santa Rosa Island, dates approximately to 11,000 cal B.C., contemporary with the existence of Santarosae (Glassow et al. 2007; Johnson et al. 2000).

Daisy Cave, an archaeological site located on San Miguel Island, dates to roughly 9,000 years BP or about 7,000 BC. Daisy Cave contains some of the earliest evidence for the hook and line method of fishing in North America (Erlandson et al. 2005). It is clear that fishing was the most important method of obtaining food at Daisy Cave due to the large amounts of fish bones present at the site. This site, along with Arlington Springs, provides the earliest evidence of human occupation in North America (Glassow et al. 2007; Johnson et al. 2000). Other sites on the coast show evidence for net fishing during this time, supported by the presence of fish that normally travel in schools (Erlandson et al. 2005).

Millingstone Horizon: 7,000-5,000 cal. B.C.

Increased population densities along the Chumash coastal region occurred during this period, along with an increase in the presence of millingstones (metate and mano) within archaeological assemblages (Glassow et al. 2007). An increased diversification of food resources, such as a greater focus on shellfish, birds, and small mammals, accompanied the increase in millingstone frequency.

Due to the increased prevalence of millingstones in the archaeological record, it is clear the main portion of the diet came from the processing and the milling of hard seeds or grains. Individual populations during this time never reached a size larger than extended families of mobile foragers with limited socio-political complexity (Glassow et al. 2007). In the Santa Monica Mountains, millingstone sites usually consist of flaked stone tools, cores, and core tools such as scraper planes (King 1990).

Early Period: 5,000-500 cal. B.C.

Three phases of the early period were identified by Chester King (1990), which were termed X, Y, and Z. These three phases were created as a result of the identification of a sequence of changes in beads and ornaments (King 1990). During this period, mainland subsistence appears to have relied heavily on terrestrial plant foods. Those fortunate to live by the coast appear to have relied on shellfish in addition to plant foods (Erlandson et al. 1992).

Toward the end of the early period, we begin to see an increase in fishing tackle and mortars/pestles within the archaeological record, which appears to be a result of an increased focus on land mammals, fish, and acorns. The Channel Islands were devoid of most land mammals, therefore shellfish and certain plant species that were available to the island Chumash were more intensively used (Erlandson et al. 2009).

Middle Period: 500 cal. B.C.-1150 A.D.

During the middle period, population size increases, tool technology becomes more complex, new food resources begin to be utilized and a greater increase in social complexity occurs. There is also a substantial increase in evidence for intergroup trade and interaction between the coastal groups and the mainland groups (Glassow et al. 2007). Shell beads manufactured on the Channel Islands begin to appear in mainland coastal sites as well as the interior valley. Obsidian seems to be the material used to trade for these beads, but since no source is present locally, it most likely came from the inland desert region, possibly through Newhall pass or the Simi Valley pass (Corbett and Guttenberg 2014).

The increase in the breadth of tool technology includes an increased emphasis on mortar/pestle use (expanding from the increased use in the middle period) and an increase in the prevalence of flaked stone within archaeological sites, which denotes an increase in hunting. The circular fishhook also seems to appear within this period, as well as a large breadth of shell and bone tools (Glassow et al. 2007). The Chumash archaeological sites dating to this time suggest that groups lived in small seasonal or year-round camps (Glassow et al. 2007).

The Chumash *tomol* is invented during this time, evident by the increased presence of fin fish vertebrae (species of and relating to swordfish) as you move through the middle period from around 500 A.D. (Arnold 2001, 2007). An elaborate headdress made from the scales of a swordfish was found and has been dated to around 600 AD. The tomol was the only Chumash watercraft capable of taking swordfish in the open ocean (Arnold 2007).

Late Period: 1150 A.D-Contact

The hallmarks of the late period include a substantial increase in the number of settlements along the coast, as well as a change in social organization and technology. A greater emphasis on fishing, which is a direct result of the increase in tool technology, also occurred during this time. During this period, the tomol reached its peak form, allowing the facilitation of sociopolitical activities such as information exchange, elite individual's manipulation of goods and craft production, accumulation of goods and moving large quantities of goods over long distances (Arnold 1995). Using their lithic innovations, inland populations became more effective hunters, relying on terrestrial animals as well as acorns and tubers for food (Glassow et al. 2007).

Sedentism increased during this period, particularly on the coast. In addition, changes in social organization in this period indicate an increased focus on ceremonial and elaborate ritual practice (Gamble, 2008). There is also much greater evidence for a further increase in trade between the Channel Islands and the mainland Chumash groups (Glassow et al. 2007).

During this time, we see the appearance of the bow and arrow in the archaeological record. This dramatically increased the effectiveness of hunters due to the increased accuracy over the atlatl. Craft specialization becomes more developed at this time, particularly on the Channel Islands with regards to shell bead manufacturing (Arnold 2001). During this time, the Ventureño Chumash occupied the western portion of the Simi Hills as well as the area immediately north of Simi Valley, making the SSFL a place of frequent and prolonged cultural interaction (Corbett and Guttenberg 2014).

The Chumash: An Ethnographic Description

At the time of European contact, the Chumash people were made up of eight subgroups, each speaking mutually unintelligible languages that collectively formed the Chumashan language family. This language family is not affiliated with any other language family in the Americas, making it a classificatory isolate (Arnold 2001; Golla 2011). This would suggest great antiquity for the Chumashan language family within the region. These eight groups consisted of the Barbareño, Ventureño, Purisimeño, Obispeño, Ineseño, Cruzeño, Emigdiano, and the Cuyama Chumash. The first five sub-groups were named due to their affiliation with missions that were erected within their territory after the Spanish conquest of California, however these names were not what these groups identified as. Each of these groups shared a large amount of their material culture and religious practices (Arnold 2001).

The Chumash region at the time of contact began at modern day Malibu and stretched up to San Luis Obispo and included extensive land in the backcountry and the Northern Channel Islands. The land area occupied by the Chumash totaled over 25,000 square kilometers. The Chumash population at the time of contact is thought to be around 20,000 individuals with around 66% of them living in coastal and island villages (Johnson 1999). These prime areas make up only 6% of the total land occupied by the Chumash. This means that roughly 12,000 individuals occupied an area of 1,500 square kilometers while the other 6,000 occupied an area of more than several thousand square kilometers (Arnold 2001). Most of these high density villages were located along the coastline in areas where marine resources were at their richest, as well as areas that proved to be good launching points for the tomol and the tule balsas (Arnold 2001).

The Chumash were one of the most complex hunter/gatherer societies in the world (Arnold 1995). Chumash society was organized within a hierarchy, with high status positions being ascribed. The hereditary chief or wot was the central authority. Sometimes there were more than one wot at a village (King 2011). This position was not gender bound, as the Spanish noted during their exploration of the Chumash region. The chief held inherited rights to all aspects of Chumash life, such as rights to property, rituals, titles, and had control over the labor and activities of others (Arnold 1995).

The Chumash economic system was far reaching and involved interactions with surrounding tribal groups which resulted in trade beads being found a large distance from their source. This intensive craft specialization occurred at sites out on Santa Cruz Island (Arnold 2001). The Chumash economic reach is evident by the presence of steatite bowls that were made on Catalina Island, which is one of the southern Channel Islands, by the Gabrielino/Tongva and traded to the Chumash (Arnold 2001). Fragments of steatite, obsidian, and shell beads manufactured on the northern Channel Islands were found in sites within the SSFL, a testament to the long-range trade network controlled by the Chumash (Corbett and Guttenberg 2014).

Chumash material culture and subsistence strategies were as complex and diverse as their society itself. Their material culture partially consisted of steatite bowls, sandstone bowls, basketry made from plant fibers, projectile points used for hunting, harpoons for marine mammals and fin fish, hook/line technology, nets, net weights, digging stones, pipes, beads, and canoes such as the tomol and the tule balsa (Gibson 1991). This rich array of cultural material is directly related to the rich environment the Chumash lived in. The most well know piece of Chumash material culture is the tomol. The tomol was a 30-foot plank canoe that was utilized by the Chumash for crossing the channel and transporting goods to and from the islands and the mainland. The invention of the tomol is directly related to the increase in sociopolitical complexity and attainable wealth observed in the archaeological record between the middle and late periods (Arnold 2001).

The Chumash intensely relied on plants and animals for their survival and utilized just about every aspect of their environment. Plants played a role in almost everything the Chumash made or used, such as housing material and basketry to name a few (Timbrook 2007). Plant materials were also used in healing and to treat specific ailments. Plants made up roughly 75% of the Chumash diet; even more than that in villages located away from the coast (Gibson 1991).

Animals included within their diet consisted of deer, fox, rabbits, squirrels, coyotes, and various other land dwelling animals (Grant 1978). The Chumash also hunted birds and reptiles as well. The bulk of the Chumash diet consisted of shellfish and marine resources, particularly true of villages on the coast and on the islands (Arnold 2001).

The Chumash were makers of some of the finest basketry in the world. The Chumash utilized basketry in every aspect of their lives. Baskets were used as water bottles, for storage, for leaching tannic acid from acorns, and for cooking (Hudson and Blackburn 1983). Baskets that served as water bottles had a small bottled neck near the mouth of the basket and were lined with asphaltum to make them waterproof (Hudson and Blackburn 1983). The Chumash were capable of incorporating elaborate designs into their weaving techniques which allowed them to make baskets that were as visually appealing as they were functionally superior.

The Chumash made paints from red ochre and other soft stones which they used for painting rock art on the walls of rock shelters (Gibson 1991). The Chumash were avid users of asphaltum. They would line their baskets with it to make them waterproof, caulked the tomol planks with it to form a waterproof seal, use it to mount shell beads onto various objects such as bowls, baskets and even the tomol. It is thought that asphaltum was traded to the islands from the mainland due to the lack of a reliable source on the Channel Islands (Arnold 2001).

The Chumash Presence at the SSFL

The Santa Susana Field Laboratory is located in the Eastern Simi Hills and contains numerous archaeological sites, of which Burro Flats is the most well-known. Burro Flats is a rock art site that contains numerous polychrome pictograph motifs, as well as monochrome pictographs in black, red, and white; all of which can be placed within the Ventureño Chumash sub-style (Grant 1965; Knight 2012). The Chumash are not the only native peoples to leave their mark on Burro Flats, as evident by pictographs that are not typically found within Chumash rock art. This is most likely due to the multi-tribal use of the land in and around the SSFL.

In addition to the presence of the Ventureño sub-style of rock art present at Burro Flats, ethno-historic data exist to further support the presence of the Chumash within the Simi Hills and Santa Susana Mountains. Several villages within the region had names in both Chumash and Fernandeño (Johnson 1997). One such village was Humaliwu (Chumash name), which was the main village of the region and today is known as Malibu (Knight 2012). Another example of this is the well-known Rancheria name El Escorpión, nestled in the western end of the San Fernando Valley. The Ventureño Chumash name for El Escorpión was Huwam, however it appears as "Jucjauybit" in Mission San Fernando's records (Johnson 2006). The existence of multiple names for these locations can be seen as evidence to support the frequent, multi-tribal use of the SSFL and its surrounding area.

References

Arnold, J. E., 1995, Transportation Innovation and Social Complexity among Maritime Hunter-Gatherer Societies. *American Anthropologist*, *New Series*. Volume 97, No. 4:733-747.

Arnold, J. E., 2001, The Chumash in World and Regional Perspectives. In *The Origins of a Pacific Coast Chiefdom: The Chumash of the Channel Islands*. The University of Utah Press. Salt Lake City, Utah.

Arnold, J. E., 2007, Credit Where Credit is Due: The History of the Chumash Oceangoing Plank Canoe. *American Antiquity*, Volume 72, No. 22: 196-209.

Corbett, R. and R. B. Guttenberg, 2014, Phase I Archaeological Survey, Santa Susana Field Laboratory Area I, Area III, and the Southern Undeveloped Land, Canoga Park, CA.

Erlandson, J. M., M. A. Glassow, and C. Rozaire, 1992, 4,000 Years of Human Occupation on Santa Barbara Island, California. Journal of California Great Basin Anthropology Vol. 14, No.1: 85-93.

Erlandson, J. M., T. J. Braje, T. C. Rick, and J. Peterson, 2005, Beads, Bifaces, and Boats: An Early Maritime Adaptation on the South Coast of San Miguel Island, California. *American Anthropologist*, Volume 4, No. 4: 677-683.

Erlandson, J. M., T. C. Rick, and T. J. Braje, 2009, Fishing Up the Food Web?: 12,000 Years of Maritime Subsistence and Adaptive Adjustments on California's Channel Islands. *Pacific Science,* Volume 63 (4): 711-724.

Gamble, L., 2008, *The Chumash World at European Contact*. University of California Press. Berkeley and Los Angeles.

Gibson, R. O., 1991, *The Chumash.* Chelsea House Publishers, New York and Philadelphia.

Glassow, M., L. Gamble, J. Perry and G. Russell, 2007, Prehistory of the Northern California Bight and the Adjacent Transverse Ranges. *California Prehistory: Colonization, Culture, and Complexity*, edited by T. Jones and K. Klar, pp. 191-213. Altamira Press, Lanham, Maryland.

Golla, V., 2011, *California Indian Languages.* University of California Press, Berkeley.

Grant, C., 1965, *The Rock Paintings of the Chumash*. University of California Press, Berkeley.

Grant, C., 1978, Eastern Coastal Chumash, *Handbook of the North American Indians, Volume 8*, California, pp. 509-519. Smithsonian Institution, Washington DC.

Hudson, T., and T. Blackburn, 1983, *The Material Culture of the Chumash Interaction Sphere Volume II: Food Preparation and Shelter*. Ballena Press/ Santa Barbara Museum of Natural History Cooperative Publication, Menlo Park, California.

Johnson, J. R., 1997, Chumash Indians in Simi Valley. In Simi Valley: A Journey through Time, edited by Patricia Havens and Bill Appleton, pp. 4-21. Simi Valley Historical Society and Museum.

Johnson, J. J., 1999, Cultural Affiliation and Lineal Descent of Chumash Peoples in the Channel Islands and the Santa Monica Mountains.

Johnson, J. J., 2006, Ethnohistoric Overview for the Santa Susana Pass State Historical Park Cultural Resources Inventory Project, Department of Anthropology Santa Barbara Museum of Natural History, Santa Barbara, California (available on-line at Santa Susana Pass SHP - General Plan).

Johnson, J. J., T. Stafford, H. O. Ajie, and D. Morris, 2000, Arlington Springs Revisited, Proceedings of the Fifth California Islands Symposium, pp. 541-545, U.S. Department of the Interior Minerals Management Service, Pacific OCS Region.

King, C. D., 1990, The Evolution of Chumash Society: A Comparative Study of Artifacts Used for Social System Maintenance in the Santa Barbara Channel Region before A.D. 1804. Garland Publishing Inc., New York.

King, C. D., 2011, Overview of the History of American Indians in the Santa Monica Mountains. Report prepared by Topanga Archaeological Consultants, Topanga, California.

Knight, A., 2012, Three Polychrome Pictograph Sites in the Eastern Simi Hills. SCA Proceedings, Volume 26: 256-271.

Timbrook, J., 2007, *Chumash Ethnobotany: Plant Knowledge Among the Chumash People of Southern California*. Santa Barbara Museum of Natural History. Santa Barbara, California.

9.2 Embracing our Past

Patrick Tumamait

In the early part of Spring 2010, I was invited by the Boeing Company to attend a bus tour of Santa Susana Field Laboratory (SSFL) property along with other Native representatives from the surrounding area. Boeing graciously provided a tour bus for all of us to see the old ROCKETDYNE facility. Mr. Paul Costa of Boeing also informed us of the toxic fuel waste that was not properly disposed of. For the past 50 years the facility was used as a rocket testing site and failed to properly dispose the hazardous waste material. Now, a massive hazardous waste clean-up by Boeing, NASA, and the Department of Energy is planned. Many of the people in the group were uncomfortable and worried about their safety. Mr. Costa assured us that we were safe and had nothing to worry about. He advised us that the property had been closed off to the general public for the past 50 years and had concerns about the archaeological and cultural resources in the area. Like many, I did not know what to expect. Looking out of the window at the grassy meadow surrounded by large wave-like sandstone outcrops, I wanted to exit the bus and climb onto each and every one of them. After a few minutes into the ride, the bus stopped, overlooking the valley below. With the cool morning breeze blowing through my hair and the clear blue sky above, I thought to myself what a beautiful day for a bus ride. My mind began to wander and I could hear the sunrise morning song blowing in the wind and feel the peace and serenity of the Native people who once lived on the land. I envisioned the footsteps of my brothers and sisters walking through the tall blades of grass greeting one another after a long journey. Everything came to life with the feeling of returning home after being gone for so long. Tears of sadness and joy weighed upon my heart. I knew then I wanted to be a part of the project. After the brief stop, we drove to the area where the Red Burro painting was in a small rock shelter at the west end of the property known as Burro Flats. By the end of the day, we visited many other sites, each one as unique as the first one. After the tour, everyone left with mixed emotions about what to do except for me. I was excited and anxious to return to the site and wanted to know more about how to get involved. I asked Mr. Costa what I needed to do to apply for the monitoring position. He stated that my contact number and my address was all that was needed. A few months passed and I received a call from a Mr. Frank Spizzio, a Boeing representative, requesting information regarding a contract for hire.

A few weeks later I was on the job site monitoring with my good friend Charlie Cooke, an honorary Chief of the Chumash Nation. I first met Charlie through my father, Vincent James Tumamait, at a POW-WOW. Since that time we have been good friends. Charlie and I spent many hours together on the project and often checked on Charlie for he was not in the best of health. Our job was simple. We monitored the earth disturbance by the HYDROGEOLOGIC (HGL) crew and the vegetation clearing crew. It was a simple task but it allowed me the time to think about how the Native people survived and utilized the area as their home. Every day was an adventure. I could see a pattern in the landscape of how they would hunt for deer and small game. The rock shelters and hunting blinds on either side of the meadow gave them an advantage. I was truly fascinated by the surrounding landscape. The archaeologist on site was a good friend of mine, Allen Knight. Al and I surveyed the grounds for evidence of occupation and artifacts left behind by the Native people. We often talked about how they lived here on the land. It was late spring / early summer and the deer began to feed on the tall grass in the meadow. That particular day I counted and photographed seven bucks grazing on the tall grass. I'm sure that they felt safe even though it was close to hunting season because hunting was not allowed on site. As time passed, I was able to take many other photos of the animals on the site including horned toad lizards, cottontail rabbits and birds. The wildlife was abundant and thriving off the land. By this time Al and I had covered a lot of land. With his expertise and my keen eye we discovered eight new sites and met some new friends. Working with HGL and their staff was a rewarding experience for me. I have a great respect for the work that they do and it was an honor to work with them. To the Boeing staff, NASA, and the Department of Energy I owe a great deal of gratitude on how we were treated and respected as Native Chumash people during the project.

Sincerely,

Patrick Tumamait

9.3 Fernandeño Tataviam

The information presented in this ethnography is based off the interpretations of the present-day enrolled citizens, elders, and the tribal leadership of the Fernandeño Tataviam Band of Mission Indians, constructed off data gathered by anthropologists, archaeologists, and linguists.

Fernandeño: Regional Terms

"Fernandeño" (or "Fernandiño") is a Spanish regional term representing the people of four diverse territories enslaved during the Mission San Fernando period. J.P. Harrington archives Fernandeño Takic terms, one of the many languages spoken among the Indians of Mission San Fernando, for the four related, yet culturally diverse, territories prior to the Mission period. Using *Pasekivitam,* the people of the villages of San Fernando, the Mission, and the basin of the valley, as a central point of reference would position *Tatavitam* as the people of the region north of *Pasekivitam, Simivitam* as the western people inhabiting Simi Valley in territories south of *Tatavitam*, and the *Vanyume* as the most eastern groups encompassing Antelope Valley (Harrington 1917). The *Tatavitam*, *Pasekivitam*, and *Vanyume* maintained slightly distinct Takic languages, while the people of Simi Valley and coastal areas were members of the Chumashan language. There are several alternative names that represent ethnic (tribal) perspectives for the words recorded by both the Spanish priests and Harrington, but the general rule stands with four important Takic suffixes: *–vit, -pet, -bit, or –bet* refer to one person or lineage[1]*, -am* is plural and can convert one person (-vit) to multiple people (-vit*am*)*,* and *-nga* is a locative reference. Language types and marital patterns did not determine political or national organization among the pre-mission Fernandeños. They exercised power over territory, self-government, a judicial system, and upheld a network of social, economic, and political ties to other lineages over an extensive area. The lineages are important distinctions from physical locations, since the actual villages were abandoned when the Indians were recruited to Mission San Fernando. These lineages continued as the major form of social and political organization through the Mission period, and are the primary form of indigenous organization among the present-day descendants of the Fernandeños.

Fernandeño and Gabrieleño: The Difference

Although the Fernandeño and Gabrieleño are linguistically related, they represent two geographical areas that shall not be confused, or interchanged, with one another. *Sivavitam*, the people of Los Angeles Basin, are known as the Gabrieleños during the Mission period. The people of Mission San Gabriel, Gabrieleños, referred to the Fernandeños as *Pavasikwar*, which exemplifies the separate native identities associated with the two post-Mission era names. Additionally, the Fernandeños referred to the Gabrieleños inhabiting areas further east of the Los Angeles Basin as *Komivitam,* or the people in the eastern portion of San Gabriel Valley, which further established a line between the two mission-associated regional terminologies.

Pasekivitam, Tatavitam, and Simivitam Overview

The distinct community of the present-day Fernandeño Tataviam Band of Mission Indians (Band) (Figure 9–4) originated in the lineages, villages, and culture of the pre-Mission period. Mission San Fernando was established on September 8, 1797 at the village of *Achoicominga* and, for years following, gathered converts from the Indian villages in the geographically surrounding area, ranging from present day Santa Catalina Island and Malibu in the west, Cahuenga and Encino in the south, Tujunga in the east, and the present-day Tejon Ranch in the north. Before the founding of Mission San Fernando, the Indians in the region lived in lineages within villages that were associated with territories. The tribal villages, or tribelets, consisted of speakers from the Takic branch of the Uto-Aztecan language, who intermarried with individuals from other linguistic groups within the area, as well as strengthened economic, social, and cultural relations with those outside of their language group by practicing exogamy. Each tribelet or lineage held territory and maintained political and economic sovereignty over its local area, but was also linked through social exchange to neighboring villages and lineages.

[1] For consistency, the contemporary Fernandeño Tataviam (Band) administration made the decision to use the –bit suffix when referring to lineages.

Band's Link to Villages/Rancherías

The entire Fernandeño region formed a network of intermarriages that produced the basis for cooperative economic and social exchanges. Each lineage group, from which citizens of the Band descend, were economically, socially, and politically autonomous. Although the villages[2] of *Jucjayunga*, *Momonga*, and *Tapuu* (Figure 9–1) were predominantly *Simivitam,*[3] the intermarriages with *Tatavitam*[4] highlight the Band's ancestral ties to families of Simi Valley and surrounding areas. The mixed marriages among lineages and across linguistic lines were typical of the region before the establishment of Mission San Fernando. Specifically, the Ortega and Garcia lineages, which link to the Band's progenitors, can be traced to the three former villages.

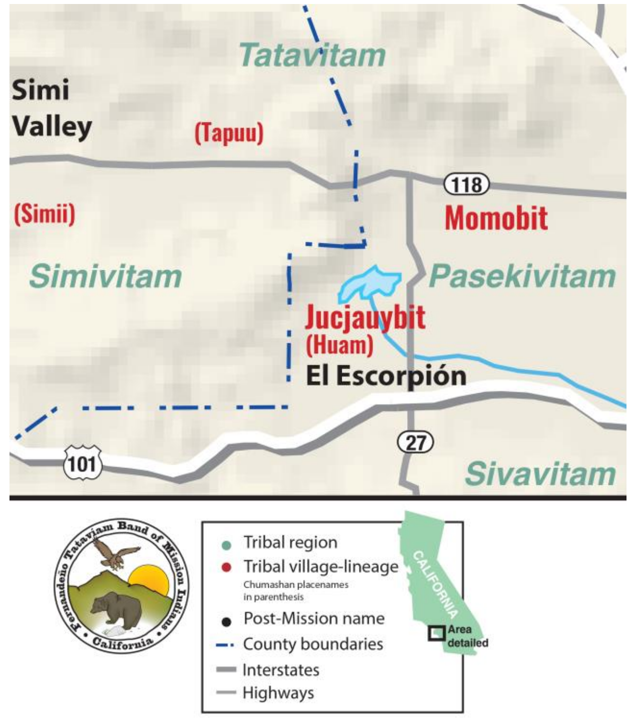

Figure 9–1 Village (Lineage) Map

Ortega: ties to Tapuu and Momonga

Maria Rita Alipas is a progenitor of the Ortega lineage. Tracing her ancestry patrilineally, through her father Francisco Papabubaba, leads us to Juan Maria, a first generation convert born in the lineage of *Chaguayabit*. Francisco's wife, Paula Cayo, was born at Mission San Fernando. Paula's father, Tiburcio Cayo, was born at *Tapuu*, the *Simivitam* village in present-day Simi Valley (Figure 9–1). In short, Maria Rita Alipas had ancestors from the lineages of *Chaguayabit* (Chaguayanga), *Cabuebit* (Cahuenga), *Suitcabit* (Siutcanga), and *Tapuu*. This reveals that her ancestry contained members of the Takic and Chumashan linguistic groups and indicates the regularity of mixed marriages between the *Tatavitam* and *Simivitam*. Maria's relationship with the lineage of *Tapuu* links Ortega tribal descendants, enrolled with the Band today, to the ancient ancestral sites of Simi Valley and surrounding areas. Moreover, on September 1, 1845, Maria Rita Alipas and Benigno were married at Mission San Fernando. The list of witnesses for this marriage illustrates the breadth of community that continued to exist. For example, the first witness was Thomas of *Momobit*, the lineage located at *Momonga*, east of present-day Stoney Point. *Momonga* was located near a major trail that crossed over the original Santa Susana Pass into Simi Valley, which was home to the rancherías located at *Tapuu, Simii*, and *Quimisac* (Johnson 2006:15), and likely contained members of both Takic and Chumashan languages. Another witness was Vicente Francisco, an Alcalde who was a member of a prominent family at Fort Tejon, and a progenitor for the Fort Tejon Tribe.

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[2] Note: the lineages that existed at those villages are noted on the map: Jucjauybit, Momobit, and Tapuu.

[3] See "Fernandeño: Regional Terms." Simivitam: People of Simi Valley prior to the recruitment of Mission San Fernando.

[4] See "Fernandeño: Regional Terms." Tatavitam: People of the region north of the Simivitam prior to the recruitment of Mission San Fernando. Their territory extended to the south-facing slopes of Liebre and Sawmill mountains (King and Blackburn 1978: 535).

Garcia: Ties to Tapuu

Leandra Culeta, the progenitor of the Garcia line, was born at Mission San Fernando on March 28, 1840. Culeta's ancestor, Amando, originated at *Chaguayabit,* the *Tatavitam* lineage ancestrally tied to the Ortega family. Culeta's patrilineal ties to *Chaguayabit* suggest that she is a blood relative to Francisco Papabubaba, and his daughter Maria Rita Alipas.[5] Culeta's godmother was Rafaela, the wife of Vicente Francisco, the Alcalde who witnessed Benigno and Maria Rita Alipas' marriage in 1845. Vicente Francisco was also Leandra Culeta's great uncle, since his sister Teofila married Culeta's maternal grandfather, Francisco del Espiritu Santo. The god parenting relation of Rafaela to Leandra Culeta reaffirmed relations between Culeta and her Kitenamuk relatives at Tejon. Rafaela was born at Mission San Fernando, and her parents Dionisio and Dionisia, were both from the *Simivitam* lineage at *Tapuu.* Leandra and Juan Leyva's daughter, Josephine Levya, also had a daughter. She, Frances Garcia Cooke, was a sister to Petra Garcia Rivera Valenzuela, an ancestor of the Fernandeño Tataviam Band's citizens through her great granddaughter Victoria Olivarez. Frances Garcia Cooke and her daughter, Della Cooke Martinez, were active in organizing the Garcia lineage members, living in Newhall in 1928, to apply to the California Indian judgment roll. Frances Garcia Cooke's son, Dolore Cooke, was the father of Charlie Cooke, the elder who visited the Burro Flats pictographic site in the late 20th century. In summary, Leandra's patrilineal ties to *Chaguayabit* and matrilineal ties to *Tujubit* were augmented by social ties to the *Simivitam* lineage at *Tapuu*.

Rocha: Ties to Jucjayunga (El Escorpión)

A third lineage progenitor is Rogerio Rocha, a captain in San Fernando in the 1850's. The Band has exhausted research on Rocha's family and cannot identify any living descendants. However, the Garcia lineage identified him as the previous captain of their family on the 1928 California Indian judgment roll. Rocha's father, German, was a captain during the Mission period. Rocha's grandfather, Mariano Antonio, and German were born at the *Simivitam* village of *Quimisac*, which was located in the region north of present-day Simi Valley. His wife, Maria Manuela, was born at Mission San Fernando. Maria's mother, Nerea, was from the *Tatavitam* lineage of *Pirubit* located at *Pi'írukŋga*,[6] and her father, Efren, was from the lineage located at *Jucjayunga*, historically located at *El Escorpión,* at the mouth of Bell Canyon. Efren's mother, Benita, and maternal grandmother, Saturnina, were both born at *El Escorpión*. Rocha's in-laws in the *Tujubit* lineage were of the same lineage as Leandra Culeta's[7] ancestors. Both Culeta and Rocha lived and worked in the same village, as well as shared a common ancestral identity.

El Escorpión (Jucjayunga) and Rocketdyne: Rudy Ortega, Sr. and Charlie Cooke

The *Simivitam* village located at the mouth of Bell Canyon was called *Huwam* in the neighboring language, but was most often referred to as *Jucjauybit* in the registers of Mission San Fernando (Johnson 2006:5). *Jucjayunga* is identified, in the post-mission period, as *El Escorpión* (Harrington 1917 Reel #106-152:1:7).[8] The El Escorpión Rancheria may have been occupied as recently as 1820 C.E. (Knight 2002, NASA 2010:22). Some speculate that native speakers of both Takic and Chumashan languages resided at El Escorpión, creating a multilingual community (Brown 1967:8; Forbes 1966:138; King and Johnson 1999:88-89, 91-92; Johnson 2006:7). Moreover,

5 See "Ortega: Ties to Tapuu and Momonga"
6 Also known as Piru
7 See "Garcia: Ties to Tapuu"
8 Also known as El Escorpión de las Salinas

El Escorpión was one of the larger villages in the San Fernando Valley during the period of recruitment from the area by the Mission San Fernando (King 2011:46).

The west San Fernando Valley was an area of religious and ceremonial prominence for the *Simivitam*, *Tatavitam, Pasekivitam,* and *Sivavitam*. The polychrome pictographs located in the Simi Hills were, most likely, places where ceremonial activities took place (Romani 1981:91). Studies suggest that the northern component of the village of *Jucjayunga* was the host village for the regional winter solstice festivals, in honor of the return of the sun (Romani 1981:92-93). In 1917, J.P. Harrington, while visiting the El Escorpión Rancheria, encountered the ancestral polychrome and red monochrome pictographs of the Lake Manor site,[9] located near the Chatsworth reservoir in the northern section of the area inhabited by the eastern *Simivitam* and western *Pasekivitam*. Another important ceremonial location and pictographic site west of San Fernando Valley[10] is part of the *Pasekivitam* village of *Momonga* (Johnson 2006:15-23; NEA and King 2004:112) and contained fresh water and sulphur springs that remain active today (Knight 2002:265).

Just north of El Escorpión, at Chatsworth Lake Manor, are the complex polychrome Burro Flats pictographs.[11] In 1971, fifth generation Mission Indian Rudy Ortega, Sr. (Figure 9–2 and Figure 9-3), of the Ortega lineage, began his pursuit of preserving the dramatic and well-preserved pictographs left behind by his ancestors. His contribution to the protection of Santa Susana led the descendants of the Mission San Fernando Indians to conduct a petition drive that pushed for a portion of Rocketdyne's engine test site to be declared a historical monument. Since 1978, Charlie Cooke, of the Garcia lineage, visited Burro Flats Cave site and witnessed winter and summer solstices. On September 10, 2013, Cooke submitted a letter to the Native American Heritage Commission requesting that Burro Flats Pictograph Cave site be listed by California as a sacred place. In 2009, Elders of the Fernandeño Tataviam Band gathered at Burro Flats to honor the sacred site. An attempt to hold a small winter solstice ceremony at the pictographic site in 2013 demonstrates the continued use and importance of the cultural resources of the area. The presence of scattered pre and post-Mission activity present in the Simi Valley, in the form of pictographs and ancient ancestral deposits, elucidate the extent of preservation that Rudy Ortega, Sr. and Charlie Cooke fought for.

Figure 9–2 Rudy Ortega, Sr. (Chief Little Bear) at Rocketdyne, 1971

[9] Lake Manor Site (VEN-148/149)
[10] Chatsworth Site (LAN-357)
[11] Burro Flats Site (VEN-1072)

Although the pictographs are not definitively *Simivitam,* they are stylistically related. Through the genealogical evidence, one can deduce that the affiliation of the pictographs would lie with *Simivitam, Tatavitam*, *Sivavitam*, and *Pasekivitam,* or, through intermarriage, a combination of the four. The pictographs and surrounding terrain had been described by Rudy Ortega, Sr. as being "important in the sense that it is a real find in the Mission Indian's search for self-identity and heritage…they are the few physical links to our heritage."

Figure 9–3 Steven Ortega (son of Rudy Ortega, Sr.) at Rocketdyne, 1971

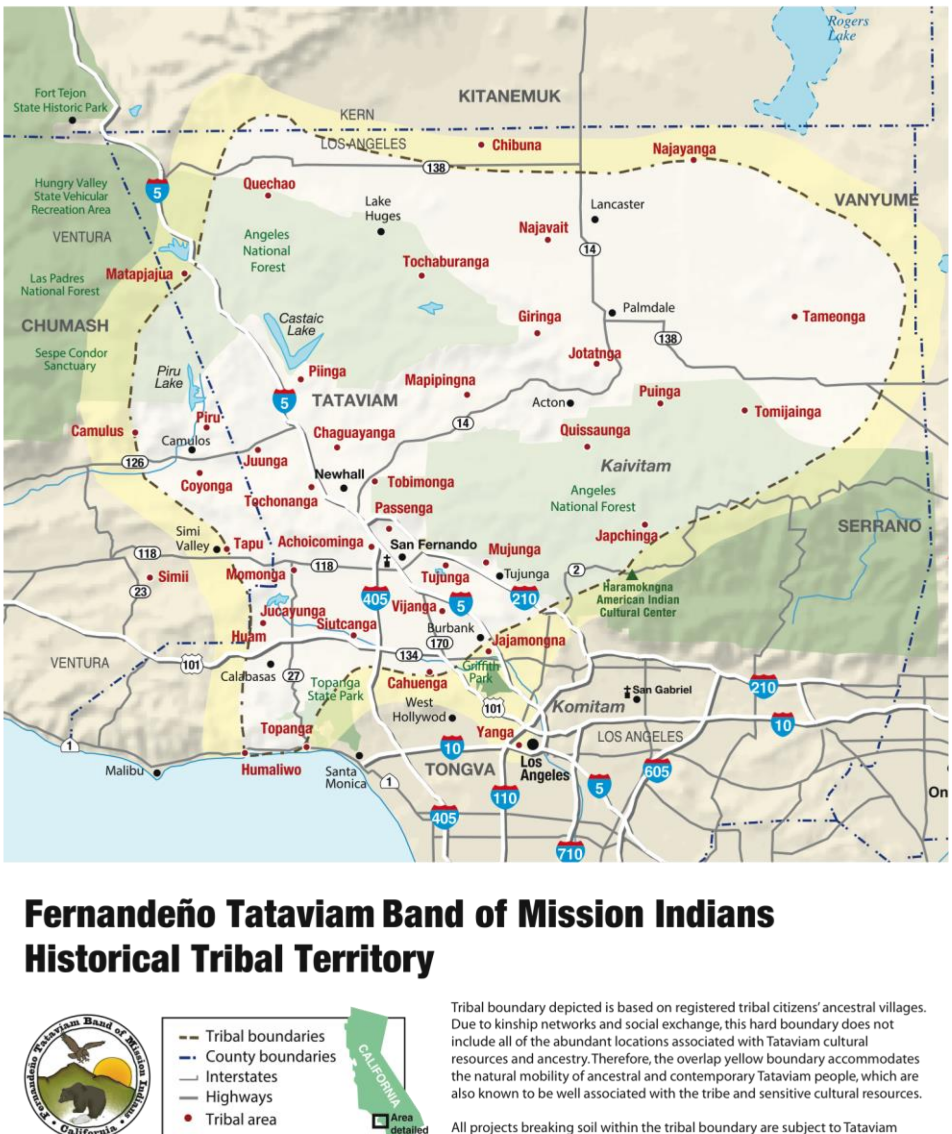


Figure 9–4 Tataviam (band) Tribal Territory

References

Brown, A. K., 1967, *The Aboriginal Population of the Santa Barbara Channel*. Reports of the University of California Archaeological Research Facility 69. University of California, Berkeley.

Forbes, J. D., 1966, The Tongva of Tujunga to 1801. In *Annual Reports of the University of California Archaeological Survey*, vol. 8, pp. 137-150. University of California, Los Angeles.

Harrington, J. P., 1917, J. P. Harrington's Field Notes: Fernandeño, Reel #106. J. P. Harrington Database Project.

John J., 2006, *Ethnohistoric Overview for the Santa Susana Pass State Historical Park Cultural Resources Inventory Project*, Santa Barbara Museum of Natural History, Santa Barbara, California.

King, C., 2011, Overview of the History of American Indians in the Santa Monica Mountains, 471 pp.

King, C. D., and J. R. Johnson, 1999, The Chumash Social-Political Groups of the Santa Monica Mountains. In *Cultural Affiliation and Lineal Descent of Chumash Peoples in the Channel Islands and Santa Monica Mountains*, edited by Sally McLendon and John R. Johnson, pp. 67-92. Report prepared for the Archeology and Ethnography Program, National Park Service. Hunter College, City University of New York, and Santa Barbara Museum of Natural History.

King, C. and T. C. Blackburn, "Tataviam," Handbook of North American Indians 8 (1978): 535-537.

Knight, A., 2002, "Three Chumash-Style Pictograph sites in Fernandeño Territory." *Proceedings of the Society for California Archaeology* 26 (2012).

NASA (National Aeronautics and Space Administration), 2010, *Integrated Cultural Resources Management Plan for Santa Susana Field Laboratory, Ventura.*

Northwest Economic Associates and Chester King, 2004, *Ethnographic Overview of the Angeles National Forest: Tataviam and San Gabriel Mountain Ethnohistory*. Report prepared for USDA Southern California Province, Angeles National Forest. Northwest Economic Associates, Vancouver, WA, and Topanga Anthropological Consultants, Topanga, CA.

Romani, J., 1981, Astronomy and Social Integration: An Examination of Astronomy in a Hunter and Gatherer Society. Unpublished Master's thesis. Department of Anthropology, California State University, Northridge.

9.4 Gabrielino Tongva Indians of California

Christina Conley

Columbia University cultural anthropologist, Alfred Kroeber, characterized the Gabrielino Tongva Indians of California as the "wealthiest and most thoughtful of all the Shoshoneans of the state." [12] In 1805, sea captain, William Shaler, wrote that they were "a handsome people, remarkably sprightly, courteous, and intelligent, and display great ingenuity in all their arts." [13]

My family are descendants of the Gabrielino Tongva Indians of California and lived on what is now called the Santa Susana Field Laboratory (SSFL). As with many tribes who lived in that area, their ability to sustain themselves with hunting and gathering allowed them to settle the land for many generations. This way of life fostered a spiritual culture of appreciating and respecting the land they lived on as it nourished and sheltered them like a parent.

Learning to sustain themselves with food from the land went beyond a lesson, it was also a bonding time between the young and old. The uncles of my uncles taught them how to hunt with a "throw stick" that was crafted with a hook on the end and would be cast toward the small animal prey. This rudimentary hunting would be a valuable trait when there was a lull in the capture of bigger game. The aunts of my aunts taught them to select and gather the vegetation to provide nourishment.

The many rock hunting blinds found on the property suggest the land was vibrant for hunting. A successful hunter would have awoken before dawn and tracked their prey by following wildlife trails which still exist today across the property. Successful tracking within the surrounding meadows required an intimate knowledge of the land: observation of newly etched antler marks made by bucks on trees and/or crows circling above in the sky. The hunter understood that the deer had a heightened sense of smell. Hunters did not perch themselves on the ridges or the large boulders but positioned themselves down-wind below the high points of the topography.

An increase of hunting success would have occurred before winter (August-November) during mating season. At this time, the bucks would stop eating and become weak and delirious and more vulnerable to a strike.

Hunters used soapstone from Catalina Island (steatite) to straighten arrow shafts in order to make their weapon more aerodynamic. Arrow tips were crafted from stone or bone. The arrow would shoot only as far as 30' demanding the hunter be expertly skilled. Some used disguises made of heads and necks of deer to enable the hunter to approach his prey more closely.

In our contemporary times, we perceive a person who is easily distracted as holding a negative trait, but for the Gabrielino Tongva hunter, it would have been a virtuous and admirable characteristic. This hunter relied on all of his senses and would continually check that the wind was in his face, mindful of his step and cognizant of the noise he generated. A focused hunter would not be acute to all of his senses: not recognizing the wind shifts which would take his scent to the prey and expose him, unaware of his footing and noisily stumbling. The SSFL area has a constant breeze along with the seasonal Santa Ana winds thus, a constant obstacle to the hunt. If a hunter gave away

[12] *Kroeber, A.L.* Handbook of the Indians of California. *Bureau of American Ethnology Bulletin 78, Smithsonian Institution, Washington, DC. 1925.*

[13] *Shaler, William,* Journal of a Voyage Between China and the North Western Coast of America, Made in 1804 by William Shaler. *Sanders Studio Press, Claremont, California. 1935.*

his location to a deer, it would take at least 2 hours for the deer to return. The characteristics of this "focused" hunter would deem him less valuable to the tribe.

The myriad of complexities to the hunt of large animals forced them to find alternative sources of meat to compensate. Snares, throwing clubs and slings were used to capture rabbits, squirrels and other small animals.

The plentiful orchards of oak trees amongst the aromatic chaparral of the meadows still carry the voices of those who would gather their acorns for food. Acorns were pulverized in mortars and flushed with water to remove the tannic acid which made them bitter and unpalatable. Several mortars are found throughout the property and several large mortar bowls are found near the creek at the foot of Burro Flats ceremonial area. The winter and summer solstice celebrations held there would have required more food and hence, the larger volumed bowls.

The thoughtful preservation of this sacred land respects our past and preserves our future.

Christina Conley
Gabrielino Tongva Indians of California

9.5 Kizh/Gabrieleno: Ethnographic Culture and Project Area Connections

Ernest P. Salas Teutimes, Chief and Spiritual Leader,
Andrew Salas, Tribal Chairman,
Dr. Gary Stickel, Tribal Archaeologist

Ethnographic Culture

The Kizh/Gabrieleno people have lived in the southern California area for thousands of years. The Tribe occupied a vast area that "…the Gabrielino mainland territory included…the San Fernando Valley, the San Gabriel Valley, the San Bernardino Valley, and the Los Angeles-Santa Ana Plain" (McCawley 1996, 24; cf Kroeber 1925; Johnston 1962, 1-2; Bean and Smith 1978; LaLone 1980). The Tribal territory also included the Sea of Kizh with its four islands: Santa Catalina, San Nicolas, San Clemente, and Santa Barbara (McCawley 1996, 75-87; cf. Johnston 1962, 112-113; Bean and Smith 1978, 538). Within the Tribal territory our ancestors created a remarkable and beautiful culture in an outstanding environment. Our homeland was life-sustaining and beautiful to all who looked upon it, from the diving dolphins and breaching great whales who circled Pimu'na (Catalina Island), to the deer, big horn sheep, and grizzly bears who roamed our hills and mountains. It was a marvelous world filled with wonders. We strive today to preserve what precious little of it remains within the vast urban sprawls of the greater Los Angeles basin area. Thus, we are committed to the preservation of the Burro Flats site (CA-VEN 1072) and our other sacred sites located on the present property of the Santa Susana Field Laboratory (Teutimes, Salas, Swindall-Martinez and Stickel 2013).

Our people lived in villages comprised of a number of thatched-roofed domiciles, called a Kizh (pronounced Keech) (McCawley 1996, 10). A Chief led the village residents in their daily activities. Because we had a hunting-gathering culture, the tasks were divided as follows; the men hunted large game such as deer, small game like rabbits, sea mammals, and fished the pacific ocean. The women collected plant foods such as chia and acorns, that provided a sustained subsistence system (McCawley 1996, 118-123, 128-131; Teutimes 2013). Our people ranged far and wide throughout our occupied lands, from the mountains to the valleys, and we traveled to and from our channel islands in planked boats, called Ti'ats (Te'aat, McCawley 1996, 128) that, along with the similar

Chumash boats (Tomols), were unique in the Americas. We traded between the islands and the mainland and our trade network extended far to the east. For example, our abalone and other shell pieces were utilized and prized as jewelry by other cultures such as the Hopi and other Pueblo Indians (Keoke and Porterfield 2005, 50).

Our social organization was as follows; the administrative leader of each village was a Chief who was from an elite lineage or class. We also had a middle class of boat captains and similar status individuals and a third class of everyone else. When our ancestors married, the couples came from nearly equal social rank but from different lineages (i.e. lineage exogamy). After the woman was married, the wife would reside at her husband's home in his village (i.e. patrilocal residence). When married couples had children, they were treated in an exceptional way:

> *Children were treated with such love, devotion and fondness by their parents that the Spanish missionaries were astonished and commented that the children were treated like 'little idols' (Johnston 1962; Bean and Smith 1978, 545).*

We had an exceptional belief system which we call today the Yovaar Religion. The Yovaar was a large circular enclosure within which we would worship. Our religion was a sacred belief system that provided us with a bond between ourselves and the Spirit world, a bond between us and our natural world, a bond between our different communities (villages), and a bond between our peoples and other peoples. The bonds were sustaining and long lasting. We worshiped a Great Spirit - a principal Creator God, named "Quaoar" the giver of life, and recognized another manifestation of the Creator named Chingichngish (Bean and Smith 1978, 548; McCawley 1996, 144). Other supernaturals that were recognized were Tamet (Sun Father also called Ta' a met) and Chukit (Earth Mother). Each village had one or more spiritual leaders or Shamans who conducted all religious ceremonies and events. Our most famous shaman was a young woman named Toypurina. She is unique in American History as she is the only Native American woman to have led a revolt. We published an acclaimed book about her entitled *Toypurina: the Joan of Arc of California* (Teutimes, Salas, Swindall-Martinez and Stickel 2013). "The Gabrielino Shaman possessed an extensive knowledge of Astronomy and Cosmology which he used to predict the future and to schedule the proper dates on which to celebrate religious festivals" (McCawley 1996, 100). A major sacred site of our people is called Burro Flats which has both a Winter and Summer Solstice Monument within the Santa Susana Field Laboratory property (Krupp 1983).

Altogether our culture was outstanding and has been acknowledged by renowned anthropologists and scholars:

> The Gabrielino…seem to have been the most advanced group south of Tehachapi, except perhaps the Chumash. They certainly were the wealthiest and most thoughtful of all the Shoshoneans of the State, and dominated these civilizationally wherever contacts occurred (Kroeber 1925, 621).

A similar opinion was expressed by authors Lowell Bean and Charles Smith in their important article on us in the volume "California" published as part of the landmark twenty volume series on the American Indian by our National Museum, the Smithsonian Institution. They have said of us:

> The Gabrielino (Gabrieleno) are, in many ways, one of the most interesting - yet least known of Native California peoples. At the time of Spanish contact in 1769, they occupied the most richly endowed coastal section in southern California…With the possible exception of the Chumash, the Gabrielino were the wealthiest, most populous, and most powerful ethnic nationality in aboriginal southern California…(Bean and Smith 1978, 538).

And more recently William McCawley, in his most comprehensive book on us to date entitled *The First Angelinos: the Gabrielino Indians of Los Angeles* (1996), has said of us:

> …the Gabrielino are revealed by the ethnographic and the ethnohistorical records as a people of material wealth and cultural sophistication…They maintained a maritime trade network…The prestige and political strength of the Gabrielino were enhanced by impressive achievement in pre-industrial technology and economics as well as religion and oral literature (McCawley 1996, 3).

Project Area Connections

The Santa Susana Field Laboratory area is located in the Simi Hills west of the San Fernando Valley. This area was the borderlands between our Kizh/Gabrieleno People and the Chumash People. The most prominent archaeological site known on the property is known as the Burro Flats (State of California site number: CA-VEN-1072). The former Curator of Archaeology for the Los Angeles Natural History Museum, Charles Rozaire, published the site in 1959. The site was first formally investigated and reported upon for the U.S. Government in 1973 by Professor Frank Fenenga who was assisted by our present Tribal Archeologist Dr. Gary Stickel, both of whom were on the faculty of California State University, Long Beach, at the time. In addition to the solstice monuments at the site mentioned in the previous section, the site is remarkable for its main rock shelter which has a large panel of striking pictographs (i.e. cave paintings). A landmark book entitled, *The Rock Paintings of the Chumash* was published by Campbell Grant in 1965. It discussed the many pictograph and petroglyph sites throughout the Chumash territory. Campbell Grant was not a professional Anthropologist or Archaeologist, but an inspired artist. In his book, he mistakenly included the Burro Flats site as a Chumash pictograph site. However, his only comment on the site was that "There are many unusual elements here - the two comets in the upper right, figures with "rake" hands and feet, and people with feathered headdresses at right" (Campbell 1965, Plate 25). The reason those designs were "unusual" to him is that they were not Chumash but Kizh/Gabrieleno in origin. The evidence for that interpretation is presented in an article by Bob Edberg (1985, 65-92). Although he tries to consider the ethnography of the Chumash to interpret the paintings, he states: "Therefore I have, of necessity, sought out corresponding ethnographic information from such groups as the southern Gabrielino, Luiseno, Kitanemuk, and Yokuts (Edberg 1985, 70). Consequently, he interprets the five concentric circles motif involved with the Winter Solstice as representing the "Five Worlds of the Universe" as possibly relating to the mythologies of the Chumash and Gabrielino (Teutimes, Salas, Martinez and Stickel 2013, 16-19). In addition, the two comet motifs he says are Gabrieleno which are supported by the two tall stalk-like designs which he properly interprets as "Kutu-mit poles (monuments) of the Gabrielino mourning ceremony" (Edberg 1985, 75). Further emphasizing the Gabrieleno connection to the site, Edberg mentions "There are other pole motifs in the main panel which may depict poles other than Kutu-mit poles, but also used by the Gabrielino" (Edberg 1985, 84). Edberg also mentioned "centipede motifs", but he was uncertain about their possible meaning. Edberg was apparently unaware that there was a great centipede that was one of the "avengers" of Chingichngish who would punish the Gabrielenos who were not faithful to his laws (Harrington 1933, 129-135; McCawley 1996, 146). Therefore, since Edberg ascribes most of his identified images at Burro Flats to the Gabrieleno, the weight of the evidence supports the interpretation that the site belongs to our people.

There is an oral legend of our people with another strong connection to a recorded archeological site on the Santa Susana Field Laboratory property. This is the Kizh/Gabrieleno legend of Sparrow Hawk and his wife which is similar to the Greek legend of Orpheus and Euridice. An excerpted version is as follows:

> Koo-neet's (Sparrow Hawk's) beloved wife died. They burned the girl's body on a pyre. As the corpse was consumed by the flames, Sparrow Hawk noticed a small whirlwind of ashes swirl and move away. Sparrow Hawk knew that this was the spirit of his departed wife, so he followed it across the sea to the land of the dead. Sparrow Hawk cried out in sorrow. The girl took pity on her grieving husband and agreed to return to him to the land of the living if he agreed to hold a ceremony when they arrived back home. She explained that the ceremony must last for nine days, and while it's being celebrated he must not touch her (have sex) or she would leave him forever. Sparrow Hawk promised to follow all of her instructions. For eight nights he kept his word, but finally on the last night he could not restrain himself any longer. He took hold of her to make love. Suddenly she turned and barked at him in anger "What do you want with me?" she demanded, "Is this what you want?", she then pulled out her vulva and flung it at him. The organ struck a rock and imprinted itself on a stone. The woman disappeared forever, but her genital remained imprinted in the stone in the hills above Chatsworth. (Harrington 1986, R106 F233-240; McCawley 1996, 178).

We believe that legendary site may well be the site on the subject property that Dr. Ray Corbett identifies as "a vulva-form site" known as CA-VEN-1476. These professional anthropological accounts of our ancestor's sites are corroborated by our oral history.

The Santa Susana Field Laboratory area as well as the adjacent San Fernando Valley were part of our Tribe's territory (its NW region; see Figure 9–5). The first overview of all the Indian Tribes of California was entitled, *Handbook of the Indians of California*. That landmark book was published by the renowned Anthropologist A.L. Kroeber in 1925 by the United States Government's Bureau of American Ethnology. Kroeber noted the terms Gabrielino and "Fernandeno" were Spanish terms for the Indians associated with those missions (Missions San Gabriel and San Fernando). Kroeber understood that the two names referred to one Native culture: "…there is no known point in which the two groups differed in customs. It will be best, therefore, to treat them as a unit…" (Kroeber 1925, 620). Anthropologists have noted that there were dialect differences within the overall Gabrieleno language: "The Gabrielino had four different dialects; Gabrielino, Fernandeno, Santa Catalina Island language, and San Nicolas Island language" (Harrington *in* Johnston 1962, viii). The first book exclusively about our Tribe, entitled *California's Gabrielino Indians* by Bernice Eastman Johnston, was published in 1962. On her map entitled, "The Gabrielino Indians at the time of the Portola Expedition," she indicates the villages of "Totogna", "Pasekngna", and "Kawengna." Note that our village of Pasheekwnga was located at San Fernando Mission, and that Kawengna is better known by the spelling, Cahuenga (as in Cahuenga Blvd.). Also, just to the northwest of the valley was our village of Tujungna, which survives as the city of Tujunga today (See Appendix 1-1 for a copy of the Johnston map).

In 1978 a significant article was published by Lowell Bean and Charles Smith that was entitled "Gabrielino". It was included in one of the twenty volumes published by our National Museum, the Smithsonian Institution, in the volume entitled *California* (which covered all the tribes in the state). In this publication they describe the territory of our people which includes the San Fernando Valley and Santa Susana Field Laboratory area (see Appendix 1-2 for a copy of the Bean & Smith 1978 map).

The most recent comprehensive book regarding our culture was entitled, *The First Angelinos - The Gabrielino Indians of Los Angeles* by William McCawley (1996). In it he says the following, "The western region of the San Fernando Valley is rich in Gabrielino heritage" (McCawley 1996, 35). McCawley presented on overall map of the Gabrieleno territory (p. 22; see Appendix 1-3). McCawley also presented a "map 5" entitled "Gabrielino communities located within the San Fernando Valley" (see Appendix 1-4). On that map he has eleven villages noted including "Burro Flats" (McCawley 1996, 36; see Figure 1 and Appendix 1-4 for a copy of McCawley's map). The above quoted books are major authoritative academic sources whose information can be trusted. For example, Kroeber conducted his ethnographic research for his book in the early years of the 20th century when he had access to very knowledgeable Gabrielino informants who knew the truth of the matters of which they spoke. A contemporary of Kroeber was J.P. Harrington whose outstanding and extensive notes on the Chumash as well as the 8,000 + pages he wrote on our people are considered accurate and authoritative by both Tribes. Mr. Harrington interviewed our Chief Ernest P. Salas' great aunt Feliciana Perez, Great uncle Juan Perez, and cousin Felicita Montana as well as other elders of our tribal community. Accurate information was obtained from all of them which supports this narrative (cf. Harrington and Perez 1920-1930). Such information has been used in studies of the locations of the local Indian Tribes of the area (e.g. King 1975; see Appendix 1-5 for King's map of the tribal border area between the Gabrieleno and the Chumash).

Regarding Harrington, it is important to note that at the United States National Archives, where the original Harrington notes are housed, there is no reference to the alleged "Fernandeno" tribal area. The only reference to the area in question is listed exclusively as "Gabrielino"

Our Ancestors' village names (such as Cahuenga, Tujunga, and Passenga [aka Pasheekwnga]) had a suffix of -nga. The "-nga" suffix, in our language, meant "the place of" (Johnston 1962, 9). For example, the village of Topanga, located in Topanga Canyon near the pacific ocean, meant "…the place where mountains run out into the sea" (Johnston 1962, 10). It should also be noted that when the suffix "-bit" is used (e.g. Jucjauybit), it does not refer to a village, but rather the suffix "-bit, -pet, or vit" means that a person derives from a given village (Johnston 1962, 10). That is, if a Kizh/Gabrieleno said "Cahuengabit", it meant that he or she was saying, "I am from the village of Cahuenga".

The above information should indicate to the United States government, to the Boeing Company, and to all other objective parties, that the Santa Susana Field Laboratory area was the borderlands between the Kizh/Gabrieleno Tribe and the Chumash Tribe and we thereby maintain our tribal right to preserve and protect our sacred sites such as the Burro Flats site (CA-VEN-1072) in perpetuity.

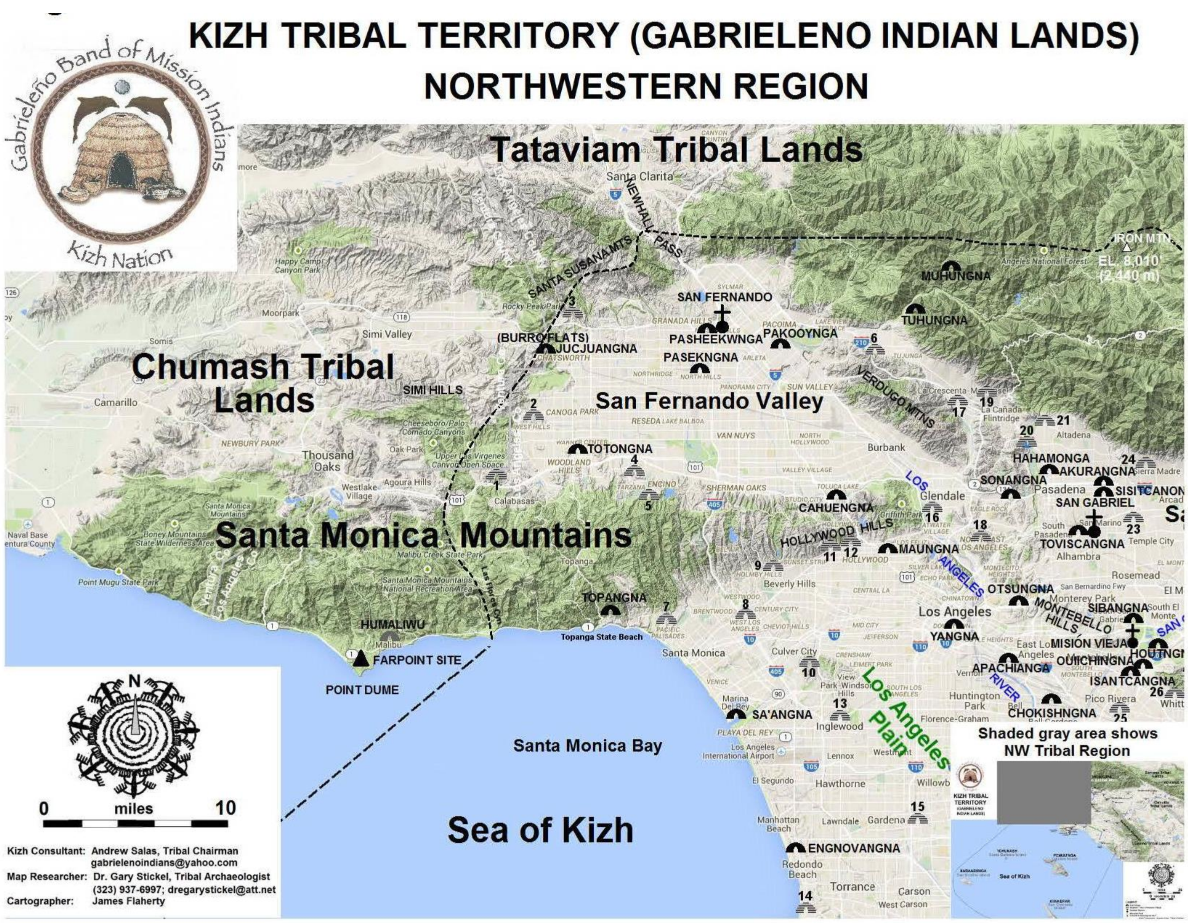
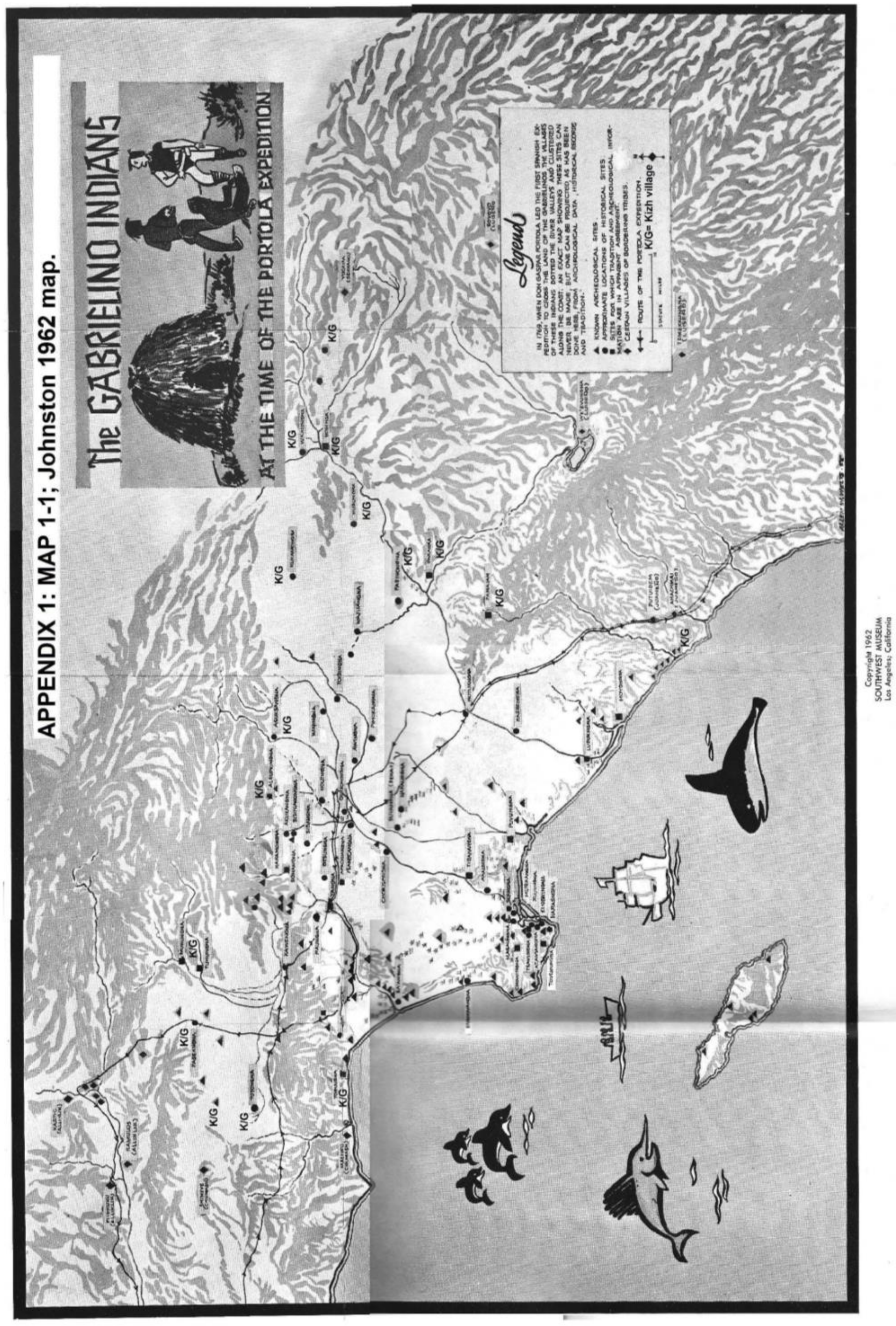


Figure 9–5 Kizh Tribal Territory (Gabrieleno Indian Lands) Northwestern Region

Appendix 1: Supplemental Material for the Kizh/Gabrieleno


APPENDIX 1: MAP 1-1; Johnston 1962 map.
The GABRIELINO INDIANS
AT THE TIME OF THE PORTOLA EXPEDITION
Legend
K/G= Kizh village
Copyright 1962
SOUTHWEST MUSEUM
Los Angeles, California

APPENDIX 1: Map 1-2; Bean and Smith 1978 map.

Gabrielino

LOWELL JOHN BEAN AND CHARLES R. SMITH

The Gabrielino (gäbrēəlˈēnō) are, in many ways, one of the most interesting—yet least known—of native California peoples. At the time of Spanish contact in 1769 they occupied the "most richly endowed coastal section in southern California" (Blackburn 1962–1963:6), which is most of present-day Los Angeles and Orange counties, plus several offshore islands (San Clemente, Santa Catalina, San Nicolas). With the possible exception of the Chumash, the Gabrielino were the wealthiest, most populous, and most powerful ethnic nationality in aboriginal southern California, their influence spreading as far north as the San Joaquin valley Yokuts, as far east as the Colorado River, and south into Baja California. Unfortunately, most if not all Gabrielinos were dead long before systematic ethnographic studies were instituted; and, as a result, knowledge of them and their lifeways is meager.

Language, Territory, and Environment

Gabrielino was one of the Cupan languages in the Takic family, which is part of the Uto-Aztecan linguistic stock (Bright 1975).* Internal linguistic differences existed, Harrington (1962:viii) suggesting four dialects and Kroeber (1925), six. Harrington's four-part division includes: Gabrielino proper, spoken mainly in the Los Angeles basin area; Fernandeño, spoken by people north of the Los Angeles basin, mainly in the San Fernando valley region; Santa Catalina Island dialect; and San Nicolas Island dialect—although according to Bright (1975) insufficient data exist to be sure of the Cupan affiliation of the San Nicolas speech. There were probably dialectical differences also between many mainland villages, a result not only of geographical separation but also of social, cultural, and linguistic mixing with neighboring non-Gabrielino speakers.

The names Gabrielino and Fernandeño (fernänˈdā-ˌnyō) refer to the two major Spanish missions established in Gabrielino territory—San Gabriel and San Fernando. It was to these two missions that the majority of the Indians living on the coastal plains and valleys of southern California were removed.

Although the major outlines of Gabrielino territorial occupation are known, the fixing of definitive boundaries is difficult. Generally, Gabrielino territory included the watersheds of the Los Angeles, San Gabriel, and Santa Ana rivers, several smaller intermittent streams in the Santa Monica and Santa Ana mountains, all of the Los Angeles basin, the coast from Aliso Creek in the south to Topanga Creek in the north, and the islands of San Clemente, San Nicolas, and Santa Catalina (fig. 1). The area thus bounded encompassed several biotic zones (such as Coast-Marsh, Coastal Strand, Prairie, Chaparral, Oak Woodland, Pine) and, following Hudson's (1971) studies, can be divided into four macro-environmental zones (excluding the islands): Interior Mountains/Adjacent Foothills, Prairie, Exposed Coast, and Sheltered Coast. Each area is characterized by a particular floral-faunal-geographical relationship that allows delineation of subsistence-settlement patterns "according to the macro-environmental setting." The interior mountains and foothills, according to Hudson, comprise an area of numerous resources including "many small animals, deer, acorns, sage, piñon nuts, and a variety of other plants and animal foods." Settlement-pattern studies

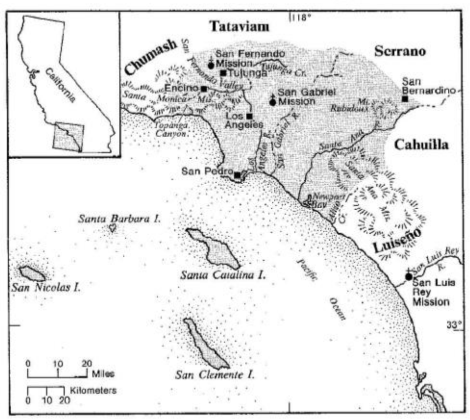


Fig. 1. Tribal territory.

* Italicized Gabrielino words have been written in a phonemic alphabet by Kenneth C. Hill, on the basis of John Peabody Harrington's unpublished field notes. The consonants are: (stops and affricate) *p, t, ç, k, kʷ, ʔ*; (fricatives) *s, ṣ, x, h*; (nasals) *m, n, ŋ*; (approximants) *v, ð, r, ṛ, w*. Stressed vowels are *i, e* [ɛ], *a, o* [ɔ], *u*, which may occur long or short; in unstressed syllables the vowels are only *i* [e], *a*, and *u* [o].

APPENDIX 1: Map 1-2; Bean and Smith 1978 map.

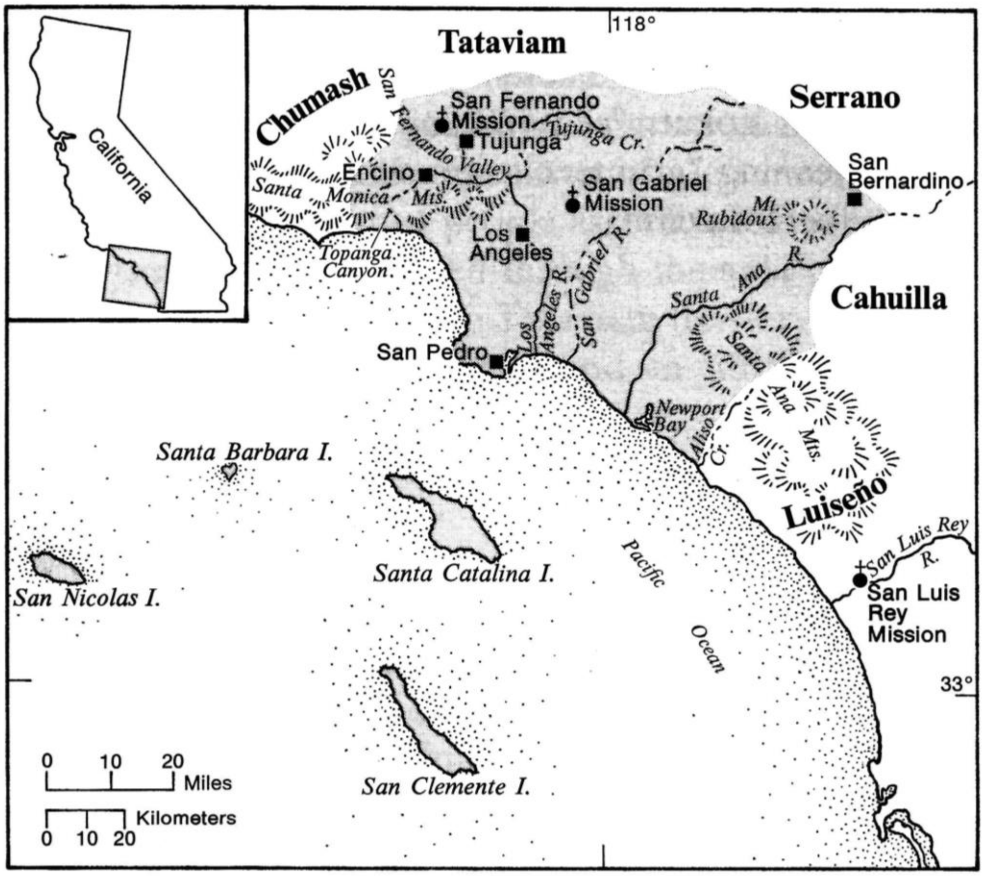
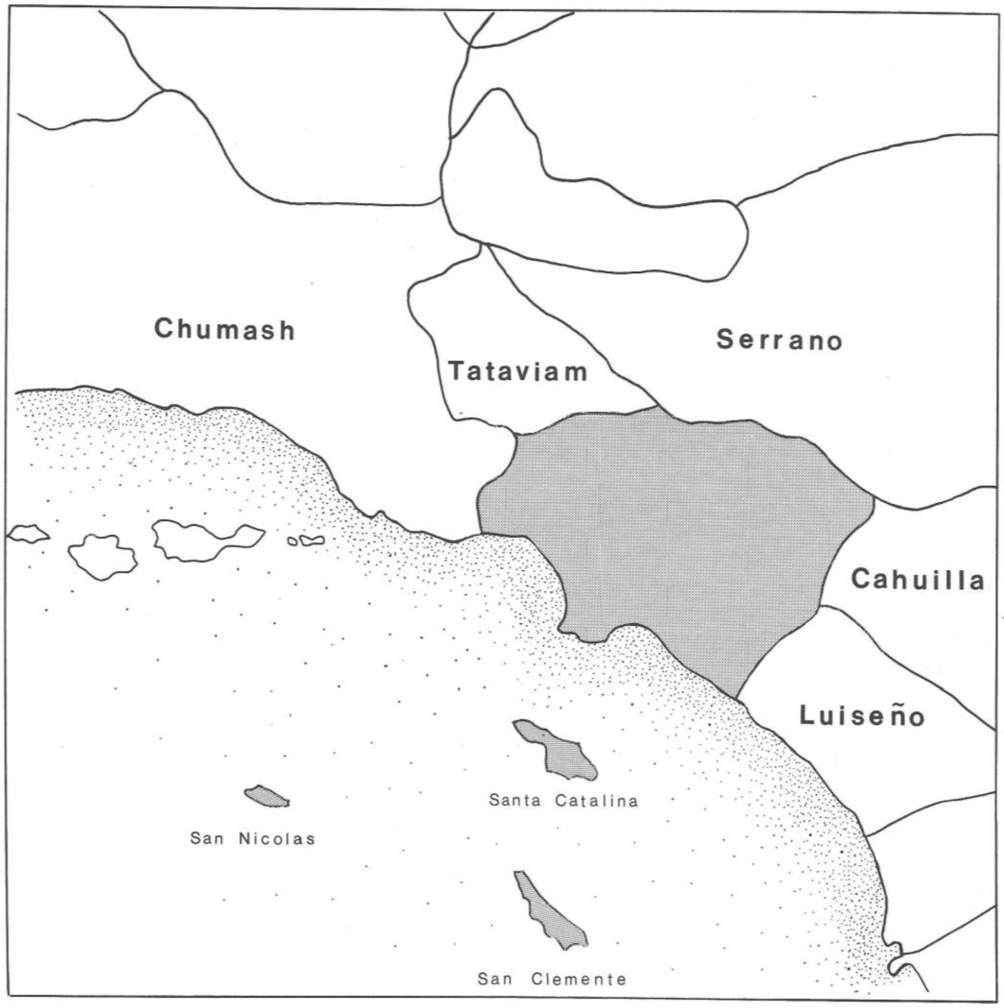


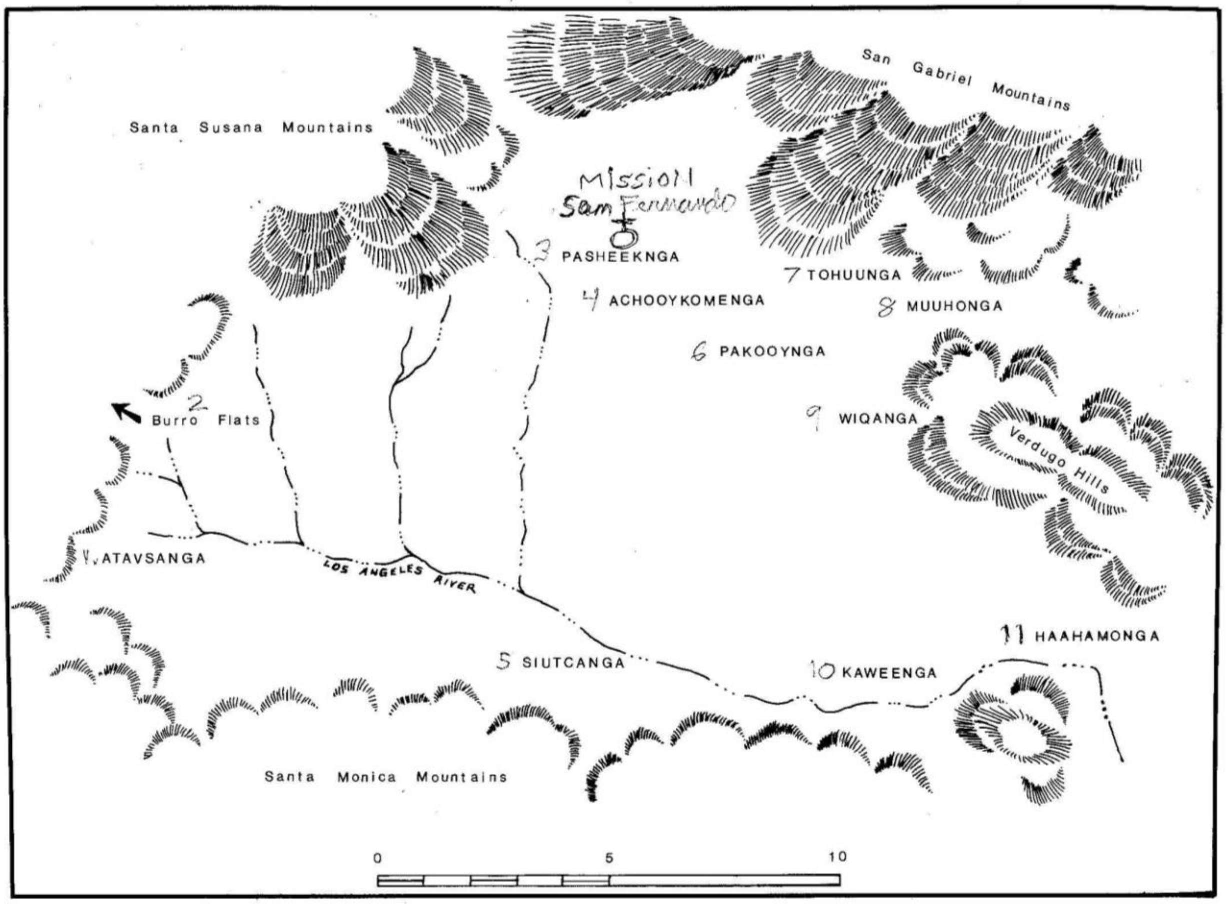
Fig. 1. Tribal territory.

APPENDIX 1: Map 1-3; McCawley 1996 map.



Map 2. The Gabrielino territory (shaded) and neighboring Indian groups. Tiny Santa Barbara Island (which lies west of Santa Catalina and northeast of San Nicolas) is not shown; the Gabrielino visited Santa Barbara Island but did not occupy the island.

APPENDIX 1: Map 1-4; McCawley 1996 map.



Map 5. Gabrielino communities located within the San Fernando Valley. The scale on this and the following maps is in statute miles.

APPENDIX 1: Map 1-5; King 1975 map.

Map source:
King, Chester
1975 The Names and Locations of Historic Chumash Villages. IN *The Journal of California Anthropology*, Vol. 2, Issue 2, pp. 171-179.

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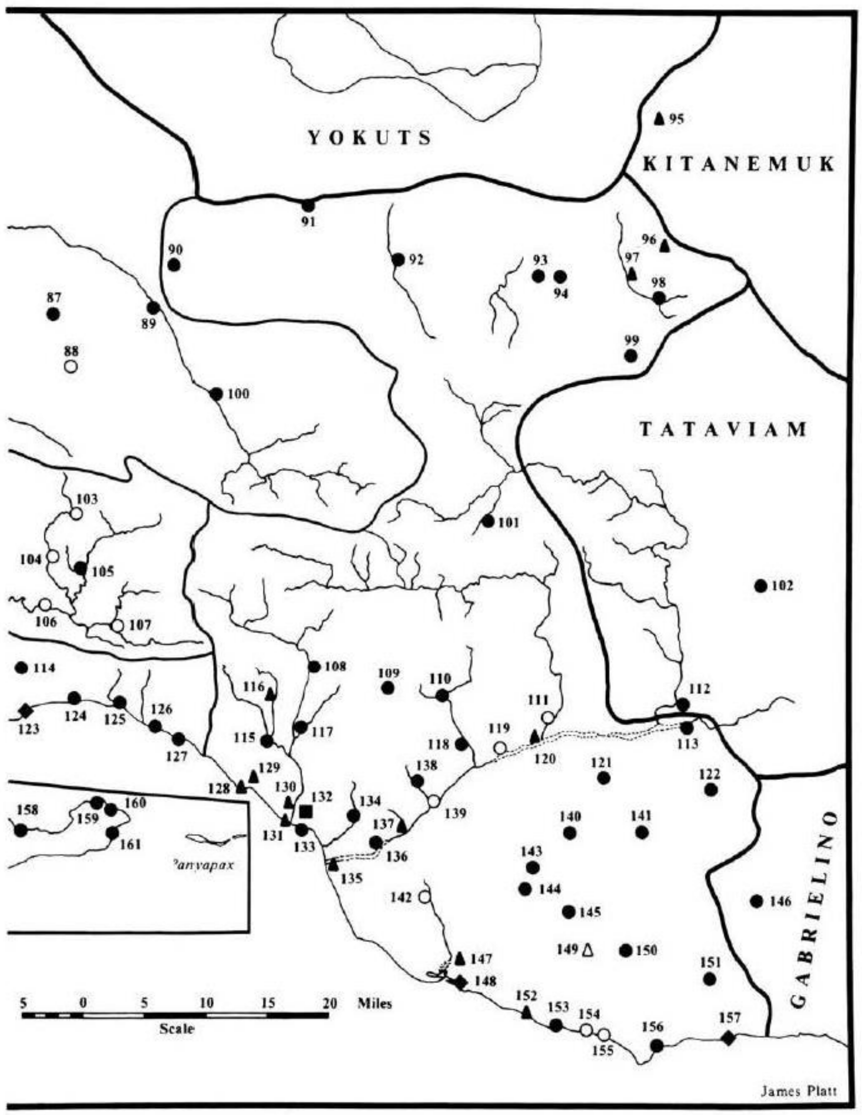


122 - Ta'apu; 146 - Huwam; 157 - Humaliwo

References

Bean, L. J., and C. R. Smith, 1978, Gabrielino. In *California*, edited by Robert F. Heizer. Handbook of North American Indians, Smithsonian Institution, Washington DC, pp. 538-549.

Edberg, B., 1985, Shamans and Chiefs: Visions of the Future. In Earth and Sky: *Papers from the Northridge Conference on Archaeoastronomy, edited by A. Benson and T. Hoskinson*. Slo'w Press, Thousand Oaks, pp. 65-92.

Grant, C., 1965, *The Rock Paintings of the Chumash: A Study of a California Indian Culture*. University of California Press, Berkeley.

Harrington, J. P., 1933, *Annotations. In Chinigchinich: A Revised and Annotated Version of Alfred Robinson's Translation of Father Geronimo Boscana*. Fine Arts Press, Santa Ana.

Harrington, J. P., 1986, John Harrington Papers, Volume 3: Southern California/Basin. Smithsonian Institution, National Anthropological Archives, Washington, DC

Johnston, B. E., 1962, *California's Gabrielino Indians*. Southwest Museum, Los Angeles.

Keoke, E. D. and K. M. Porterfield, 2005, *American Indian Contributions to the World*. Chelsea House, New York.

King, C., 1975, The Names and Locations of Historic Chumash Villages. In *The Journal of California Anthropology*, Vol. 2, Issue 2, pp. 171-179.

Kroeber, A. L., 1925, *Handbook of the Indians of California*. Bureau of American Ethnology, Bulletin 78, Smithsonian Institution, Washington, DC.

Krupp, E. C., 1983, Echoes of the Ancient Skies: The Astronomy of Lost Civilizations. . Harper and Row, New York.

LaLone, M., 1980, Gabrielino Indians of Southern California: An Annotated Ethnohistoric Bibliography. *University of California Institute of Archaeology Occasional Paper 6*, Los Angeles. National Anthropological Archives 2015 Personal Communication.

McCawley, W., 1996, The First Angelinos: The Gabrielino Indians of Los Angeles. Ballena Press.

Harrington, J. P. and F. Perez, 1920-1930, Personal communication between J. P. Harrington and F. Perez, J. Perez and F. Montana 1920 to 1930, Field notes housed at the National Anthropological Archives. Accessed 2015.

Teutimes, M., 2013, A Compendium of Gabrieleno Indian Utilized Flora and Fauna. http://gabrielenoindians.org.

Teutimes, E. S., A. Salas, C. Swindall-Martinez and G. Stickel, 2013, *Toypurina: the Joan of Arc of California*. Kizh Tribal Press, San Gabriel, CA.

9.6 Tongva Ancestral Territorial Tribal Nation (TATTN)

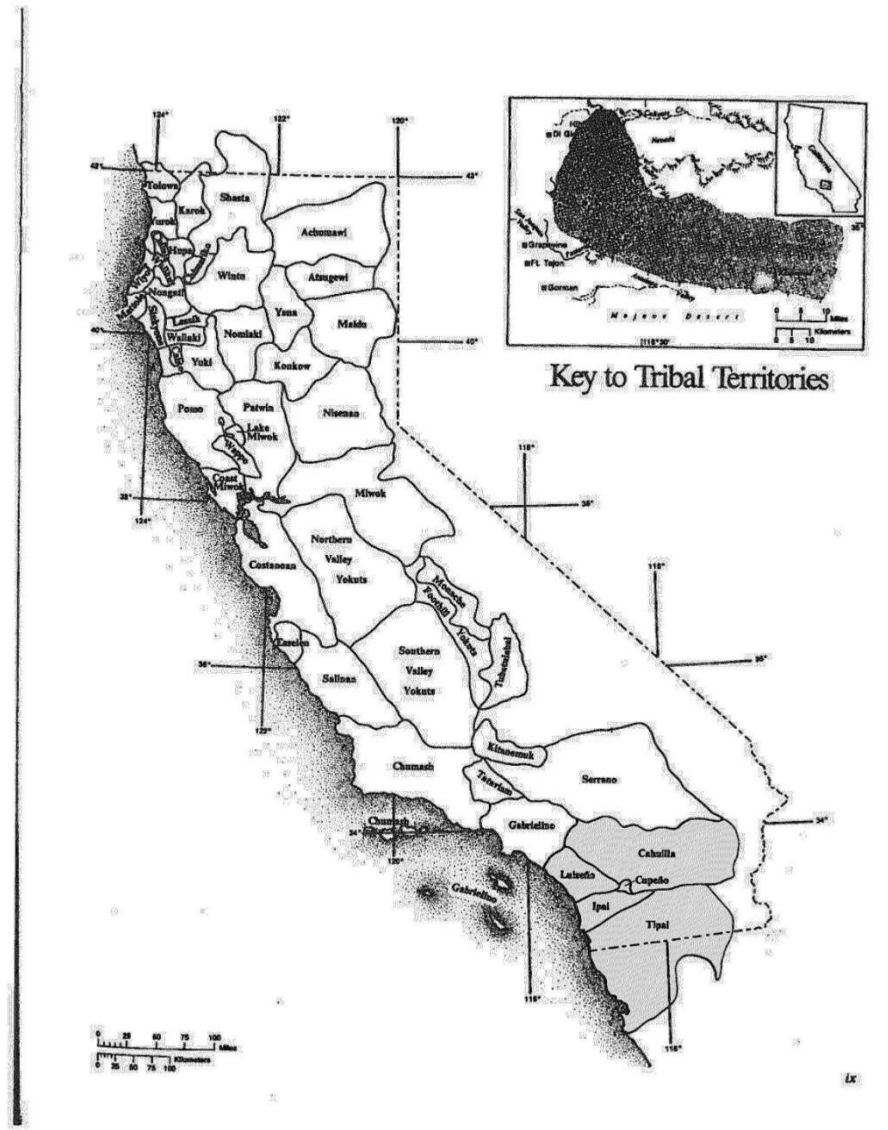
John Tommy Rosas

Material submitted by the Tongva Ancestral Territorial Tribal Nation (TATTN) representing their history and perspective has been included in the SSFL EIS Administrative Record. Documents that will found there consist of the following:

- Jones, T. L., 2008, Culture or Adaptation: Milling Stone Reconsidered. In *Avocados to Millingstone: Papers in Honor of D.L. True, e*dited by Georgie Waugh and Mark E. Basgall. Pages 137-153. *Monographs in California and Great Basin Anthropology* Number 5, November 2008.
- Corbett, R., R. B. Guttenberg, and A. Knight, 2012, Final Report, Cultural Resource Compliance and Monitoring Results for USEPA'S Radiological Study of the Santa Susana Field Laboratory Area IV and Northern Buffer Zone, Ventury County, California. Prepared by John Minch and Associates, Mission Viejo, CA for HydroGeoLogic, Inc., Calabasas. December.
- Early California Population Project Database – Basic Search. N.d. Early California Population Project, Huntington Library (http://www.huntington.org/Information/ECPPmain.htm).
- Hale, J, P., 2010, Rock Art in the Public Trust: Managing Prehistoric Rock Art on Federal Land. A Dissertation submitted in partial satisfaction of the requirements for the degree of Doctor of Philosophy in History. University of California Riverside, UC Riverside Electronic Theses and Dissertations (https://escholarship.org/uc/item/6042z0fk).
- Martz, P. C., 2003, Prehistoric Settlement and Subsistence on San Nicolas Island. Proceedings of the sixth California Islands Symposium. pp 65-82.
- Kerr, S. L. and G. M. Hawley, Population Replacement on the Southern Channel Islands: New Evidence from San Nicolas Island. *Proceedings of the Fifth California Islands Symposium* (Santa Barbara, CA: Santa Barbara Museum of Natural History): pp 546–554.
- Vellanoweth, R. L., A. F. Ainis, J. M. Erlandson, and L. D. Thomas-Barnett, 2014, An Olivella Grooved Rectangle Bead Cluster from San Nicolas Island, California. Journal of California and Great Basin Anthropology, Vol. 34, No. 2; pp. 229–246.
- Gamble, L. H, 2002, Archaeological Evidence for the Origin of the Plank Canoe in North America. Lynn H. Gamble. American Antiquity, Vol 67, No 2, 2002, pp 301-315.
- King, C., 2011, Overview of the History of American Indians in the Santa Monica Mountains. Geology and soils by Jeff Parsons. Prepared by Topanga Anthropological Consultants. Prepared for the National Park Service Pacific West Region, Santa Monica Mountains National Recreation Area.
- Surface current patterns off southern California (map) from Kerr, S. L. and G. M. Hawley. Population Replacement on the Southern Channel Islands: New Evidence from San Nicolas Island. *Proceedings of the Fifth California Islands Symposium* (Santa Barbara, CA: Santa Barbara Museum of Natural History): pp 546–554

- Johnson, J. R., 2006, Ethnohistoric Overview for the Santa Susana Pass State Historic Park Cultural Resources Inventory Project. June. Prepared for Southern Service Center, State of California Department of Parks and Recreation. In fulfillment of Agreement for Services No. A05E0023, Ethnographic Study Services.
- Map. Key to Tribal Territories. From Smithsonian Institution. 1978. Key to Tribal Territories. In California, Volume 8. *Handbook of the North American Indians,* Robert F. Heizer, Volume Editor, pp. 509-519. Smithsonian Institution, Washington DC. Also available at http://www.bia.gov/cs/groups/xasia/documents/text/idc-020878.pdf, accessed 7/1/2015.
- Map. Surface current patterns off southern California. From: Kerr, Susan L. and Georganna M. Hawley. 2002 Population Replacement on the Southern Channel Islands: New Evidence from San Nicolas Island. Proceedings of the Fifth California Islands Symposium (Santa Barbara, CA: Santa Barbara Museum of Natural History): pp 546–554.
- Map. Map of Tongva territory showing ethnographic villages and Momonga (red dot). Based on Bean, Lowell John, and Charles R. Smith, 1978, Gabrielino. In *California*, edited by Robert F. Heizer. In *Handbook of North American Indians,* Smithsonian Institution, Washington DC, Volume 8, pp. 538-549.
- Map. Map from TATTN illustrating Tongva territory. Based on Google Earth Pro image. John Tommy Rosas 2015.
- Map. Map from TATTN illustrating Tongva territory, including indigenous sea rights. Based on Google Earth Pro image. John Tommy Rosas (2015).
- Depiction of Tongva Territory. Original map source unknown.

Figures 9–6 through 9–11, below, extracted from the material provided by the TATTN and presented in the AR, are various maps related to the historical extent of Tongva territories.



SMITHSONIAN HANDBOOK OF NORTH AMERICAN INDIANS MAPS DEPICTING KITANEMUK TERRITORY. MAIN MAP IS FOUND AT IX, INSET MAP IS FOUND AT 564.

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Figure 9–6 Key to Tribal Territories

From Smithsonian Institution. 1978. Key to Tribal Territories. In California, Volume 8. *Handbook of the North American Indians,* Robert F. Heizer, Volume Editor, pp. 509-519. Smithsonian Institution, Washington DC. Also available at http://www.bia.gov/cs/groups/xasia/documents/text/idc-020878.pdf, accessed 7/1/2015.

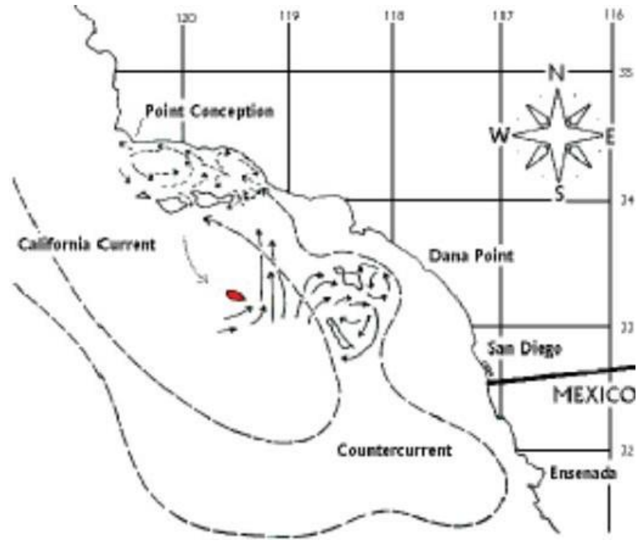

Figure 9–7 Surface current patterns off southern California

From: Kerr, Susan L. and Georganna M. Hawley. 2002 Population Replacement on the Southern Channel Islands: New Evidence from San Nicolas Island. *Proceedings of the Fifth California Islands Symposium* (Santa Barbara, CA: Santa Barbara Museum of Natural History): pp 546–554.

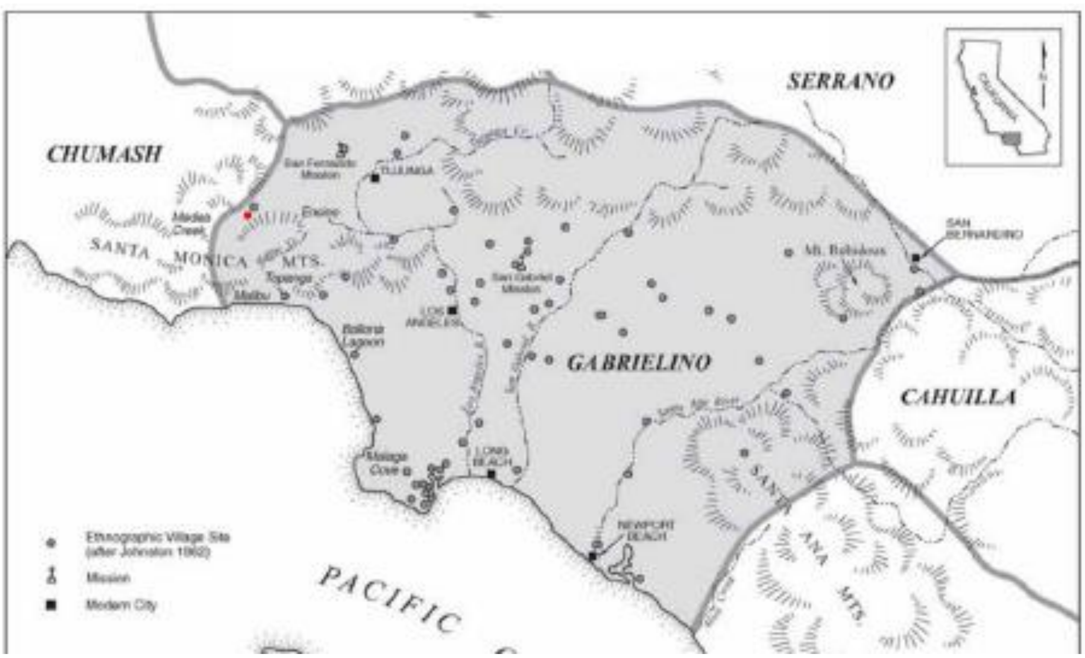

Figure 9–8 Map of Tongva territory showing ethnographic villages and Momonga (red dot)

Based on Bean, Lowell John, and Charles R. Smith, 1978, Gabrielino. In *California*, edited by Robert F. Heizer. In *Handbook of North American Indians,* Smithsonian Institution, Washington DC, Volume 8, pp. 538-549.

Figure 9–9 Map from TATTN illustrating Tongva territory

Based on Google Earth Pro image. John Tommy Rosas 2015.

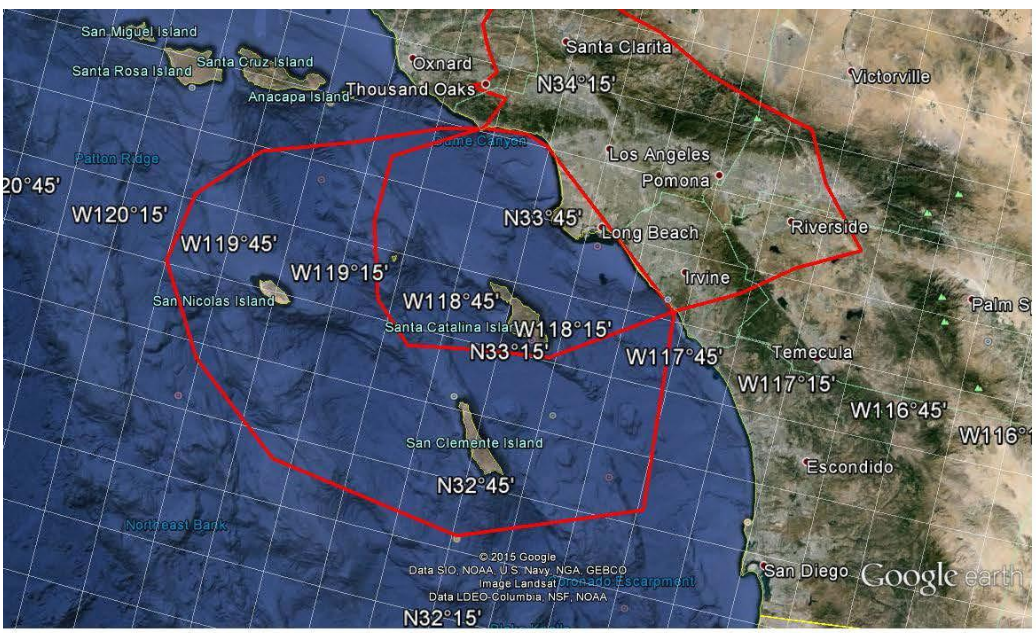

Figure 9–10 Map from TATTN illustrating Tongva territory, including indigenous sea rights

Based on Google Earth Pro image. John Tommy Rosas (2015).

Figure 9–11 Depiction of Tongva Territory. Original map source unknown.

Chapter 10
References

10.0 REFERENCES

ACHP (Advisory Council on Historic Preservation), 2008, *Consultation with Indian Tribes in the Section 106 Review Process: A Handbook*, Washington, DC (available at http://www.achp.gov/regs-tribes2008.pdf), November.

ACHP (Advisory Council on Historic Preservation), 2012a, *Traditional Cultural Landscapes in the Section 106 Review Process*, Washington, DC (available at http://www.achp.gov/na_culturallandscapes.html), March 19.

ACHP (Advisory Council on Historic Preservation), 2012b, *Native American Traditional Cultural Landscapes and the Section 106 Review Process: Questions and Answers*, Washington, DC (available at http://www.achp.gov/na_culturallandscapes.html), July 11.

Adams, L. S., 2009, Secretary for Environmental Protection, California Environmental Protection Agency, Letter to L. Jackson, Administrator, U.S. Environmental Protection Agency, February 24.

Applegate, R. B, 1974, "Chumash Placenames," *The Journal of California Anthropology* Vol. 1, No. 2, University of California Merced Library (available at http://escholarship.org/uc/item/3s34f5ss).

ARB (California Air Resources Board), 2013, *Ambient Air Quality Standards*, California Environmental Protection Agency (available at http://www.arb.ca.gov/research/aaqs/aaqs2.pdf).

ARB (California Air Resources Board), 2014a, *Area Designations Maps/State and National*, California Environmental Protection Agency (available at http://www.arb.ca.gov/desig/adm/adm.htm).

ARB (California Air Resources Board), 2014b, *Air Quality Data (PST) Query Tool*, California Environmental Protection Agency (available at http://www.arb.ca.gov/aqmis2/aqdselect.php).

ARB (California Air Resources Board), 2014c, *Mobile Source Emission Inventory – Categories - EMFAC2014*, California Environmental Protection Agency (available at http://www.arb.ca.gov/msei/categories.htm#emfac2014).

ARB (California Air Resources Board), 2015a, *California Air Basin Map*, California Environmental Protection Agency (accessed on July 10, 2015, http://www.arb.ca.gov/ei/maps/statemap/abmap.htm).

ARB (California Air Resources Board), 2015b, *Mobile Source Emission Inventory – Categories – Off-road Motor Vehicles – OFFROAD2011 Emissions Model*, California Environmental Protection Agency (available at http://www.arb.ca.gov/msei/categories.htm#offroad_motor_vehicles).

AREVA (AREVA NP Inc.), 2008, *Report of Radiological Characterization and Confirmatory Survey Results for the SNAP Environmental Test Facility – Building 4024*, Charlotte, North Carolina (available at http://www.etec.energy.gov/Library/Main/SETF_Char_Report_finalr_010908%20_2_.pdf), January.

ASTM (ASTM International), 2013, *Standard Guide for Greener Cleanups*, ASTM E2893-13e1, West Conshohocken, Pennsylvania, November.

ATSDR (Agency for Toxic Substances and Disease Registry), 1999, *Draft Preliminary Site Evaluation, Santa Susana Field Laboratory (SSFL), Ventura County, California*, CERCLIS No. CAD074103771, Agency for Toxic Substances and Disease Registry, Division of Health Assessment and Consultation, Atlanta, Georgia, December 3.

Baldwin, B. G., D. H. Goldman, D. J. Keil, R. Patterson, T. J. Rosatti, and D. H. Wilken, 2012, *The Jepson Manual: Vascular Plants of California*, Second Edition, University of California Press, Berkeley, California.

Barry, T. and J. Reagan, 1978, *FHWA Highway Traffic Noise Prediction Model*, Report No. FHWA-RD-77-108, U.S. Department of Transportation, Federal Highway Administration, December.

Bean, L. J. and C. R. Smith, 1978, "Gabrielino," *Handbook of North American Indians*, Vol. 8, *California*, R. F. Heizer, Ed., Smithsonian Institution, Washington, DC, pp. 538-549.

Birnbaum, C. A., 1994, "Protecting Cultural Landscapes: Planning, Treatment and Management of Historic Landscapes," *Preservation Briefs 36*, U.S. Department of the Interior, National Park Service, Cultural Resources, Preservation Assistance (available at http://www.nps.gov/tps/how-to-preserve/briefs/36-cultural-landscapes.htm), September.

Boeing (The Boeing Company), 1999, Memorandum from J. Shao, Radiation Safety, to P. Rutherford, "17th Street Drainage Area Radiation Characterization Surveys and Excavation," January 18.

Boeing (The Boeing Company), 2000, *Area 4020, MARSSIM Final Status Survey Report*, RS-00010, August 31.

Boeing (The Boeing Company), 2005, Fact sheet: *Boeing Santa Susana Field Laboratory Update The September 2005 Topanga Fir*e, Environmental Communications Office, November 8.

Boeing (The Boeing Company), 2007a, *Sodium Reactor Experiment (SRE) Accident*, Santa Susana Field Laboratory, Canoga Park, California, July 2.

Boeing (The Boeing Company), 2007b, *Site Environmental Report for Calendar Year 2006 DOE Operations at The Boeing Company Santa Susana Field Laboratory, Area IV*, Santa Susana Field Laboratory, Canoga Park, California, September.

Boeing (The Boeing Company), 2007c, *2006 Annual NPDES Discharge Monitoring Report*, Santa Susana Field Laboratory, Canoga Park, California (accessed on July 14, 2014, http://www.boeing.com/boeing/aboutus/environment/santa_susana/ents/monitoring_reports_archives.page), March 1.

Boeing (The Boeing Company), 2007d, *Radioactive Materials Handling Facility Current Radiological Status*, Santa Susana Field Laboratory, Canoga Park, California, March 16.

Boeing (The Boeing Company), 2007e, *FINAL Combined Summary Report: Radioactive Materials Handling Facility Building Surveys*, Santa Susana Field Laboratory, Canoga Park, California, October.

Boeing (The Boeing Company), 2008a, *Site Environmental Report for Calendar Year 2007 DOE Operations at The Boeing Company Santa Susana Field Laboratory, Area IV*, Santa Susana Field Laboratory, Canoga Park, California, September.

Boeing (The Boeing Company), 2008b, *Final Consensus Recommendation on a Site Specific Design Storm for Santa Susana Field Laboratory*, Boeing Santa Susana Field Laboratory Stormwater Expert Panel (accessed on June 2, 2015, http://www.boeing.com/assets/pdf/aboutus/environment/santa_susana/ents/ENTS_Expert_Panel_PublicMeeting_050108.pdf), April 30.

Boeing (The Boeing Company), 2008c, *2007 Annual NPDES Discharge Monitoring Report*, Santa Susana Field Laboratory, Canoga Park, California (accessed on July 14, 2014, http://www.boeing.com/boeing/aboutus/environment/santa_susana/ents/monitoring_reports_archives.page), February 28.

Boeing (The Boeing Company), 2009a, *2008 Annual NPDES Discharge Monitoring Report*, Santa Susana Field Laboratory, Canoga Park, California (accessed on July 14, 2014, http://www.boeing.com/boeing/aboutus/environment/santa_susana/ents/monitoring_reports.page), February 27.

Boeing (The Boeing Company), 2009b, *Site Environmental Report for Calendar Year 2008 DOE Operations at The Boeing Company Santa Susana Field Laboratory, Area IV*, Santa Susana Field Laboratory, Canoga Park, California, September.

Boeing (The Boeing Company), 2010a, *2009 Annual NPDES Discharge Monitoring Report*, Santa Susana Field Laboratory, Canoga Park, California (accessed on July 14, 2014, http://www.boeing.com/boeing/aboutus/environment/santa_susana/ents/monitoring_reports.page), February 26.

Boeing (The Boeing Company), 2010b, *Site Environmental Report for Calendar Year 2009 DOE Operations at The Boeing Company Santa Susana Field Laboratory, Area IV*, Santa Susana Field Laboratory, Canoga Park, California, September.

Boeing (The Boeing Company), 2011a, *2010 Annual NPDES Discharge Monitoring Report*, Santa Susana Field Laboratory, Canoga Park, California (accessed on July 14, 2014, http://www.boeing.com/boeing/aboutus/environment/santa_susana/ents/monitoring_reports.page), February 28.

Boeing (The Boeing Company), 2011b, *Site Environmental Report for Calendar Year 2010, DOE Operations at the Boeing Company Santa Susana Field Laboratory Area IV*, Santa Susana Field Laboratory, Canoga Park, California (accessed on July 14, 2014, http://www.etec.energy.gov/environmental_and_health/Documents/ASERS/ASER_2011.pdf), September.

Boeing (The Boeing Company), 2012a, *Site Environmental Report for Calendar Year 2011 DOE Operations at The Boeing Company Santa Susana Field Laboratory, Area IV*, Santa Susana Field Laboratory, Canoga Park, California, September.

Boeing (The Boeing Company), 2012b, *10 CFR 851 Compliance Plan*, Santa Susana Field Laboratory, Canoga Park, California, June 8.

Boeing (The Boeing Company), 2012c, *2011 Annual NPDES Discharge Monitoring Report*, Santa Susana Field Laboratory, Canoga Park, California (accessed on July 14, 2014, http://www.boeing.com/boeing/aboutus/environment/santa_susana/ents/monitoring_reports.page), February 27.

Boeing (The Boeing Company), 2013a, *2012 Annual NPDES Discharge Monitoring Report*, Santa Susana Field Laboratory, Canoga Park, California (accessed on July 14, 2014, http://www.boeing.com/boeing/aboutus/environment/santa_susana/ents/monitoring_reports.page), February 26.

Boeing (The Boeing Company), 2013b, *Site Environmental Report for Calendar Year 2012 DOE Operations at The Boeing Company Santa Susana Field Laboratory, Area IV*, Santa Susana Field Laboratory, Canoga Park, California, September.

Boeing (The Boeing Company), 2014a, *Santa Susana Surface Water Monitoring Locations* (accessed on July 14, 2014, http://www.boeing.com/boeing/aboutus/environment/santa_susana/monitoring_locations.page).

Boeing (The Boeing Company), 2014b, *2013 Annual NPDES Discharge Monitoring Report*, Ventura County, California (accessed on July 14, 2014, http://www.boeing.com/boeing/aboutus/environment/santa_susana/ents/monitoring_reports.page), February 26.

Boeing (The Boeing Company), 2014c, *Site Environmental Report for Calendar Year 2013 DOE Operations at the Boeing Company Santa Susana Field Laboratory, Area IV*, Santa Susana Field Laboratory, Canoga Park, California (available at http://www.etec.energy.gov/environmental_and_health/ASER.html), June.

Boeing (The Boeing Company), 2014d, Personal communication (email) from P. Rutherford, to T. Rucker, Leidos, Inc., "RE: Radioactivity Data," with attachments RMHF_B4022_vault 7 block D pre-fixative_732-A_2012-02-07.xlsx; RMHF_B4022_vault 7 Shield Blocks_732-A_2011-10-19.xlsx, December 11.

Boeing (The Boeing Company), 2015a, *Transportation Agreement for the Santa Susana Field Laboratory Ventura County, California Between the Boeing Company (Boeing) and the U.S. Government As Represented by the National Aeronautics and Space Administration (NASA) and the Department of Energy (DOE).*

Boeing (The Boeing Company), 2015b, Personal communication (email) from D. W. Dassler to J. Wondolleck, CDM Smith; A. J. Lenox, The Boeing Company; and J. Jones, and S. Jennings, U.S. Department of Energy, "Re: Boeing Buildings in Area IV," April 20.

Boeing (The Boeing Company), 2015c, Personal communication (email) from D. W. Dassler to C. Walsh, Cleanuprocketdyne.org, and A. J. Lenox and P. J. Costa, The Boeing Company, "Re: Cleanup standard for the Boeing portion of the site," September 2.

Boeing (The Boeing Company), 2015d, Personal communication (email) from A. J. Lenox to S. Jennings, U.S. Department of Energy, "Cumulative Analysis for our EIS," September 23.

Boeing (The Boeing Company), 2015e, Personal communication (email) from A. J. Lenox to S. Jennings, U.S. Department of Energy, "RE: Boeing's Project Paragraph for our cumulative discussion," November 11.

Boeing (The Boeing Company), 2015f, Personal communication (email) from D. W. Dassler to J. Wondolleck, CDM Smith, "Re: DOE EIS questions," June 11.

Boeing (The Boeing Company), 2016a, *Santa Susana Field Laboratory*, Santa Susana Backgrounder (accessed on January 7, 2016, http://www.boeing.com/resources/boeingdotcom/principles/environment/pdf/Santa_Susana_backgrounder.pdf).

Boeing (The Boeing Company), 2016b, Letter from S. L. Shestag, Director Environment, Santa Susana Site Executive, to S. Kuehl, Supervisor, Third District County of Los Angeles, M. Englander, Los Angeles City Councilman, and F. Pavley, Senator, 27th District Calabasas, "Re: Letter of December 14, 2015 from Supervisor Kuehl, Councilman Englander, and Senator Pavley to Barbara Lee, Director California Department of Toxic Substances Control," February 22.

Boeing and NASA (The Boeing Company and National Aeronautics and Space Administration), 2011, *Northern Drainage Restoration, Mitigation and Monitoring Plan*, Santa Susana Field Laboratory, Ventura, California (accessed on November 17, 2014, http://www.boeing.com/assets/pdf/aboutus/environment/santa_susana/water_quality/tech_reports/tech_rpts_11-10-05_ND_RMMP_Pt_1_Txt_Tbls_ Figs.pdf), October.

Bureau of Street Services, 2015, *2013-2014 Annual Pavement Preservation Program* (available at http://bss.lacity.org/Resurfacing/FundingSources.html).

Burgesser, T., 2015, Memorandum to K. Roberts and J. Wondolleck, *An Evaluation of Chemicals of Natural Origin on Reported Total Petroleum Hydrocarbon Concentrations at the Santa Susana Field Laboratory*, October 8.

CA EO (California Executive Order), 2015, Executive Order B-29-15, April 1.

California Department of Conservation, 1998, *State of California Seismic Hazards Zones – Calabasas Quadrangle*, Official Map, Division of Mines and Geology, February 1.

California Department of Conservation, 2015, *Division of Oil, Gas and Geothermal Resources Well Finder*.

California Department of Finance, 2014, Report P-1 (County), *Total Population Projections for California and Counties, 2010-2060 (5-year increments)* (accessed on February 25, 2015, http://www.dof.ca.gov/research/demographic/reports/projections/P-1/).

California Energy Commission, 2012, *Our Changing Climate 2012 Vulnerability and Adaptation to the Increasing Risks from Climate Change in California*, A Summary Report on the Third Assessment from the California Climate Center (available at http://www.climatechange.ca.gov/adaptation/third_assessment/), July.

CalPIF (California Partners in Flight), 2002, *The Oak Woodland Bird Conservation Plan: A Strategy for Protecting and Managing Oak Woodland Habitats and Associated Birds in California*, Version 2.0, Point Reyes Bird Observatory, Stinson Beach, California (available at http://www.prbo.org/calpif/plans.html).

CalPIF (California Partners in Flight), 2004, *The Coastal Scrub and Chaparral Bird Conservation Plan: A Strategy for Protecting and Managing Coastal Scrub and Chaparral Habitats and Associated Birds in California*, Version 2.0, PRBO Conservation Science, Stinson Beach, California (available at http://www.prbo.org/calpif/plans.html).

Caltrans (California Department of Transportation), 2012, *2012 Annual Average Daily Truck Traffic on the California State Highway System*, Traffic Data Branch, prepared in cooperation with the U.S. Department of Transportation, Federal Highway Commission (available at http://traffic-counts.dot.ca.gov/docs/2012_aadt_truck.pdf).

Caltrans (California Department of Transportation), 2013, *2013 Traffic Volumes on the California State Highway System,* Division of Traffic Operations, Sacramento, California (available at http://traffic-counts.dot.ca.gov/2013all/).

Caltrans (California Department of Transportation), 2015a, *District 7 Projects* (accessed on September 24, 2015, http://www.dot.ca.gov/dist07/travel/projects.php).

Caltrans (California Department of Transportation), 2015b, *Minor Project List* (accessed on March 10, 2015, http://www.dot.ca.gov/dist07/travel/projects.php).

Caltrans (California Department of Transportation), 2015c, *District 7 Projects US-101/SR-23 Interchange Improvement Project* (accessed on October 10, 2015, http://www.dot.ca.gov/dist07/travel/projects/details.php?id=39).

Caltrans (California Department of Transportation), 2015d, *District 7 Environmental Documents* (accessed September 24, 2015, http://www.dot.ca.gov/dist07/resources/envdocs).

Cameron, J. S., 1963, *Simi Grows Up The Story of Simi, Ventura County, California*, Anderson, Ritchie & Simon, Simi, California.

Carroll, J. W., J. M. Marzec, and A. M. Stelle, 1982, *RMDF Leach Field Decontamination Final Report,* Rockwell International, Atomics International Division, September 15.

CBCMP (California Breast Cancer Mapping Project), 2012, *California Breast Cancer Mapping Project: Identifying Areas of Concern in California* (available at http://www.cehtp.org/file/cbcmp_report_final_pdf), November.

CDC (Centers for Disease Control and Prevention), 2008, "Deaths: Preliminary Data for 2006," M. P. Heron, D. L. Hoyert, J. Xu, C. Scott, B. Tejada-Vera, *National Vital Statistics Reports*, Vol. 56, No. 16, Atlanta, Georgia (available at http://www.cdc.gov/nchs/data/nvsr/nvsr56/nvsr56_16.pdf), June 11.

CDC (Centers for Disease Control and Prevention), 2011, "Deaths: Leading Causes for 2007," M. P. Heron, *National Vital Statistics Reports*, Vol. 59, No. 8, Atlanta, Georgia (available at http://www.cdc.gov/nchs/data/nvsr/nvsr59/nvsr59_08.pdf), August 26.

CDC (Centers for Disease Control and Prevention), 2012a, "Deaths: Leading Causes for 2008," M. P. Heron, *National Vital Statistics Reports*, Vol. 60, No. 6, Atlanta, Georgia (available at http://www.cdc.gov/nchs/data/nvsr/nvsr60/nvsr60_06.pdf), June 6.

CDC (Centers for Disease Control and Prevention), 2012b, "Deaths: Leading Causes for 2009," M. P. Heron, *National Vital Statistics Reports*, Vol. 61, No. 7, Atlanta, Georgia (available at http://www.cdc.gov/nchs/data/nvsr/nvsr61/nvsr61_07.pdf), October 26.

CDC (Centers for Disease Control and Prevention), 2013, "Deaths: Final Data for 2010," S. Murphy, J. Xu, K. Kochanek, *National Vital Statistics Reports*, Vol. 61, No. 4, Atlanta, Georgia (available at http://www.cdc.gov/nchs/data/nvsr/nvsr61/nvsr61_04.pdf), May 8.

CDC (Centers for Disease Control and Prevention), 2014, *Sources of Valley Fever (Coccidioidomycosis)*, Atlanta, Georgia (accessed on May 5, 2015, http://www.cdc.gov/fungal/diseases/coccidioidomycosis/causes.html), May 14.

CDFW (California Department of Fish and Wildlife, formerly California Department of Fish and Game [CDFG]), 2015, "Full Condensed Report for Selected Elements," *Natural Diversity Database,* (updated February 1, 2015), Sacramento, California, 9 Quad search report generated February 12.

CDM Smith, 2012, *Worker Safety and Health Program for Chemical Data Gap Investigation Phase 3 Soil Chemical Sampling at Area IV, Santa Susana Field Laboratory, Ventura County, California*, Denver, Colorado, April.

CDM Smith, 2015a, *Final RCRA Facility Investigation (RFI) Groundwater Work Plan, Portions of Area IV under DOE Responsibility, Santa Susana Field Laboratory, Ventura County, California*, November 9.

CDM Smith, 2015b, *Soil Treatability Studies, Area IV Santa Susana Field Laboratory, Ventura County, California,* Version 2, Denver, Colorado, September.

CDM Smith, 2016a, *Report on Quarterly Groundwater Monitoring Area IV, First Quarter 2016*, Santa Susana Field Laboratory, Ventura County, California, September.

CDM Smith, 2016b, Personal communication (email) from J. Wondolleck to K. Owens, Leidos, Inc., "Area IV Fieldworker Dosimetry Results," January 26.

CDM Smith, 2017, *Chemical Data Summary Report, Santa Susana Field Laboratory, Ventura County, California*, Denver, Colorado, May.

CDMG (California Division of Mines and Geology), 1981, *Mineral Land Classification of Ventura County*, Special Report 145, Parts I, II, and III, Sacramento, California.

CDWR (California Department of Water Resources), 2014, *California Water Plan, Update 2013*, Vol. 2, Regional Reports, *South Coast Hydrologic Region*, Southern Region Office, Glendale, California, October.

CEC (California Energy Commission), 2014, *Solar Power Plant Licensing Projects* (available at http:/www.energy.ca.gov/maps/renewable/Solar_Power_Plant_Licensing_Projects.pdf), March 13.

CEC (California Energy Commission), 2015, *Status of All Projects* (accessed on March 10, 2015, http://www.energy.ca.gov/sitingcases/all_projects.html), February 23.

Census (U.S. Census Bureau), 2000, *Profile of General Demographic Characteristics: 2000, Census 2000 Summary File 1 (SF 1) 100-Percent Data* (available at www.factfinder.census.gov).

Census (U.S. Census Bureau), 2010a, *Profile of General Population and Housing Characteristics: 2010, 2010 Demographic Profile Data* (available at www.factfinder.census.gov).

Census (U.S. Census Bureau), 2010b, *2010 Census Sex by Age Universe: Total Population 2010 Census Summary File 1* (available at www.factfinder.census.gov).

Census (U.S. Census Bureau), 2010c, *Census Glossary* (accessed on January 12, 2015, http://www.census.gov/glossary).

Census (U.S. Census Bureau), 2010d, 2010 Census Tract TIGER [Topologically Integrated Geographic Encoding and Referencing]/Line Shapefiles, Geography Division, Geographic Projects Bipanel.

Census (U.S. Census Bureau), 2013a, *Age and Sex, 2013 American Community Survey 1-Year Estimates*, (available at www.factfinder.census.gov).

Census (U.S. Census Bureau), 2013b, *Selected Housing Characteristics, 2009-2013 American Community Survey 5-Year Estimates* (available at www.factfinder.census.gov).

Census (U.S. Census Bureau), 2013c, *DP03: Selected Economic Characteristics 2009-2013 American Community Survey* (available at www.factfinder.census.gov).

Census (U.S. Census Bureau), 2013d, *Sex by Age Total Population 2009-2013 American Community Survey 5-Year Estimates* (available at www.factfinder.census.gov).

Census (U.S. Census Bureau), 2014, *County Business Patterns (CBP), ZIP Code Business Patterns (ZBP)*; multiple datasets (available at http://www.census.gov/econ/cbp/index.html), Washington, DC.

CEQ (Council on Environmental Quality), 1981, "Memorandum to Agencies: Forty Most Asked Question's Concerning CEQ's National Environmental Policy Act Regulations," 46 FR 18026, Executive Office of the President, Washington, DC, *Federal Register*, Vol. 46, March 23, as amended.

CEQ (Council on Environmental Quality), 1997, *Environmental Justice Guidance Under the National Environmental Policy Act*, Executive Office of the President, Washington, DC, December 10.

CEQ (Council on Environmental Quality), 2014, *Revised Draft Guidance on the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in NEPA Reviews*, Executive Office of the President, Washington, DC, December 18.

CEQ (Council on Environmental Quality), 2016, *Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews*, Executive Office of the President, Washington, DC, August 1.

CEQ and ACHP (Council on Environmental Quality and Advisory Council on Historic Preservation), 2013, *NEPA and NHPA: A Handbook for Integrating NEPA and Section 106*, Executive Office of the President, Washington, DC (available at http://energy.gov/sites/prod/files/G-CEQ-NEPA_NHPA_Section_106_Handbook_Mar2013.pdf), March.

CEQ/OPR (Council on Environmental Quality and California Governor's Office of Planning and Research), 2014, *NEPA and CEQA: Integrating Federal and State Environmental Reviews*, Executive Office of the President, Washington, DC, and Governor's Office of Planning and Research, Sacramento, California, February.

CH2M Hill, 2008, *Group 5 – Central Portion of Areas III and IV, RCRA Facility Investigation Report, Santa Susana Field Laboratory, Ventura County, California*, Volume IX, *RFI Site Reports*, Appendix T, "Systems for Nuclear Auxiliary Power," Draft, November.

CH2M Hill, 2009, *Draft Group 3 Remedial Investigation Report at the Santa Susana Field Laboratory, Ventura County, California,* May.

CHABA (Committee on Hearing, Bioacoustics, and Biomechanics), 1977, *Guidelines for Preparing Environmental Impact Statements on Noise*, Assembly of Behavioral and Social Sciences, National Research Council, National Academy of Sciences, Washington, DC.

Cherry, J., D. McWhorter, and B. Parker., 2009, *Site Conceptual Model for the Migration and Fate of Contaminants in Groundwater at the Santa Susana Field Laboratory, Simi, California,* Volume 1, *Overview and 20 Site Conceptual Model Elements*, Draft, December.

CHP (California Highway Patrol), 2012, "Table 8A Fatal and Injury Collisions by County, City, and Road Classification – 2012," *California Statewide Integrated Traffic Records System (SWITRS), Collison Data* (available at http://www.chp.ca.gov/switrs/).

Chumash (Santa Ynez Band of Chumash Indians), 2014, Personal communication (email) from S. Cohen, Government and Legal Specialist to S. Jennings, U.S. Department of Energy, "Santa Ynez Chumash Comment opposing restriction of EIS alternatives," March 12.

City of Agoura Hills, 2015, *Palo Comado Canyon Road Interchange (At Chesebro)* (accessed on October 10, 2015, http://www.ci.agoura-hills.ca.us/government/departments/public-works-engineering/palo-comado-canyon-road-interchange-at-chesebro).

City of Calabasas, 2014, *The Lost Hills Road Interchange Improvement Project Update*, City Council Agenda Report, August 26.

City of Industry, 2008, *Final Puente Hills Intermodal Facility Final Environmental Impact Report*, Vol. 1, State Clearinghouse No. 20006021097 (available at http://lacsd.org/solidwaste/wbr/phimf/default.asp), May.

City of Industry, 2009, *Addendum to the Puente Hills Intermodal Facility Environmental Impact Report*, State Clearinghouse No. 2006021097 (available at http://lacsd.org/solidwaste/wbr/phimf/default.asp), February.

City of Los Angeles, 2001, *The Citywide General Plan Framework, An Element of the City of Los Angeles General Plan*, Los Angeles City Planning Department (accessed on April 29, 2015, http://planning.lacity.org/), August 8.

City of Los Angeles, 2006, *L.A. CEQA Thresholds Guide: Your Resource for Preparing CEQA Analyses in Los Angeles*, Section I, "Noise," (accessed on July 31, 2014, http://www.environmentla.org/programs/Thresholds/Complete%20Threshold%20Guide%202006.pdf).

City of Los Angeles, 2014, *Year-End Financial Status Report,* 2013-14 Budget, CAO File No. 0116-00001-0000, Office of the City Administrative Officer (available at http://clkrep.lacity.org/onlinedocs/2013/13-0600-s156_rpt_cao_5-29-14.pdf), Los Angeles, California, May 29.

City of Simi Valley, 2012, *Simi Valley General Plan Environmental Impact Report*, Vol. I, *Final EIR*, (accessed on August 21, 2015, http://www.simivalley.org/Modules/ShowDocument.aspx?documentid=6886), June.

City of Ventura, 2013, *Economic Development Strategy 2013-2018* (available at http://www.cityofventura.net/files/file/comm-develop/Economic%20Development/Economic%20Information-Data%20Book/EDstrategy_adopted%281%29.pdf), March 11.

Clean Harbors (Clean Harbors Environmental Services), 2014a, Personal communication (email) from M. Atkinson to G. Roles, Leidos, Inc., "RE: Clean Harbors Facility Information," May 8.

Clean Harbors (Clean Harbors Environmental Services), 2014b, Personal communication (email) from M. Atkinson to G. Roles, Leidos, Inc., "RE: Clean Harbors Facility Information," May 8.

Clean Harbors (Clean Harbors Environmental Services), 2014c, Personal communication (email) from M. Atkinson to G. Roles, Leidos, Inc., "RE: Clean Harbors Facility Information," May 8.

Clean Harbors (Clean Harbors Environmental Services), 2014d, *Transportation and Disposal, Westmorland, California Facility Facts* (available at http://clark.cleanharbors.com/ttServerRoot/Download/12543_FINAL_Westmorland_CA_Facility_FS_010507.pdf).

Clean Harbors (Clean Harbors Environmental Services), 2015, Personal communication (email) from M. Atkinson to G. Roles, Leidos, Inc., "RE: Questions about the Buttonwillow and Westmorland facilities," August 31.

CMWD (Calleguas Municipal Water District), 2011, *2010 Urban Water Management Plan*, Black & Veatch (available at http://www.calleguas.com/images/docs-water-resources-and-quality/cmwd2010uwmpfinal.pdf), May.

CMWD (Calleguas Municipal Water District), 2014, *A Resolution of the Board of Directors of Calleguas Municipal Water District Appealing for Implementation of Extraordinary Conservation Efforts and a Minimum 20 Percent Reduction in Water Use Within its Service Area in Consideration of Historic Drought Conditions*, Resolution No. 1845 (available at http://www.calleguas.com/images/docs-water-resources-and-quality/bay-delta-conservation/CMWD_BDCP_Support_Res070214.pdf), July 2.

CMWD (Calleguas Municipal Water District), 2016, Personal communication (email) from C. Johnson, Development Programs Administrator, to G. Roles, Leidos, Inc., "Re: Request for additional information about per-capita water use in Calleguas' service area," February 22.

CNPS (California Native Plant Society), 2015, "Astragalus brauntonii," *Inventory of Rare, Threatened, and Endangered Plants of California* (online edition, v8-02), Rare Plant Program (accessed on October 16, 2015, http://www.rareplants. cnps.org), Sacramento, California.

Cochran, T. B., 2009, *Sodium Reactor Experiment Fuel Meltdown-July 1959*, SRE [Sodium Reactor Experiment] Workshop August 29, 2009, Natural Resources Defenses Council, Inc., August 29.

Countess Environmental, 2006, *WRAP Fugitive Dust Handbook,* prepared for the Western Governors' Association (available at http://www.wrapair.org/forums/dejf/fdh/content/FDHandbook_Rev_06.pdf), Westlake Village, California, September 7.

County of Ventura, 2014, *2014 Locally Important Plant List*, Ventura County Planning Division (accessed on December 1, 2014, http://www.ventura.org/rma/planning/pdf/conservation/2014-Locally-Important-Plant-List.pdf).

CPUC (California Public Utilities Commission), 2015a, *Current Projects* (accessed on March 10, 2015, http://www.cpuc.ca.gov/PUC/energy/Environmental/Current+Projects/index.htm), February 17.

CPUC (California Public Utilities Commission), 2015b, *Southern California Edison's Presidential Substation Projec*t (accessed on October 9, 2015, http://www.cpuc.ca.gov/Environmental/info/esa/presidential substation/index.html).

CPUC (California Public Utilities Commission), 2015c, *Southern California Edison – Moorpark-Newbury 66 kV Subtransmission Line Project* (accessed on October 9, 2015, http://www.cpuc.ca.gov/Environmental/info/esa/moorpark_newbury/index.html), June 11.

CPUC (California Public Utilities Commission), 2015d, *Southern California Gas Company Aliso Canyon Turbine Replacement Project* (accessed on October 9, 2015, http://www.cpuc.ca.gov/Environmental/info/ene/aliso_canyon/aliso_canyon_home.html), September 17.

CRWQCB (California Regional Water Quality Control Board), 1994, *Water Quality Control Plan Los Angeles Region Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties*, Monterey Park, California, June.

CRWQCB (California Regional Water Quality Control Board), 2007, Letter from D. Hung, Chief, Watershed Regulatory Section, to T. Gallacher, Director, SSFL Safety, Health and Environmental Affairs, The Boeing Company, "National Pollutant Discharge Elimination System Permit (NPDES) (Order No. R4-2007-0055 and Cease and Desist Order (Order No. R4-2007-0056) for the Boeing Company, Santa Susana Field Laboratory, Canoga Park, NPDES No. CA0001309, CI No. 6027," November.

CSIL (California Spatial Information Library), 2002, Railroads, Geographic Information Systems shapefile derived from U.S. Census Bureau Topologically Integrated Geographic Encoding and Referencing (TIGER) system, Sacramento, California.

CSLC (California State Lands Commission), 2014, *State Oil and Gas Leases (A Report to the California State Lands Commission)* (accessed on March 10, 2015, http://www.slc.ca.gov/Reports/Offshore_Oil_and_Gas_Home_Page.html), April 20.

CSP (Cancer Surveillance Program), 2007, *Evaluation of retinoblastoma incidence in children in Los Angeles and Ventura counties*, University of Southern California, October 1.

Denning, R., 2009, *Assessment of Radioactive Material Release during the Accident at the Sodium Reactor Experiment*, SRE [Sodium Reactor Experiment] Workshop, Ohio State University, August 29.

DHS (California Department of Health Services), 1992, *Cancer Incidence Near the Santa Susana Field Laboratory, 1978-1989*, M. Coye and L. Goldman, March 27.

DHS (U.S. Department of Homeland Security), 2008, *Nuclear/Radiological Incident Annex*, Federal Emergency Management Agency, Washington, DC, June.

Dibblee, T. W. and H. E. Ehrenspeck, 1992, *Geologic Map of the Calabasas Quadrangle*, *Ventura and Los Angeles Counties, California*, Map DF-37, Scale 1:24000, 2008 edition, Ed., J. Minch, Santa Barbara Museum of Natural History, Santa Barbara, California.

DOE (U.S. Department of Energy), 1997a, *Final Environmental Assessment for Off-Site Transportation of Low-Level Waste from Four California Sites Under the Management of The U.S. Department of Energy Oakland Operations Office*, DOE/EA-1214, Oakland Operations Office, Oakland, California, October.

DOE (U.S. Department of Energy), 1997b, *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste*, Vol. 1, DOE/EIS-0200-F, Office of Environmental Management, Washington, DC, May.

DOE (U.S. Department of Energy), 2003a, *Final Environmental Assessment for Cleanup and Closure of the Energy Technology Engineering Center*, DOE/EA-1345, National Nuclear Security Administration Service Center, Oakland, California (available at http://www.etec.energy.gov/Regulation/RegDocs/ETECEA.pdf), March.

DOE (U.S. Department of Energy), 2003b, *Estimating Radiation Risk from Total Effective Dose Equivalent (TEDE),* ISCORS Technical Report No. 1, Rev. 1, DOE/EH-412/0015/0802, Office of Environmental Policy and Guidance, January.

DOE (U.S. Department of Energy), 2003c, *Final West Valley Demonstration Project Waste Management Environmental Impact Statement,* Appendix D, "Transportation," DOE/EIS-0337F (available at http://energy.gov/nepa/downloads/eis-0337-draft-environmental-impact-statement), West Valley Area Office, West Valley, New York, December.

DOE (U.S. Department of Energy), 2004, *Recommendations for the Preparation of Environmental Assessments and Environmental Impact Statements*, Second Edition, Office of NEPA Policy and Compliance, Washington, DC (available at http://energy.gov/sites/prod/files/nepapub/nepa_documents/RedDont/G-DOE-greenbook.pdf), December.

DOE (U.S. Department of Energy), 2005, *Topanga Wildfire Santa Susana Field Laboratory* (available at http://www.etec.energy.gov/Library/Main/BoeingSSFLTopangaFireFactSheet.pdf).

DOE (U.S. Department of Energy), 2008, *Area IV Santa Susana Field Laboratory Environmental Impact Statement Draft Gap Analysis Report* (available at http://www.etec.energy.gov/EIS/Documents/Full_Report_Draft_Gap_Analysis_Report_Area_IV_SSFL_EIS.pdf), June 1.

DOE (U.S. Department of Energy), 2009, *Scoping Comment Responses for the Environmental Impact Statement for Remediation of Area IV of the Santa Susana Field Laboratory* (available at http://www.etec.energy.gov/EIS/Documents/SSFL%20Area%20IV%20Final%20Scoping%20CRD.pdf), September 28.

DOE (U.S. Department of Energy), 2010a, *Clean Update* (newsletter published by the Energy Technology Engineering Center, Area IV, Santa Susana Field Laboratory and available at http://etec.energy.gov/Cleanup/CleanUpdate/CleanUpdate_Mar_10.pdf), March.

DOE (U.S. Department of Energy), 2010b, *Occupational Injury and Illness Summary Report 2009 – January Through December,* Computerized Accident/Incident Reporting System, Office of Health, Safety and Security, February 18.

DOE (U.S. Department of Energy), 2010c, *Community Involvement Plan Area IV Santa Susana Field Laboratory,* prepared by CDM Smith and Science Applications International Corporation (available at http://www.etec.energy.gov/EIS/Documents/SSFL_Area_IV_Community_ Involvement_Plan_2-26-10.pdf), February.

DOE (U.S. Department of Energy), 2011a, *Draft Field Report Traffic and Noise Monitoring at Area IV Santa Susana Field Laboratory Ventura County, California*, prepared by CDM Smith and Science Applications International Corporation, October.

DOE (U.S. Department of Energy), 2011b, *Administrative Change to DOE O 458.1, Radiation Protection of the Public and the Environment*, Change 3 (January 15, 2013), Office of Health, Safety and Security, Washington, DC.

DOE (U.S. Department of Energy), 2013a, *Final Site-Wide Environmental Impact Statement for the Continued Operation of the Department of Energy/National Nuclear Security Administration Nevada National Security Site and Off-Site Locations in the State of Nevada*, Vol. 1, Book 1, DOE/EIS-0426, National Nuclear Security Administration, Nevada Site Office, Las Vegas, Nevada, February.

DOE (U.S. Department of Energy), 2013b, *Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington*, DOE/EIS-0391, Richland, Washington, November.

DOE (U.S. Department of Energy), 2014a, *ETEC: Energy Technology Engineering Center Closure Project* (available at http://www.etec.energy.gov/Environmental_and_Health/Worker.html), June.

DOE (U.S. Department of Energy), 2014b, *Environmental Impact Statement for Remediation of Area IV and the Northern Buffer Zone of the Santa Susana Field Laboratory Final Scoping Summary* Report (available at http://www.etec.energy.gov/Library/Cleanup_and_Characterization/EIS/Final%20Scoping%20 Summary%20Report%20SSFL%20EIS.pdf), August 6.

DOE (U.S. Department of Energy), 2014c, *DOE Handbook, Optimizing Radiation Protection of the Public and the Environment for Use with DOE O 458.1, ALARA Requirements*, DOE-HDBK-1215-2014, Washington, DC, October.

DOE (U.S. Department of Energy), 2014d, DOE Meeting with California SHPO on December 16, 2014 Meeting Notes, Sacramento, California, December 16.

DOE (U.S. Department of Energy), 2015a, *Final Surplus Plutonium Disposition Supplemental Environmental Impact Statement,* Vol. 1, Chapter 4, Table 4-48, DOE/EIS-0283-S2, Washington, DC, April.

DOE (U.S. Department of Energy), 2015b, *Executive Order 13693 – Planning for Federal Sustainability in the Next Decade*, Memorandum for Distribution from M. Gilbertson, Deputy Assistant Secretary for Site Restoration, Washington, DC, September 10.

DOI (U.S. Department of the Interior), 1998, *Guidelines for Evaluating and Documenting Traditional Cultural Properties*, National Register Bulletin 38, National Park Service (available at http://www.nps.gov/ nr/publications/bulletins/pdfs/nrb38.pdf).

DOT (U.S. Department of Transportation), 2012, *2012 Emergency Response Guidebook*, RAMREG-12-2008, Pipeline and Hazardous Materials Safety Administration, Washington, DC.

DTSC (State of California Department of Toxic Substances Control), 1999a, *Health Studies at Santa Susana Field Laboratory*, *Expert Panel Review*, M. Petreas, Hazardous Materials Laboratory, June 20.

DTSC (State of California Department of Toxic Substances Control), 1999b, *Rocketdyne Inquiry, Summary of Findings and Report*, California Environmental Protection Agency (available at http://www.etec.energy.gov/environmental_and_health/Documents/CancerStudies/Rocketdyne_ Inquiry_Report.pdf), August.

DTSC (State of California Department of Toxic Substances Control), 2007, *The State of California Environmental Protection Agency, Department of Toxic Substances Control, The Boeing Company, the National Aeronautics and Space Administration, and the United States Department of Energy, In the Matter of: Santa Susana Field Laboratory, Simi Hills, Ventura County, California, Consent Order for Corrective Action*, Docket No. P3-07/08-003, Health and Safety Code Section 25187, August 16.

DTSC (State of California Department of Toxic Substances Control), 2009, *Interim Advisory for Green Remediation* (available at http://www.dtsc.ca.gov/OMF/upload/GRT_Draft_-Advisory_-20091217_ac1.pdf), December.

DTSC (State of California State of California Department of Toxic Substances Control), 2010a, *The State of California Environmental Protection Agency, Department of Toxic Substances Control and the United States Department of Energy, In the Matter of: Santa Susana Field Laboratory, Simi Hills, Ventura County, California, Administrative Order on Consent for Remedial Action*, Docket No. HSA-CO 10/11-037, Health and Safety Code Sections 25355.5(a)(1)(B), 58009 and 58010, December 6.

DTSC (State of California Department of Toxic Substances Control), 2010b, *The State of California Environmental Protection Agency, Department of Toxic Substances Control and the United States National Aeronautics and Space Administration, In the Matter of: Santa Susana Field Laboratory, Simi Hills, Ventura County, California, Administrative Order on Consent for Remedial Action*, Docket No. HSA-CO 10/11-038, Health and Safety Code Sections 25355.5(a)(1)(B), 58009 and 58010, September 3.

DTSC (State of California Department of Toxic Substances Control), 2012, Memorandum from K. C. Ting, J. Quinn, C. Wortham, and M. Sam, Environmental Chemistry Laboratory, Technical Advisory Team, to Mark Malinowski, DTSC SSFL Project Manager, October 30.

DTSC (State of California Department of Toxic Substances Control), 2013a, *Draft Provisional Radiological Look-Up Table Values* (available at http://www.dtsc-ssfl.com/files/lib_look-uptables/radiological/66513_65861_ Draft_Provisional_Radiological_Look-Up_Table_Values_1-30-13.pdf), January.

DTSC (State of California Department of Toxic Substances Control), 2013b, *Chemical Look-Up Table Technical Memorandum, Santa Susana Field Laboratory, Ventura, California*, June 11.

DTSC (State of California Department of Toxic Substances Control), 2013c, Letter from M. Malinowski, Santa Susana Field Laboratory Program Manager, to D. Dassler, The Boeing Company, "Re: Department of Toxic Substances Control Approval to Implement the Groundwater Interim Measures Work Plan, Santa Susana Field Laboratory, Ventura County, California," March 12.

DTSC (State of California Department of Toxic Substances Control), 2015, *EnviroStor Cleanup Sites* (available at http://www.envirostor.dtsc.ca.gov/public/mapfull.asp?global_id=&x=-119&y=37&zl=18&ms=640,480&mt=m&findaddress=True&city=calabasas&zip=&county=&state_response=true&voluntary_cleanup=true&school_cleanup=true&ca_site=true&tiered_permit=true&evaluation=true&military_evaluation=true&school_investigation=true), May 15.

DTSC and LARWQCB (State of California Department of Toxic Substances Control and Los Angeles Regional Water Quality Control Board), 2014, *Groundwater and Surface Water at the Santa Susana Field Laboratory (SSFL)*, presentation to the Community Advisory Group Meeting, May 21.

Ecology and Environment, 1989, *Summary Review of Preliminary Assessment/Site Inspections of Rockwell International Santa Susana Field Laboratory*, July 19.

Edwards, R. D., D. F. Rabey, and R. W. Kover, 1970, *Soil Survey, Ventura Area, California*, U.S. Department of Agriculture, Soil Conservation Service, in cooperation with the University of California Agricultural Experiment Station, April.

EMC (Environmental Monitoring Company, Inc.), 2012, *The Boeing Company Area 4 Meteorological Monitoring Program Annual Report, January – December 2011*, Paso Robles, California, January.

EMC (Environmental Monitoring Company, Inc.), 2013, *The Boeing Company Area 4 Meteorological Monitoring Program Annual Report, January – December 2012*, Paso Robles, California, January.

Environ (Environ International Corporation and the California Air Districts), 2013, *CalEEMod California Emissions Estimator Model User's Guide, Version 2013.2* (available at http://www.caleemod.com), July.

EPA (U.S. Environmental Protection Agency), 1974, *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*, EPA Report 550/9-74-004, Office of Noise Abatement and Control (accessed on July 31, 2014, http://www.nonoise.org/library/levels74/levels74.htm), March.

EPA (U.S. Environmental Protection Agency), 1981, *Noise Effects Handbook: A Desk Reference to Health and Welfare Effects of Noise*, EPA Report 550/9-82-106, Office of Noise Abatement and Control (accessed on July 31, 2014, http://www.nonoise.org/library/handbook/handbook.htm), July.

EPA (U.S. Environmental Protection Agency), 1989, *Risk Assessment Guidance for Superfund*, *Volume 1, Human Health Evaluation Manual (Part A) Interim Final*, EPA/540/1-89/002, Office of Emergency and Remedial Response, December.

EPA (U.S. Environmental Protection Agency), 1996, *EPA Environmental Engineering Sourcebook*, J. R. Boulding, Ed., Ann Arbor Press, Chelsea, Michigan.

EPA (U.S. Environmental Protection Agency), 1999, *Consideration of Cumulative Impacts in EPA Review of NEPA Documents*, EPA 315-R-99-002, Office of Federal Activities, Washington, DC, May.

EPA (U.S. Environmental Protection Agency), 2003, *Site Inspection Report Energy Technology Engineering Center/Area IV, Simi Hills, California*, EPA ID No. CA3830090001, September.

EPA (U.S. Environmental Protection Agency), 2006a, *Compilation of Air Pollutant Emission Factors, AP-42,* Vol. I, Section 13.2.4, Aggregate Handling and Storage Piles (available at http://www.epa.gov/ttn/chief/ap42/ch13/final/c13s0204.pdf).

EPA (U.S. Environmental Protection Agency), 2006b, *Compilation of Air Pollutant Emission Factors, AP-42,* Vol. I, Section 13.2.5, Industrial Wind Erosion (available at http://www.epa.gov/ttn/chief/ap42/ch13/final/c13s0205.pdf).

EPA (U.S. Environmental Protection Agency), 2007a, *Preliminary Assessment/Site Inspection Report Santa Susana Field Laboratory Simi Valley California,* EPA ID No.: CAN000908498 (accessed on November 12, 2014, http://www.epa.gov/region9/superfund/santasusana/SSFL-PASI-report-r2-complete.pdf), November 30.

EPA (U.S. Environmental Protection Agency), 2007b, *Remedial Site Assessment Decision – EPA Region IX,* EPA ID: CAN000908498, Site Name: SSFL: Santa Susana Field Laboratory, November 30.

EPA (U.S. Environmental Protection Agency), 2009a, *Biological Assessment for the Santa Susana Field Laboratory Area IV Radiological Study, Ventura County, California*, Region 9, San Francisco, California, USEPA, December 11.

EPA (U.S. Environmental Protection Agency), 2009b, *Principles for Greener Cleanups*, Office of Solid Waste and Emergency Response, Washington, DC, August 27.

EPA (U.S. Environmental Protection Agency), 2011, *Compilation of Air Pollutant Emission Factors, AP-42,* Volume I, Section 13.2.1, Paved Roads (available at http://www.epa.gov/ttn/chief/ap42/ch13/final/c13s0201.pdf).

EPA (U.S. Environmental Protection Agency), 2012, Fact sheet: *Santa Susana Field Laboratory, EPA Radiological Characterization Study Results*, San Francisco, California, November.

EPA (U.S. Environmental Protection Agency), 2015a, *The Green Book Summary Nonattainment Area Population Exposure Report* (available at http://www.epa.gov/air/oaqps/greenbk/index.html), October 1.

EPA (U.S. Environmental Protection Agency), 2015b, *Prevention of Significant Deterioration Basic Information* (accessed on May 14, 2015, http://www.epa.gov/nsr/psd.html).

EPA (U.S. Environmental Protection Agency), 2015c, *General Conformity De Minimis Levels* (accessed on May 14, 2015, http://www.epa.gov/air/genconform/deminimis.html).

EPA (U.S. Environmental Protection Agency), 2015d, *National Priorities List (NPL)* (accessed on May 13, 2015, http://www.epa.gov/superfund.sites/query/queryhtm/nplmapsg.htm?949).

EPA (U.S. Environmental Protection Agency), 2015e, *Integrated Risk Information System* (available at http://www2.epa.gov/iris).

EPA and Army (U.S. Environmental Protection Agency and U.S. Army), 2007, *Clean Water Act Jurisdiction Following the U.S. Supreme Court's Decision in Rapanos v. United States and Carabell v. United States*, Guidance Memorandum, June 5.

ESA (Environmental Science Associates), 2015a, Personal communication (email) from J. Ricks to S. Enyeart, Leidos, Inc., "Noise measurements," April 2.

ESA (Environmental Science Associates), 2015b, Personal communication (email) from J. Ricks to S. Enyeart, Leidos, Inc., "Re: SSFL Cumulative MAP," May 12.

FAA (Federal Aviation Administration), 1985, *Aviation Noise Effects*, FAA Report EE-85-2, Office of Environment and Energy, Washington, DC (accessed on July 31, 2014, http://www.nonoise.org/epa/Roll18/roll18doc3.pdf), March.

Farmer, A. M., 1993, "The Effects of Dust on Vegetation – A Review," *Environmental Pollution*, Vol. 79, pp. 63-75.

Faulkner, D. K., 2010, Personal communication to T. Mulroy, SAIC, "RE: Site Assessment for Quino Checkerspot Butterfly, Santa Susana Field Laboratory (SSFL) Area IV, Ventura County, California," conducted under USFWS Permit #TE-838743-5, July 15.

Fenenga, F., 1973, *An Archaeological Survey of the Area of Air Force Plant 57, Coca Test Area, Santa Susana Field Laboratory, Ventura County, California*, on file under V-211, South Central Coastal Information Center of the California Historical Resources Information System, October.

FHWA (Federal Highway Administration), 2006, *FHWA Roadway Construction Noise Model User's Guide*, FHWA-HEP-05-054, Office of Natural and Human Environment (available at http://www.fhwa.dot.gov/environment/noise/construction_noise/rcnm/rcnm.pdf), January.

FICON (Federal Interagency Committee on Noise), 1992, *Federal Agency Review of Selected Airport Noise Analysis Issues* (accessed on July 31, 2014, http://www.fican.org/pdf/nai-8-92.pdf), August.

FICUN (Federal Interagency Committee on Urban Noise), 1980, *Guidelines for Considering Noise in Land Use Planning and Control,* NIIS PB83-184838 (available at http://www.nonoise.org/epa/Roll7/roll7doc20.pdf), Washington, DC, June.

Fidell, S., K. Pearsons, R. Howe, B. Tabachnik, L. Silvati, and D. S. Barber, 1995, "Field study of noise-induced sleep disturbance," *Journal of the Acoustical Society of America*, Vol. 98, No. 2, Part 1, pp. 1025–1033, August.

Finegold, L. S., C. S. Harris, and H. E. vonGlerke, 1994, "Community Annoyance and Sleep Disturbance: Updated Criteria for Assessing the Impacts of General Transportation Noise on People," *Noise Control Engineering Journal*, Vol. 42, No. 1, pp. 25–30, January–February.

Flow Science (Flow Science, Inc.), 2007, *Potential Background Constituent Levels in Storm Water at Boeing's Santa Susana Field Laboratory*, Pasadena, California, June 25.

Geosyntec, 2012, *2012 BMP Plan Addendum Santa Susana Site, Ventura County, California*, prepared with the Santa Susana Site Surface Water Expert Panel, Los Angeles, California, September 28.

Glassow, M. A., L. H. Gamble, J. E. Perry, and G. S. Russell, 2007, "Prehistory of the Northern California Bight and the Adjacent Transverse Ranges," *California Prehistory: Colonization, Culture, and Complexity*, T. Jones, K. Klar, Ed., AltaMira Press, Lanham, Maryland, pp. 191–213.

Gordon, S. J., 2015, National Security Technologies, LLC, Personal communication (email) to G. Roles, Leidos, Inc., "RE: Waste from Remediation of SSFL," January 12.

Gordon, S., 2014, National Security Technologies, LLC, Personal communication (email) to G. Roles, Leidos, Inc., "RE: Waste from Remediation of SSFL," April 28.

Grant, C., 1978, "Eastern Coastal Chumash," *Handbook of North American Indians*, Vol. 8, *California*, R. F. Heizer, Ed., Smithsonian Institution, Washington, DC, pp. 509–519.

GreenFacts, 2015, "Granular activated carbon" (accessed on June 3, 2015, http://www.greenfacts.org/glossary/ghi/granular-activated-carbon.htm).

Griffith Wildlife Biology, 2010, *2010 California Gnatcatcher Habitat Assessment & Protocol Survey of Potential Habitat Within Santa Susana Field Laboratory Area IV and Northern Buffer Zone,* Calumet, Michigan, June 15.

Griffith Wildlife Biology, 2011, *2011 California Gnatcatcher Habitat Assessment & Protocol Survey of Potential Habitat Within Santa Susana Field Laboratory Area IV and Northern Buffer Zone,* Calumet, Michigan, July 6.

Griffith Wildlife Biology, 2012, *2012 California Gnatcatcher Habitat Assessment and Protocol Survey of Potential Habitat within the Santa Susana Field Laboratory Area IV and the Northern Buffer Zone,* Calumet, Michigan, July 4.

Guevara, R. E., 2014, *Valley Fever in Los Angeles County: A Presentation for the Santa Susana Field Laboratory Community Advisory Group*, July 23.

Haley and Aldrich (Haley & Aldrich, Inc.), 2010, *Site-Wide Water Quality Sampling and Analysis Plan, Santa Susana Field Laboratory Ventura County, California*, Revision 1, Tucson, Arizona, December.

Halstrom, S., 2014, Energy*Solutions*, Personal communication (email) to G. Roles, Leidos, Inc., "FW: Remediation and D&D of SSFL in Simi Valley, California," May 15.

Havens, P., 1997, *Simi Valley: A Journey Through Time*, Simi Valley Historical Society and Museum, Simi Valley, California.

Headley, L., 2010, "The Visual Modification Class Approach to Preparing NEPA and CEQA Compliant Visual Impact Assessments," *Environmental Monitor*, Winter 2010, pp. 11-19.

Hedquist, S. L., L. A. Eillison and A. Laurenzi, 2014, *Public Lands and Cultural Resources Protection: A Case Study of Unauthorized Damage to Archaeological Sites on the Tonto National Forest, Arizona*, Archaeology Southwest, Tucson, Arizona (available at https://www.archaeologysouthwest.org/pdf/Advances-D-14-00007.pdf), August.

HESIS (Hazard Evaluation System and Information Service), 2013, Fact sheet: *Preventing Work-Related Coccidioidomycosis (Valley Fever)*, California Department of Public Health, California Department of Industrial Relations, Richmond, California (available at https://www.cdph.ca.gov/programs/hesis/Documents/CocciFact.pdf), June.

HGL (HydroGeoLogic, Inc.), 2010, *Site Management Plan Area IV Radiological Study*, *Santa Susana Field Laboratory Site, Ventura County California*, September 24.

HGL (HydroGeoLogic, Inc.), 2011, *Final Radiological Background Study Report, Santa Susana Field Laboratory, Ventura County, California*, prepared for the U.S. Environmental Protection Agency, Region 9, October.

HGL (HydroGeoLogic, Inc.), 2012a, *Final Historical Site Assessment, Santa Susana Field Laboratory Site, Area IV Radiological Study, Ventura County, California*, prepared for the U.S. Environmental Protection Agency, Region 9, Ballston Lake, New York, October.

HGL (HydroGeoLogic, Inc.), 2012b, *Final Radiological Characterization of Soils, Area IV and the Northern Buffer Zone, Area IV Radiological Study, Santa Susana Field Laboratory, Ventura County, California*, prepared for the U.S. Environmental Protection Agency, Region 9, December 21.

HGL (HydroGeoLogic, Inc.), 2012c, *Final Technical Memorandum, Look-up Table Recommendations, Santa Susana Field Laboratory Area IV Radiological Study*, prepared for the U.S. Environmental Protection Agency, Region 9, November 27.

HGL (HydroGeoLogic, Inc.), 2012d, *Final Groundwater Report, Area IV Radiological Study*, *Santa Susana Field Laboratory, Ventura County, Californi*a, prepared for the U.S. Environmental Protection Agency, Region 9, July 24.

HGL and Envicom (HydroGeoLogic Inc., and Envicom Corporation), 2011a, *Annual Biological Monitoring Report 2010–2011, Radiological Study of the Santa Susana Field Laboratory Area IV and Northern Buffer Zone*, August 8.

HGL and Envicom (HydroGeoLogic Inc., and Envicom Corporation), 2011b, *Quarterly Biological Monitoring Report #5, Radiological Study of the Santa Susana Field Laboratory Area IV and Northern Buffer Zone*, October 28.

HGL and Envicom (HydroGeoLogic Inc., and Envicom Corporation), 2012, *Final Biological Monitoring Report 2010–2012, Radiological Study of the Santa Susana Field Laboratory Area IV and Northern Buffer Zone*, October 3.

Holland, R. F., 1986, *Preliminary Descriptions of the Terrestrial Natural Communities of California*, State of California Department of Fish and Game, The Resources Agency, October.

Hubbard, J., 2014, US Ecology, Inc., Personal communication (email) to G. Roles, Leidos, Inc., "RE: SSFL Decommissioning Table 2 for USE," May 8.

ICRP (International Commission on Radiological Protection), 1977, *Recommendations of the International Commission on Radiological Protection*, ICRP Publication 26, Annals of the ICRP, Vol. 1 (3).

ICRP (International Commission on Radiological Protection), 1983, *Cost-Benefit Analysis in the Optimization of Radiation Protection*, ICRP Publication 37, Annals of the ICRP, Vol. 10 No 2/3.

IEI (International Epidemiology Institute), 2005, *Rocketdyne Worker Health Study*, *IEI Executive Summary*, July 13.

IPCC (Intergovernmental Panel on Climate Change), 2013, *Climate Change 2013, The Physical Science Basis,* Working Group I Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, New York, New York (available at http://www.climatechange2013.org/images/report/WG1AR5_ALL_FINAL.pdf).

ITRC (Interstate Technology and Regulatory Council), 2011a, *Technology Overview, Green and Sustainable Remediation: State of the Science and Practice* (available at http://www.itrcweb.org/GuidanceDocuments/GSR-1.pdf), May.

ITRC (Interstate Technology and Regulatory Council), 2011b, *Technical Regulatory Guidance, Green and Sustainable Remediation: A Practical Framework* (available at http://www.itrcweb.org/GuidanceDocuments/GSR-2.pdf), November.

Jennings, C. W., and W. A. Bryant, 2010, *California Geological Survey 150th Anniversary Fault Activity Map of California* (available at http://www.quake.ca.gov/gmaps/FAM/faultactivitymap.html).

Johnson, J. R., 1997, "Chumash Indians in Simi Valley," Chapter 1, *Simi Valley: A Journey Through Time*, P. Havens, Simi Valley Historical Society and Museum, Simi Valley, California, pp. 5–21.

Johnson, J. R., 2006, *Ethnohistoric Overview for the Santa Susana Pass State Historic Park Cultural Resources Inventory Project*, Santa Barbara Museum of Natural History, Santa Barbara, California (available at http://www.parks.ca.gov/pages/21299/files/sspshp%20ethnohistory-complete.pdf), June.

Johnson, J. R., and D. D. Earle, 1990, "Tataviam Geography and Ethnohistory," *Journal of California and Great Basin Anthropology*, Vol. 12, No. 2, pp. 191-214.

Johnson, P. E. and R. D. Michelhaugh, 2003, *Transportation Routing Analysis Geographic Information System (TRAGIS) User's Manual,* ORNL/NTRC-006, Rev. 0, Oak Ridge National Laboratory, National Transportation Research Center, Oak Ridge, Tennessee, June.

Keeling, C. D., 1960, "The Concentration and Isotopic Abundances of Carbon Dioxide in the Atmosphere," *Tellus*, Vol. 12, pp. 200-203.

King, C., and J. Parsons, 1999, *Archaeological Records of Settlement and Activity in the Simi Hills*, Draft, Topanga Anthropological Consultants, Topanga, California, on file under VN-2239, South Central Coastal Information Center of the California State University, Fullerton, Fullerton, California.

King, C., and T. C. Blackburn, 1978, "Tataviam," *Handbook of North American Indians*, Vol. 8, *California*, R. F. Heizer, Ed., Smithsonian Institution, Washington, DC, pp. 535–537.

Knight, A., 2001, "Rock Art of the Santa Monica and Santa Susana Mountains," Santa Barbara Museum of Natural History, Santa Barbara, California, unpublished manuscript on file at Leidos, Inc., Carpinteria, California, July.

Kroeber, A. L., 1925, "The Chumash," Chapter 37, *Handbook of the Indians of California*, 1976 edition by Dover Publications, Inc., New York, New York.

Kryter, K. D., 1984, *Physiological, Psychological, and Social Effects of Noise*, National Aeronautics and Space Administration Reference Publication 1115, Acousis Company, Bodega Bay, California, July.

LA (City of Los Angeles), 2006, *L.A. CEQA Thresholds Guide, Your Resource for Preparing CEQA Analyses in Los Angeles*.

LADWP (Los Angeles Department of Water and Power), 2016, *Where is California water use decreasing?*, Water consumption for December 2015 in the Los Angeles Department of Water and Power, (accessed on February 18, 2016, http://projects.scpr.org/applications/monthly-water-use/los-angeles-department-of-water-and-power/).

LAEDC (Los Angeles County Economic Development Corporation, 2012, *Policy Booklet 2012-2013*, "Strategic Plan for Economic Development" (available at http://laedc.org/wp-content/uploads/2012/03/LAEDC-2012-2013-Policy-Booklet.pdf).

LAEDC (Los Angeles County Economic Development Corporation), 2016, *Los Angeles County Strategic Plan for Economic Development* (available at http://lacountystrategicplan.com), Los Angeles, California.

Landberg, L. C. W., 1965, *The Chumash Indians of Southern California*, Southwest Museum Papers No. 19, Southwest Museum, Los Angeles, California.

Landis, B., 2007, *Surveys and Observations of Braunton's milkvetch (Astragalus brauntonii) 2006 and 2007*, California Native Plant Society, August 31.

Leidos (Leidos, Inc.), 2015, *Draft Environmental Impact Statement for Remediation of Area IV and the Northern Buffer Zone of the Santa Susana Field Laboratory – Air Emissions Methods*.

Lichvar, R. W., and S. M. McColley, 2008, *A Field Guide to the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the United States*, *A Delineation Manual*, ERDC/CRREL TR-08-12, (available at http://www.spk.usace.army.mil/Portals/12/documents/regulatory/pdf/Ordinary_High_Watermark_Manual_Aug_2008.pdf), August.

Mack, T., 2014, *Cancer Occurrence in Offsite Neighborhoods Near the Santa Susana Field Laboratory*, presentation at a Santa Susana Field Laboratory Community Meeting, April 9.

Macon, J., 2014, U.S. Department of Energy, Personal communication (email) to G. Roles, Leidos, Inc., with attachment: LedosDataRq.xls: CAIRs data for Boeing operations from 2008 through the first half of 2014, July 16.

Matsumoto, M. R., and J. Martin, 2015, *Summary Report: Santa Susana Field Laboratory (SSFL) Soil Partitioning Treatability Study*, University of California, Riverside, Riverside, California, May.

McCawley, W., 1996, *The First Angelinos The Gabrielino Indians of Los Angeles*, Malki Museum Press, Banning, California, and Ballena Press, Novato, California.

Mealey, M., and N. Brodie, 2005, *Santa Susana Pass State Historic Park Cultural Resources Inventory: Archaeology*, California State Parks, Southern Service Center, October.

Minch (John Minch and Associates, Inc.), 2012, *Final Report Cultural Resource Compliance and Monitoring Results for USEPA's Radiological Study of the Santa Susana Field Laboratory Area IV and Northern Buffer Zone, Ventura County, California*, Mission Viejo, California, December.

Minch (John Minch and Associates, Inc.), 2014, *Paleontological Resources Assessment, Boeing Administrative Areas I, III, and Southern Undeveloped Land, Santa Susana Field Laboratory (SSFL)*, *Simi Hills, Ventura County, California*, Mission Viejo, California, October.

MWH (MWH Americas, Inc.), 2003, *Near-Surface Groundwater Characterization Report, Santa Susana Field Laboratory*, Ventura County, California, November.

MWH (MWH Americas, Inc.), 2006, *Group 6 – Northeastern Portion of Area IV RCRA Facility Investigation Report, Santa Susana Field Laboratory, Ventura County, California*, Vol. 1, Arcadia, California, September.

MWH (MWH Americas, Inc.), 2007, Appendices C, "Empire State Atomic Development Authority Area (SWMU 7.9)," and D, "Former Sodium Disposal Facility," *Group 8-Western Portion of Area IV, RCRA Facility Investigation Report, Santa Susana Field Laboratory*, Volume III – RFI Site Reports, Arcadia, California, September.

MWH (MWH Americas, Inc.), 2008 *Work Plan (Revision 2), Groundwater Interim Measures, Santa Susana Field Laboratory, Ventura County California,* Arcadia, California, July 14.

MWH (MWH Americas, Inc.), 2009a, *Group 7 – Northern Portion of Area IV RCRA Facility Investigation Report, Santa Susana Field Laboratory, Ventura County, California*, Vol. 1, Arcadia, California, June.

MWH (MWH Americas, Inc.), 2009b, *Draft Site-Wide Groundwater Remedial Investigation Report, Santa Susana Field Laboratory, Ventura County, California*, December.

MWH (MWH Americas, Inc.), 2012, *Stormwater Pollution Prevention Plan for the Santa Susana Site*, Revision 7, prepared for The Boeing Company, Santa Susana Site, Arcadia, California, October.

MWH (MWH Americas, Inc.), 2014, *Final Standardized Risk Assessment Methodology Revision 2 Addendum, Santa Susana Field Laboratory, Ventura County, California*, Pasadena, California, August.

MWH (MWH Americas, Inc.), 2015, Personal communication (email) from A. Fischl to C. Woods, Leidos, Inc., "Boeing Project Description GIS Layers," June 11.

MWH and AMEC (MWH Americas, Inc., and AMEC Earth and Environmental, Inc.), 2005, *Addendum to the Biological Conditions Report Santa Susana Field Laboratory Ventura County*, California, September.

MWH and Hargis (MWH Americas, Inc., and Hargis + Associates), 2009, *Addendum to Revision 2 of the Work Plan for Groundwater Interim Measures, Santa Susana Field Laboratory, Ventura California*, February.

MWH Global, Inc., 2009, *Biological Report on Braunton's Milk-Vetch Habitat*, Arcadia, California, October 2.

NAHC (Native American Heritage Commission), 2014, *Native American Heritage Commission Sacred Lands Inventory, Santa Susana Sacred Sites and Traditional Cultural Landscape*.

NAHC (Native American Heritage Commission), 2015, *California Indians Language Groups*, based on Hinton, Leanne, *Flutes of Fire: Essays on California Indian Languages*, Berkeley, California, (accessed on June 29, 2015, http://www.parks.ca.gov/?page_id=23548).

NASA (National Aeronautics and Space Administration), 2014a, *Final Environmental Impact Statement for Proposed Demolition and Environmental Cleanup Activities at Santa Susana Field Laboratory, Ventura County, California*, George C. Marshall Space Flight Center, Huntsville, Alabama, March.

NASA (National Aeronautics and Space Administration), 2014b, *Record of Decision, Environmental Impact Statement for Proposed Demolition and Environmental Cleanup Activities at Santa Susana Field Laboratory* (available at http://www.nasa.gov/sites/default/files/files/SSFL_EIS_ROD.pdf), April.

NASA (National Aeronautics and Space Administration), 2015a, Personal communication (email) from A. Elliott to S. Jennings, U.S. Department of Energy, "Re: DOE's request for information for cumulative analysis," May 11.

NASA (National Aeronautics and Space Administration), 2015b, Personal communication (email) from A. Elliott, to S. Jennings, U.S. Department of Energy, "Re: Cumulative Analysis for our EIS," September 24.

Nasseri, K., 1997, Letter from K. Nasseri, County of Santa Barbara Health Care Services, Tri-Counties Regional Cancer Registry, to P. Lorenz, Ventura County Public Health, September 29.

NCI (National Cancer Institute), 2015, *Cancer Mortality – All 2008-2012, Death Rate Report for California by County, Death Years Through 2012* (accessed on November 4, 2015, http://statecancerprofiles.cancer.gov/index.html).

NCRP (National Council on Radiation Protection and Measurements), 2009, *Ionizing Radiation Exposure of the Population of the United States*, NCRP Report No. 160, March 3.

Nelson, Y. M., K. Croyle, M. Billings, A. Caughey, M. Poltorak, A. Donald, and N. Johnson, 2014, *Feasibility of Natural Attenuation for the Remediation of Soil Contaminants at the Santa Susana Field Laboratory*, California Polytechnic State University, San Luis Obispo, California, August 18.

Nelson, Y. M., K. Croyle, M. Billings, and M. Poltorak, 2015a, *Natural Attenuation Study for the Santa Susana Field Laboratory Final Report*, California Polytechnic State University, San Luis Obispo, California, April 27.

Nelson, Y. M., M. Poltorak, M. Curto, P. Waldburger, A. Koivunen, and D. Dowd, 2015b, *Phytoremediation Study for the Santa Susana Field Laboratory Final Report*, California Polytechnic State University, San Luis Obispo, California, April 16.

Nelson, Y. M., M. Billings, K. Croyle, C. Kitts, and A. Hamrick, 2015c, *Bioremediation Study for the Santa Susana Field Laboratory Final Report*, California Polytechnic State University, San Luis Obispo, California, May 7.

Nelson, Y. M., S. Cronin, K. Cochran, and A. Varni, 2015d, *Chemical Characterization of Residual Fuel Hydrocarbons in Soils at the Santa Susana Field Laboratory, Final Report*, California Polytechnic State University, San Luis Obispo, California, July 31.

New York Times, 2016, *In Sharp Reversal, California Suspends Water Restrictions*, May 18.

Nickens, P. R., S. L. Larralde, and G. C. Tucker, Jr., 1981, *A Survey of Vandalism to Archaeological Resources in Southwestern Colorado*, Cultural Resources Series, No. 11, prepared for the Bureau of Land Management, Colorado.

NOAA (National Oceanic and Atmospheric Administration), 2014, *Annual Mean Growth Rate of CO2 at Mauna Loa, Hawaii*, Earth System Research Laboratory, Global Monitoring Division (available at http://www.esrl.noaa.gov/gmd/ccgg/trends), July.

North Wind (North Wind Incorporated), 2014, personal communication (email) from B. Frazee to S. Jennings, U.S. Department of Energy, "ETEC D&D Waste Quantity Estimates," November 10.

North Wind (North Wind Incorporated), 2015a, *Waste Management Plan, Energy Technology Engineering Center, Santa Susana Field Laboratory, Simi Valley, CA*, Revision 0-B, WMP-10784, June 9.

North Wind (North Wind Incorporated), 2015b, *Closure Plan, Hazardous Waste Management Facility: Buildings T029 and T133, ETEC, Santa Susana Field Laboratory, Area IV, Ventura County, California*, Revision 0, July 16.

North Wind (North Wind Incorporated), 2015c, *RCRA Closure Plan, Radioactive Materials Handling Facility, Buildings 4021, 4022, and 4621, ETEC, Santa Susana Field Laboratory, Area IV, Ventura County, California*, Revision 0, July 16.

NPS (National Park Service), 1995, *How to Apply the National Register Criteria for Evaluation*, National Register Bulletin 15 (available at http://www.nps.gov/nr/publications/bulletins/pdfs/nrb15.pdf).

NPS (National Park Service), 1998, P. Parker and T. F. King, *Guidelines for Evaluating and Documenting Traditional Cultural Properties*, National Register Bulletin 38 (available at https://www.nps.gov/nr/publications/bulletins/pdfs/nrb38.pdf).

NPS (National Park Service), 2013, *Rim of the Valley Corridor Special Resource Study*, "Frequently Asked Questions" (accessed on April 20, 2014, http://www.nps.gov/pwro/rimofthevalley/index.htm).

NPS (National Park Service), 2015a, *Santa Monica Mountains National Recreation Area*, "Current Projects" (accessed on March 10, 2015, http://parkplanning.nps.gov/parkHome.cfm?parkID=341).

NPS (National Park Service), 2015b, *SMMNRA Interagency Trail Management Plan* (accessed on October 10, 2015, http://parkplanning.nps.gov/projectHome.cfm?projectID=13510).

NPS (National Park Service), 2015c, *Redwood National Park/Santa Monica Mountains National Recreation Area Invasive Plant Management Plan Environmental Assessment* (accessed on March 11, 2015, http://parkplanning.nps.gov/projectHome.cfm?projectID=44351).

NPS (National Park Service), 2015d, *Visitor Center at King Gillette Ranch* (accessed on October 10, 2015, http://parkplanning.nps.gov/projectHome.cfm?projectID=23534).

NPS (National Park Service), 2015e, *Rim of the Valley Corridor Draft Special Resource Study and Environmental Assessment*, Pacific West Regional Office, Park Planning and Environmental Compliance, San Francisco, California, April.

NRC/EPA/DOE/DOD (U.S. Nuclear Regulatory Commission, U.S. Environmental Protection Agency, U.S. Department of Energy, U.S. Department of Defense), 2000, *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)*, NUREG-1575, Rev. 1, EPA 402-R-97-016, Rev 1, DOE/EH-0624, Rev. 1, August.

Ogden (Ogden Environmental and Energy Services Co., Inc.), 1998, *Biological Conditions Report Santa Susana Field Laboratory, Ventura County, California*, San Diego, California, April.

OHP (Office of Historic Preservation, California Department of Parks and Recreation), 2010, Personal communication (email) from M. W. Donaldson to C. Cooper, U.S. Environmental Protection Agency, "Re: Santa Susana Field Laboratory Area IV Radiological Testing, Ventura County, California," Sacramento, California, July 15.

OHP (Office of Historic Preservation, California Department of Parks and Recreation), 2015, Letter from C. Roland-Nawi to J. Jones, U.S. Department of Energy, ETEC Director, "RE: Section 106 initiation and APE consultation for Santa Susana Field Laboratory Proposed Action," Sacramento, California, February 25.

P2 Solutions, 2009, *Report on Community Interviews, Community Concerns and Preferences for Public Participation in Cleanup of Area IV, Santa Susana Field Laboratory* (available at http://www.etec.energy.gov/EIS/Documents/Community_Interviews.pdf), Idaho Falls, Idaho, February.

P2 Solutions, 2011, *Santa Susana Field Laboratory Former Worker Interviews* (available at http://etec.energy.gov/Environmental_and_Health/Documents/WorkerHealthFiles/former_Worker_Interview_Final_Report.pdf), Idaho Falls, Idaho, November.

Padre (Padre Associates, Inc.), 2010, Letter-report from S. Powell to P. Costa, The Boeing Company, "Re: Santa Susana Field Laboratory Preliminary Vernal Pool Assessment and Environmental Constraints Analysis for Special-Status Branchiopod Species," Project No. 1002-0021, Sacramento, California, April 8.

Padre (Padre Associates, Inc.), 2014, *Vernal Pool Branchiopod Habitat Assessment for the Boeing Santa Susana Field Laboratory, Ventura County, California*, Project No. 1402-0661, Sacramento, California, August.

Payton, W., 2014, Recology Environmental Solutions, Inc., Personal communication (e-mail) to G. Roles, Leidos, Inc., "Re: Contaminated Soil from Southern California," August 27.

Pearsons, K. S., D. S. Barber, B. G. Tabachnick, and S. Fidell, 1995, "Predicting noise-induced sleep disturbance," *Journal of the Acoustical Society of America*, Vol. 97, No. 1, January, pp. 331-338.

Penrod, K., C. R. Cabanero, P. Beier, C. Luke, W. Spencer, E. Rubin, R. Sauvajot, S. Riley, and D. Kamradt, 2006, *South Coast Missing Linkages Project: A Linkage Design for the Santa Monica-Sierra Madre Connection*, South Coast Wildlands, Idyllwild, California (available at http://www.scwildlands.org/reports/SCML_SantaMonica_SierraMadre.pdf), June.

Pickard, P. S., 2009, Sandia National Laboratories, *Sodium Reactor Experiment Accident – July 1959*, SRE [Sodium Reactor Experiment] Workshop, August 29.

Post/Hazeltine Associates, 2009, *Historic Structures/Sites Report for Area IV of the Santa Susana Field Laboratory*, Santa Barbara, California, April 9.

Public Health Institute, 2006, Letter from K. Nasseri, County of Santa Barbara Health Care Services, Tri-Counties Cancer Surveillance Program, "Re: concern about the possible increase in cancer cases in your neighborhood," Santa Barbara, California, October 10.

Recology (Recology Environmental Solutions, Inc.), 2014a, Fact sheet: *Hay Road Facility* (accessed on November 20, 2014, http://www.recologyhayroad.com/index.htm).

Recology (Recology Environmental Solutions, Inc.), 2014b, Fact sheet: *Ostrom Road State-of-the-Art Landfill* (accessed on November 20, 2014, http://www.recologyostromroad.com).

Rockwell (Rockwell International), 1976, *Building 003 Decontamination and Disposition Final Report*, AI-ERDA-13158, Canoga Park, California, February.

Rockwell (Rockwell International), 1982, *Radioactive Materials Disposal Facility Leach Field Environmental Evaluation Report*, ESG-DOE-13365, Canoga Park, California, February 23.

Rockwell (Rockwell International), 1983, *Sodium Reactor Experiment Decommissioning Final Report*, ESG-DOE-13403, Canoga Park, California, August 15.

Rockwell (Rockwell International), 1990, *Final Decontamination and Radiological Survey of the Old Conservation Yard*, Safety Review Report, August 16.

Rockwell (Rockwell International), 1992, *Tritium Production and Release to Groundwater at SSFL*, Safety Review Report, Canoga Park, California, December 1.

Roderick, K., 2001, *The San Fernando Valley: America's Suburb*, *Los Angeles Times Books*, Los Angeles, California.

Rozaire, C. E., 1959, "Pictographs at Burro Flats," *Ventura County Historical Society Quarterly*, Vol. 4, No. 2, February, pp. 2-6.

SAIC (Science Applications International Corporation), 2009a, *Fall Biological Survey Report for Santa Susana Field Laboratory Area IV and Northern Undeveloped Areas*, Carpinteria, California, November 13.

SAIC (Science Applications International Corporation), 2009b, *Characterization of Existing Conditions with Respect to Invasive Non-Native Species and Preliminary Recommendations to Minimize their Spread: Santa Susana Field Laboratory Area IV and Northern Undeveloped Areas*, Carpinteria, California, November 16.

SAIC (Science Applications International Corporation), 2010, *California Red-legged Frog Habitat Site Assessment at Santa Susana Field Laboratory Area IV and Vicinity*, Carpinteria, California, March 25.

Santa Ynez Band of Chumash Indians, 2014, Letter from V. P. Armenta, Tribal Chairman, to S. Jennings, NEPA Document Manager, U.S. Department of Energy, "Re: Santa Susana Field Laboratory (SSFL), Area IV and Northern Buffer Zone EIS, Acceptance of invitation to be Cooperating Agency," Santa Ynez, California, February 9.

Sapere (Sapere Consulting, Inc.), 2005, *Historical Site Assessment of Area IV, Santa Susana Field Laboratory, Ventura County, California*, May.

Saricks, C. L., and M. M. Tompkins, 1999, *State-Level Accident Rates of Surface Freight Transportation: A Reexamination*, ANL/ESD/TM-150, Center for Transportation Research, Argonne National Laboratory, Argonne, Illinois, April.

SCAG (Southern California Association of Governments), 2012, *Regional Transportation Plan 2012-2035, Sustainable Communities Strategy Towards a Sustainable Future*, Los Angeles, California, April 12.

SCAQMD (South Coast Air Quality Management District), 2013, *Final 2012 Air Quality Management Plan*, Diamond Bar, California, February.

SCCIC (South Central Coastal Information Center), 2009, "Re: Records Search for the Santa Susana Field Laboratory," SCCIC #10100.6981, Fullerton, California, December 22.

SCCIC (South Central Coastal Information Center), 2014, Letter from Michele Galaz to Stephen Bryne, SAIC, "Re: Santa Susana Field Laboratory," SCCIC #14058.219, Fullerton, California, June 10.

Scripps (Scripps Institution of Oceanography), 2014, *CO2 Concentration at Mauna Loa Observatory, Hawaii* (accessed on January 7, 2015, http://scrippsco2.ucsd.edu/), La Jolla, California.

SDLAC (Sanitation Districts of Los Angeles County), 2014, Fact sheet: Mesquite Regional Landfill (accessed on November 18, 2014, http://www.mrlf.org).

SFWQCB (San Francisco Bay Regional Water Quality Control Board), 2013, *2013 Tier 1 ESLs*, California Environmental Protection Agency, Water Boards, Oakland, California, December.

SMMC (Santa Monica Mountains Conservancy), 2014, Fact sheet: *Upper Las Virgenes Canyon Open Space Preserve (formerly Ahmanson Ranch)* (accessed on May 15, 2014).

SMMC (Santa Monica Mountains Conservancy), 2015, Fact sheet: *Sage Ranch Park* (accessed on April 4, 2015, http://lamountains.com/parks.asp?parkid=53).

SNL (Sandia National Laboratories), 2013, *RADTRAN6/RadCat 6 User Guide*, SAND2013-8095, Albuquerque, New Mexico, and Livermore, California, September.

South Coast Wildlands, 2008, *South Coast Missing Linkages: A Wildland Network for the South Coast Ecoregion* (available at http://www.scwildlands.org/reports/SCMLRegionalReport.pdf).

SSFLAP (Santa Susana Field Laboratory Advisory Panel), 2006, *Report of the Santa Susana Field Laboratory Advisory Panel*, (available at http://www.ssflpanel.org/files/SSFLPanelReport.pdf), October.

SWRCB (State Water Resources Control Board), 2009, *State General Permit for Storm Water Discharges Associated with Construction Activities* (accessed on April 16, 2015, http://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/constpermits/wqo_2009_0009_complete.pdf).

SWRCB (State Water Resources Control Board), 2010, California 2010 303(d) Combined California 2010 303(d) List (accessed on July 14, 2014, http://maps.waterboards.ca.gov/webmap/303d/files/2010_USEPA_approv_303d_List_Final_122311wsrcs.xls).

SWRCB (State Water Resources Control Board), 2014, *Wastes Allowed for Discharge at Disposal Facilities* (accessed on November 14, 2014, http://www.waterboards.ca.gov/water_issues/programs/land_disposal/walist.shtml).

SWRCB (State Water Resources Control Board), 2016, *California Drought*, State Water Board Adopts 'Stress Test' Approach to Water Conservation Regulation, May 18.

Target (Target Products Ltd.), 2015, Fact sheet: *Granular Activated Carbon Filter Media*, Burnaby, British Columbia, March.

TRB (Transportation Research Board), 2010, *HCM 2010 Highway Capacity Manual*, Fifth Edition, National Academies of Science, Washington, DC.

UCCE (University of California Cooperative Extension), 2014, Fact sheet: *Climate, Fire, and Habitat in Southern California,* Sustainable and Fire Safe Landscapes, California Division of Agriculture and Natural Resources, (accessed on January 1, 2015, http://ucanr.edu/sites/SAFELandscapes/Fire_in_Southern_California_Ecosystems/).

UCLA (University of California at Los Angeles), 1997, *Epidemiologic Study to Determine Possible Adverse Effects to Rocketdyne/Atomics International Workers from Exposure to Ionizing Radiation*, UCLA School of Public Health, June.

UCLA (University of California at Los Angeles), 1999, *Epidemiologic Study to Determine Possible Adverse Effects to Rocketdyne/Atomics International Workers from Exposure to Selected Chemicals*, Addendum Report, UCLA School of Public Health, January.

UM (University of Michigan), 2007, *Cancer Incidence in the Community Surrounding the Rocketdyne Facility in Southern California*, University of Michigan School of Public Health, Ann Arbor, Michigan, March.

UMTRI (University of Michigan Transportation Research Institute), 2003, *Evaluation of the Motor Carrier Management Information System Crash File, Phase One,* UMTRI-2003-6, Center for National Truck Statistics, Ann Arbor, Michigan, March.

Urban Crossroads, 2011, *Santa Susana Field Laboratory Area IV Traffic Noise Analysis, County of Los Angeles, California*, Irvine, California, October 12.

Urban Crossroads, 2012, *Santa Susana Field Laboratory Area IV Preliminary Pavement Condition Survey and Potential Pavement Construction Impact Cost Evaluation*, Irvine, California, January 13.

URS (URS Corporation), 2012, *Final Chemical Soil Background Study Report*, *Santa Susana Field Laboratory, Ventura County, California*, prepared for the California Environmental Protection Agency, Department of Toxic Substances Control, Los Angeles, California, December.

USACE (U.S. Army Corps of Engineers), 1987, *Corps of Engineers Wetlands Delineation Manual*, Wetlands Research Program Technical Report Y-87-1, Waterways Experiment Station, Vicksburg, Mississippi (available at http://el.erdc.usace.army.mil/elpubs/pdf/wlman87.pdf), January.

USACE (U.S. Army Corps of Engineers), 2008, *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)*, Wetlands Regulatory Assistance Program Vicksburg, Mississippi (available at http://www.usace.army.mil/Portals/2/docs/civilworks/regulatory/reg_supp/trel08-28.pdf), September.

USDA (U.S. Department of Agriculture), 2014a, Soil Survey Geographic (SSURGO) Database, Tabular Data Version 8, Map Unit Description, ShE-Saugus Sandy Loam, Natural Resources Conservation Service (available at http://websoilsurvey.nrcs.usda.gov), September 25.

USDA (U.S. Department of Agriculture), 2014b, Soil Survey Geographic (SSURGO) Database, Tabular Data Version 8, Map Unit Description, ZmC-Zamora Loam, Natural Resources Conservation Service (available at http://websoilsurvey.nrcs.usda.gov), September 25.

USDA (U.S. Department of Agriculture), 2014c, Soil Survey Geographic (SSURGO) Database, Tabular Data Version 8, Map Unit Description, ZmD2-Zamora Sandy Loam, Natural Resources Conservation Service (available at http://websoilsurvey.nrcs.usda.gov), September 25.

USDA (U.S. Department of Agriculture), 2014d, Soil Survey Geographic (SSURGO) Database, Tabular Data Version 8, Map Unit Description, SnG-Sedimentary Rock Land, Natural Resources Conservation Service (available at http://websoilsurvey.nrcs.usda.gov),September 25.

USFWS (U.S. Fish and Wildlife Service), 1998a, *Draft Recovery Plan for the Least Bell's Vireo*, *(Vireo bellii pusillus)*, Portland, Oregon.

USFWS (U.S. Fish and Wildlife Service), 1998b, *Vernal Pools of Southern California Recovery Plan*, Portland, Oregon, September.

USFWS (U.S. Fish and Wildlife Service), 1999, *Recovery Plan for Six Plants from the Mountains Surrounding the Los Angeles Basin*, Portland, Oregon, September.

USFWS (U.S. Fish and Wildlife Service), 2002, *Recovery Plan for the California Red-legged Frog (Rana aurora draytonii)*, Portland, Oregon, May 28.

USFWS (U.S. Fish and Wildlife Service), 2005, *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon*, Portland, Oregon (available at http://ecos.fws.gov/docs/recovery_plans/2006/060307_docs/doc531.pdf), December 15.

USFWS (U.S. Fish and Wildlife Service), 2006a, "Endangered and Threatened Wildlife and Plants: Designation of Critical Habitat for Four Vernal Pool Crustaceans and Eleven Vernal Pool Plants," *Federal Register*, Vol. 71, No. 28, February 10, pp. 7118-7316.

USFWS (U.S. Fish and Wildlife Service), 2006b, "Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Astragalus brauntonii and Pentachaeta lyonii," *Federal Register* Vol. 71, No. 219, November 14, pp. 66374-66423.

USFWS (U.S. Fish and Wildlife Service), 2010, *Biological Opinion for the Santa Susana Field Laboratory Area IV Radiological Study Project, Ventura County, California*, Ventura, California, May 25.

USGCRP (U.S. Global Change Research Program), 2014, *Climate Change Impacts in the United States*, U.S. National Climate Assessment, Washington, DC (available at http://www.globalchange.gov/nca3-downloads-materials), May.

Ventura County, 2011a, *Ventura County General Plan*, "Land Use Appendix," Ventura, California, June 28.

Ventura County, 2011b, *2011-2016 County of Ventura Strategic Plan, 2014 Update* (available at http://vcportal.ventura.org/CEO/docs/publications/Strategic_Plan_091311-1.c.pdf), September.

Ventura County, 2015a, *Ventura County General Plan Goals, Policies, and Programs*, PL 13-0109, Ventura, California (available at http://www.ventura.org/rma/planning/pdf/plans/Goals-Policies-and-Programs.pdf), September 22.

Ventura County, 2015b, *Ventura County Non-Coastal Zoning Ordinance, Division 8, Chapter 1 of the Ventura County Ordinance Code*, Ventura County Planning Division, Ventura, California (available at https://www.ventura.org/rma/planning/pdf/zoning/VCNCZO_current.pdf), March 24.

Wagner, J. R., and M. Perkins, 2009, *20 Elements of the Santa Susana Field Laboratory Site Conceptual Model of Contaminant Transport, Site Conceptual Model Element 4-1*, Draft, Technical Memorandum: Characteristics of Joints at the Santa Susana Field Laboratory, Simi, California, December 10.

Waste Management, 2014, Fact sheet: *Altamont Landfill and Resource Recovery Facility*, Livermore, California (available at https://www.wmsolutions.com/pdf/factsheet/Altamont_Landfill.pdf).

WCI (Waste Connections, Inc.), 2014a, Personal communication (email) from M. Dufort to G. Roles, Leidos, Inc., "RE: SSFL D&D EIS Information," May 7.

WCI (Waste Connections, Inc.), 2014b, Personal communication (email) from M. Dufort to G. Roles, Leidos, Inc., "RE: SSFL D&D EIS Information," May 8.

WCS (Waste Control Specialists LLC), 2016, Our Facilities, Site Capabilities (accessed on June 21, 2016, http://www.westexas.com/facilities/site-capabilities/), Dallas Texas.

Werner, S. M., 2012, *Least Bell's Vireo Protocol Survey of the EPA Radiological Study Area at the Santa Susana Field Laboratory, 2012*, Werner Biological Consulting, Ojai, California, July.

WMI (Waste Management, Inc.), 2014, Personal communication (email) from M. Amirseyedian to G. Roles, Leidos, Inc., "RE: Santa Susana Field Laboratory (Simi Valley, CA) – Contaminated Soil," May 6.

WMI (Waste Management, Inc.), 2015, Personal communication (email) from M. Amirseyedian to G. Roles, Leidos, Inc., "RE: McKittrick Waste Treatment Site," September 3.

WMI (Waste Management, Inc.), 2016, Personal communication (email) from M. Amirseyedian to G. Roles, Leidos, Inc., "RE: McKittrick Waste Treatment Site," October 11.

WRCC (Western Region Climate Center), 2014, *Canoga Park Pierce Coll, California (041484),* "Period of Record Monthly Climate Summary," Period of Record: 7/1/1949 to 8/10/2011 (accessed on August 5, 2015, http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca1484).

Wright, W. E., and C. Perkins, 1990, Research and Surveillance Program, Memorandum to R. L. Holtzer, Environmental Epidemiology and Toxicology Branch, "Re: Cancer incidence rates, L.A. County," October 10.

Yuan, Y. C., S. Y. Chen, B. M. Biwer, and D. J. LePoire, 1995, *RISKIND—A Computer Program for Calculating Radiological Consequences and Health Risks from Transportation of Spent Nuclear Fuel*, ANL/EAD-1, Argonne National Laboratory, Argonne, Illinois, November.

Chapter 11
Glossary

11.0 GLOSSARY

***absorbed dose* —** The energy imparted by ionizing radiation per unit mass of the irradiated material (e.g., biological tissue).

***adsorption* —** Atoms, ions, or molecules from a gas, liquid, or dissolved solid sticking to a surface.

***air pollutant* —** Generally, an airborne substance that could, in high enough concentrations, harm living things or cause damage to materials. From a regulatory perspective, an air pollutant is a substance for which emissions or atmospheric concentrations are regulated, or for which maximum guideline levels have been established because of potential harmful effects on human health and welfare.

***air quality* —** The cleanliness of the air as measured by the levels of pollutants relative to standards or guideline levels established to protect human health and welfare. Air quality is often expressed in terms of the pollutant for which concentrations are the highest percentage of a standard (e.g., air quality may be unacceptable if the level of a single pollutant exceeds its standard, even if levels of other pollutants are well below their respective standards).

***alluvium* —** Clay, silt, sand, gravel, or similar material that has been eroded from rocks transported from the rocks location of origin by gravity, wind, or water and deposited by running water.

***alpha particle* —** Alpha particles consist of two protons and two neutrons. They can travel only a few centimeters in air and can be stopped easily by a sheet of paper or by the skin's surface. (See *neutron*.)

***ambient air quality standards* —** Regulations prescribing the levels of airborne pollutants that may not be exceeded during a specified time within a defined area.

***aquifer* —** A body of rock that is sufficiently porous and permeable (i.e., contains spaces between the rock and soil particles that permit water to move through) to store, transmit, and yield significant quantities of groundwater to wells and springs.

***archaeological resources* —** Resources that occur in places where people altered the ground surface or left artifacts or other physical remains (e.g., arrowheads, glass bottles, pottery). Archaeological resources can be classified as either sites or isolates. Isolates generally cover a small area and often contain only one or two artifacts, while sites are usually larger in size, contain more artifacts, and sometimes contain features or structures. Archaeological resources can date to either the pre-contact, ethnographic, or post-contact eras.

***architectural resources* —** Standing buildings, facilities, wells, canals, bridges, and other such structures. In the Santa Susana Field Laboratory region, they are generally affiliated with the historic era.

***area of potential effects* —** The geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist.

***average daily traffic* —** The average number of vehicles passing a specific point in both directions in a 24-hour period, normally measured throughout a year.

***bedrock* —** Solid rock underlying loose deposits, such as soil or alluvium.

***beta particle* —** Beta particles are smaller and lighter than alpha particles and have the mass of a single electron. A high-energy beta particle can travel a few meters in air. Beta particles can pass through a sheet of paper but may be stopped by a thin sheet of aluminum or glass. (See *alpha particle*.)

***cancer fatality* —** A death resulting from cancer; also referred to as cancer mortality.

***cancer incidence* —** The occurrence of a cancer; also referred to as cancer morbidity.

***characterization (waste)* —** The determination of waste composition and properties, whether by review of process knowledge, nondestructive examination or assay, or sampling and analysis, that is generally done to determine appropriate storage, treatment, handling, transport, and disposal requirements.

***chert* —** A microcrystalline or cryptocrystalline sedimentary rock material composed of silicon dioxide.

circa (from Latin, meaning "around, about") **—** Means "approximately" in several European languages, including English, usually in reference to a date.

***collective dose* —** The sum of the individual doses received in a given period of time by a specified population from exposure to a specified source of radiation. In this environmental impact statement, collective dose is expressed in units of person-rem.

***community noise equivalent level (CNEL)* —** The average noise level over a 24-hour period with decibel "penalties" applied to noise events during the evening and night. The CNEL metric is used to predict the percentage of an affected population that would be highly annoyed by noise.

***concentration* —** The quantity of a substance in a unit quantity (e.g., milligrams per liter or micrograms per kilogram).

***conglomerate* —** Rock composed of rounded pebbles that are cemented together with another mineral substance. Clay, silt, and sand can also be present.

***Council on Environmental Quality regulations* —** Regulations found in Title 10, *Code of Federal Regulations*, Parts 1500–1508, that direct Federal agencies in complying with the procedures of and achieving the goals of the National Environmental Policy Act.

***criteria pollutants* —** An air pollutant that is regulated by the National Ambient Air Quality Standards. The U.S. Environmental Protection Agency must describe the characteristics and potential health and welfare effects that form the basis for setting, or revising, the standard for each regulated pollutant. Criteria pollutants include sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone, lead, and two size classes of particulate matter (less than 10 micrometers [0.0004 inches] in diameter and less than 2.5 micrometers [0.0001 inches] in diameter). New pollutants may be added to or removed from the list of criteria pollutants as more information becomes available.

***cultural landscapes* —** Geographic areas where cultural and natural resources and wildlife have been associated with historic events, activities, or people, or which serve as an example of cultural or aesthetic value. The four types of cultural landscapes are historic sites (e.g., battlefields, properties of famous historical figures); historic designed landscapes (e.g., parks, estates, gardens); historic vernacular landscapes (e.g., industrial parks, agricultural landscapes, villages); and ethnographic landscapes (contemporary settlements, religious sites, massive geological structures) (Birnbaum 1994). This latter category includes traditional cultural landscapes.

cultural resources — A prehistoric or historic district, site, building, structure, or object considered to be important to a culture, subculture, or community for scientific, traditional, religious, or other reasons. Cultural resources are usually divided into three major categories: prehistoric and historic archaeological resources, architectural resources, and traditional cultural resources.

cumulative impacts — Impacts on the environment that result when the incremental impact of a proposed action is added to the impacts from other past, present, and reasonably foreseeable future actions, regardless of which agency (Federal or non–Federal) or person undertakes the other actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time (Title 40, *Code of Federal Regulations,* Section 1508.7).

curie — The basis unit used to describe the intensity of radioactivity in a sample of material; it is equal to 37 billion disintegrations per second. One trillionth of a curie is a picocurie. (See *radioactivity*.)

daughter product — An isotope that is formed by the radioactive decay of another isotope.

decibel — A unit used to measure the intensity of a sound or the power level of an electrical signal by comparing it with a given level on a logarithmic scale (in general use, a degree of loudness).

decibels A-weighted (dBA) — A-weighted decibels are an expression of the relative loudness of sounds in air as perceived by the human ear. In the A-weighted system, the decibel values of sounds at low frequencies are reduced; no correction is made for audio frequency when unweighted decibels are used. The correction is made using dBAs because the human ear is less sensitive to low audio frequencies, especially those below 1000 Hertz, than high audio frequencies.

decommissioning — Removing facilities such as processing plants, waste tanks, and burial grounds from service and reducing or stabilizing radioactive contamination. Includes the following concepts: decontamination, dismantling, and return of an area to its original condition without restrictions on use or occupancy; partial decontamination; isolation of remaining residues; and continued surveillance and restrictions on use or occupancy.

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 or chemical contamination from facilities, equipment, or soils by washing, heating, chemical or electrochemical action, mechanical cleaning, or other techniques.

diffusion — The transfer of molecules from an area of higher concentration to an area of lower concentration.

dioxin — A poisonous chemical that is sometimes used in farming and industry; sometimes a byproduct of manufacturing chemicals and burning fuels and waste.

dip — The angle at which a stratum or other planar feature is inclined from the horizontal. The strike of a structure is perpendicular to the direction of the dip.

disposal — As used in this environmental impact statement, the term is used for emplacing waste in a manner that ensures its isolation from the biosphere, with no intent of retrieval; as such, deliberate action would be required to gain access after emplacement.

disposal facility — A natural and/or man-made structure in which waste is disposed. (See *disposal*.)

dose (radiation) — As used in this environmental impact statement, it means total effective dose, a term referring to the amount of energy absorbed by a tissue or organ adjusted by a radiation weighting factor, a tissue weighting factor, and other factors that allows radiation of different types received through different modes of exposure to be compared on a common basis.

emission — A material discharged into the atmosphere from a source operation or activity.

enhanced groundwater treatment — As used in this environmental impact statement, injection of a chemical or a nutrient into groundwater to enhance chemical or biological degradation of chemical constituents in groundwater.

environmental assessment — A concise public document prepared pursuant to the National Environmental Policy Act that provides sufficient evidence and analysis for determining whether a Federal agency should issue a Finding of No Significant Impact or prepare an environmental impact statement.

environmental impact statement (EIS) — A detailed written statement required by Section 102(2)(C) of the National Environmental Policy Act (NEPA) for a proposed major Federal action significantly affecting the quality of the human environment. A U.S. Department of Energy (DOE) EIS is prepared in accordance with applicable requirements of the Council on Environmental Quality NEPA regulations in Title 40, *Code of Federal Regulations*, Parts 1500-1508 (40 CFR Parts 1500–1508) and the DOE NEPA regulations in 10 CFR Part 1021. The statement includes, among other information, discussions of the environmental impacts of the proposed action and all reasonable alternatives; adverse environmental effects that cannot be avoided should the proposal be implemented; the relationship between short-term uses of the human environment and enhancement of long-term productivity; and any irreversible and irretrievable commitments of resources.

environmental justice — 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 racial, ethnic, or socioeconomic groups, 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. Executive Order 12898 directs Federal agencies to make achieving environmental justice part of their missions by identifying and addressing disproportionately high and adverse effects of agency programs, policies, and activities on minority and low-income populations.

ephemeral drainage — A stream or drainage feature that flows only briefly and in response to precipitation in the immediate vicinity. The channel of the ephemeral drainage is above the water table.

equivalent single-axle load — A measure of the impact of the damage caused to road pavement by the passing of a single 18,000-pound vehicle axle.

ethnographic — Refers to time periods during which specific cultures existed and related information can be systematically studied and recorded. Formal study of Native American culture in the United States is considered to have begun in the late 1800s.

excess lifetime risk — The additional or extra risk of developing a cancer due to exposure to a toxic substance incurred over the lifetime of an individual.

exposure — Being exposed to a radioactive or chemical material.

fault — Linear geologic structures along which movement of rocks has taken place. Movement, or displacement, along the fault can be a few feet or hundreds of feet.

fault zone — A fault that is expressed as a zone of many smaller faults. A fault zone may be hundreds of feet wide.

Finding of No Significant Impact (FONSI) — A public document issued by a Federal agency that briefly presents the reasons why an action for which the agency has prepared an environmental assessment has no potential to have a significant effect on the human environment and, thus, does not require preparation of an environmental impact statement. (See *environmental assessment* and *environmental impact statement*.)

gamma radiation — Gamma rays (and x-rays), unlike alpha or beta particles, are waves of pure energy. Gamma radiation is very penetrating and can travel several hundred feet in air. Gamma radiation requires a thick wall of concrete, lead, or steel to stop it. (See *alpha particle* and *beta particle*.)

global warming potential (GWP) — The ability of a gas or aerosol to trap heat in the atmosphere. The GWP rating system is standardized to carbon dioxide, which has a value of one. For example, methane has a GWP of 28, which means that it has a global warming effect 28 times greater than carbon dioxide on an equal-mass basis.

granular activated carbon — A highly porous, adsorbent material produced by heating organic matter, such as coal, wood, and coconut shell, in the absence of air and crushing the material into granules.

greenhouse gases — Gases that trap heat in the atmosphere by absorbing infrared radiation.

groundwater — Water below the ground surface in a zone of saturation.

half-life (radiological) — The time in which one-half of the atoms of a particular radionuclide disintegrate into another nuclear form. Half-lives for specific radionuclides vary from millionths of a second to billions of years.

hazard index — The sum of hazard quotients of noncarcinogenic chemicals that affect the same target organ or organ system. A cumulative hazard index below 1.0 will likely not result in adverse noncancer health effects over a lifetime of exposure.

hazard quotient — A unitless value determined by: (1) dividing the exposure concentration by the reference concentration reported in the U.S. Environmental Protection Agency Integrated Risk Information System for direct inhalation exposures or (2) dividing the average daily dose by the reference dose for oral exposures. The reference concentration is an estimate of a continuous exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime.

hazardous air pollutants — Air pollutants that are not covered by the National Ambient Air Quality Standards, but may present a threat of adverse human health or environmental effects. Those specifically listed in Title 40, *Code of Federal Regulations*, Section 61.01 are asbestos, benzene, beryllium, coke oven emissions, inorganic arsenic, mercury, radionuclides, and vinyl chloride. More broadly, hazardous air pollutants are any of the 189 pollutants listed in or pursuant to Section 112(b) of the Clean Air Act. Very generally, hazardous air pollutants are any air pollutants that may realistically be expected to pose a threat to human health or welfare. (See *toxic air contaminants*.)

hazardous waste — Waste that is defined as hazardous waste under the Resource Conservation and Recovery Act (Title 42, *United States Code*, Section 6901 et seq.) or state statute or regulation. State regulations may define a larger spectrum of materials as hazardous waste than Federal regulations.

heavy-duty truck — As used in this environmental impact statement, a vehicle used for transporting materials and having a gross vehicle weight rating exceeding 33,000 pounds.

***historic properties* —** Any pre-contact or post-contact districts, sites, buildings, structures, or objects included in, or eligible for inclusion in, the *National Register of Historic Places* (Title 36, *Code of Federal Regulations*, Sections 800.16(l)(1) and (2)).

***in situ* —** In its original place.

***isotope* —** Any of two or more variations of an element in which the nuclei have the same number of protons (i.e., the same atomic number) but different numbers of neutrons so that their atomic masses differ. Isotopes of a single element possess almost identical chemical properties, but often different physical properties (e.g., carbon-12 and -13 are stable, but carbon-14 is radioactive).

***joint* —** A fracture in rock, generally more or less vertical to the bedding, along which no appreciable movement has occurred.

***latent cancer fatality* —** Deaths from cancer resulting from and occurring sometime after exposure to ionizing radiation or other carcinogens.

***leach field* —** A plot of land on which sewage liquid undergoes natural biological decontamination as it is filtered through soil horizons.

***level of service* —** A qualitative measurement of operational conditions affecting the traffic on a roadway based on factors such as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience, and safety.

low-level radioactive waste —Radioactive waste not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or the tailings or wastes produced by the extraction or concentration of uranium or thorium from ore processed primarily for its source material. Test specimens of fissionable material that are irradiated for research and development only, not for the production of power or plutonium, may be classified as low-level radioactive waste, provided the transuranic concentrations are less than 100 nanocuries per gram of waste (DOE Order 435.1).

***maximally exposed individual* —** A hypothetical individual worker or member of the public whose location and habits result in the highest total radiological or chemical exposure (and thus dose) from a particular source for all exposure pathways (inhalation, ingestion, external exposure).

***maximum contaminant level (MCL)* —** Standards that are set by the United States Environmental Protection Agency for drinking water quality. An MCL is the legal threshold limit on the amount of a substance that is allowed in public water systems under the Safe Drinking Water Act.

***medium-duty truck* —** As used in this environmental impact statement, a vehicle used for transporting materials that has a gross vehicle weight rating between 14,001 and 26,000 pounds.

***midden* —** A mound or deposit containing shells, animal bones, and other refuse that indicates the site of a human settlement.

***millirem* —** One-thousandth of a roentgen equivalent man (rem) (see r*oentgen equivalent man*).

***mitigation* —** Includes: (1) avoiding an impact altogether by not taking a certain action or parts of an action; (2) minimizing impacts by limiting the degree or magnitude of an action and its implementation; (3) rectifying an impact by repairing, rehabilitating, or restoring the affected environment; (4) reducing or eliminating the impact over time by preservation and maintenance operations during the life of an action; or (5) compensating for an impact by replacing or providing substitute resources or environments.

***mixed low-level radioactive waste* —** Low-level radioactive waste that also contains hazardous components regulated under the Resource Conservation and Recovery Act (RCRA) (Title 42, *United States Code*, Section 6901 et seq.) or state statute or regulation. State regulations may define a larger spectrum of materials as hazardous waste than Federal RCRA regulations.

***monitored natural attenuation* —** Natural attenuation is the use of natural processes to contain or reduce the concentrations of constituents at a cleanup site. Monitored natural attenuation integrates monitoring, through sampling and analysis of groundwater, with natural attenuation to confirm that the concentrations of chemicals of interest are in fact decreasing. Mechanisms include biodegradation (degradation caused by naturally occurring microbes), as well as physical processes such as volatilization, dispersion, dilution, and radioactive decay.

***National Pollutant Discharge Elimination System (NPDES)* —** A provision of the Clean Water Act that prohibits discharge of pollutants into waters of the United States unless a special permit is issued by the U.S. Environmental Protection Agency, a state, or, where delegated, a tribal government. An NPDES permit typically includes effluent limitations based on applicable technology and water quality standards, as well as monitoring and reporting requirements, and may include other provisions such as special studies or compliance schedules.

***National Priorities List (NPL)* —** The U.S. Environmental Protection Agency's (EPA) list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial action under the Comprehensive Environmental Response, Compensation, and Liability Act. The list is based primarily on the score a site receives from the Hazard Ranking System described in Title 40, *Code of Federal Regulations*, Part 300, Appendix A. EPA must update the NPL at least once a year.

***neutron* —** A neutron is an atomic particle that has about one-quarter the weight of an alpha particle. Like gamma radiation, it can easily travel several hundred feet in air. Neutron radiation is most effectively stopped by materials with high hydrogen content, such as water or plastic. (See *alpha particle* and *gamma radiation*.)

***nonattainment area* —** An area that the U.S. Environmental Protection Agency has designated as not meeting (i.e., not being in attainment of) one or more of the National Ambient Air Quality Standards for sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone, lead, and particulate matter. An area may be in attainment for some pollutants, but not for others.

***nonhazardous waste* —** Discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations or from community activities. This category does not include source, special nuclear, or byproduct material as defined by the Atomic Energy Act (Title 42, *United States Code*, Section 2011 et seq.)

***Notice of Intent (NOI)* —** A notice published in the *Federal Register* that an environmental impact statement (EIS) will be prepared and considered. The NOI is intended to briefly describe the proposed action and possible alternatives; describe the agency's proposed scoping process, including whether, when, and where any scoping meeting(s) will be held; and state the name and address of a person within the agency who can answer questions about the proposed action and the EIS.

***off-link* —** A term used in radioactive transportation analyses to describe populations living within 0.50 miles of a shipment route.

***offsite* (adjective) —** Denotes a location, facility, or activity occurring outside of the boundary of a U.S. Department of Energy complex site.

***on-link* —** A term used in radioactive transportation analyses to describe pedestrians and car occupants sharing the shipment route.

***onsite* (adjective) —** Denotes a location or activity occurring within the boundary of a U.S. Department of Energy complex site.

particulate matter (PM) — Any finely divided solid or liquid material, other than uncombined (i.e., pure) water. A subscript denotes the upper limit of the diameter of particles included. Thus, PM_{10} includes only those particles equal to or less than 10 micrometers (0.0004 inches) in diameter; $PM_{2.5}$ includes only those particles equal to or less than 2.5 micrometers (0.0001 inches) in diameter.

perched groundwater — A saturated zone in a formation that is discontinuous from the water table below it. The perched zone may be ephemeral (i.e., may be in direct response to precipitation in the immediate vicinity) or be recharged by percolation from a nearby surface water body.

perchlorate — Perchlorates are salts derived from perchloric acid.

perchloroethylene — A colorless, nonflammable liquid (chemical formula: C_2Cl_4) used primarily for dry cleaning fabrics and degreasing metals. It is also called tetrachloroehylene.

permanganate — The general name for a chemical compound or salt containing the manganate(VII) ion (MnO4−). Because manganese is in the +7 oxidation state, the permanganate(VII) ion is a strong oxidizing agent.

permeability — A measure of a rock's ability to transmit fluid (in this case water); also, the rate at which the fluid can move a given distance over a given interval of time.

person-rem — A unit of collective radiation dose applied to a population or group of individuals. It is calculated as the sum of the estimated doses, in rem, received by each individual of the specified population. For example, if 1,000 people each received a dose of 0.001 rem (1 millirem), the collective dose would be 1 person-rem (1,000 persons × 0.001 rem) (see *roentgen equivalent man* and *millirem*).

pH (literally, power of hydrogen) — A measure of a solution's acidity or alkalinity. The pH of distilled water is 7, which is neutral. Any solution with a pH below 7 (i.e., a pH of 1.0 to 6.9) is an acid. Any solution with a pH above 7 (i.e., a pH of 7.1 to 14) is an alkali.

phytoremediation — A process of decontaminating soil or water by using plants and trees to absorb or break down pollutants.

piezometer — A vertical pipe installed in a manner similar to wells, except that the casing is typically a much smaller diameter than that used for a groundwater monitoring well. A piezometer's main function is measuring the depth to water in an aquifer and collecting water samples.

plume — The elongated volume of contaminated water or air originating at a pollutant source such as an outlet pipe or a smokestack. A plume eventually diffuses into a larger volume of less-contaminated material as it is transported away from the source.

polychlorinated biphenyls — A group of toxic, persistent chemicals regulated under the Toxic Substances Control Act that is used for insulating purposes in electrical transformers and capacitors and in gas pipeline systems.

polycyclic aromatic hydrocarbons — Any of a class of carcinogenic organic molecules that consist of three or more benzene rings and are commonly produced by fossil fuel combustion.

porosity — The ratio of the volume of the space (or pores) between particles in a rock to the volume of the entire rock (expressed as a percentage).

pre-contact and post-contact — These terms refer to the periods before and after an indigenous people encounter an outside culture. The Spanish 1769 arrival in California is considered to be the turning point from pre-contact to post-contact.

Preliminary Remediation Goal — Concentrations levels set for individual chemicals or radionuclides that, for carcinogens, corresponds to a specific cancer risk level, and for noncarcinogens corresponds to a hazard quotient of 1.

pump and treat — A widely used groundwater treatment involving pumping contaminated water to the surface for treatment by a variety of possible methods.

rad — See *radiation absorbed dose.*

radiation absorbed dose (rad) — A unit of absorbed dose. One rad is equal to an absorbed dose of 0.01 joules per kilogram. (See *absorbed dose.*)

radiation (ionizing) — Particles (alpha, beta, neutrons, and other subatomic particles) or photons (i.e., gamma, x-rays) emitted from the nucleus of unstable atoms as a result of radioactive decay. Such radiation is capable of displacing electrons from atoms or molecules in the target material (such as biological tissues), thereby producing ions.

radioactive decay — The decrease in the amount of any radioactive material with the passage of time, due to the spontaneous emission from the atomic nuclei of either alpha or beta particles, often accompanied by gamma radiation. (See *half-life.*)

radioactive waste — Solid, liquid, or gaseous material that contains radionuclides regulated under the Atomic Energy Act of 1954, as amended, that is of negligible economic value considering the costs of recovery.

radioactivity —

Defined as a process: The spontaneous transformation of unstable atomic nuclei, usually accompanied by the emission of ionizing radiation.

Defined as a property: The property of unstable nuclei in certain atoms to spontaneously emit ionizing radiation during nuclear transformations.

radioisotope or radionuclide — An unstable isotope that undergoes spontaneous transformation, emitting radiation. (See *isotope.*)

Record of Decision (ROD) — A concise public document that records a Federal agency's decision(s) concerning a proposed action for which the agency has prepared an environmental impact statement. The ROD is prepared in accordance with the requirements of the Council on Environmental Quality National Environmental Policy Act regulations (Title 40, *Code of Federal Regulations*, Section 1505.2). A ROD identifies the alternatives considered in reaching the decision, the environmentally preferable alternative(s), factors balanced by the agency in making the decision, whether all practicable means to avoid or minimize environmental harm have been adopted, and if not, why they were not. (See *environmental impact statement.*)

region of influence — A site-specific geographic area in which the principal direct and indirect effects of actions are likely to occur and are expected to be of consequence for local jurisdictions.

rem — See r*oentgen equivalent man.*

remediation — The process, or a phase in the process, of rendering radioactive, hazardous, or mixed waste environmentally safe, whether through processing, entombment, or other methods.

risk — The probability of a detrimental effect from exposure to a hazard. To describe impacts, risk is often expressed quantitatively as the probability of an adverse event occurring, multiplied by the consequence of that event (i.e., the product of these two factors). However, a separate presentation of probability and consequence to describe impacts is often more informative.

risk-based screening levels — Risk-based, site-specific, corrective action target levels for chemicals or radionuclides of concern.

roentgen — A unit of exposure to ionizing radiation equal to the amount of gamma or x-rays that produces one electrostatic unit charge in a cubic centimeter of air. (See *gamma radiation.*)

roentgen equivalent man (rem) — A unit of radiation dose used to measure the biological effects of different types of radiation on humans. The dose in rem is estimated by a formula that accounts for the type of radiation, the total absorbed dose, and the tissues involved. One thousandth of a rem is a millirem. (See *absorbed dose and millirem*.)

sacred sites — Well-known areas that are associated with the cultural practices or beliefs of a living community. Most traditional cultural properties, resources, or sacred sites in the Santa Susana Field Laboratory region are associated with Native Americans.

sandstone — Rock composed of sand-sized particles that also contains finer-grained particles that form the "matrix" or the material in which the sand grains are embedded.

scope — In a document prepared pursuant to the National Environmental Policy Act, the range of actions, alternatives, and impacts to be considered.

scoping — An early and open process for determining the scope of issues and alternatives to be addressed in an environmental impact statement (EIS) (or other National Environmental Policy Act [NEPA] document) and for identifying the significant issues related to a proposed action. The scoping period begins after publication in the *Federal Register* of a Notice of Intent to prepare an EIS (or other NEPA document). The public scoping process is that portion of the process where the public is invited to participate. The U.S. Department of Energy (DOE) also conducts an early internal scoping process for environmental assessments or EISs (and supplemental environmental impact statements [SEISs]). For EISs and SEISs, this internal scoping process precedes the public scoping process. DOE's scoping procedures are found in Title 10, *Code of Federal Regulations*, Section 1021.311.

shale — Rock composed predominately of clay-sized particles.

siltstone — Rock composed predominately of silt-sized particles.

soil vapor extraction — A remedial technology that reduces concentrations of volatile constituents in petroleum products adsorbed to soils in the unsaturated (vadose) zone. Using this technology, a vacuum is applied through wells near the source of contamination in the soil. Volatile constituents of the contaminant mass "evaporate," and the vapors are drawn toward the extraction wells. Extracted vapor is then treated as necessary (commonly with carbon adsorption) before being released to the atmosphere. The increased airflow through the subsurface can also stimulate biodegradation of some of the contaminants, especially those that are less volatile. Wells may be either vertical or horizontal. In areas of high groundwater levels, water table depression pumps may be required to offset the effect of upwelling induced by the vacuum.

soils — All unconsolidated materials above bedrock. Also, natural earthy materials on the Earth's surface, in places modified or even made by human activity, that contain living matter and support or are capable of supporting plants out of doors.

***strike* —** The bearing or direction of a horizontal line in the plane of an inclined surface, including strata, joints, faults, or other structural planes.

***total petroleum hydrocarbon* —** A term used to describe a large family of several hundred chemical compounds that originally come from crude oil.

***toxic air contaminants* —** Airborne toxic compounds that pose some level of acute or chronic health risk (cancer or noncancer) to the general public. The California Air Resources Board regulates these compounds as "toxic air contaminants." The U.S. Environmental Protection Agency regulates them as "hazardous air pollutants."

***traditional cultural properties* —** Areas that are associated with the cultural practices or beliefs of a living community that link the community to its past, are "important in maintaining the continuing cultural identity of the community," and are potentially eligible for listing or are listed on the *National Register of Historic Places*. Traditional cultural properties may also be associated with other traditional life ways, such as agriculture. Traditional cultural properties can include archaeological resources, locations of pre-contact or post-contact events, sacred areas, traditional hunting and gathering areas, or landscapes.

***traditional cultural resources* —** Resources that are associated with the cultural practices or beliefs of a living community, link the community to its past and help maintain its cultural identity, but have not been evaluated for *National Register of Historic Places* (NRHP) eligibility or may not meet the NRHP eligibility criteria. Traditional cultural resources may also be associated with other traditional life ways, such as agriculture. Traditional cultural resources can include archaeological resources, sources of raw materials used in the manufacture of tools and/or sacred objects, and certain plants.

***trichloroethylene* —** A nonflammable toxic liquid (molecular formula C_2HCl_3) used especially as an industrial solvent.

***tritium* —** A beta-particle-emitting radioactive isotope of hydrogen whose nucleus contains one proton and two neutrons. Because it is chemically identical to natural hydrogen, tritium can easily be taken into the body by any ingestion pathway. (See *neutron*.)

***unweathered bedrock* —** Bedrock that has either never been exposed at the earth's surface or has been exposed at the surface, but whose character has not been changed as a result of the actions of air, rainwater, plants, bacteria, or mechanical action as a result of changes in temperature.

***vadose zone* —** The unsaturated soil above the water table. The vadose zone may contain residual water, but it is not completely saturated. Air and gases in the vadose zone are under atmospheric pressure.

***vernal pool* —** A seasonal body of standing water that typically forms in the spring from melting snow and other runoff, dries out completely in the hotter months of summer, and often refills in the autumn.

***viewshed* —** The extent of the area that may be viewed from a particular location. Viewsheds are generally bounded by topographic features such as hills or mountains.

***volatile organic compounds* —** Organic chemicals that have a high vapor pressure at ordinary room temperature. Their high vapor pressure results from a low boiling point, which causes large numbers of molecules to evaporate or sublimate from the liquid or solid form of the compound and enter the surrounding air.

***water table* —** The surface of an aquifer or perched zone formed by the upper limit of the zone of saturation; along this surface, the pressure is the same as atmospheric pressure.

weathered bedrock — Bedrock that has been exposed at the earth's surface and subjected to the actions of air, rainwater, plants, and bacteria and mechanical action resulting from changes in temperature that collectively cause bedrock to change in character, decay, and finally become soil.

wetland — An area that is inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

CHAPTER 12
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12.0 INDEX

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CHAPTER 14
DISTRIBUTION LIST

14.0 DISTRIBUTION LIST

The U.S. Department of Energy provided copies of the *Draft Environmental Impact Statement for Remediation of Area IV and the Northern Buffer Zone of the Santa Susana Field Laboratory* (*Draft SSFL Area IV EIS*) to members of Congress; Federal, state, and local elected and appointed government officials and agencies; Native American representatives; and organizations and individuals as listed. Approximately 15 copies of the *Draft SSFL Area IV EIS,* 700 copies of the Summary of the *Draft SSFL Area IV EIS*, and 35 compact discs of the *Draft SSFL Area IV EIS* were sent to interested parties. Copies will be provided to others upon request.

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The Honorable John Cornyn, Texas
The Honorable Ted Cruz, Texas
The Honorable Michael D. Crapo, Idaho
The Honorable Dianne Feinstein, California
The Honorable Orrin G. Hatch, Utah
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U.S. House of Representatives Committees

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The Honorable Lamar Smith, Chairman
The Honorable Eddie Bernice Johnson, Ranking Member

Committee on Science, Space, and Technology, Subcommittee on Energy
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The Honorable Alan Grayson, Ranking Member

Federal Agencies

Agency for Toxic Substances and Disease Registry
National Aeronautics and Space Administration
National Institute for Occupational Safety & Health
National Marine Fisheries Services
Naval Facilities Engineering Service Center
Santa Monica Mountains National Recreation Area
U.S. Army Corps of Engineers
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
U.S. Nuclear Regulatory Commission

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Senator Hanna-Beth Jackson, District 19
Senator Henry Stern, District 27

California State Assembly
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Dante Acosta, District 38
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Office of Assembly Member Scott Wilk
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Peter Raftery
Cassandra Owens
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State Historic Preservation Office
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Ed Carroll

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California

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Janice Parvin, City of Moorpark
Bob Huber, City of Simi Valley
Al Adam, City of Thousand Oaks
Susan McSweeney, Westlake Village

Council Members
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Steve Freedland, City of Hidden Hills
Staurt Siegel, City of Hidden Hills
Rob McCoy, City of Thousand Oaks
Claudia de la Pena, City of Thousand Oaks
Andrew Fox, City of Thousand Oaks
Keith Mashburn, City of Simi Valley
Steven Sojka, City of Simi Valley
Cheryl Heitmann, City of Ventura
Bob Blumenfield, City of Los Angeles
Mitchell Englander, City of Los Angeles

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Corinne Ho

Chatsworth Neighborhood Council
Andre van der Valk

City of Agoura Hills
Harry Schwartz

City of Hidden Hills
Marv Landon
Cherie Paglia

City of Moorpark
David Pollock, Mayor Pro Tem
Steven Kueny
Roseann Mikos
Keith Millhouse
Mark Van Dam

City of Simi Valley
Glen Beccera, Mayor Pro Tem
James Purtee
Mike Judge
Eric Levitt
Samantha Argabrite
Mark Oyler

City of Thousand Oaks
Joel Price, Mayor Pro Tem
Andrew Powers

County Commission Small Business
Ray Bishop

Los Angeles City Attorney's Office
Mike Feuer Jr.

Los Angeles City/County Native American Indian Commission
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Shelia Kuehl
Michael Antonvich
Hilda Solis

Los Angeles County Department of Public Health

Los Angeles County Fire Department
Tom Klinger
Chief William Jones

Office of LA City Councilmember Mitchell Englander
Nicole Bernson

Office of Supervisor Sheila Kuehl
Angelica Ayala

Simi Valley Police Department
Chief Mitch McCann

South Coast Air Quality Management District
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West Hills Neighborhood Council
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Woodland Hills Warner Center Neighborhood Council
Scott Silverstein

Native American Representatives

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Julie-Lynn Tumamait-Stennslie
Patrick Tumamait

Chumash/Tataviam
Beverly Folkes
Randy Folkes
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Coastal Band of the Chumash Nation
Maura Sullivan

Fernandeno Tataviam Band of Mission Indians
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Colin Cloud Hampson
Caitlin Gulley
Mark Villasenor

Gabrielino Tongva Indians of California
Christina Conley Marsden
Sandonne Goad

Kizh Gabrieleno Band of Mission Indians
Martha Gonzalez
Tim Poyurena Miguel
Andy Salas
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Gary Stickel
Christina Swindall

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Santa Ynez Band of Chumash Indians
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Brian Holguin

Santa Ynez Band Tribal Elders Council
Freddie Romero

Tataviam
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Tongva Ancestral Territorial Tribal Nation
John Tommy Rosas

Wishtoyo Foundation
Mati Waiya

Public Reading Rooms and Libraries

A complete copy of the *SSFL Area IV EIS* and references may be reviewed at any of the reading rooms and libraries listed below.

California

CA State University
Northridge Oviatt Library, Room 265
18111 Nordhoff Street
Northridge, CA 91330
818-677-2285

CA Department of Toxic Substances Control
Chatsworth Regional Office
9211 Oakdale Ave
Chatsworth, CA 91311-6505
818-717-6500

Platt Branch Library – Los Angeles
23600 Victory Boulevard
Woodland Hills, CA 91367
818-340-9386

Simi Valley Library
2969 Tapo Canyon Road
Simi Valley, CA 93063-6831
805-526-1735

Washington, DC

Freedom of Information Act Reading Room
U.S. Department of Energy
1000 Independence Avenue, SW, 1G-033
Washington, DC 20585
(202) 586-5955

Organizations and Public Interest Groups

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Shelly Backlar, Friends of the Los Angeles River
California Public Interest Research (CALPIRG)
Thomas Cochran, Natural Resources Defense Council - Washington Office
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Ann Coombs, League of Women Voters
Elizabeth Crawford, RocketdyneWatch Organization
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Lois Marie Gibbs, Center for Health, Environment and Justice
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Maria Hamilton, Simi Valley Community Care Center, Inc.
Dan Hirsch, Committee to Bridge the Gap
Harry Hiscocks, Cleanup Rocketdyne
John Holroyd, Conejo Group Sierra Club
Wade Hunter, North Valley Coalition
David Kranz, California Farm Bureau Federation - News
Elizabeth Landis, Los Angeles/Santa Monica Mountains Chapter
Jessica Lass, Natural Resources Defense Council
Betty Lawson, League of Women Voters
Jeanne & Sol Londe, Rocketdyne Cleanup Coalition
Marie Mason, Rocketdyne Cleanup Coalition
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Sierra Club National Headquarters
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Jane Williams, California Communities Against Toxics

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